James B. Beard
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Proceedings
Of The
31st Northwest Turfgrass Conference

Oct. 5 - Oct. 7, 1977
Salishan Lodge
Gleneden Beach, Oregon

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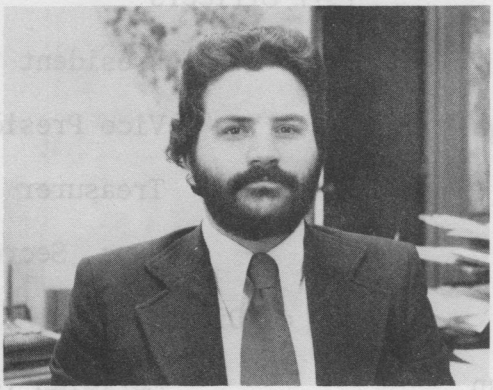
PRESIDENT'S MESSAGE



Joe Lymp

As my term as President of the Northwest Turfgrass Association come to an end, I wish to express my sincere thanks to all those that have helped make this a great year.

This year we saw the retirement of Dr. Chuck Gould. Dr. Gould's contributions to the NTA are immense. We will really miss him.

Also this year Tom Cook accepted a teaching position with Oregon State University. We are happy for Tom both for the opportunity and challenge he will have at OSU. I am thankful his move kept him in the Northwest (he is even closer for us Oregon superintendents now).

We truly are fortunate to have had the help of people like Dr. Roy Goss, Mr. Al Law, Dr. Engibous, Dr. Davison, Dr. Bay, Tom Cook, and the list goes on - it's too large to mention everyone.

I wish to express my sincere thanks to the NTA Board Members for their time and effort in making this a successful year.

NORTHWEST TURFGRASS ASSOCIATION

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PRACTICAL USES OF TURF-TYPE PERENNIAL[1] RYEGRASSES IN THE PACIFIC NORTHWEST

William A. Meyer[2]

Introduction

Improved varieties of turf-type perennial ryegrass are now commercially available which have many practical uses for turf in the Pacific Northwest. Perennial ryegrass is a cool-season grass which has the ability to germinate and establish more rapidly than other species except annual ryegrass. The perennial ryegrasses are best adapted for permanent turf in areas such as the western side of the mountains in the Pacific Northwest, having a relatively moderate climate. This is the area I have had experience in evaluating turf-type varieties of this species.

My experience east of the mountains has been in the evaluation of varieties for winterhardiness in trials in central Oregon for the past two winters. The good survival of some varieties in these tests and the acceptable performance of improved turf-type perennial ryegrass across the United States in northern locations indicates this species can also be useful east of the mountains as well.

1/ To be presented at the 31st Annual Northwest Turfgrass Association Conference, Salishan Lodge, Gleneden Beach, OR, October 5, 6 and 7, 1977.

2/ Research Director, Turf-Seed, Inc., Hubbard, OR.

History of Turf-type Perennial Ryegrass

Manhattan and Pennfine were two new improved varieties of perennial ryegrass which became commercially available in the late 1960's. They were called turf-type perennial ryegrasses because of their improved turf-density, mowing qualities, disease resistance and lower growth habit compared to earlier varieties and common or Linn perennial ryegrass. NK-200 and Eton were also turf-types developed during this period with slightly lower performance ratings than Pennfine and Manhattan. These turf-type varieties have been tested and planted widely with good results. The varieties Birdie, Citation, Derby, Diplomat, Loretta, Omega, Regal, Yorktown, and Yorktown II are examples of improved turf-type perennial ryegrasses which have given good turf performance in tests across the U.S. and in my turf trials in the Willamette Valley.

Disease Resistance and Adaption

The performance of the above available varieties varies considerably during different seasons of the year. I have found that the diseases Stem Rust (*Puccinia graminis*), Crown Rust (*P. coronata*), *Corticium* Red Thread, *Fusarium* Patch (*F. nivale*) and Brown Blight (*Helminthosporium siccans*) are the most serious disease problems of perennial ryegrass in the Willamette Valley.

Stem rust can be severe starting in late spring on through the summer. To date none of the commercially available varieties have had resistance to this disease. We have a breeding program in progress to develop varieties with resistance to this disease. If fertility and water levels are maintained adequately, the damage from this disease can be minimized in turf.

Crown Rust usually appears in the fall. The varieties Birdie and Loretta have had the least amount of damage from this disease in our trials. Again good cultural practices will reduce the disease damage.

The diseases *Fusarium* Patch, Red Thread and Brown blight have been the most serious diseases of perennial

ryegrass in our trials. Manhattan and Omega were found to have improved resistance to Brown Blight. None of the commercial varieties were found to have high levels of resistance to Red Thread and *Fusarium* Patch. Some experimental selections appear to have resistance and are being used in breeding work. It appears that the damage from Red Thread and *Fusarium* Patch can be greatly reduced when perennial ryegrasses are used in mixtures with Kentucky bluegrass.

Varieties such as Citation have been found to have better summer heat tolerance, while other varieties have had better cold hardiness ratings. Because of the season performance differences between varieties, it is a good practice to blend two or more of the presently available varieties for the best performance.

New Plantings

Perennial ryegrass can be used effectively for new plantings in mixtures with Kentucky bluegrasses or fine fescues for home lawns, parks, athletic fields and golf course fairways and tees. In athletic situations with heavy traffic, mixtures with Kentucky bluegrass and a higher percentage of perennial ryegrass should perform best because of their improved wear tolerance. Mixtures with fine fescues and Kentucky bluegrasses are desirable from the standpoint of reduced mowing requirements. When a good balance of the bluegrass, fescue and perennial ryegrass is desired, the percentage by weight of perennial ryegrass in the mixture should not be above 20-30 percent with normal seeding rates. Higher percentages will prevent the establishment of the other two species because of the rapid establishment of perennial ryegrass. Another practice that has been used successfully involves the planting of the fine fescues or Kentucky bluegrass first and then overseeding with perennial ryegrass 10-14 days later.

Renovation of Golf Course Fairways and Old Turf Areas with Roger's Seeder

Turf-type ryegrasses have given excellent results in fall periods when seeded with a Roger's Seeder which

cuts a slit in existing turf and places the seed in contact with the soil. The rapid germination of the perennial ryegrass gives it a competitive advantage over *Poa annua* in establishment. I have observed successful renovation programs using a Roger's Seeder on golf course fairways in the Willamette Valley, the Midwest and Eastern part of the United States. Perennial ryegrass can be observed on many Willamette Valley golf courses in walk-off areas as the only species tolerating the heavy traffic.

Renovation of Old Turf Areas with Roundup and Overseeding

In the fall periods the new chemical Roundup can be used to kill existing grasses and weeds prior to overseeding. We have used this technique to kill mixtures of bentgrass and fescues in the fall followed shortly with an overseeding of a turf-type perennial ryegrass. The use of a dethatcher prior to overseeding will greatly improve contact of seed in the soil. The rapid germination of the perennial ryegrass in the dead thatch layer results in a minimum care period for good establishment.

Repair of Damaged or Diseased Turf

Perennial ryegrasses mixed in topdressing can be used to repair worn tee areas or weak areas of fairways or lawns. Usually these worn areas require a more wear tolerant grass which is a strength of perennial ryegrass.

Old lawns which have been thinned by disease and thatch can be verticut severely and then overseeded with perennial ryegrass to achieve improved uniformity and turf quality. One of the advantages of perennial ryegrass is that they are not thatch prone like some bluegrasses, chewings fescues and bentgrasses.

In Shade Mixtures

In our shade evaluations new turf-type perennial ryegrasses have given better performance than all but a few of the commercially available Kentucky bluegrasses

and fine fescues. Their ability to germinate and develop rapidly after the leaves drop off trees in the fall gives them a real advantage. If shade does thin the stands, an annual overseeding should help to maintain good stands.

Conclusion

The development of these new turf-type perennial ryegrasses has given the professional turf manager and home owner a new tool for maintaining good turf areas. Their ease of establishment and acceptable turf-forming abilities make them a very useful species. There is still a need to improve the disease resistance, mowing qualities and cold hardiness in this species, but the progress that has been made in the last ten years with perennial ryegrass must be noted as a major accomplishment in the turfgrass industry.

TOPDRESSING — EXPERIENCES, SUCCESSES,[1] METHODS AND PROBLEMS
A PANEL DISCUSSION

Charles Nolan[2], Kevin Van[3], and Tim Manion[4]
Panel Moderator — Dr. Roy L. Goss

INTRODUCTION

Topdressing is certainly nothing new to turfgrass managers. The golf course superintendent has been topdressing putting greens and other areas for a great many years. Every conceivable mixture and combination of soil, sand, organic material and synthetic products have been applied to putting greens over this period of time. Each superintendent has thought the system he has used was best. In many cases these programs have been highly successful and in other cases the treatments have caused damage to putting green surfaces.

1/ To be presented at the 31st Annual Northwest Turfgrass Association Conference, Salishan Lodge, Gleneden Beach, OR., October 5, 6 and 7, 1977.

2/ Superintendent, Inglewood Golf and Country Club, Kenmore, WA.

3/ Superintendent, Auburn Municipal Golf Course, Auburn, WA.

4/ Superintendent, Columbia-Edgewater Golf Course, Portland, OR.

A great deal of interest has been regenerated in sand topdressing since Dr. John Madison and his associates have published the results of their studies at the University of California at Davis, CA. Various modifications of Madison's program are being used in the Pacific Northwest today, most with remarkable success.

Each of the panelists appearing on this program will share with you his experiences with topdressing programs at his particular location. Prepared statements by each of the panelists will be published in the Proceedings but some of the discussion which will come out of the panel will not be published. We hope these experiences will be useful to those of you who have problems that could be helped by topdressing programs.

SAND TOPDRESSING

Charles Nolan

You have all heard of a topdressing program from time to time. However, the program at Inglewood may be of some interest to you.

To begin with, we must go back five years to the beginning of the program. Our first move was to core the greens with 5/8 inch tines, remove the cores, and topdress with fine sand and overseed. We followed up with another coring three months later, again removing the cores and topdressing with sand. Three months later we cored the greens again. This time we verticut the cores, topdressed, overseeded and drug the greens. The second year of our program we cored the greens four times, verticut, topdressed and drug in the material. The third year we cored the greens four times, verticut the cores, and topdressed. We also topdressed once every week and overseeded in August with 1/4 lb of seed per 1000 sq ft.

The fourth and fifth years, we have been sanding every Monday morning. The greens now have a mix of sand soil of about 3-4 inches and a layer of sand, 2-1/2

inches on top. The sand is spread with a fertilizer spreader pulled by a Cushman. It takes three men 3 hours to put down 9 cu ft of sand per green. This way all 18 greens are sanded by 10 a.m. at which time we start dragging. Overseeding is done in August; fertilizing on Mondays. The greens are watered heavy on Monday night and mowed Tuesday without catchers. We have little or no problem with the mowers or golfers.

The greens have been taking water much easier the past two years, using half the fertilizer, and are more consistent. The greens are drier during the wet season and to some degree have less disease and dead spots.

To sum it up, we are happy with our success.

SAND TOPDRESSING PROGRAMS

AT AUBURN MUNICIPAL GOLF COURSE

Kevin Van

Frequent topdressing is becoming a common topic of discussion among professional turfmen. Since it is still a fairly new concept in turf management, there are a variety of methods, procedures, problems, and experiences, none of which are truly standardized at this time.

I will tell you why I began a topdressing program, what details are involved and how I conduct this program.

The reason I started the topdressing program on nine of my 18 greens was simple. The sand that was used in the putting green construction had too many fines which resulted in poorly drained and wet greens which became unplayable and unmanageable.

The game plan was to build an adequate soil structure at the cheapest cost so the nine greens could become playable and manageable throughout the fall and winter. The best method for me in carrying out an accurate topdressing program is to use 4.2 cu ft of plaster sand per 1000 sq ft once every three weeks at

least 10 times a year. At this rate I build a sand structure of one-half inch per year. The procedure I use is based on time since I have continual early morning weekly play.

There are three stockpile sites located in key areas on the course. This saves transport time. I topdress the greens that get sunlight first with a Cushman mounted topdresser. I apply the sand in a circular direction and when I near the center of the green and cannot turn properly, I park the Cushman just outside of the unfinished circle and topdress the remainder by hand. As soon as possible, another man begins dragging the greens two ways with an 8 ft by 8 ft drag mat. When this is accomplished, another man mows the greens with an old riding greens mower set at about 1/64 inch higher than the normal cutting height. The purpose of this is to smooth and cut the ruffled grass and pick up the few larger sand particles, if any. Then late in the evening I water the sand in with about 65 to 70 gallons of water per 1000 sq ft.

The problems with the topdressing that may arise with this program are as follows:

Be sure to acquire the proper sanding material. If it is too coarse, it will not drag in properly and if it is too fine, you are defeating your purpose. I have had my best luck with plaster sand.

A storage shed to keep the sand dry is a real asset. Wet sand is heavy and more weight promotes more mechanical wear. Wet sand also takes longer to dry; therefore, it decreases progress.

When topdressing, you should go out onto the collars at least six feet. This will eliminate the problem of having wet fringes and dry greens.

The first two years of topdressing at Auburn produced greens that became somewhat hard, apparently for two reasons. The sand profile was not built up enough to cushion the ball and the soil water movement was

increased. By the end of the third year the greens began holding better and they are now quite satisfactory.

When you are topdressing during summer stress periods, it is best not to topdress weaker greens. If they are thin, they may become thinner.

There were some early concepts that if you carried out a frequent topdressing program, you would not have to aerify. This was a bad idea. I did not aerify one of my topdressed greens for two years. This green slowly became weak, thin and ugly. Two weeks after I aerified, recovery was remarkable. Your roots still need air, water and nutrients.

All of my experiences with a frequent topdressing program have been very beneficial. Greens become smoother, thatch is decreased, and surfaces become drier; therefore, during the fall and winter months traffic damage is at a minimum and disease is playing second fiddle.

If you are converting a green that is part *Poa annua* and part bent to a bentgrass green, you will notice slight gain in the bentgrass throughout each topdressing season.

I feel that if your greens have been properly built, all that is needed is aerification and a vertical mowing program. But if your greens are not properly composed and you have drainage problems, you will find a light, frequent topdressing program will be most rewarding.

LIGHT, FREQUENT TOPDRESSING AND WHAT HAS IT MEANT

Tim Manion

Dick Malpass asked me to be a part of this panel just after the fact that I had lost numerous greens prior to the 1977 LPGA Tournament.

I'm confident that without topdressing our greens at Columbia-Edgewater Country Club for the past 2-1/2 to 3 years, we would have lost more turf than we did during the heat spell of last August. Also, more damage would have resulted during the following week when 3 inches of rain fell during the Annual Oregon Seniors Championship. Columbia-Edgewater's greens were built of their native soils back in 1924. The soil, having the physical structure of silty clay loam is easily compacted and drainage, in the practical sense, is non-existent. Root development of our *Poa annua* turfgrass measured 1/2 inch in depth in May of 1969. At this time a program of spring and fall aerification, using 5/8 inch tines, cores removed and backfilled with sand, was adopted. These aerifications helped, but weren't enough to keep pace with the increased play and the ever-increasing demands of providing a smoother, faster putting surface. Thus, the light, but frequent sand topdressing concept was adopted within our aerification program.

This combination of aerifying and frequent topdressings serves us in numerous ways: the aerifying prevents a layer effect from developing which one would expect if topdressings were used solely. By aerifying, we can develop a gradual transition of clay to sand which is desired. The aerifications allow us to remove more of the clay soil more rapidly than if only topdressings were done. With aerifications we work from the bottom up and with topdressing, from the surface up.

This fall we have made two alterations within our program. We will use an aerifier which penetrates 6 inches deep in our fall aerifications. The 3 inch tine aerifier will still be used in the spring. Coarser sand, almost small gravel, will be used in backfilling the aerification holes. Before, we were using smaller particle size sand in both the aerifying and topdressing. The reasons for using smaller particle size sand when topdressing is that it works into the turf better, less pick up of the sand with our mowers and less damage to the mowers.

We topdress more frequently during the winter (wet) months than during the summer (dry) months. Winter topdressing rates range up to 5 cu ft of sand per 1000 sq ft. When wet, we use a walking topdresser, otherwise a Cushman topdresser. During winter we make no attempts to work the sand into the turf. The rains do it for us. During the drier months, we work the sand into the turf with a drag mat. We have found that a steel mat, 6 ft x 6 ft, pulled behind a Cushman, works best for us. There is a secondary benefit using the drag mat, it will eliminate grain better than anything I have seen.

During the playing season when we cut our greens on a schedule, topdressing is only done on Monday. The following Tuesday we cut without baskets. On Wednesday we use the same reels with baskets. Thursday we use well adjusted sharp cutting units. Thursday is our normal day for verticutting our greens. However, we wait 2-1/2 weeks following any topdressings before resuming our verticutting schedule because verticutting brings up the sand to the putting surface. The frequency at which we topdress varies with the weather. In wet months on problem greens we topdress twice a month; otherwise, every third week. During the summer we topdress at least once every six weeks for an average of 12 to 18 times per year.

What have these frequent sandings meant to me and to the members of Columbia-Edgewater? For the past three winters there hasn't been a need for a temporary green. The greens are drier, firmer, have less footprints and fewer cleat marks. The puffiness problems of our heavily thatched 18th green has decreased. The root systems are deeper and there is some free water available for plant absorption. The most important benefit from these frequent sandings is that it has promoted lateral water movement within the upper soil surface.

Before this time there was no way of removing excess water from the surface of our greens. If any type of drainage system was installed, only that area containing the installed system drained and the area

immediately surrounding that area remained wet. In summer, the turf over these various drainage systems would die out due to the lack of moisture. Today even with our still limited, but existing sandy soil zone, we can install the necessary drainage systems for a particular problem area and get results with no dry outs causing problems with that particular system during drier months.

I would like to mention two examples of how we utilized the advantage of the lateral water movement. Our practice putting green is flat with numerous small depressions where water would collect and stay for days during the winter months. Therefore, after a heavy rain we would auger holes one foot in diameter and 7 feet deep in the areas of standing water. These holes were backfilled with sand and we would drill as many auger holes as were necessary to remove all the standing water in the depression. Sod which had sand for its soil was laid over the auger holes. We drilled some 63 auger holes within this putting green. Today after a heavy rain the standing water is gone within a few hours. In summer there are no isolated dry spots to reveal these auger holes.

Last August, during the hot spell we had a sprinkler go out of control and run for 10 hours for two consecutive nights. Previously, this would have meant disaster, but the green survived and remained in good condition.

Columbia-Edgewater's 6th green is relatively flat around its outer perimeter, but its center portion is concave. Water would collect to a depth of 4 inches before it would overflow. Thus, on the outer perimeter we augered holes as we did on our practice green to rid ourselves of small water puddles.

Through the middle of the 6th green we dug a 4 inch trench some 20 inches deep, graded a 3 inch layer of pea gravel for our tile line. For tile, we used a 1-1/2 inch plastic irrigation pipe with holes drilled through it every 4 inches. This tile line was then covered with another 3 inches of pea gravel. The trench

was backfilled with sand up to 6 inches of the green's surface. The upper 6 inches was backfilled with a soil mixture consisting of 50% sand and 50% fine bark dust. In the middle (lowest spot) of this concave section of green we put a tee in the tile line and brought up a 3/4 inch galvanized pipe to the surface of the green. In times of heavy rain we will pull the sod away from this extended pipe and get immediate drainage, as if draining a bath tub. Today, we get root growth during the winter months instead of turf rot. During the summer months this green would die August after August. This year No. 6 remained healthy!

We have proven to our Board of Directors and Greens Committee that these systems work. Therefore, they approved installations of various drainage systems on seven other greens for this winter.

In conclusion, I could say that we are building new greens over old ones by maintenance practices. This program could be a possible alternate to the bull dozer approach.

TREES AND GOLF COURSES[1]

Dale Bever[2]

A. Why

1. Psychological atmosphere
   a. Back to the country
   b. Isolation (hole by hole)

2. Control
   a. Keep golfers within prescribed limits
   b. Influence the difficulty of the hole

3. Aesthetics
   a. Color
      (1) Flowering
      (2) Fall leaves
   b. Texture
   c. Interesting shapes
      (1) Bizare
      (2) Picturesque
      (3) Grotesque
   d. Fruits
      (1) To eat
      (2) To look at

4. Wildlife
   a. Birds
   b. Animals

5. Weather
   a. Wind
   b. Shade

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2/ Asst. Dean of School of Forestry, Oregon State University, Corvallis, OR.

B. How

1. Depends on what you start with
   a. Completely wooded over
   b. Completely cleared land
   c. Combination (cow pasture)
   d. Ready made golf course

2. Going from where you are to where you want to be
   a. The chain saw
   b. The planting tool
      (1) Plant when dormant
      (2) Follow planting directions
      (3) Keep grass away from trees
      (4) Water first summer
      (5) Match tree with proper environment
      (6) Impress help with importance
         (a) Mower damage
         (b) Wire brace damage
   c. The brain

3. Special maintenance problems
   a. Dirt around trunk
   b. Drainage changes
   c. Windfirmness
   d. Leaves and unwanted fruit
   e. Roots and rootsprouting
   f. Branches - dead, dying and pruning

C. Which ones

1. Basic plantings - native to Northwest
   a. The first (*Pseudotsuga* and *Abies*)
   b. The oaks (Oregon white and *Lithocarpus*)
   c. The pines (2 and 3 needles)
   d. The cypress family (*Tsuga, Libocedrus, Cupressus* and *Juniperus*) NOT *Chamaecyparis*
   e. The maples (Bigleaf and vine)
   f. The poplars (black and trembling aspen)

2. Secondary plants - native to U.S.
   a. The oaks (northern red, pin)
   b. Other decidious
      (1) *Liquidambar* - sweetgum

(2) Sugar maple
(3) Birch and beech (copper)
(4) Eastern cottonwood, bigtooth
(5) Dogwood
(6) Magnolia (ornamental varieties)
(7) *Liriodendrom* - tulip poplar
(8) Nut trees - walnuts, hickories

3. Selecting special trees
   a. Flowering
   b. Slope
   c. Fall color
   d. Bark
   e. Texture
   f. Special effects

4. Non-U.S. trees available for use in the Northwest

D. Question and answer session

CORRECTING WET SPOTS IN ESTABLISHED TURFGRASSES[1]

Roy L. Goss[2]

Soils may be excessively wet for a variety of reasons. Entrapment of water such as that which occurs in lakes, peat bogs or ponds and other depressed areas will usually result in free-standing water if sufficient rainfall or irrigation is available. An important prerequisite for holding this water is the inability for this water to percolate downward. Deep percolation can be prevented by bedrock, cemented hardpan, or very heavy clay soil. If any of these conditions exist, poor drainage characteristics will result if water in excess of that required for plant growth and evapotranspiration is available.

CORRECT DRAINAGE PROBLEMS WHEN BUILDING

Most drainage problems are the result of faulty construction. This may be caused by inadequate funds to do the job right or lack of knowledge on the part of the builders to recognize these problems and install safeguards.

There are several means of correcting potential drainage problems during construction and some of these may be listed as follows:

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2/ Agronomist/Extension Agronomist, Western Washington Research and Extension Center (WSU), Puyallup, WA.

1. Install underground interceptor drains at the toes of slopes adjacent to heavily trafficked areas. This will prevent any weepage water from collecting in small important areas.

2. Surface contouring or grading, particularly on golf courses where irregular surfaces may be desirable for aesthetic purposes. This will allow excess water to run to collection points where tile drain may be installed to carry away excess water.

3. French or surface inlet drains can be installed in low points where water usually collects after prolonged rainfall or excess irrigation runoff.

4. Use of subsoilers or rip teeth on a bulldozer to loosen the surface one foot or more of soil following construction compaction. Soils may have good drainage characteristics before disturbance, but after construction and particularly so when the soils are wet, compaction can result in permanent damage.

5. Addition of highly permeable soil to deepen the profile over heavy textured soils, bedrock and hardpan.

These are but a few of the methods of preventing serious drainage problems and a number of other factors could be discussed but this will serve to illustrate some of the things that can be done. The intensity of drainage must be determined on a practical basis. In other words, what is the use of the area. If the area is a heavily used playfield, football field, putting green, or golf tee, then tile drains should be established at closer intervals. Sometimes it is necessary to install drain lines as close as 10 feet apart in various patterns to effect rapid drainage.

THE COMPACTION FACTOR

If we assume that a given recreational facility had good drainage characteristics at the time it was developed but later became wet and unmanageable, we can generally assume that this was caused by compaction of various

sorts. Vehicular traffic notably that from maintenance tractors, mowers, and golf cars as well as hand carts, probably accounts for the most severe compaction. Foot traffic is extremely important also. Football, soccer and golf shoes where concentrated can cause extreme compaction in the surface 2 to 3 inches.

Compaction is strongly related to soil type and soil physical condition. Heavy soils, those with higher contents of silt and clay, will compact more readily than sands. Heavy soils, in their original state, generally have some structural characteristics; that is, they may be aggregated, having large pore spaces. When soils of this type are compacted in a wet state, the air pore spaces are compressed or eliminated until there is little air porosity left. This restricts both infiltration and permeability rates of water, restricts oxygen in the soil, restricts root penetration, and results in poor or no drainage. Once soil structure has been destroyed due to excessive tillage or compacting when wet, it is quite difficult to restructure this soil so that it may regain its original drainage characteristics. Therefore, excess water and concentrated traffic frequently spell doom to heavier textured soils.

Concentrated traffic will cause weak, thin turf, or the invasion of shallow rooted weedy species and allow soils to become more compacted. The best insurance against compaction is a good, dense stand of turf to absorb the shock of all sorts of traffic. Plant roots, if not restricted in growth and development, will increase infiltration and permeability in heavier textured soils.

CORRECTING WET SPOTS

If your turfgrass area is a victim of problems previously discussed, then remedial programs should be developed at once. A large, wet, muddy area on a playground, park, football field or golf course will not correct itself under heavy use. They generally become worse. Restricting traffic in these areas is not always practical. There may be nowhere to go. I suggest some of the following ideas:

1. Investigate the causes of the wetness. Is it due to high water table, water moving in from sloping areas, springs, leaking sprinkler systems, collection points for rainfall, or other? From any of these causes corrective measures are not too difficult.

2. If the problem appears to be the result of excessive traffic under normal maintenance conditions, examine the soil profile to determine exactly where the compaction is. Usually this will be found in the surface 4 inches. Once the soil has lost its structure it becomes a mass of fluid soil particles and organic debris with little or no drainage characteristics. A quick solution is to remove all of this wet material down to the depth where normal percolation should occur and replace this with sand or a soil with extremely high sand content. Turf can then be reestablished by seeding or sodding. It is very important when resodding to know the soil textural and structural characteristics of that on which the sod was grown since a layer of only 1/2 inch or so of incompatible soil over the sand can result in essentially the same problem that you experienced originally. Sod for the repair of these areas should be grown on sand or a soil that would classify as a loamy sand. Frequent aerification and topdressing with sand on these areas following resodding will give you additional insurance that the area will drain properly. If poor subsoil drainage characteristics were found during the removal process, it is wise to install additional drain lines to insure proper drainage. Seeding of these repaired areas is usually the safest and best guarantee for avoiding future problems.

If the soil structure was destroyed from concentrated traffic of all sorts where there is no place to go, then it may be wise to install paths to eliminate this factor.

Another practice, which has proven very successful in a number of instances, is heavy frequent topdressing with sand. In the Pacific Northwest the best time to initiate this practice is during periods of

lowest rainfall when the grass is actively growing. Continued topdressings along with aerification of these areas will create stable surface conditions that will not puddle or compact if a good turfgrass stand is maintained. Sand is a single grained structural material and will maintain reasonable infiltration and permeability rates even under compaction.

Much has been said and written about the use of turf-type ryegrasses. In the writer's opinion these grasses have demonstrated their ability to both heal and prevent soil structural damage better than any other grasses for this region. Turf-type ryegrasses germinate quickly and have strong seedling vigor plus the ability to withstand heavy wear. Overseeding these areas by any means available will help to maintain a better stand of turfgrass and provide more cushion to absorb the shock of traffic and to resist shearing forces in the soil surface under relatively unstable conditions.

Aerification has proven its worth many times over in eliminating or preventing excess compaction and to increase surface infiltration of water. There are a number of types of aerifiers available. If hollow-tined aerification is undesirable aesthetically at certain times of the year, there are other devices which produce continuous aerification with minor amounts of surface littering resulting. The other alternative is to remove aerifier cores, but this is not practical on large areas such as football fields, playgrounds and golf course fairways.

CONCLUSION

The causes for poor drainage are simple. We usually create them. There is no suitable alternative for preventative maintenance such as maintaining dense turfgrass stands, aerification, traffic control, and frequent sanding to maintain drier surface condition.

MANAGEMENT[1]

Albert D. Angove[2]

There are several types of management to consider. For our purposes we will consider Personnel Management.

a. The very first thing to remember is that you "ride the waves of success on your employee's back."

With this in mind, let's look at employees - and how we have managed them in the past.

First, you have the complete autocratic manager who insists that his word is law and never seeks or takes suggestions from his employees - this type of manager is all too common within our present management structures.

On the other end of the spectrum, you have a democratic manager who seeks everyone's opinion prior to making a decision. There are some real problems with this type of management, as you will find out as we explore management in detail.

Lets explore autocratic leadership or management, always keeping in mind that economics are an extremely important facet in management.

1/ To be presented at the 31st Annual Northwest Turfgrass Association Conference, Salishan Lodge, Gleneden Beach, OR, October 5, 6 and 7, 1977.

2/ Park and Recreation Director, Spokane County Parks and Recreation, Spokane, WA.

I think there are several things you can tell about a manager as a person if you sense he is a strict autocratic manager. They are:

a. Not much confidence
b. Impatient - and
c. A poor economic risk

In closer detail, each one of the aforementioned items are important to understand and be able to recognize in yourself. An autocratic leader lacks self-confidence -

a. He has not prepared his people to do the job and thus feels he is the only one who can make decisions - lacking confidence within himself to trust others to think and respond to specific situations.

Impatience -

a. Since an autocratic leader makes all the decisions, he assumes he is behind and most of the decisions are of an emergency nature. Have you worked for someone like that?

Economics -

a. Since one man is making all the decisions - the on the spot decisions that can save money and prevent problems are generally not made, since I don't know of any superintendents that are supermen. The economics of these decisions are incredible, as we shall see later.

On the other end of the spectrum is the democratic leader who asks everyone's opinion and generally has a difficult time making up his mind. This type of non-leadership is just as disastrous as being an autocratic leader and reflects the same traits - lack of self-confidence and economic problems.

Well then, what is a good manager? It is the person who can combine the best of both worlds - be autocratic when you have to be and democratic at the

right times - that sounds easy, but very difficult to do.

I would like to go over with you a few techniques I have learned and hopefully have been successful with:

a. Develop a decision-making model to include your lowest paid employee. In other words, your lowest paid employee should have some areas in which he is expected to make a decision.

b. Confer with your employees about long range projects and seek their opinion - do not give them the impression you are going to let them make the decision, but the input they give will be carefully considered and is desired when making your decision.

c. Give credit where credit is due! If an employee comes up with a good idea, give him credit in front of his peers - (club members, public, etc.) Make him feel as if his concern for doing a good job is both noticed and rewarded. Remember money usually is the last thing when a person lists reasons for job satisfaction.

d. Make decisions when they need to be made, make your decisions direct and without emotion - this will create the atmosphere of authority and will keep your employees aware of who is the boss. You, as a manger, must draw a fine line between being a boss and a friend - too much one way or the other and you will lose your effectiveness.

One other technique I use is to have once a month meetings with your employees where they can say anything they want. Nothing is harder than to listen to criticism about yourself. This type of meeting will do two things:

1. Lets employees tell you what they think, without fear of losing their job. This usually lasts only for the first or second meeting, then it

turns into a bull session, but important even then.

2. Lets you explain in detail why some decisions are made in the way they were. You can also talk about their role in your scheme of things and get their reaction.

Most of all, you can develop confidence in them as employees and create confidence in your ability to manage.

Unions - Some of you probably have unions to deal with. The reasons unions are formed, or people join unions, is generally job dissatisfaction, i.e., working conditions or an employer who always knows what is best for an employee without ever asking the employee.

One of the major problems with unions is that you generally have an outside influence determining demands i.e., union representative. His job is to get greater benefits for his members so his job will be more secure.

You can be well aware of dissatisfaction with your employees by your monthly meetings and can head a lot of the more reasonable ones off prior to the union demand stage. Of course, wage demands made can be settled by a board of commission that is out of your control.

Decisions generally cost money in the capital cost, such as new greens, drainage, etc., but decisions also cost money from a manpower usage standpoint. The manager who can maximize his personnels' potential is successful. I am sure you know lots of people who cannot.

People who make management decisions should not be expected to dig the ditches, too. Certainly, in our profession a little ditch digging is necessary, but you are paid to plan and make adjustments in your programs to meet ever changing needs.

It would be nice for your board member to see you working your tail off in a ditch, but that will soon

catch up with you. What is more important to a good board is that your overall program makes economic sense and your planning is consistent with the funds available.

When explaining any program you have, or any major management decisions you make, justify it first on an economic basis - that goes for equipment, course or park changes - the biggest example is changing from manual to automatic irrigation. Before you make a decision, see if you can economically justify your decision.

If you have time, look at your decisions and plans and, figure them out economically if you can - use the results as an indicator to how well your decision making is.

POA ANNUA CAN BE CONTROLLED[1]

Thomas W. Cook[2]

Would you believe there was once an article in the USGA Green Section Record about a fellow who invented a machine that would brush up crabgrass stems so they would cut cleaner and leave the turf looking better? I don't remember the exact issue but I will never forget the photograph. Most of you from the east side of the Cascades who have been around for a while can probably remember when lots of people thought seriously about living with crabgrass. Crabgrass was one of the toughest weed problems ever faced in turf management. However, all that changed when somebody found a herbicide that could kill germinating crabgrass seed. Crabgrass control in many areas has been so successful that treatment is no longer needed on a regular basis.

What does crabgrass control have to do with annual bluegrass control? In many ways the problem is quite similar. Ever since fine turf has been grown, turf managers have been forced to accept *Poa annua* because there just hasn't been any way to get rid of it. Over the years two distinct schools of thought have developed. One school says, "I like *Poa annua*. It's the best grass we've got. Why don't they try to improve it?" The other school says, "*Poa annua* drives me crazy.

1/ To be presented at the 31st Annual Northwest Turfgrass Association Conference, Salishan Lodge, Gleneden Beach, OR, October 5, 6 and 7, 1977.

2/ Department of Horticulture, Oregon State University, Corvallis, OR.

It's the most undependable grass there is. Why don't they figure out some way to control it?"

In the meantime both schools have mastered the art of growing *Poa annua*, and as it stands today some of the best *Poa annua* in the world is probably grown in the Pacific Northwest. Also, in the meantime there have been many attempts to both improve and control *Poa annua*. Most have ended in disappointing failures but research goes on. Now the stage is set for a sticky problem. What if someone came up to you and said, "Your worries are over, if you will follow my program you can control *Poa annua* now!"

People who like *Poa annua* would probably throw him off their property. People who want to control *Poa* would probably figure he was just another quack peddling miracles. But some brave soul just might say yes and if it worked, some of the other not so brave souls might follow suit. And if it worked for them we might soon see a lot of clean turf free of *Poa annua*. If you strongly believe that *Poa* is the best grass you might as well stop reading because the rest of this article deals with a program which we feel can control *Poa annua*, if used properly and intelligently.

When considering any *Poa annua* control program it is necessary to recognize one important fact. If a herbicide is applied that kills the *Poa*, the dead grass will turn brown and the turf will look terrible until desirable grass fills in the bare spots. How brown and how terrible the turf looks will depend on how much *Poa annua* is in the turf. If levels are high, the first treatment will discolor the turf badly. Fortunately, succeeding treatments will be less alarming since less *Poa annua* will be killed. With this principle in mind we can proceed to a discussion of *Poa annua* control in turf.

As I have said many times before, to control *Poa annua* you must do two things. First, get rid of existing *Poa annua* plants, and second, prevent new ones from developing. The latter requirement can be achieved with intelligent use of pre-emergence herbicides such as

bensulide, benefin, dacthal, and others. The difficult part has been selectively killing existing *Poa annua* plants. We have had excellent success with the 19.2% di-sodium salt solution of endothall. The following sections describe several important factors that determine the limits and potential success with endothall.

TOLERANCE OF TURFGRASSES

All Kentucky bluegrass varieties tested have tolerated endothall treatment acceptably. Twelve selected varieties are listed in Table 1. Even though initial tolerance was variable, there was no lasting injury to any of the varieties tested.

All perennial ryegrass varieties and selections under test were treated with endothall in mid-summer in temperatures near 85°F. Under these conditions more discoloration occurred in the ryegrass than in the bluegrasses. Nevertheless, most ryegrasses tolerated endothall quite well. Tolerance ratings for six of the improved types are listed in Table 2. As with the bluegrasses, no lasting injury occurred to any of the varieties in this test.

In late April of this year, thirty bentgrass varieties and selections maintained as putting turf were treated with endothall at a rate of 1.25 kg/ha ai plus a spreader. While results of that test have not been tabulated yet, the general response is quite obvious. All creeping and colonial types tolerated the treatment with only short term discoloration. Velvet bentgrasses were injured severely, but have since recovered fully.

Fine leave fescues do not tolerate endothall treatments well. However, they will generally survive a single spraying at rates used on Kentucky bluegrass. In non-replicated tests this summer, I observed that Highlight and Jamestown chewings fescues recovered significantly faster than several experimental selections. This is worthy of further investigation since tolerant fescues may exist that we are not aware of.

RATES

After considering this year's work and surveying work of the last three years, some adjustments appear in order for rates on all grasses.

For all around safety and effectiveness on Kentucky bluegrass mowed at 3/4 - 1½ inches, rates of 2 - 2.5 lb acid equivalent per acre plus addition of a spray adjuvant at a 1:800 dilution ratio are desirable. Control can be achieved as low as 1.5 lb/acre, but at that rate resistant types are more persistent. Bluegrass can tolerate rates considerably higher than 2.5 lb/acre but there doesn't seem to be any advantage to this approach.

Perennial ryegrasses maintained at 3/4 inch can be treated at the same rates (2 - 2.5 lb/acre) as Kentucky bluegrass. Testing with reygrasses has not been as extensive as with Kentucky bluegrass but the data collected so far indicate these rates are acceptable.

Bentgrass putting turf (colonial and creeping) tolerates endothall rates between 3/4 and 1¼ lb/acre acid equivalent plus addition of a spreader at 1:800 dilution ratio. The lower rates are not as effective at controlling *Poa annua* as the higher rates. Rates on the order of 1½ to 2 lb/acre begin to cause unacceptable discoloration of the desirable bentgrass.

Bentgrass lawn turf maintained at 3/4 inch can tolerate endothall at the 1½ to 2 lb/acre rates with a spreader. In this case the individual plants are larger and under less physiological stress from mowing. Consequently, the higher rates do not cause unacceptable discoloration.

TIMING OF APPLICATIONS

For all grasses timing is very important. Endothall applied too early in the spring (e.g. before mid-May on Kentucky bluegrass) will usually cause unacceptable discoloration and loss of density (Table 3) The same is true in the fall, particularly after the

first of October (Table 4). In both these cases, applications made when frost is likely will result in severe injury. Similarly, temperatures above 85°F may decrease selectivity and cause unacceptable discoloration to desirable grasses. Optimum times for treating the various grasses in western Washington are illustrated in Figure 1. More important than the actual time periods is the fact that each grass species must be treated during a time when it is growing vigorously without heat, cold, or drought stress. Obviously, these times will vary from region to region and from grass to grass.

INFLUENCES OF FERTILITY

Tests this summer failed to show conclusively that high levels of nitrogen fertilizer increase *Poa annua* kill or decrease discoloration from an application of endothall (Table 5). Nevertheless, grass growing vigorously from adequate nitrogen fertilizer does appear to regain color and fill in thin areas faster, thus contributing to better control. This is one case where rapid growth is desirable and nitrogen fertilizer appears to be the easiest solution.

ROLE OF PRE-EMERGENCE HERBICIDES

When you think about it, it is obvious that without using a pre-emergence herbicide there is no way to keep *Poa annua* seed from germinating and filling in areas where mature plants were killed. Overseeding with vigorous germinating desirable grasses such as perennial ryegrass may be the best alternative to pre-emergence herbicides simply because it offers some competition for germinating *Poa annua*. Nitrogen fertilizer will increase the rate of fill in by desirable grasses, but will not otherwise discourage young *Poa annua* seedlings. Outside of these alternatives pre-emergence herbicides are still the only way to prevent regrowth of *Poa annua* from seed.

NUMBER OF TREATMENTS

Tests up to this point indicate that more than one application of endothall is necessary for adequate control of annual bluegrass. With a single application at optimum rates control will vary from 50 to 80%. This is the case even when pre-emergence herbicides and strong fertilizer programs are used. Repeat applications no closer than 8 weeks later will generally achieve additional control (Table 6). After the first year, applications can be made on an as needed basis to keep *Poa* populations under control. Under normal conditions no more than two applications in a year should be made. Frequent repeated applications will cause thinning of the desirable turf.

ADDITIONAL FACTORS

Several management factors also effect the ultimate success of any *Poa annua* control program. Vertical grooving, coring, and topdressing with cores or nonfumigated soil mixtures can all encourage *Poa annua* invasion by introducing seed and/or providing a good seed bed for germinating *Poa annua*. A solution to this problem would be to apply a pre-emergence herbicide after completion of these chores, prior to germination of the *Poa* seed.

As you have undoubtedly heard before, one of the most commonly abused management tools is the fertilizer program. In attempting to control *Poa annua* it is important to keep phosphorus levels low, nitrogen levels moderate, and for bentgrasses, sulfur levels around 2.5 to 3.5 lb S/1000 sq ft/year. Excessive nitrogen and phosphorus and disregard to proper balance of nutrients has helped to make the *Poa annua* problem much worse than it should be.

In new seedings failure to choose the best adapted grass generally means *Poa annua* will invade rapidly. The classic and continuing example of this is the use of Kentucky bluegrass in wet shady areas such as tees. The added stresses of low mowing and heavy wear means failure everytime. A better choice might be a mixture

of fine fescue and perennial ryegrass followed by periodic overseedings with ryegrass.

SUMMARY

After three years of testing, a basic program for control of annual bluegrass in turf has been developed. The basis of the program in selective post-emergence removal of the *Poa* with endothall herbicide. Pre-emergence herbicides are used to prevent *Poa* from reinvading from seed. A strong nitrogen fertilizer program is necessary to speed up fill in by desirable grasses. Factors influencing success include herbicide rates, timing, temperature, moisture, and maintenance before and after treatment. All must be in acceptable ranges for acceptable results. Details of the program have been worked out for western Washington in particular. Less information is available for eastern Washington and adjacent areas east of the Cascades. Climatic factors in these regions may alter both timing and rates. It is difficult at the present time to extrapolate to these areas.

RECOMMENDATIONS

Endothall is not presently registered for *Poa annua* control at the rates we have found effective. Therefore, it cannot be used legally for *Poa annua* control in turf as described in this paper. We are now working with the manufacturer in an effort to get appropriate label changes so endothall can be used in the Pacific Northwest. If and when label changes occur, we will publish a comprehensive recommendation for the use of endothall in turf.

ACKNOWLEDGEMENT

I can't thank the Northwest Turfgrass Association and its generous members enough for their contributions to this special research fund. Without their help this research could not have been done. My one hope is that the future bears out it was money well spent.

TABLE 1. Response of selected Kentucky bluegrass cultivars to endothall at 2.5 lb/acre ai + X-77.

Cultivar	Tolerance	Cultivar	Tolerance
EVB 532	9.3	Sydsport	8.4
Baron	8.8	Adelphi	8.3
Nugget	8.8	Bonnieblue	8.3
A-34	8.8	Merion	8.3
Victa	8.6	Fylking	7.5
Glade	8.4	Windsor	7.3

Scale: 1 = complete kill, 10 = not affected

TABLE 2. Response of selected perennial ryegrass cultivars to endothall at 2.5 lb/acre ai + X-77

Cultivar	Tolerance	Cultivar	Tolerance
Derby	8.3	Yorktown	7.6
Pennfine	8.0	Citation	7.5
Ensporta	7.8	Manhattan	7.5

Scale: 1 = complete kill, 10 = not affected

TABLE 3. Kentucky bluegrass color as affected by timing of endothall applications

Treatment kg/ha ai	Color	
	April 20, 1977	July 13, 1977
2.0	7.3	6.7
2.0 + X-77	5.5	7.2
2.5	6.5	7.0
2.5 + X-77	4.7	6.3
3.0	5.3	6.3
3.0 + X-77	4.0	6.0
Check	9.0	8.3

1 = Brown, 10 = Dark Green

TABLE 4. Effect of fall endothall applications on bluegrass color and density (sprayed 10/4/76).

Treatment	Color 1 wk	Density 8 wks	Density 12 wks
Check	9.0	9.0	9.0
1.5 kg + spreader	6.0	7.8	7.5
2.25 kg + spreader	4.5	5.3	5.6
3.0 kg	5.3	6.3	6.9
3.0 kg + spreader	3.8	4.3	4.4

FIG. 1. Appropriate times for spraying endothall

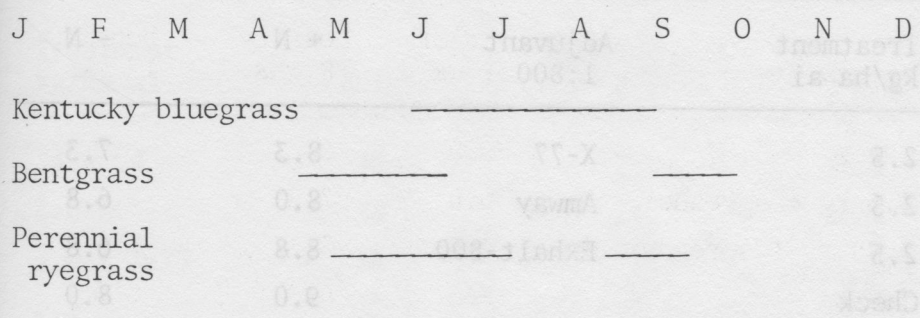

TABLE 5. Effects of N fertilization and spray adjuvants on bluegrass color after endothall treatment.

Treatment kg/ha ai	Adjuvant 1:800	+ N	- N
2.5	X-77	8.3	7.3
2.5	Amway	8.0	6.8
2.5	Exhalt-800	8.8	6.8
Check		9.0	8.0

TABLE 6. Effect of endothall rate and number of treatments on Poa annua control.

Treatment kg/ha ai	% Poa annua		
	Before	1 trt.	2 trt.
.4 + .4	40	28.3	28.3
2.0	38	21.7	10.7
2.0 + X-77	38	7.3	1.3
2.5	37	7.7	5.0
2.5 + X-77	37	7.0	3.0
3.0	42	6.3	2.0
3.0 + X-77	37	4.3	1.7
Check	33	41.7	58.7

WATER — AN EXHAUSTIBLE RESOURCE[1]

J. R. Watson[2]

Water is a basic constituent of all life. Through the centuries, its availability in a usable state has been a determining factor in the rise and fall of civilizations and in the location of villages, towns and cities. Man, living in those areas where rainfall was inadequate to support or sustain his industry or his agricultural pursuits, learned to impound streams, dig wells and to move water through ditches, canals and pipes from distant areas more bountifully supplied.

Water covers seven-tenths of the earth's surface; yet, it is not an inexhaustible resource. Droughts, fluctuations in the supply of water and recognition that man's activities can both disrupt the hydrologic cycle and pollute water to an extent that renders it non-potable have brought the water issue clearly into focus. As supplies of water dwindle, the same kind of controversy generated by diminishing supplies of oil and natural gas will inevitably arise.

As with oil, the U. S. consumes as much water as a population many times our size. And, because we assign virtually no cost to water -- only to manpower and machinery needed to extract and transport it to the consumer -- we have stimulated and encouraged

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1/ To be presented at the 31st Annual Northwest Turfgrass Association Conference, Salishan Lodge, Gleneden Beach, OR, October 5, 6 and 7, 1977.

2/ Vice President, The Toro Company, Minneapolis, MN.

practices that have been wasteful and in some cases nonsensical. It will be economically painful and politically distasteful to launch corrective procedures.

Water is a finite structure -- a fixed supply -- the water used by Adam and Eve is the same water available today. All we have done is pollute it, thereby diminishing the amount of potable water available.

Both as responsible corporate citizens and as managers of a company supplying product and services to the multi-billion dollar "green" industry and the even larger food-growing industry, we at Toro are deeply concerned about many water related problems. For example, there are many sections of the country today that have insufficient water to maintain normal activity in homes, farms and industry. Tucson, San Antonio and Miami have been informed that they are taking water from their underground supply, upon which they are solely dependent, almost five times faster than it is being replenished by nature. In Long Beach, California, and Baytown, Texas, there has been land subsidence to such an extent that it has cracked utility lines and undermined building foundations, subsidence created by over-pumping of wells. In south central Minnesota, a farmer is defying an order from the state's Department of Natural Resources to stop irrigating from his deep-sunk well which apparently has caused other area wells to run dry. It is possible to cite many such examples, most of them in the western half of our country.

It is not merely a two-year drought that has brought the water issue to a critical point. It is a centry of waste aggravated by a government policy of cheap water and a Panglossian optimism that we could make deserts bloom at little cost. And, it is, finally, recognition that our finite supply of water must be managed to meet future demands imposed by the worldwide, explosive growth of population with an ever-increasing demand for food, clothing and shelter -- all of which must come from existing water supplies.

We have large concentrations of industry and population in areas that do not have the water supplies necessary to support them and no distributive system to deliver water from areas that have an oversupply. We have farmers who continue to use water as if it were a low-cost, inexhaustible resource. And we have a Congress that continues to vote public money for irrigation projects whose purpose is to promote further waste by supplying water at bargain prices. No one seems able to tell us how long the present critical situation will continue. Some climatologists say nothing can be done, that the situation will correct itself in 5-10-25 years.

Over 80 percent of all water used in the world today goes for agriculture, yet it is estimated that we will need a 75 percent boost in agriculture by 1985 to feed the addition in the world's population. The U. S. is already supplying 55 percent of all feed grains that move in world trade, 50 percent of the wheat and 70 percent of the soybeans.

The green spaces that form the lawns around our homes, office buildings and factories; the parks, golf courses, playgrounds and athletic fields, the turf areas on airports and alongside our highways all perform vital roles and all require water. We cannot afford to overlook their value or permit them to be legislated out of existence. For they serve to cool the air and cleanse it of pollutants. They dampen noise. They help satisfy our aesthetic needs and also form the principal environment for the healthful utilization of the leisure hours that have become an integral part of modern-day life. The value of recreational turf and other green areas has never been fully appreciated. At the first threat of drought, authorities are apt to deny water to green areas -- lawns, parks and golf courses -- equating their irrigation with the washing of automobiles. Artificial turf will not serve these functions; yet, without supplemental water, this may become the "grass" of the future.

The growing of food and the maintenance of these green spaces are by no means the only demands on water that the population makes. There are energy needs,

including hydropower; the need to preserve habitats for fish and wildlife; to maintain adequate river depths for navigation; to control salinity in river mouths and on arable land; to provide for water-related recreation, and to supply the water required in industry and commerce.

Faced with this situation, we cannot afford to ignore an important water resource which we are not now utilizing intelligently. It is aptly called wastewater. Standards by which to categorize our wastes are urgently needed, for we are producing them in perpetually increasing amounts and ever more diversity in and near areas of great population density. Among the varieties of wastewater there are liquids which we now send -- treated or raw -- into rivers, that can help alleviate the water shortage problem.

After treatment, wastewater -- or effluent as it is called -- is virtually pure water. There has been some hesitancy about using it to irrigate field crops for human consumption although effluent from Tucson was used by the local farmers there for more than 20 years until it was discontinued in 1970.

However, there is no bar in most states to the use of effluent to irrigate turfgrasses. In fact, it should be strenuously promoted. For active-growing grass will remove a major portion of the impurities in effluent; the soil with its microflora will remove the remainder. The nitrogen removed benefits the turfgrass, diminishing the need for fertilizers. Not only does the effluent provide the nutrients as well as much of the water required by turf, but as a result of filtration, good quality water will percolate through the soil down to the level of groundwater aquifers and, in effect, replenish them.

This system of using treated effluent, which often is dumped as a pollutant into the nearest stream or large body of water, is ideal for irrigating recreational turfgrass, especially in those areas where grasses grow all year round. For example, a city of 5,000 could use all the treated effluent it produces to irrigate approxi-

mately 45 to 75 acres of turfgrasses, less than the acreage occupied by one golf course. A number of our military installations in this country are already making use of the effluent they produce in just such a manner.

Another consideration that makes wastewater irrigation of recreational turf attractive is that it provides for on-land disposal which the Environmental Protection Agency is encouraging as an alternative to disposal into navigable waters. There are most than 2,000 facilities in the U. S. today which provide such a low-cost method of on-land disposal of municipal and industrial wastewater. Their effluent irrigates farm crops, grazing land, forests, sod farms, nurseries or golf courses.

The amount of wastewater available for irrigation is going to expand dramatically in the next few years since many pollution control authorities are making it very difficult, if not impossible, to discharge treated wastewater into coastal waters.

In short, recreational turf -- golf courses and parklands and athletic fields -- can provide a very important public service to the community as a disposal/treatment site, to help conserve water, and to help replenish aquifers while yielding important savings to those recreational facilities in water and fertilization costs. As of now, we know of about 75 golf courses, out of the 12,500 in the U. S., that are using treated wastewater for irrigation.

For a number of years, sprinkler irrigation equipment has been available that applies water wisely and without waste. The major advantage cited for automatic irrigation is that it places control in the hands of the best qualified individual on that turfgrass facility -- the turfgrass manager. Automatic controllers coupled with valve-in-head, or valve-under-head, sprinklers geared to apply water commensurate with the ability of the soil to accept it, conserves substantial quantities of water; and produces superior turfgrass.

This same technology is available (or fast becoming so) for agricultural irrigation. Farmers, like turfgrass managers, must learn to manage their water. And they are doing so. They are learning that, when they overwater, growth and yield are both reduced, due to oxygen deficiency. Experiments in Nebraska disclosed that potato farmers were using two and three times as much water as was needed. Elsewhere through controlled application, citrus growers have been able to reduce water usage approximately 75 percent without affecting yield.

Should the use of treated effluent, wastewater or other non-potable waters be extended to all farm acreage, automatic irrigation systems are ready to handle this application. And they could be equally effective in applying brackish water as more salt-tolerant crops become commercially feasible.

Why is a discussion of agricultural irrigation pertinent to this discussion? For one reason, the dependency of this country on imported oil continues to increase and we pay for that oil in large measure through our exportable foods. Our economy is inexorably tied to oil. Water, therefore, is a critical resource that we must learn to manage wisely and, where possible, learn to replenish.

What are the possibilities, other than wise use of effluents, to replenish our water supply? Dig more wells? Hardly an answer when water tables are already sinking dangerously low in water-short areas. Cloud seeding and desalination are, for the most part, prohibitively expensive and of limited benefit. Both are possibilities for the future. And, in the case of desalinization, it may be useful to harness national energies and funds behind a drive to find an inexpensive way to change "sea" water into "fresh" water, if for no other reason, because of the great amounts of sea water available.

And, we should encourage breeding and selection of salt tolerant and salt-resistant crops, including turfgrasses. In many areas there are supplies of brackish

water that could be used to irrigate plants. These supplies, like sewage effluents, go begging because the plants that respond to such waters have no economic value.

We must approach the problem of water utilization and water management like businessmen and advocate and support policies that ensure its conservation and its availability to all levels of mankind.

There are a number of alternatives open to us that will lead to the sensible management of our water resources rather than the panic restrictions that are applied piecemeal when drought hits.

Here are a few which Toro advocates:

1. The establishment of a Federal policy on water management which would encompass: consolidated census of fresh-water reserves, usage, rate of depletion and recharge, federal standards on treatment and use (rather than disposal) of effluent.

2. Strong Federal support for developing the technology of:

...weather modification (including cloud-seeding);
...desalinization, as well as extended use of saline and brackish water;
...methods of water transfer;
...optimum water application on crops;
...development, through breeding, selection and utilization, of salt-tolerant plants.

3. Federal encouragement of: regional councils, similar to the one recently formed by the High Plains States to study the effects of the depletion of water and energy reserves on the economy of that area; and of cooperative irrigation systems for the use of river water.

4. The legal requirement of water flow meters for all usage so that we will have a more realistic idea of water costs, as well as a measure of its use.

We believe that water management is essentially a task for state and city governments. However, the Federal government must take the initiative if we are to act in time, and if we are to have the proper economic incentive to promote wastewater treatment plants and distributive systems.

It will take a Federal coordinator to ride herd on the score of Federal agencies already involved, as well as the state and municipal bodies concerned. What is important is that we have water where we need it, when we need it, and of a quality necessary to continue the activities basic to our way of life.

YOU ARE THE DIFFERENCE[1]

Andrew Bertoni[2]

This will be an unorthodox and relaxed approach to this fine clinic and get-together. You will have a lot of technical and scholarly stuff stuffed in your ear. You have a program of the best practical turfgrass people in the country -- the very finest -- learn from them, they really know. They are willing to share their knowledge with you, to help you improve, to help you do a better job. They can be the difference in your work and in your life.

This talk, "You are the Difference", is non-technical, non-academic, and observes the human side of your profession. It deals with how to apply what you will have learned. It is important that you share the knowledge you receive here, because knowledge is not knowledge unless it is shared. Surely, if the speakers here kept everything to themselves, we would learn nothing. Learning, knowing, and sharing makes a big difference.

1/ To be presented at the 31st Annual Northwest Turfgrass Association Conference, Salishan Lodge, Gleneden Beach, OR, October 5, 6 and 7, 1977.

2/ W. A. Cleary Corporation, Somerset, NJ.

We are all grateful to Dr. Roy Goss for promoting this conference. He is considered by his peers as one of the best in his profession. I personally want to thank him for the many things I have learned, used and profitted by his super efforts. He does make a difference. My gratitude to all the doctors, salespeople, supers for their friendship, continual help and advice. They were a plus difference for me. Especially do I want to emphasize my admiration for Dr. Paul Sartoretto. He is research director for W. A. Cleary Corporation. He is acclaimed as the best turf chemist in the business. He has created many turf chemicals and research that has been a big difference for us all, as well as better golfing conditions.

This also presents me an opportunity to introduce the W. A. Cleary Chemical Corporation. They manufacture the finest of turf fungicides, weedicides, and specialty items. It has been a pleasant and rewarding experience for me to be associated with such fine people and company because of their thorough dedication to the customer. To me this made a difference.

All the above people are the difference -- they influence our lives and our daily chores. They make it a better world because of their know-how and their willingness to share this with us. Their goals are set high, their achievements are phenominal, and they can influence you to also be the difference.

Let us see how we can be the difference -- in the great epic Homer has Achilles state on his return to battle, "You shall know the difference now that I am back again." You too, can be the difference; in fact, you are the difference.

Let's check your everyday operation. How are your relations with your crew, your co-workers, your customers, your family, your church, your community? Do you make life easier? Are you pleasant? Do you just sell a service, or do you sell the beauty of the job? Do you let the customer realize that he is enhancing the beauty of the place -- and hence the value? Do you make your customers' place so attractive that neighbors

will request your business? Does your family love you and respect you? If they do, you have achieved greatness. Are you involved in church and community affairs? They need leaders and directions -- these are times that try the hearts of men. Be a leader and be the difference of a better environment. There is so much good to be done -- strive to bring joy and hope -- not gloom, into the lives of others. To use a well-known motto, "It is better to light one candle than to curse the darkness."

Apply this to your everyday life. Communicate with people; they are afraid to make the first move. Do you tip the scale to make it a better day for people you come into contact with? Remember you can be the difference. If people are down, lift them up. If people are up, compliment them. Mark Twain said, "A good compliment can last me for two months." At least you noticed -- you were the difference. Inspire people to compliment others; it's contageous. I like the attitude of the fellow who says, "All women are beautiful, some are more beautiful than others." Make people happy -- it's so easy. Lincoln said, "Die when I may, I want it said of me by those who knew me best, that I always plucked a thistle and planted a flower where I thought a flower would grow." Have you planted enough flowers -- have you ever seen anyone kick a flower?

There is so much beauty in this world. Enjoy it. Teach others to enjoy it. It will make you different people. There are many people in this world who need you. You are the difference in their lives. You can make them miserable or you can make their lives worthwhile. Let people realize that they should count and enjoy their blessings. It is so easy to give a word of encouragement and love. It is so rewarding to see the response. In all your good efforts, it is gratifying to see the difference a kind remark will make. Ask yourself, 'are people better because they know me?'

Don't be John Average or Dick Mediocre -- be a leader even in a small way. Influence people to be better, do better, live better. Someone once said,

"I expect to pass through this world but once. Any good, therefore, that I can do, or any kindness that I can show to my fellow creature, let me do it now... for I shall not pass this way again."

Especially do we feel that one of our great responsibilities is to make fond memories for people -- especially children. It is our Godgiven duty to instruct, direct, and influence children in the ways of truth and happiness.

Our profession is one that is difference. We work with the Great Architect and carry out His beautiful plan -- this poem tells it all:

Prayer for God's Good Earth

Father,
You looked on everything that you had made
and saw that it was good.
But we have squandered
the riches of creation.
We have laid the ax to the mighty
forests.
We have despoiled the green
hillsides
and wasted earth's mineral wealth.
We have fouled the air,
littered the countryside
and polluted lakes, streams and
oceans.
Voices have been raised to stop us
from squandering our inheritance.
May we heed them.
May we heal the earth.
And one day, may we look on our
planet
and say with pride,
once again,
"Behold, it is good."

So stop sometime and ponder how wonderful our vocation is. It helps the environment, it creates beauty. Keats said, "A thing of beauty is a joy forever." Your

work with nature makes this a wonderful, beautiful world. Do you see the beauty around you? Walter Hagan said, "As I go through life I want to stop and smell the flowers."

You are the difference in every step of your work. As we in the industry say, "Our product is only as good as the applicator." If you put on a chemical or fertilizer too heavy, it will burn and cause damage; if applied too lightly, it will be ineffective. If not properly protected, it can hurt flowers, plants, trees that received the dose in error. You again are the difference -- not only for yourself but your employer, who could easily lose the contract. Remember, no matter whose payroll you are on, you are working for yourself. Work to please others.

Adopt a positive attitude, about yourself, and your job. Have a personal individual committment; have a game plan. Motivate yourself, do it better than anyone else. You are better than you think. Go two steps further in your plan, make it two points better. Thank God that you can envision what you and your work can do. Don't accept anything less than perfection, and when you finish your days labor look up and thank your maker for letting you be the difference.

EQUIPMENT MAINTENANCE FOR ALL TURF[1]

W. H. 'Babe' Brinkworth[2]

Welcome to this session on Toro Preventive Maintenance. We will deal primarily with institutional or commercial equipment in the presentation. However, the great majority of the information discussed here may be directly applicable to homeowner equipment also.

Let's define "Preventive Maintenance". It is a scheduled program of attention designed to insure that a piece of equipment will incur a minimum of repair expenses and down time.

"America's beautification program is grass, more grass, and still more grass." This will mean an increase in manpower requirements, cutting equipment requirements, and dollar expenditures. Cost saving techniques are already important and will become even more important in the future as inventories of equipment grow. Preventive maintenance is one of these important cost savings practices.

Let us break up the topic of preventive maintenance into nine specific areas. Let's look at cleaning, lubrication, care of reels and bed knives, care of rotary blades, engine maintenance, daily inspections and adjustments, storage areas, work area, and operator training.

1/ To be presented at the 31st Annual Northwest Turfgrass Association Conference, Salishan Lodge, Gleneden Beach, OR, October 5, 6 and 7, 1977.

2/ Toro Manufacturing Company, Cupertino, CA.

Grass is one of the most widespread crops that man cultivates. It has substantial economic value, and is the base of most recreational activities. To make it look beautiful man applies many and varied cultural techniques. Mowing is one of these, but it is the last thing we do, from a maintenance standpoint, and really and truly, how grass is mowed does more to reveal its true beauty than perhaps any other maintenance factor.

For years the lawn mower industry manufactured small handmade tools, something a little better than an actual scythe or sickle, but still involving a lot of manpower and labor. Even when they realized that a self-propelled unit could make a man more productive and get more work done, for too many years these units were crude, did mow the grass but in most cases were hard to handle and dangerous to use. In my thirty years at Toro I have seen the industry go from this type of equipment to some really sophisticated units.

Ten and 15 years ago hand walk mowers were still a large percentage of our sales and that of the industry, but the demand has been for increased production and ease of maintenance, operator comfortand width of cut. I think the major development over the past five years has been to make turf equipment wider in cut, minimize turf damage and simplify it so that the operator can be more productive and leave the area with a well groomed look.

With a wider cut, more power, and with the demand for a less expensive maintenance, chains, gears, counter shafts and belts are disappearing for a more economical way to drive cutter reels, rotary blades and traction units. Hydraulic power is certainly here to stay. Hydraulic components are low-maintenance, longlasting, but do require a greater amount of skill for repair or maintenance for the unit. Gone are the days when a screwdriver or a wrench will suffice as tools to make necessary adjustments and do repair work to this type of equipment. Skill and knowledge are two of the main ingredients in servicing hydraulic equipment. Therefore, training of your mechanics is essential.

Three years ago Toro made a major contribution to the industry in setting up one of the finest service training centers in the United States. Hundreds of service people have gone through this school to learn how to service hydraulic equipment, sharpen reels, work on air cooled and water cooled engines, and in general to refine their expertise to where they are making a solid contribution toward making this equipment run correctly.

In some areas of the United States where miles make it very costly to travel to Minneapolis to their service center, Toro has embarked on a program to bring service to the users of Toro equipment. We have done so with a mobile service van. Currently 41 of these vans are in the field across the United States. This van brings service to your door, not only for your equipment but for training your personnel on the spot. This van is driven by a factory trained man, well versed in all concepts of mowing equipment. He has in his truck a complete complement of equipment to test, overhaul or sharpen any of your mowing equipment. He is there on a regular basis, just like your mailman.

I'm sure there is not a man sitting in the audience who has not equated what costs may be when a unit is not working. We define it as down time, and of course, down time equals parts plus labor plus hours lost of productive use of your equipment. The industry is endeavoring to reduce down time by making equipment better and designed specifically for longer hours of mowing.

Today we just don't buy a piece of equipment and put it on the job, continue to run it and minimize the maintenance that should go into the unit on a regular basis. We should keep maintenance records on each piece of equipment that we use. Ready reference of the model and serial number is important. The engine type and the engine serial number is sometimes good information to have on hand, especially when purchasing parts. To know the purchase date of the equipment and when the warranty expires, as well as who you purchased the unit from -- all this is vital for service repair. I recommend keeping this form simple. Otherwise, if it is too compli-

cated no one will make the daily entry to your record. Fill out this simple daily record, and here are some of the things that it will do for you. It will certainly indicate to you your operation costs on that specific unit. It will also indicate the amount of down time the machine has had for repairs. A replacement guide: It is wise to know when to trade a machine that is costing you a lot of money to operate. Fourth, and I feel most important, it gives you an accurate guide as to when to service the unit.

Another important part of the machinery business is the need for properly trained operators. There are people who are mechanically inclined, and there are people who could receive all the training in the world and still not have a knack for running equipment. I feel it is very important that you choose an operator carefully, and then make sure he gets proper instruction.

I have jotted down five important segments of a training program. To have thorough knowledge of the equipment goes without saying. Know its limitation. Know its capabilities, and know the area in which it should work and work well. Don't have the operator experiment. This can be costly.

Second, a smart operator observing the way the equipment is operating can certainly save you money if something gets ready to fail. A lot of us go on a program of "work the unit until it fails", rather than preventive maintenance. Waiting for something to fail can really be costly, because usually the failure of a component on a piece of equipment takes two or three other components with it.

Third, knowing the proper patterns of mowing. This is an area where an operator can save money, mowing the full width of his unit, knowing which way to mow a bank. To oppose the grass in his cut from a previous mow is good Agronomy maintenance.

Fourth, to spend some time each day inspecting and cleaning his equipment. This is essential and should be charged into the daily program as a must.

The fifth ingredient is something that is hard to find today in the working people . . . the word "pride". If you can instill pride in your operator, this will be a very important ingredient.

To have an adequate storage area that is clean and well managed is a very important ingredient. In my travels I have seen good plants and bad plants. Make sure your man is well trained, that he has proper tools for working on the equipment, and some supervision in this area to make sure that he works clean and neat, especially around hydraulic components.

The days of poor working conditions for maintenance have essentially gone. But it is surprising how many of us continue to try to maintain expensive equipment with inadequate facilities. But usually you find that type of maintenance with this type of service yard -- poorly managed, poorly planned. To get equipment out of this equipment storage shed -- which was a good one, I might add -- took time, cost money, and risked damaging smaller units in the crunch to go to work in the morning.

Here's an example of a man that was assigned to collect mowing equipment from several different areas in a truck with a hydraulic dump. Giving no thought to cost through damage, he merely dumped the load to make sure he would be at the corporation yard in time to quit. Little did he know how much damage he caused to this reel cutting equipment.

Daily cleaning is essential. This picture was taken in Japan, and I guess if I had my druthers as to how equipment should be cleaned, this is a clear indication of how to do it. Here in America the cost would be prohibitive, but something between this type of cleaning and the cleaning you will see in my next slide --- should be done on a daily basis. I don't recommend the high pressure hose being used in seals and bearing areas. I would recommend the man take the nozzle from the hose and let a large volume of water wash the grass and dirt off, and at the same time the unit should be closely

inspected and lubricated and made ready for an early start the next day. Washing is essential.

We have talked briefly on some preventive maintenance techniques and the direction in which the industry is moving. Let's look now at some different areas and how they are maintained, and how this maintenance is performed in this manner.

Fertilizer, a sharp mower carefully selected, a mowing pattern, a meticulous superintendent, and a beautiful looking ball park. These are the ingredients that make up successful turf management.

Utilizing the choice of proper equipment to mow large areas can certainly make the difference in the cost of mowing. To mow an area such as this with a triplex mower would run on an average of $2.75 an acre. This is exclusive of the operator. This would include gas and oil maintenance, sharpening and pro-rating the cost of the equipment over a three year period. Approximately $2.75 an acre. Look at the same area mowed with a 7-gang hydraulically operated turf tractor, where you can increase and enlarge your width of cut with a simple flick of a lever. Cost per acre over a 5 year program would run in the neighborhood of 75 cents an acre.

When we buy a piece of equipment we generally look at the price. Price is the dollar amount for which a piece of equipment is purchased. It is only a small part of the cost. Before we get confused, the cost we are now talking about is not the producer's cost, or the seller's cost, but rather the purchaser's cost. It is the total expense of owning, operating and maintaining a piece of equipment over a total period of serviceable life. It should always be expressed as cost of unit or work time. In the case of a mower total cost is as follows:

1. Price, plus
2. Cost of fuel, plus
3. Cost of operator, plus
4. Cost of repair parts, plus
5. Cost of labor to repair, plus

6. Cost of insurance, plus
7. Cost of interest on investment.

Add these, subtract the resale value at the end of the service life and equate the rest against lifetime productivity. In other words, what will be your total cost -- "Dollar per acre mown?"

Choosing the proper piece of equipment for an area such as this will not only enhance the beauty of the turf, but will save you dollars. Keeping an area looking as you see this certainly is your billboard as to what kind of an operator you really are. This is where you display your wares in the finished product. I have seen good turf mutilated by mowing, and have also seen fair quality turf made to look excellent through a carefully planned mowing exercise.

Turf can be made to look beautiful with a lawn mower. In Japan beauty is of the utmost. Green grass, a nice tree tastefully reflected in a pond -- all these certainly enhance the beauty of this area. What I am saying here is, speed can take away from the look on how grass is cut. I know time is money, but sometimes we have to slow down to get the job done right. This picture shows how speed was the prime offender in mowing this good stand of grass. The operator made his turns so fast with a triplex mower that no design by any engineer could keep a full floating gang of mowers on an even keel at the speed this operator was mowing. To have made his turns more slowly, with a little thought to enhancing the beauty of this area, could have avoided the grass looking mutilated.

A correct frequency of clip and also a height of cut adjustment could have made this motel putting green look a lot better. This picture shows a lack of interest, a lack of knowledge, and a lack of good training on how bentgrass should be cut. Green grass, properly cut, can certainly enhance the beauty of an area, and also keep the grass plant healthy.

Here are six ingredients that might help some of you choose the correct mowing machine in your operation.

Know the correct height of cut to mow the grass. We know that bentgrasses certainly need to be cut very short in order for them to grow and continue to be healthy. The height of bluegrass, fescue and bermuda -- we should look to all these different types of grasses with different needs for mowing equipment.

Frequency of clip, which is the number of bites that the reel type lawn mower makes in its forward motion. A mower cutting with a frequency of 1/4 inch clip is designed to mow grass in a very low height of cut. The height of cut and the frequency must be compatible. If you are mowing at 1½ inch, then you must have a mower with no less than 1 inch frequency of clip. To get it too far out of the compatible range would either result in corrugating or fanning of the grass, so be careful in selecting your mower. Make sure that the frequency of clip is suited to the type mowing you will do in certain species of grass.

Mowing patterns. Certainly we have an area here that we should look at. We should want to consider a safe pattern for your operator. Hills and banks should be maneuverable safely, and well within the limitations of the mower's capability. Trying to mow hills the wrong way can certainly result in mechanical damage.

Save time with full width of cut. To oppose the grass from a different angle each time prevents matting and thatching, and will help to leave a distinct pattern on the mowed surface.

Conditions. I am sure that we would all choose a perfect condition of dry grass if we had our choice, but it is not always dry when we have to mow, so be sure when choosing a mower you have adequate flotation on the tires and that the mower is very sharp. It takes a sharper mower to cut wet grass than it does dry. Make sure that your mower will cover and work in the terrain that you are going to cut. So many people try to substitute a mower not capable of climbing or without the stability to stay on hilly terrain.

Operation is a big word. It encompasses a well-trained operator, a well-serviced mower, and many other mowing techniques that we learn in this area.

There is a trend in the industry to enhance beauty on commercial buildings, schools, parks and homes by picking up the clippings and debris. Also, customers are asking for multiple use units. They want to cut and vacuum, and still have a machine that, when the snow starts to fly, can be equipped with snow plowing equipment. I see a very sudden shift to filling these requirements being done in the industry.

Varying width of cut. Machines that are simple to maintain, easy to operate, and have tremendous maneuverability. I think the things that I hear most from a lot of users are that they want a mower to give them a good width of cut and high production, yet the mower must have hand mowing trimming capabilities, and of course, larger capacity, with hoppers more durable, have been requested. Most landscape people have to consider flower beds, curbing and trees as obstacles that must be trimmed. To eliminate handwork, of course, is certainly an important consideration.

Tree trimming. With the ease of operation the operator is in no danger of damaging expensive trees. The man you see here has complete control of his 52-inch width of cut, yet he is trimming this tree as it would be done with hand equipment.

Our company was the first to introduce water cooled engines to equipment such as this. We have found that it has made a big hit in the industry, and has proven to be a very smart move for our company. Water cooled engines run longer and cooler and can do this on less maintenance than the air cooled. Manufacturers are protecting engines now with thermo-couples to shut engines down when too much heat is experienced in the engine area, and cannot be re-started until either the cause of overheating has been corrected or the engine has cooled.

Again, manufacturers are all designing grass pickup to fit all types of rotaries, and landscape men are now designing turf areas to accommodate equipment like this. Even though this machine is capable of carrying 600 to 800 lb of debris, it hasn't taken away from its maneuverability. Reel type machines are still in the line, but are being replaced with large rotaries, and with the introduction of their bagging capability reel mowers are not now considered formal mowers unless you are cutting in the very low height of cut ranges. All types of hydraulic prime mowers are being introduced, and the little box scraper for light landscaping in tight areas has certainly made a big hit with the landscapers.

Tractor drawn gang mowers that can be controlled by hydraulic lifts are still popular on the larger areas, and still perform at a lower dollar cost per acre than anything that has been designed. This is an example of operator comfort, but in the summer and in the winter. Air conditioning, roll bar safety, stereo, power steering, and all the niceties that the automotive industry has given us for a number of years. Comfort of the operator means higher productivity.

I guess if there were four words to sum up what I have said about prime mowers and mowing equipment, they would be maneuverability, traction, control and capacity. Last but not least, a four letter word that we should all make ourselves aware of -- ANSI. This is the government agency that writes the safety standards. Make sure that the equipment that you buy carries this sticker. Make sure that it conforms to ANSI standards, and for any of you who would like to read the standards, it is ANSI-B 71.1 - 1974. These are the requirements they have written for the outdoor power equipment institute.

In closing I would like to mention briefly trends that are in the industry. The string mower, as the industry calls them. This is a gas or electric powered edger that cuts reeds and grass with a monofilament fishing line. At the southern turfgrass show in Orange County there were from ten to fifteen suppliers, all making different configurations of the string mower, and in the next few slides I will show you the different types.

1. Electric two-cycle power.

2. Edger type configuration with a string.

3. Units in a horizontal position or a vertical position or a vertical position with the mere squeeze of the handle.

4. A two-cycle Olson-Wright engine on the cutter head. Gas tank and breathers in the handle, and as the manufacturer says, light weight-heavy duty, which is a phrase too often used, I would think, the engine being a very vulnerable part of a maintenance area.

Toro has not entered the two-cycle field, but the Japanese have, and from the users' standpoint this seems to be one of the durable units in the industry. It is made by the Green Manufacturing Company.

Grass growing and grass cutting are always going to be a necessary factor in our economy today. How we do it certainly plays an important part in the landscaper's life. The industry is moving at a very fast pace, and you will see many changes in the next five years. Manufacturers used to design equipment basically for parks, golf courses, schools, etc. Today the non-golf market is making a very big picture in the manufacturer's future plans.

I am sure you will all agree that training in how to maintain this equipment is certainly here to stay. New models in different shapes and different confiru-rations will certainly be here in the very near future. Because the lawn mower industry is growing at a very rapid pace and you, the customer, are our main consideration.

TURF GRASS RESEARCH REPORT[1]

Alvin G. Law[2]

At the last conference we reported initial effects of the application of a biological material, furnished for these trials by U S Steel, Agricultural Chemicals Division. We found an effect on bentgrass thatch but no effect of the biodethatch on Kentucky bluegrass. In 1977 we resampled the areas with a turf plugger of 1 inch diameter, washed out the soil and measured the amount of thatch by oven drying the material, then firing it to burn the organic matter and determining the total organic matter by the difference in weight. The data are reported in Table 1. In each case the green material was removed from the plugs prior to washing and burning.

TABLE 1. Effect of biodethatch on the amount of thatch accumulation under Penncross bent and Fylking Kentucky bluegrass.

	Bent av. grams o.m.	Bluegrass av. grams o.m.
Control	4.1	3.03
Biodethatch*	5.8	3.52

* Applied to Bent July '75 and April '76 but only April '76 to Bluegrass.

1/ To be presented at the 31st Annual Northwest Turfgrass Association Conference, Salishan Lodge, Gleneden Beach, OR, October 5, 6 and 7, 1977.

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

Thus there has been no reduction in thatch accumulation under Penncross bentgrass from two successive years of application of the biological degradation material. There are reports from the south in turf conference proceedings that the material has a beneficial effect on the decomposition of the thatch. It may be that our cool nights and long cool winters reduces the likelihood of the biological activity in the thatch.

A second experiment to determine the value of available chemicals on the control of annual bluegrass was initiated in May 1977. Table 2 summarizes the data currently available from the trials, carried on in cooperation with Steve Poole of the Pullman golf course.

TABLE 2. Annual bluegrass control trial - Pullman, WA, 1977.

Treatment Appl. 5/26		Phytotoxicity[1]			Original An. Blue Rating	Control[2] Readings		
		5/31	6/8	9/6		6/8	7/12	9/6
	Rate[3]							
1 Posan	2	1	1		4	2	7	4
2 Roundup	1/4	2	5	1	5	3	8	3
3 Nortron	1/2	1	1	1	5	1	7	3
4 "	3/4	2	1	1	5	2	6	3
5 "	1-1/2	2	1	3	4	2	9	2
6 Endothall	2	3	3	2	3	3	8	1
7 "	3	5	4	1	3	4	7	2
8 " 2 + Sticker		6	5	2	3	6	8	2

1/ 1 = no damage 9 = severe damage

2/ 1 = no control 9 = complete control

3/ lbs. active material per acre

Roundup at 1/4 lb per acre and endothall at all three rates showed a great deal of burning of the bluegrass turf in the evaluation made at two weeks after

treatment. By early September, however, this phytotoxicity had disappeared and there was no permanent injury to the turf. Control estimates varied depending on the time after treatment that the reading was taken. On July 12, about 2 months after treatment, Roundup, Nortron at 1-1/2 lbs per acre and endothall at 2 lbs plus a sticker-spreader gave good control. By September there was some recovery of the annual bluegrass and the Posan treatment was superior.

A third research project in cooperation with the Jacklin Seed Company, Dishman, division of the Vaughn-Jacklin Corporation involves the evaluation of available ryegrass and bluegrass varieties for general purpose turf in the Inland Empire area. Data are available on the winter survival and mowability of 28 ryegrass varieties. All have survived two winters in the state-line area of Washington-Idaho where they were kept close mowed for turf. These include the fine leaved types such as Pennfine, Manhattan, Eton, Caravelle, NK-200 and Citation among others. In seed production trials many of these do not survive beyond the first season. We observed the extent of mower damage to the ryegrasses and found the fine leaved types showed somewhat less leaf shredding after mowing than occurred on the standard types. Within the fine leaved varieties, Pennfine, Citation, and NK-200 showed the least shredding after mowing.

ADVANCED MANAGEMENT STUDIES ON 29 VARIETIES[1] AND CULTIVARS MANAGED AS PUTTING GREEN TURF

Roy L. Goss[2]

Bentgrass varieties and cultivars have been evaluated for 4 years to determine quality characteristics and management response to fertilization, topdressing, mowing, aerification and disease susceptibility.

Plots have received two levels of nitrogen - 5 and 10 lb/1000 sq ft/year with uniform applications of phosphorus and potassium. Potassium has been applied at 2 and 4 lb/1000 sq ft/year, and phosphorus at 2 lb P_2O_5 per 1000 sq ft/year. One-half of each plot has continuously received maintenance levels of selected fungicides, except those containing sulfur, to determine quality factors without fungicides and determine resistance of these grasses to *Fusarium* patch disease. In general, the plot portion receiving maintenance fungicides are superior in quality to the part receiving no fungicide. The response of the various bentgrasses to high and low levels of nitrogen are extremely variable. Some varieties exhibit no difference in color, density nor growth characteristics between high and low N. Some varieties have better color and density at the high N level while a few have better quality turf at the low N level.

1/ To be presented at the 31st Annual Northwest Turfgrass Association Conference, Salishan Lodge, Gleneden Beach, OR, October 5, 6 and 7, 1977.

2/ Agronomist/Extension Agronomist, Western Washington Research and Extension Center (WSU), Puyallup, WA.

Except in a few instances *Poa annua* encroachment has been greater on plots receiving high N as compared to the low N portion. Endothall was applied to all plots in the summer of 1977 and a significant portion of the *Poa annua* population was removed and those with high levels of *Poa annua* have shown significant improvement up to present. None of the varieties except Kingstown velvet bent showed any adverse response to endothall applications. Table 2 indicates response of bentgrass varieties and cultivars to management treatment.

TABLE 2. Response of bentgrass varieties and cultivars to putting green management.

Variety	Color Rating - March, 1977 High N	Low N
Stolonized:		
Arlington	8.9	8.3
Nimisila	9.5	8.8
Northland	9.5	8.8
Waukanda	9.5	8.9
Yale	9.6	9.3
Keen's 36	8.8	8.3
Arrowwood	8.1	8.8
MCC-3	8.6	8.4
UCR-30	8.8	8.5
Penn #5	8.9	8.8
Smith 721	9.1	8.4
Smith 732	8.9	8.3
Smith 736	9.1	8.3
Hayden Lake	9.5	8.6
Dudeck III	8.0	8.0
Seeded:		
Bardot	8.9	8.8
Boral	8.5	8.0
Highland	8.0	7.3
Kingstown	9.6	9.1
Novobent	8.8	8.1
Penncross	9.3	8.3
Prominent	8.8	7.8
Emerald	8.6	8.0
Tracenta	9.5	8.8
A-75	9.3	8.5
Rusta	8.3	8.3
Aggrettina	7.8	8.1
Tendenz	9.3	8.5
PSU-PBCB	8.8	8.8

N, P, AND S INVESTIGATIONS[1] ON PUTTING GREEN TURF ESTABLISHED ON SAND

Roy L. Goss[2] and Tom Cook[3]

Emerald creeping bentgrass turf established on a sand/sawdust medium in July, 1975 have been under prescribed treatment now for nearly 1½ years. Nitrogen sources include Milorganite, urea and ammonium sulfate. Potassium is uniformly applied as muriate of potash and phosphorus is applied at two levels from phosphoric acid.

The purpose of this investigation is to determine the levels of phosphorus and sulfur required to maintain *Poa annua*-free putting green turf established on sand. We must determine not only optimum but also the highest levels of sulfur which can be applied with sand culture.

The Emerald creeping bent has developed into an excellent stand and fine quality putting green turf during this two-year priod. Differences in color, density and *Poa annua* are shown in Table 1. This project will be continued for an additional 3 to 5-year period.

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2/ Agronomist/Extension Agronomist, Western Washington Research and Extension Center (WSU), Puyallup, WA.

3/ Dept. of Horticulture, Oregon State University, Corvallis, OR.

TABLE 1. Effects of N, P, K, and S on putting green turf established on sand.

Treatment					8-3-77 Color [2]	5-17-77 % Poa annua
	N	P	K	S[1]		
Urea	10	2	3	0	9.3	3.3
Urea	10	2	3	1	9.5	2.0
Urea	10	2	3	2.5	9.4	6.0
Urea	10	2	3	3.5	9.4	3.3
Urea	10	2	3	4.5	9.6	3.0
Urea	10	.5	3	1.0	9.5	3.5
Urea	10	.5	3	2.5	9.5	1.0
Urea	10	.5	3	3.5	9.5	2.3
Urea	10	.5	3	4.5	9.5	4.0
Urea	10	.5	3	2.5	(spring) 9.5	4.0
Urea	10	.5	3	3.5	(spring) 9.5	2.3
Urea	10	.5	3	4.5	(spring) 9.5	1.5
Ammonium sulfate	8	.5	3	0	8.9	2.8
Ammonium sulfate	12	.5	3	0	9.3	3.0
Ammonium sulfate	10	.5	3	0	9.5	2.0
Ammonium sulfate	10	.5	3	1	9.4	2.3
Ammonium sulfate	10	.5	3	2.5	9.5	1.8
Ammonium sulfate	10	.5	3	3.5	9.4	2.3
Ammomium sulfate	10	.5	3	4.5	9.1	3.5
Milorganite	10	0	3	0	8.4	28.8
Milorganite	10	0	3	1	8.8	26.3
Milorganite	10	0	3	2.5	8.8	22.5
Milorganite	10	0	3	3.5	8.9	20.0
Milorganite	10	0	3	4.5	9.0	18.8

[1]All nutrients expressed in elemental form.

[2]Color - 1-10. 10 = darkest green.

SLOW RELEASE NITROGEN TESTS[1]

Roy L. Goss[2]

Treatments were initiated in early summer of 1976 on a mixed stand of bentgrass and *Poa annua* to determine the effects of Canadian Industries Ltd. sulfur coated urea, urea formaldehyde, IBDU, and compared with ammonium sulfate and urea for turfgrass quality. Rates of nitrogen applied are 4 and 8 lb N/1000 sq ft/yr, both rates applied as single applications and split applications. Split applications are applied in April and September of each year.

Initially, 8 lb of nitrogen per 1000 sq ft applied in a single application from IBDU and CIL SCU caused some turfgrass burning. No burning was observed from the urea formaldehyde application. We are assuming that the particle density of the sulfur coated urea resulted in mechanical crushing of some particles causing a sudden release of urea which probably caused the burning. The release of large amounts of urea from IBDU at this very heavy rate probably caused the slight amount of burn observed from this treatment.

Since it is not practical nor advised to apply either 4 or 8 lb of N per 1000 sq ft in a single application from ammonium sulfate or urea, these treatments were designed for application of 1 lb of N per 1000 sq ft each month.

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2/ Agronomist/Extension Agronomist, Western Washington Research and Extension Center (WSU), Puyallup, WA.

All treatments are significantly better than check and all treatments receiving 8 lb of N rate slightly higher than those receiving 4 lb of N although the lower nitrogen application has very acceptable color, density and growth. Eight lb of N applied in one application have less color in October than those receiving 8 lb N in two equal applications. The same generally holds true for the 4 lb nitrogen rate.

Although this study is designed to continue for 3 to 5 years, it would appear at this point that split applications of slow release nitrogenous materials are superior to single applications.

Plots will be rated during fall and winter for *Fusarium* patch disease development to determine the effect of sulfur coated urea on this factor. Clipping yield and nitrogen recovery will be initiated in the spring of 1978.

RESPONSE OF HIGHLAND BENTGRASS PUTTING GREEN TURF[1] TO UNIFORM APPLICATIONS OF NITROGEN FROM UREA, AMMONIUM SULFATE AND MILORGANITE ON A SILT LOAM SOIL

Roy L. Goss[2]

Nitrogen treatments have been applied to these plots for a period of 7 years. Initially, investigations were conducted to determine the effect of variable sources of N on the development of *Ophiobolus* patch disease. After a period of four years significant differences in *Poa annua* populations in the bentgrass were observed between urea, ammonium sulfate and Milorganite. Evaluations have been made annually with regard to this factor. Plots treated with ammonium sulfate rated 15 to 20% *Poa annua*, urea, 40 to 50% *Poa annua*, and Milorganite, 70 to 80% *Poa annua*. Selected Milorganite plots were subdivided into 4 equal 5' x 5' plots and for the past three years have been treated with 50, 100 and 150 lb elemental S per acre with one untreated subplot in each main plot. After three years, some botanical composition shifts are observed in the sulfur-treated area, that is, increased bent and decreased *Poa annua*.

Selected duplicate plots of urea and Milorganite were treated with endothall in the summer of 1977 with highly significant *Poa annua* removal with no phytotoxicity to Highland bentgrass. This portion of the treatment program was conducted by Tom Cook in conjunction with his pre and post emergent *Poa annua* control studies. Plots treated with endothall in 1977 should be 95% or more free of *Poa annua* in 1978.

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2/ Agronomist/Extension Agronomist, Western Washington Research and Extension Center, (WSU), Puyallup, WA.

RESPONSE OF BLUEGRASSES, RYEGRASSES AND FINE LEAVED FESCUES TO VARIABLE LEVELS OF ELEMENTAL SULFUR[1]

Roy L. Goss[2]

Plots were established in late summer of 1977 with Bonnieblue Kentucky bluegrass, Manhattan perennial ryegrass and Highlight chewings fescue to determine their response to sulfur applications. We have previously reported several years' work on the response of Astoria colonial bentgrass to variable sulfur applications but little knowledge is available on the response of bluegrasses, ryegrasses and fescues to sulfur applications. Plots will receive two levels of nitrogen, uniform applications of phosphorus and potassium and three levels of sulfur over a minimum of a three-year period. One-half of each plot will be limed to maintain pH of approximately 6.0.

Nutritional treatments will not be initiated until later in the fall of 1977; hence, no data are available at this time.

We are grateful to the United States Golf Association Green Section for thier support of this project.

1/ To be presented at the 31st Annual Northwest Turfgrass Association Conference, Salishan Lodge, Gleneden Beach, OR, October 5, 6 and 7, 1977.

2/ Agronomist/Extension Agronomist, Western Washington Research and Extension Center (WSU), Puyallup, WA.

SNOWMOLD RESEARCH ON BENTGRASS GREENS IN IDAHO[1]

R. D. Ensign[2]

During the fall-winter of 1976-77 snowmold experiments were conducted at Moscow and McCall, Idaho, utilizing bentgrass greens at the Moscow Elks and McCall Municipal Golf Courses. The environmental conditions at these two courses were quite different and the disease expressions were also different.

During previous years of testing, *Typhula incarnata* (grey snowmold) and *Fusarium nivale* (pink snowmold) have been infectious on bentgrasses at these two locations. Eight chemicals and/or combinations of chemicals were applied at various rates as indicated in the table below. Of special interest in these tests was the evaluation of the fungicide Rhodia 26019 1-isoprophyl-carbamoyl-3(-3,5-dichlorophenyl) hydantoin which has shown effectiveness in control of both snowmold organisms.

Plot Design

All chemicals, except the Scotts dry products, were applied in a water solution with an experimental plot sprayer. The Scotts products were applied with a Scotts drop spreader at the settings as indicated. The plots were 5' x 7.5' with four (4) replications at each location. The McCall applications were made October 29, 1976 just before the usual snow cover. At Moscow the applications were made November 5 which was when the first signs of *Fusarium* infection appeared.

1/ To be presented at the 31st Annual Northwest Turf-Grass Association Conference, Salishan Lodge, Gleneden Beach, OR, October 5, 6 and 7, 1977.

2/ Professor of Agronomy, University of Idaho, Moscow, ID.

The green at McCall was Penncross, whereas the green at Moscow was Highland bentgrass.

Climatic Conditions

The precipitation at each of the plot locations was below normal for both locations. Permanent snow cover came at McCall about Thanksgiving and lasted until the 15th of April giving about 135 days of continuous snow cover, a desirable condition for *Typhula*. The precipitation was less at Moscow. September was quite dry; October was dry but about normal; and below normal precipitation was received during November and December. The snow at Moscow was light and infrequent with only short (3-8 days) periods of continuous snow cover. The green at Moscow was favorably located with a southern exposure; thus, melting and drying was rapid.

The disease expression at McCall was excellent and good comparisons were evident whereas at Moscow the infection was light and comparisons among fungicides were difficult to determine. The results of the readings taken from each location are summarized in the following table.

McCall

1. Excellent infection of snowmold pathogens was obtained at McCall with 100% coverage of the disease on the check plots.

2. Of the fungicides tested only Tersan SP in combination with Rhodia 26019 or 1991 gave effective snowmold control.

3. Tersan SP gave good control of *Typhula* where it was used alone but some infection of *Fusarium* was noted at all SP rate levels.

4. Daconil plus RP 26019 gave fair control for *Typhula* with some infection from *Fusarium*.

5. Rhodia 26019 used alone did not give adequate control. *Typhula* infection was significant with all

rates of this chemical.

6. The broad spectrum materials applied under these conditions and rates were not effective in controlling snowmold.

7. Fungicide II at this rate gave a toxic appearance to the grass. This has been previously observed and recovery was noticed after a few weeks.

8. The Course Superintendent applied 2 oz of Tersan 1991 and 10 oz ± of SP in early November and received excellent snowmold control. Summer treatments are usually not necessary.

Moscow

1. The disease expression was limited on the Moscow plots at all rates and combinations of chemicals. Only on the check plots were serious disease patterns noticed. As indicated above, the precipitation was below normal and long drying periods throughout the winter were not conducive to good epiphytotics. Also complicating the readings were the variable color and texture of this Highland bent green which was established many years ago.

2. Fungicides are necessary to control snowmold under these conditions. *Fusarium* seems to be the most infectious pathogen although with longer periods of snow cover *Typhula* could also be serious.

3. From observations it appears some chemicals give a year-to-year residual effect especially under these low rainfall and dry winter conditions. The significance of this residual with respect to disease control and subsequent fungicide rates is unknown. Additional research is needed in this area.

4. From previous research *F. nivale* and *T. incarnata* have been identified. Other workers in the intermountain area have reported a predominance of *T. idahoensis* which may exist in the higher elevations of eastern Idaho. Effectiveness of these fungicides on this species of *Typhula* under experimental conditions has not been determined in Idaho.

Table 1. Snowmold readings from research plots at McCall and Moscow, Idaho, during the winter of 1976-77.

Treatment No.	Chemicals	Rate/1000 ft.[2]	Disease Index[1/] McCall	Disease[2/] Symptoms	Moscow[3/]
1	Rhodia RP 26019	1 oz. (50% a.i.)	9.9	+++	2.0
2	Rhodia RP 26019	2 oz.	8.9	++	3.9
3	Rhodia RP 26019	4 oz.	8.7	++	3.8
4	Rhodia RP 26019	8 oz.	7.5	++	3.1
5	Rhodia RP 26019	16 oz.	5.7	++	3.5
6	26019 + Tersan SP	8 oz., 6 oz. (65% a.i.)	1.4	+	3.5
7	26019 + Tersan SP	8 oz., 8 oz.	1.9	+	2.8
8	Tersan 1991	2 oz. (50% a.i.)	7.5	+++	2.3
9	Tersan 1991	4 oz.	5.0	+++	4.6
10	Tersan SP	6 oz.	3.5	+	3.6
11	Tersan SP	8 oz.	2.3	+	3.4
12	Tersan SP	12 oz.	3.6	+	2.8
13	Tersan 1991 + Tersan SP	2 oz., 6 oz.	2.7	+	2.4
14	Tersan 1991 + Tersan SP	2 oz., 12 oz.	1.7	+	3.6
15	Tersan 1991 + Rhodia 26019	2 oz., 6 oz.	6.8	+++	3.0
16	Daconil	6 oz. (75% a.i.)	6.1	++	2.4
17	Daconil	12 oz. (75% a.i.)	5.0	+++	2.9
18	Daconil + Tersan 1991	6 oz., 2 oz.	6.4	+++	3.3
19	Daconil + RP 26019	6 oz., 6 oz.	4.1	+	2.8
20	Scotts Broad Spec., PMA + Thiram	6½ setting*	8.7	++	3.8
21	Scotts Broad Spec., PMA + Thiram	9½ setting (double rate)	5.9	++	2.8
22	Scotts 101V B.S.	6½ setting	7.8	++	3.8
23	Scotts 101V B.S.	9½ setting	5.7	+++	4.0
24	Scotts Fungicide II	8 setting	3.5	+	3.4
25	Check--No Fungicide	0	10.0	+++	7.1

1/ All index readings 1 = no disease, 10 = 100% infection of plot area
2/ Disease symptoms + = mostly Fusarium
++ = mostly Typhula
+++ = blend of 50% of each pathogen
3/ Symptoms at Moscow were Fusarium only.

TURFGRASS EVALUATIONS IN IDAHO[1]

R. D. Ensign[2]

Most of the major cool-season turfgrasses that are grown for seed in the northwest are under turf evaluations by the University of Idaho. Varieties are evaluated at two locations in the State. At Moscow in northern Idaho 111 varieties are evaluated on rather heavy silt loam soils having clay subsurfaces and where the climate is usually rather cool and moist in the spring and late fall. Supplemental irrigation is needed for turf during rather dry periods in July-September. Another test site of 20 turf varieties is located at the Parma Research and Extension Center in southwest Idaho on light silt loam of 12-15% clay but usually with a relatively high pH. The summer temperatures at Parma are characteristic of the arid Intermountain desert areas in that they are quite warm and the season is longer than at Moscow. Supplemental irrigation is required throughout the early summer to late fall.

Turfgrasses at each of these locations are evaluated for turf quality, spring, summer and fall color, texture, diseases and persistence to winter and summer climates. All of the grasses are evaluated in a monoculture except two entries at Parma are composed of a

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blend. Since Kentucky bluegrass is the dominant turfgrass in the Intermountain area a majority of the entries in both tests are composed of varieties growing in the Northwest for seed. Currently 65 Kentucky bluegrass varieties are under test. In addition, there are approximately 20 fine leaf fescues, 13 perennial ryes, 11 bentgrasses, 2 Canada bluegrasses, 3 timothies, a hard fescue, a tall fescue, and a few assorted species. Most of the grasses are grown under the variety name although some are identified by a development number only. The seed sources were primarily from major seed companies.

Detail data are available in table form and not included within this report. A summary of significant highlights of the evaluations follow:

Spring Green-up for Bluegrasses

Early	Medium	Late
Park Bluegrass	Adelphi	Nugget
Sydsport	Baron	Prato
Arboretum	Cougar	
Delta	Fylking	
K-1-139	Warrens A-34	
Six	Glade	
Troy	Newport	
K2-100	Kenblue	
Captan	Merion	
	Victa	
	Touchdown	
	Bonnieblue	
	Majestic	
	Others	

The fine leaf fescue and bentgrasses usually green up a little faster than the Kentucky bluegrasses. The Canada bluegrasses, perennial ryegrasses, and timothies green up at medium dates.

Summer Color (June-August)

Dark Green	Light Green
Adelphi	Arboretum
Baron	Delta
Fylking	Garfield
Glade	Newport
Nugget	Kenblue
Pennstar	Park
Sydsport	Brunswick
Victa	Ardita
P-164	Rugby
Ram #1	P-59
Galaxy	Troy
Sodco	
Majestic	

There are several varieties with average summer color.

Fall Color (October)

There is considerable variation among bluegrass varieties in fall color. Some varieties maintain a dark green color well into the late fall, other varieties loose some color during these cooler periods of shorter days. Varieties showing good color retention are:

Baron
Fylking
Newport
Victa
Touchdown
Aquilla
Continental

Mowing Heights vs. Color

Plots at Moscow were mowed at three mowing heights: 2.5 cm (1"), 5 cm (2"), and 7.5 cm (3"). Plots at Parma were mowed at 3.7 cm (1.5") and 7.5 cm (3"). Most bluegrass varieties exhibit best color at the 7.5 cm (3") mowing height. Varieties that best retain color at low mowing heights are:

Moscow	Parma
Cougar	Baron
Fylking	Cougar
Warrens A-34	Merion
Nugget	Nugget
Pennstar	Pennstar
Victa	Touchdown
Beltturf	
P-164	
Ram #1	
Glade	
Galaxy	
Sodco	

Texture

Fine to Medium	Semi-Coarse
Delta	Adelphi
Fylking	Baron
Garfield	Warrens A-34
Kenblue	Sydsport
Nugget	Victa
Park	Ram #1
Prato	P-164
Touchdown	Cheri
Merit	Georgetown
Plush	Holiday
Continental	Rugby
K2-100	Parade
	Majestic

Diseases

No major disease outbreaks were noticeable in these turf plots. Merion Kentucky bluegrass exhibits considerable leaf rust in the fall. Some varieties, primarily the "common" types of bluegrasses, exhibit minor infestation of *Helminthosporium* leaf spot in the spring and fall.

Persistence

All grass species and varieties have shown a high

degree of persistence. No noticeable deterioration in stand has been observed with perennial Ryegrass varieties although only two (Manhattan and Pennfine) have been evaluated as long as five (5) years.