Proceedings Of The 29th Northwest Turfgrass Conference

September 16-19, 1975
Chinook Motel & Towers
Yakima, Washington

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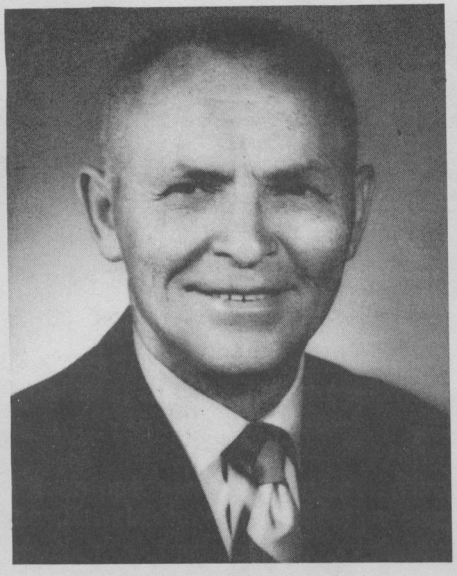
PRESIDENT'S MESSAGE



As my term as President of the Northwest Turfgrass Association draws to a close, I wish to express my thanks to all of those who have extended their support to make this year a success. We have seen our organization realize one of their many goals to hire Tom Cook as a research associate at the Western Washington Research and Extension Center at Puyallup, Washington. This was done entirely with donations and a lot of sweat and hard work from various sources brought about by our membership. We must continue this effort in every way in the future since problems in research and maintenance increase almost daily and to continue the fine program we have at this time will require the help of each member.

We are most fortunate to have in this area dedicated people like Dr. Roy Goss, Dr. Chuck Gould, Al Law and Dr. Ken Morrison and many others who are so willing to provide us with helpful service and information with problems we have the year around.

NORTHWEST TURFGRASS ASSOCIATION

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DEVELOPING PROFESSIONALISM[1]

Richard W. Malpass[2]

If I were speaking only to golf course superintendents today, I would make my contribution to the program much more blunt. In fact, I might become quite explicit in some of my comments concerning the activities of some superintendents. However, I know that there are, in this room, some students, some homeowners interested in a little information they might glean regarding care of their grass and shrubs, perhaps some landscapers, and maybe just a few who have come in out of the cold.

When we think of the word professional it brings to mind a number of occupations. Doctors, lawyers, certified public accountants, registered pharmacists, registered surveyors, dentists, and many more. In fact, you may not even be aware of some of the occupations actively engaged in a certification program. Insurance agents, or policemen, or realtors to name a few. Our modern and complex civilization, our tremendous increase in knowledge the past few years, the demand for specialization, all have contributed to the necessity for and the desire to upgrade ourselves in our chosen profession.

We speak of our own occupation -- golf course superintendency -- as a profession. Let us look at some of the criteria which are used to determine just how professional an occupation is. They are perhaps best set forth in a book "WORK AND SOCIETY" by Edward Gross who proposes six criteria which may be used.

1/ To be presented at the 29th Annual Northwest Turfgrass Association Conference, Yakima, Washington, September 17-19, 1975.

2/ Superintendent, Riverside Golf and Country Club and Vice President, GCSAA, Portland, Oregon.

(1) THE UNSTANDARDIZED PRODUCT: Certainly, as far as golf course superintendents are concerned we are dealing with an unstandardized product. No two golf courses are alike. There are variations in soils, weather conditions, grasses, layout, locations. And, as Stan Metsker pointed out in his article "How Professional are we..?" which appeared in the February 1969 GOLF SUPERINTENDENT magazine, "the golfers themselves vary in their demands from one course to another. They cannot agree among themselves whether they like fast greens or slow greens on which to play, or even what is fast or what is slow. Not only is each golf course different from any other, it varies considerably from day to day or even hour by hour depending on light, moisture, and wind."

(2) DEGREE OF PERSONALITY INVOLVEMENT: Listen to a group of superintendents talking about their place of employment. Almost invariably each will speak of his course in a most possessive manner. It is "my course" this, or "my course" that. In many cases, if his club officials are satisfied that they have a capable superintendent, he is left with a free hand to manage the golf course almost as if it were his own. Again, quoting Stan Metsker, "T. H. Marshall has said that 'The attitude of the client to the lawyer is roughly this: "I am asking you", he says, "to act as my brain in this matter. I want you to think and judge for me, please do so exactly as I should if I knew the law'." Superintendents are generally known to be dependable and loyal. There does seem to be limited confidence on the part of the employers at times, but there is no question that the superintendent is personally involved."

(3) WIDE KNOWLEDGE OF A SPECIALIZED TECHNIQUE: Jim Converse, Editor of Scott and Sons "PROTURF" magazine stated the following in Issue No. 8: "Today's superintendent is no longer a grass cutter or a farmer, and it's a sad golf course who pictures him as such. He is a man with a vast number of skills. His knowledge of turf can be superior, but working with and managing people is a definite need. He must also be an expert in diplomacy, purchasing, machinery, business relations, and a master at handling the unexpected. He must anticipate all things that will be good for his course and be prepared to make adjustments for everything that is bad.

Very few professions require solid knowledge in so many difficult areas of learning, and the list isn't growing smaller.---

(4) SENSE OF OBLIGATION TO ONE'S ART: The professional man is not supposed to work only for money. There should be a deep satisfaction for the results one has achieved working with Nature, or people, with the tools of his trade.

Who hasn't seen the glow of pride as a skilled craftsman observes a fine piece of work he has created? This feeling might be best exemplified by a portion of an article by Bob Forbes appearing in the Indiana Nursery News of May, 1974. "Frequently we see lists created to show results of the most admired professions. Have you ever seen nurserymen listed in the top five?, 10?, 20?. It is my contention we should be. Why? Several positive reasons. Not for vanity. Not for glory as such. But because our contribution to society's well-being puts us there. In my opinion there is not a nurseryman who doesn't provide viable, visible social benefits equal to 10 lawyers, 20 doctors, 30 preachers and 40 psychiatrists. Our skills and knowledge can produce results that can be seen, heard, smelled and felt for generations after we are gone. Without us the world would be dull, dreary and dead."

"Instead, it is alive, vibrant, and green. Our products and skills create solitude in the clamor and din, beauty from the dreary and decay, mind the wounds and heal the sores of a world apparently hell-bent on self destruction, and we do these things and much more for a fraction of their true value. We can shade the parched soul, soften the glitter and glare, spark the dying embers of the imagination and still not make enough money to pay our employees, or ourselves a decent wage. We preserve the secrets of creation with the most scientific expertise known to the gods and yet perpetuate the most antiquated professional profile known to man. From these contrasts several truths are evident. The need for our products and skills has never been greater and our ability to serve less. The horn blows and we do not hear--because it is someone else who plays the tune.---"

(5) SENSE OF IDENTITY WITH ONE'S COLLEAGUES: Virtually every profession has its local chapters or associations, regional groups and a national or international organization. Periodical meetings are held by members of the profession for educational or fraternal purposes. Many such groups provide various services for the benefit of their members. So, too, does the golf superintendent profession. There are many local, statewide and

regional groups as well as a national organization. In the national associations' Articles of Incorporation the purposes set forth for which the Corporation was formed are: (a) "To advance the art and science of greenkeeping, to cement the greenkeepers of the United States and Canada into a closer relationship with each other; to collect and disseminate practical knowledge of the problems of greenkeeping with a view of more efficient and economical maintenance of golf course; to provide direct financial benefits to greenkeepers who are disabled or their families and to the families of greenkeepers who die."

(6) ESSENTIAL TO WELFARE OF SOCIETY: Every profession has developed over the years on the basis of the need for the service which the profession was able to supply. The dictionary defines it as an occupation that properly involves a liberal, scientific, or artistic education or its equivalent, and usually mental rather than manual labor.

The first "greenskeepers" were probably selected for their ability to work 12-16 hours a day and the tools of their trade were a broom, shovel and scythe. The broom and shovel were to remove the evidences of the sheep or cattle having browsed down the grass of the so-called golf course, and the scythe to cut the few remaining weeds or tall grass. In an article appearing in the book "TURFGRASS SCIENCE" by Gene Nutter and James Watson, which was published in 1969 there appears the following account: "Gradually, as golf courses increased in number and as maintenance standards were raised, a more definite manpower structure evolved. Working foremen became full-time supervisory greenskeepers and eventually golf course superintendents with broad management responsibilities. Requirements for trained skills increased as mechanization replaced hand methods and as new chemicals were made available. These technological changes resulted in greater job specialization. A mechanic became essential and many golf clubs employed an assistant or a foreman to give closer supervision of labor.

Still the evolution of academic professionalism was slow. Job improvement evolved largely through greenskeeper ingenuity and the need for less laborious methods. There was very little opportunity for educational improvement.

In time, tradesmen (again, mostly greenskeepers) began to visit each other and finally to gather informally for discussion of common problems. At first, trade practices were guarded very jealously. Later, the value of exchanging experiences and ideas became evident. Gradually, some groups began to compile and distribute notes from their meetings. This led to the development of technical (educational) conferences, beginning in the mid-1920's, during the "golden era" of golf. From these meetings and conferences, a higher level of managerial skill evolved in the industry.

Although the growth of golf facilities was retarded by the depression of the 1930's, the financial austerity facing the surviving golf facilities led to more efficient maintenance and to stronger professional growth among greenskeepers and other turfgrass personnel.

The approach of World War II, in the wake of the depression, caused a further reduction in turfgrass operations. Some facilities remained open, but much of the nation's available manpower become involved directly or indirectly in the war effort. Indeed, some turfgrass specialists transferred their activities to such military functions as maintenance of air fields and training bases.

As the nation recovered from the severe deprivations of the war years, there was an urgent demand to catch up--first on rationed products, then on civilian activities. Closed golf courses were renovated and new facilities were planned. Beginning with a 20-year low of 4,800 golf courses, the 10-year period from 1946-1955 saw an increase of only 10% in the number of golf courses. This period was followed by a fantastic increase over the next 10 years (1956-1965). This expansion rate continued through the '60's to a projected figure of 10,500 golf course facilities in 1970.

Manpower requirements for the golf course industry increased at a rate comparable to the growth in golf facilities. Specialization and professionalism increased likewise. For example, in 1951 at its Silver Anniversary Meeting, the National Greenskeeping Superintendents Association changed its name to the Golf Course Superintendents Association of America, and changed the

name of their official publication from the Greenskeepers Reporter to the Golf Course Reporter. In 1966, the publication name was changed again to the GOLF SUPERINTENDENT. These changes reflect the concern of golf course superintendents in advancing their professional image.

Parallel to the explosion in golf course development was the development in other turfgrass facilities and functions. As manpower development advanced on the golf course, other turfgrass facilities also began to recognize the need for better trained and more specialized manpower. In addition, the manufacturing and servicing branches of the industry moved forward to supply products and services for the expanding facilities.

Growth at all levels of the industry brought increasing demands to the institutional branch for knowledge and technology. Turfgrass research programs developed at most land grant colleges, and some developed curricula to assist the industry in training manpower.

In addition to university training, some vocational-technical schools and colleges developed training courses specializing in turfgrass management. The first of these was the Stockbridge Winter School at the University of Massachusetts. Founded in 1927 under the inspiration of the late Professor Lawrence S. Dickinson, this institution offered an annual 8-week short course beginning in January, which stressed fundamentals of turfgrass production. Many of the nation's leading golf course superintendents are alumni of this pioneering school.

Later the Stockbridge school initiated a 2-year course for turf majors. Other vocational-technical schools have established specialized training courses in turfgrass management. Today, many technical conferences and trade expositions are held across the country on a regional, state, or local basis to provide industry personnel with refresher courses and programs of continuing education and to keep the industry abreast of new products and technologies. The International Turf Conference and Show sponsored annually by the Golf Course Superintendents Association of America features the first and currently the only national exhibit of turfgrass products as well as a national conference on turf (primarily golf) technology. At Anaheim, California, in 1974, this event reported an attendance of over 5,000 people.

Currently the Golf Course Superintendents Association of America is giving its members the opportunity to improve their managerial and technical skills by conducting seminars throughout the country. This past year they have also formed the Advisory Educational Council composed of nine members who are recognized turf authorities from Universities throughout the United States. This Committee will advise and assist the Association in its educational programs.

Whatever your profession, it will have progressed through a number of steps to reach the position of respect and public trust it may now enjoy. These steps are essentially the same for all professions. In his book "THE SOCIOLOGY OF WORK" by Theodore Caplow there are four steps described.

(1) THE ESTABLISHMENT OF A PROFESSIONAL ASSOCIATION WITH DEFINITE MEMBERSHIP CRITERIA DESIGNED TO KEEP OUT THE UNQUALIFIED

In 1926, at the Sylvania Country Club in Toledo, Ohio, the NATIONAL ASSOCIATION OF GREENKEEPERS OF AMERICA was formed. There were 29 original charter members. There are now 92 associated or affiliated chapters throughout the United States and Canada. Membership requirements are quite diverse among the chapters and the only requirement to be a Class A member of the national organization is to have been a golf course superintendent for three years and to be presently employed in that capacity. Presently there are over 3,700 members.

(2) The second step is the change of name which serves the multiple function of reducing identification with previous occupational status, asserting a technological monopoly, and providing a title which can be monopolized, the former one usually being in the public domain. In 1938 a change in name was made to the "Greenskeeping Superintendents Association", and in 1951, to the "Golf Course Superintendents Association of America". The name change from greenskeeper to Superintendent does seem to better describe the increased responsibilities of the job. Unquestionably new technological developments have given status to the occupation.

(3) The Development and promulgation of a code of ethics which asserts the social utility of the occupation, sets up public welfare rationale, and develops rules which serve as further criteria to eliminate the unqualified and unscrupulous.

The Code of Ethics of GCSAA sets forth the obligations of a superintendent to his employer, to his fellow superintendents, his association. There is not much doubt that it could be improved.

(4) Prolonged political agitation, the object of which is to obtain the support of the public power for the maintenance of the new occupational barriers. In practice, this usually proceeds by stages from the limitation of a specialized title to those who have passed an examination (registered engineer, certified public accountant, landscape engineer) to the final stage at which the mere doing of the acts reserved to the profession is a crime. While golf course superintendents have not progressed this far, some professions have. In many States there are a number of professions which may not be practiced except by licensing or by passing strict examinations.

Caplow's fourth step was prolonged political agitation, under which he mentions occupational barriers, and registration or certification. He went on to say:

"Concurrently with this activity, which may extend over a very long period of time, goes the development of training facilities directly or indirectly controlled by the professional society, particularly with respect to admission and to final qualification; the establishment through legal action of certain privileges of confidence and inviolability, the elaboration of the rules of decorum found in the code, and the establishment--after conflict-- of working relations with related professional groups."

As has been mentioned before, the Golf Course Superintendents Association of America has embarked on an active educational program. In 1970 the position of Educational Director was created. Since then an Educational Seminar program has been started and a certification program developed. Presently 180 superintendents are entitled to be known as Certified Golf Course Superintendents, or CGCS. To achieve this distinction they must have been actively engaged as a golf course superintendent and must have been a Class A member for at least three years. As presently administered this means that a college graduate in turf management will have served as a golf superintendent three years as a Class B member, then reclassified to an A member and have

served three years in that classification before being eligible to become certified. A six hour examination consisting of six different categories must be successfully passed in order to qualify for the CGCS rating.

Herbert Blumer in the preface to Vollomer and Mills "PROFESSIONALIZATION" said, "Professionalization seeks to clothe a given area with standards of excellence, to establish rules of conduct, to develop a sense of responsibility, to set criteria for recruitment and training, to ensure a measure of protection for members, to establish collective control over the area, and to elevate it to a position of dignity and social standing in the society."

In the few minutes of my time which are left I would like to discuss with you the meaning of professionalism as it applies to the individual. It has been said that there are three kinds of people:

1. Those who make things happen
2. Those who observe what is happening
3. Those who wonder what happened.

Generally, a member of a profession belongs to that select society who make things happen. As a well-trained, capable, conscientious, golf course superintendent you are a professional in every sense of the word. Recently Bob Williams, superintendent of Bob O'Link Golf Club in Chicago, presented a talk entitled "What Is Happening In the Area Relative To The Golf Course Superintendents' Future?" He began with saying, "If I were to answer this question in a nutshell, I'd refer to that old cliche that we have some good news and some bad news, First, the good news: Today's superintendents are better qualified, more talented, more articulate, more efficient and producing better results than ever before in the history of golf. Now for the bad news: The clubs can't afford them." Further on in his talk he made note of the fact that today's superintendents are younger than his counterparts of 20, 30, and even 40 years ago. We now have few superintendents in their 40's or 50's. The predominance is in the 25 to 35 year age bracket. They are better educated both technically and in general education. Many are graduates of turf management programs at leading Universities.

Our Community Colleges are turning out students who have participated in turf management or horticultural programs. In addition to his better education, today's superintendent is demonstrating better business management practices and executive ability. He keeps more and better records. He pays attention to costs, budgeting and prudent purchasing. He does a better job of communicating with his fellow superintendents, club officials and the golfing public. They display more aggressiveness and more independence than their predecessors. Mr. Williams gave a profile of today's superintendent as follows: And he is--

Young
Well educated
Technically trained
Efficient
Self-confident
Executive Oriented
Well dressed
Capable of the social graces
Articulate
Agressive
Uses a good balance of family and job interests
Respected and appreciated by both his employers and employees
And he has a great love of the game of golf.

I would like to quote from an article I recently wrote for the Northwest Turfgrass Topics. It is as follows:

Dr. Joseph Troll, from the University of Massachusetts, speaking to the Canadian Golf Course Superintendents Association said, "We are all cognizant of the fact that we never stop learning and that all education is not acquired from schools. Turf conferences such as this one, the GCSAA Conference, University conferences, field days, and the reading of professional magazines are all valuable educational programs, and are certainly to be encouraged as facets of continuing education. It appears to be the policy for today and the future, "For the job you want, get the education you need", and the education is the prime requisite for future superintendents."

Dr. Troll went on to say: "In addition, the increased interest in golf has created an even greater demand for responsible superintendents. They must be far more exacting---which requires knowledge and skill in a large number of disciplines for proper management of greens, grounds and men. I can best clarify what is meant by knowledge in a number of disciplines by quoting from a letter I received from a president of a golf

club. He was soliciting my assistance in a search for a candidate for the superintendent's position at his course. He listed the following as the essential or desirable qualifications required for the job:"

"Since we are living in a rapidly changing world, the most important characteristic is that a man must have a natural desire for learning and must have an open mind for new techniques, whether they be in labor management, choice of machinery, traffic control, chemistry, or other significant areas."

"He should have a thorough academic grounding in agronomy, with a real understanding of plant metabolism and nutrition, soil structure, plant pathology, and the knowledge of modern techniques in herbicides, pesticides and fungicides. Some actual experience in laboratory techniques would be highly desirable."

"Since the cost of labor will become an increasingly important factor, he should have a real faculty for dealing with human beings and should be able to teach and motivate those who work under him. This factor is hard to describe, but perhaps can best be stated as the ability to have people like you even though you are firm and a strict taskmaster. Perhaps a sense of humor and the ability to smile are important parts of this vague personality factor."

"He should be able to communicate well, particularly to the people working under him, but also to the people for whom he is working. This characteristic, incidentally, is closely linked with the previous qualification."

"He should have had some practical experience as an assistant or with a nine hole course of his own."

"He should have the ability, when required, to do hard manual labor and use tools effectively. Otherwise, in the beginning, he will never command the respect of those working for him."

"He should have practical common sense from a mechanical and engineering point of view."

"I believe he left out a need for a background in business management. However, the gentleman did admit that a man who had all of these qualifications would be difficult to find and certainly would be desired by many golf club associations. In brief, a superintendent is and must be truly a professional man."

A. J. Powell, Jr., Turf Specialist, Cooperative Extension Service, University of Maryland, writing in the "Agronomist" says: "when a superintendent completes his responsibilities by 8:30 a.m. each morning and spends the rest of the day in the clubhouse, his home, or just generally goofing off, then he is not displaying a professional image. His men or superiors do not like it, and he is damaging the entire profession. Why be so careless?"

"One should never hesitate to train his men as much as possible. Certain jobs should not be reserved for yourself just to show everyone you are necessary. With this type of supervision, respect will be lost. Subordinates should be allowed every educational opportunity possible. If you can create a real turf interest in the minds of laborers, they become professionals and not just "yes" men."

Dr. Roy E. Blazer, speaking to the Tenth Virginia Turfgrass Conference, in 1970, said this:

"We need to make a careful job analysis to make tasks easier and more efficient. Each one of us must maintain a positive attitude of usefulness and an honest day of services every day should be our goal. The best man in a labor pool will support a leader superintendent that "knows his stuff". If we are not committed to an honest day's work, don't expect our labor associates to do so. The associates that you employ will soon become aware of your organizational ability, your intelligence, and flexibility in an aggressive turf service program. Good men want to be associated with a dedicated professional leader--- your acts will speak louder than your words."

"Let's maintain the image of a professional. Seek every opportunity to make course improvements, cut costs, and train our subordinates and ourselves. Courses are continuously being taught and educational meetings or conferences are continuously being held to help you maintain a professional image. Why not take advantage of these with your subordinates also?"

"Anyone who stops learning is old, whether this happens at twenty, or eighty. Anyone who keeps on learning not only remains young but becomes constantly more valuable, regardless of physical capacity." ***Henry Ford***

Several years ago, our local association conducted a survey. We asked superintendents to tell us whether theirs was a nine or eighteen hole golf course, how many acres were maintained, their total budget, their own salary. Nothing on the report indicated the name of the course involved nor was the name of the superintendent requested. Would you believe that there were superintendents receiving little over $1.50 per hour. Even the lowest paid laborers on most golf courses received more than the superintendents of some courses. Have you ever considered asking local superintendents the going rate for salaries in the area where you are applying for a position that is vacant? Are you so anxious to get a job you would undersell the whole profession just to get work? Then work your tail off for the next ten years trying to get your wage up to where it should have been in the first place? And incur the displeasure of every superintendent in the area because you have hurt him, as well as yourself, by selling your services so cheaply?

Do you know or care anything about ethics? Have you heard or read this one from the GCSAA Code of Ethics?

WHEN SEEKING EMPLOYMENT

a. I will seek counsel of local GCSAA Chapters when applying for a position in any district.

b. I will make certain the position is open before making application to any prospective employer.

c. I will ascertain and uphold the salary level of the district in which I negotiate for a position.

d. I will, when possible, speak to the man who is leaving or has left the position for which I am considered.

Do you attend the meetings of your local association--regional--national?

Do you pay to attend and pay your dues out of your own pocket? Are you so afraid of your job security that you won't ask your employer for funds to attend an educational meeting which can not only make you a better superintendent but also make you of immeasureably more value to your employer?

You are the man who has been hired to maintain the turf, the trees and shrubs, the equipment, the irrigation system, to oversee the activities of your crew. Who else is going to know about new techniques, new chemicals, new fertilizers, new grasses if you don't keep up-to-date. It is <u>your</u> responsibility.

Do you know or care that the officers of your local, regional, and national associations are attempting, with all the resources at their command to provide educational opportunities for you; to upgrade salaries commensurate with the responsibilities of your job; to promote research to make your job easier, to provide new and better grasses, methods of disease control, new techniques? Do you know or care that they are doing battle for you against the forces that would take away your right to use pesticides, fungicides, or fertilizers?

Do you faithfully attend meetings of your association, serve on committees when asked to, discharge the duties of your office when elected by the membership? Or do you sit back and complain, refuse to help, skip meetings, play the loner?

Not long ago the new National Educational Advisory Committee, mentioned earlier, met in our GCSAA Headquarters Office. One of the gentlemen present, a very well known turf authority at a Midwest University, commented: "You will never have a successful association if you have only drinkers, golfers, or card players."

What is your object in attending association or other educational meetings? Are you like some of the people who inquire at my office for jobs. They are not interested in what there is to do. Their first questions are---"When do I get a paycheck?" "What are the fringe benefits?" or "When do I get a vacation?" "Can I swim in the pool?" or "When can I play golf?"

Do you greet the golfers with a smile, work with the golf professional, the club officials? Do you set a good example for your employees? Do you submit well written, concise, factual reports to your green committee, or club manager, or whoever your employer might be?

Nearly fifty years ago I learned a few words of wisdom left us, the Scriptures say, by the wisest King who ever lived, Solomon, King of Israel. They are taken from the Book of Proverbs, Chapter 3.

> "Happy is the man that findeth wisdom, and the man that getteth understanding. For the merchandise of it is better than the merchandise of silver, and the gain thereof than fine gold.
>
> She is more precious than rubies; and all the things thou canst desire are not to be compared unto her.
>
> Length of days is in her right hand; and in her lefthand riches and honour.
>
> Her ways are ways of pleasantness, and all her paths are peace.
>
> She is a tree of life to them that lay hold upon her; and happy is every one that retaineth her."

In these past few moments I have told you what it takes to become a professional, how to identify a professional. We have heard the thoughts, the concern of educators, golf superintendents, businessmen, club officials, about our profession. I hope that I have left you with a desire to learn, to improve, to act like, to be a true professional.

Now for a final quotation: "WITHOUT YOUR CONSENT IT IS IMPOSSIBLE FOR YOU TO BE A FAILURE!!"

FERTILIZERS—THE PRESENT AND FUTURE[1]

J. C. Engibous[2]

Perhaps the only non-controversial aspect of the fertilizer industry is its size. No one can deny that it is big, with total fertilizer use in the United States in fiscal 1973-74 totaling 47 million tons. On second thought, there is one other aspect of the fertilizer situation that is not argued, and that is the wide and often unexpected fluctuations in supply, demand and price.

FARM VS NON-FARM USES

Less than a year ago while the American Society of Agronomy scientific meetings were being held in Chicago, the most popular question posed by the media was: "With the tremendous fertilizer shortage, how could we justify using 15% of our production for aesthetic reasons on golf courses, playgrounds and parks?" Various congressional and other concerned spokesmen went so far as to convert this 15% figure to an equivalent of 3 million tons of nutrients, which could produce 30 million tons of rice in some developing country or countries.

1/ To be presented at the 29th Annual Northwest Turfgrass Association Conference, Yakima, Washington, September 17 - 19, 1975.

2/ Chairman and Professor of Soils, Department of Agronomy and Soils, Washington State University, Pullman, Washington 99163.

Thanks to the Association of American Plant Food Control Officials (AAPFCO) these figures have been refuted. In fact, of the total U.S. fertilizer use, 3.5% is estimated to have been used for non-farm purposes (parks, playgrounds, highway right of ways, and construction sites for erosion control plantings, lawns, gardens, golf courses, airport runway de-icing, etc.). The best estimates of AAPFCO--based on their survey--is that approximately 600 thousand tons or less of nutrients were consumed in 1973-74 for the above purposes. Washington was the only northwest state reporting in the 36 state survey, and our percentage was 6.4. Again, this is far below the 15% figure bandied around earlier.

Hopefully, most thinking people now realize that diversion of non-farm or speciality fertilizers expressly formulated for turfgrass, shrub, ornamental or garden fertilization would have little or no effect in helping grow additional food overseas. Furthermore, for a number of reasons, the fertilizer supply situation has eased substantially, and prices to some extent as well.

FERTILIZER SUPPLY SITUATION

In looking at fertilizer availability, it is logical to treat nitrogen first since it is the most expensive and widely required nutrient for plant growth. Tennessee Valley Authority specialists predict that by 1976, nitrogen supply again will exceed demand on a national basis, provided that sufficient natural gas seed stock is available and old plants are not retired. Demand may well exceed supply in the early 1980's, and additional new plants will be required to achieve a favorable supply-demand balance. The five Pacific Northwest states, incidently, presently produce considerably less nitrogen than is consumed in the region for fertilizer purposes. There is not sufficient natural gas in the Pacific Northwest to support much of an ammonia industry, and this situation will apparently worsen. Thus, the region is dependent on ammonia and nitrogen products from sources outside the region, particularly Alaska and Canada.

Phosphate rock is the raw material for the production of finished phosphate fertilizers, and the United States holds one-fourth of the world's reserves. Despite this fact, world phosphate prices are generally established by North African

producers, and they have adopted the OPEC countries marketing philosophy, which quickly resulted in tremendous price increases. On a world basis demand dropped substantially in 1974-75. Thus phosphate fertilizers are now readily found in the market place, with some price softening.

In the case of potash, the tremendous ore reserves in Canada and the large, modern production capability associated with the potash industry would seem to preclude any shortages of this vital nutrient. Unfortunately, the Canadian industry is caught in the middle of a jurisdictional tax war between Dominion and Provincial governments, which has considerably dampened enthusiasm for increased capital investment for potash production in that country.

To summarize the current and near term fertilizer picture, the widely publicized shortages of a year ago are no longer with us. Fertilizer prices have receded somewhat from the 1974 peaks, but they will never drop to the late 60's levels, which were almost suicidal for the industry. Fertilizer is still the farmer's best buy, and we can anticipate vigorous sales and merchandising efforts by the industry to once again increase consumption.

TURFGRASS FERTILIZER PRACTICES

As an old fertilizer man, I have always viewed turfgrass fertilization as a curious blend of science, art, and prejudice. Around the fringes, of course, we usually find wizardry and alleged magic. But for the most part, successful turfgrass managers have carefully followed and adopted the results of scientific research and fitted them into their own specific managerial situations, whether the products used are urea, ammonium nitrate, ammonium sulfate, urea formaldehyde, sulfur coated urea, IBDU, Milorganite, or blood meal. Phosphates generally are applied in mixed fertilizers since phosphate is the backbone of such products. In recent years, we have seen a shift in form from old normal super phosphates (with its bonus of $CaSO_4$) to triple super phosphate, and today increased use of ortho- plus poly-phosphates. On the potash scene, there is little likelihood that great inroads will be made in the lowest cost KCl and the preferred K_2SO_4, particularly in sulfur deficient areas. One producer does have a potassium poly-phosphate under development.

I don't propose today to delve into the degree of polymerization that results in distinguishable types of products generally catagorized as "Urea Formaldehydes". My training as a soil scientist persuades me that however complicated the chemistry of fertilizer production might be, subsequent processes in the soil are far more complicated, and the only way to differentiate such products performance-wise is by comparative tests under localized conditions.

Recent research has not disproved the old rule of thumb that a 3-1-2 or 4-1-2 ratio of $N-P_2O_5-K_2O$ is a pretty good turfgrass balance. Another old rule of thumb was one pound of available nitrogen per 1000 ft^2 per month of growing season. Golf putting greens require up to 50% higher rates of application than these general turf recommendations.

Frequently we hear questions about utilizing our turfgrass areas to consume sewage and solid wastes which are being produced at rates approaching seven pounds per capita per day. Certainly turfgrasses are an excellent way to finish off the land fill type of waste disposal. Research has shown that the two components of treated sewage, sludge and effluent, can be used in turfgrass production. Waste water from treatment facilities has also been used successfully. (For a more complete discussion of this subject, I refer you to WSU's Dr. David Bezdicek's article in the August 1974 issue of Golf Superintendent.)

POSSIBLE NEW FERTILIZER MATERIALS

Mention was made earlier of Pennzoil's potassium polyphosphate development. Much more activity is under way on nitrogen materials. TVA is actively researching urea--ammonium phosphate (UAP), from which grades such as 28-28-0 and 36-18-0 can be produced by ammoniating wet-process phosphoric acid to form a melt which is combined with concentrated urea solution and granulated. The product is a mixture of urea, ammonium ortho-phosphates and ammonium poly-phosphates. UAP would compete with DAP and MAP, and be blended with urea, DAP, CSP and potash to produce a wide range of high analysis, complete fertilizers. The 36-18-0 product cannot be mixed with super phosphates.

Another possibility in the urea family of fertilizers is urea ammonium sulfate (UAS). Grades between 34-0-0-10S and 40-0-0-4S have been made by granulating crystalline ammonium sulfate with urea. Such products could represent an outlet for by-product ammonium sulfate should it become available in large amounts, and would be an excellent material in the sulfur-deficient Pacific Northwest.

Most of us have heard about or had experience with sulfur-coated urea (SCU). This is a controlled release product developed by TVA and soon to be produced in a demonstration-scale plant. Granulated urea is sprayed with molten sulfur and sealed with wax or other sealant. The main objective in developing this product is to provide a more uniform supply of nitrogen than is obtained via a single application of conventional water-soluble nitrogen sources. The rate of nitrogen release can be controlled by varying the thickness of the sulfur coating. Total coatings by weight normally are varied from 14% through 21%, producing grades ranging from 40-0-0-9S to 36-0-0-16S. Costs for coating normally add about 30% more per unit of nitrogen than uncoated urea.

SUMMARY

I have tried to highlight the current fertilizer situation and relate it to your interest in turfgrasses. A somewhat timid peek into the crystal ball was attempted, all of which leaves me in an optimistic frame of mind. We need a lot more research on fertilizer efficiency under major soil and climatic conditions in our region. I urge you to continue your support of programs like that of Roy Goss. By support I mean moral and financial. I subscribe to the expression "we've come a long way, baby" but equally important to me is the fact that we have a long way to go.

THE PRESENT AND FUTURE STATUS OF PESTICIDES[1]

Stan Frederiksen[2]

First of all, my sincere thanks for the very genuine privilege of your inviting me to share with you another Northwest Turfgrass Conference. It's been several years since I've enjoyed this pleasure of being with all of you in this great Pacific Northwest, and I can assure you I'm relishing every moment of the experience. Once again I ponder the realization that I'll more than likely be taking home with me a lot more in the way of valuable information than I'll be able to contribute to your vast storehouse of knowledge. However, if I can just bring some thoughts, and perhaps some ideas, that will raise questions in your minds and possibly generate some good answers, I'll feel more than amply rewarded.

When we begin to explore the vast subject of "pesticides," particularly during these days of confusion and uncertainty on practically all fronts, we literally open up a real "Pandora's box" -- or a real "bag of worms."

For "openers," let's consider the meaning of the word itself. A simple dictionary definition says that a "pesticide" is "an agent used to destroy pests." While the same dictionary says that a "pest" is "an epidemic disease associated with high mortality," however, it causes some concern and eyebrow-raising in most of our minds, because in the field of highly maintained turf, the word "pest" usually (not always) means something

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1/ To be presented to the 29th Annual Northwest Turfgrass Association Conference, Yakima, Washington, September 16 - 19, 1975

2/ Manager, Turf Products, Mallinckrodt, Inc., St. Louis, MO

entirely different. Even when we "zero in" more closely by limiting our meaning to "turf pests," we normally think first of insects -- and of turf pesticides as primarily insecticides. In the broad definition actually envisioned by those having to do with pests and their control, the words "turf pests" actually apply to any agents whose activity in one way or another harms fine turf. Within this context then, pesticides must include not only insecticides, but also herbicides, rodenticides, fungicides, bacteriocides, or any other agents that are involved in maintaining fine turf in a healthy condition, and in getting rid of the competing forces, be they weeds, weedgrasses, fungi, or others, that seek to thwart or destroy that fine turf. Let's keep this important fact in mind, as we take a look at the overall present and future of turf pesticides.

To get to the present, there had to be a "past." And so there was. Probably centuries ago the first pesticides came into being -- culminating in the market being literally flooded with thousands of pesticidal agents designed to control or eliminate one pest or another. It was largely through the advent of chemical pesticides that fine turf became really achievable, and economic crops became so abundant that a single farmer, in recent years, could grow enough crops and produce sufficient meat and other foods to feed thousands of people, whereas just a few short years ago it was difficult for a small farm family to feed and clothe itself adequately. The age of pesticides has truly been the age of plenty.

Things in the pesticide world were moving forward with tremendous rapidity in the early sixties, when activity in the field of pesticides came to a crunching halt. Rachel Carson's book, "The Silent Spring," hit the market, and as is so often the case, people not only reacted -- they over-reacted. From the first day the book made its appearance, many people, particularly those who needed some sort of "cause" to espouse, began their crusade to "clean things up." The word "pesticide" suddenly became a naughty word. The words "ecology" and "pollution" and "environment" were thrust upon all of us, with ugly connotations. Normally level-headed people took up the cudgel, and became "instant ecologists" or "instant environmentalists," with absolutely no credentials whatever. "Natural foods" (grown without the help of chemical fertilizers), made their appearance. But, above all, the governments on the local, state and national levels stepped in to "control" the environment through the control of pesticides. Whereas foods had been

cheap and plentiful, primarily because of the tremendous impact of chemical fertilizers and pesticides, it became more and more difficult to produce plentiful foods -- and more and more difficult to produce and maintain beautiful and healthy grass -- as one after the other, the old tried and true chemicals began to be "suspect," and soon were the subject of restrictions, limitations and bans.

Quite likely Rachel Carson's purpose in writing her book was a truly noble one -- to focus attention upon the fact that chemical contamination was a very significant possibility, under many conditions, and to start some sensible thinking on the part of everyone toward using great care in the production and use of pesticides. Little did she think, in my humble opinion, that the impact of the book would actually be to negate research in the development of more and better foods, ornamentals and turfgrasses -- and to cause the escalation of prices in the marketplace of foods and other growing crops to unbelievable heights.

One of the first recognizable effects of "The Silent Spring" was a phenomenal "panicking" by the Federal Government. Almost every fault that could be thought of was suddenly found with just about every pesticide available. Federal agencies, armed with powers delegated to them by an equally panicking Congress, began removing from the marketplace all pesticides they could find that had actually caused any harm, either to people or to the "environment" -- BUT -- in addition, they started banning all that they felt "might," under any circumstances they could think of, however remote, create some sort of problem, whether there had ever been such problem reported in connection with the product or not. Further, the "possibility" of causing harm was not limited to that associated with people. The words "balance of nature" -- and "endangered species" -- and others -- began to appear. One "society" or another began worrying about whether, in the next 15 or 20 years, the "purple-crested-thing-a-ma-bob" would become extinct because of the impact in the "environment" of one chemical pesticide or another. Strangely enough, not very much attention has been paid to the really basic question -- "Should the world be made safe and adaptable for people? -- or for 'endangered species'"?

Several significant observations can be made as to what has happened since "The Silent Spring" to bring us to where we now

stand, at present, with respect to pesticides and their use. There are many, but let's enumerate just a few:

1. Gone from the marketplace are many of the important pesticides that enabled the growing of plentiful and inexpensive foods -- and sturdy and beautiful fine turf. Few of these ever were found to cause any real problems -- but (found the government agencies) they "just might" cause a problem -- so "let's get rid of them."

2. Gone is the incentive, on the part of the important chemical companies, to any significant research to the development of new pesticides of any kind. Why should they? Whereas formerly there was a chance or two in a hundred that any given pesticide compound might "make it," and become a commercially-available product, this has now dwindled to a chance or two in several thousand.

3. Gone is the source from which came many of your turf pesticides -- that source being the vast arsenal of food crop pesticides. A chemical company seldom, if ever, would start work on any pesticide screening and development process just for turf. Why? Simply because "turf" is such a small segment of the "agriculture" business that the expense of anyone getting a significant market share of this turf segment, coupled with the increasingly low probability of success in the light of present regulations, literally prohibits any work toward new turf pesticides.

4. Following publication of "The Silent Spring," when big economic crop pesticide manufacturers found their warehouses bulging with pesticides they suddenly couldn't sell because some government agencies had banned them from food use, an article appeared in a nationally circulated turf magazine, to the fact that a $14,000,000 fungicide market was available among golf courses. Producers whose pesticides no longer could be used on food crops rightly reasoned that very few people eat grass -- and that therefore their materials would find ready acceptance in the field of turfgrass maintenance. A vast array of new "turf" pesticides began to appear -- the same ones that had been banned from food use, but under different brand names, and sometimes in different formulations than before. Chemical companies never before in the turf industry were suddenly

right there -- all wanting a piece of that $14,000,000 pie. The real fact was that the "$14,000,000 pie" didn't exist! The magazine writer who developed the figure was "off-base" by a factor of at least 3 -- the real turf fungicide market was no more than a third or less of the $14,000,000 reported -- so that many of the companies who launched bravely into the turf market with their products have since withdrawn them, and a number have left the marketing of turf chemicals entirely.

5. Monsanto was a tremendous stalwart, right after "The Silent Spring," in publishing a resounding rebuttal to that now infamous book. If you'd like to see what the world would really be like without pesticides, take a look at their MONSANTO MAGAZINE issue of October 1962, in which on page 4 you'll find an article titled "THE DESOLATE YEAR." It depicts the world as it would be without pesticides. To tell the truth, it presents a rather frightening picture, in that it shows how tenuous is the slender thread that holds together human civilization, and how, without pesticides, the earth would literally be overrun by insects and diseases, just about eliminating the human race. The fact is, all the pesticides we've ever had could only hold antagonistic pests "in check." In no way could all of them be eliminated. Witness even today, in your continuing battle against turf pests, how many fungi have adapted to so many fungicides and become completely resistant to them. Witness also, how many insect pests have begun to resist control by so many insecticides. If you want further evidence of the resistance of insects to just about everything, be sure to see a really fantastic motion picture, "THE HELSTROM CHRONICLE." It shows that insects of practically all kinds, can adapt to just about everything -- and that it may not be too far in the future when insects -- not humans -- will rule the world. That is, unless mankind can continue its pressure on the world of insects and other pests, and constantly develop more and better controls -- largely, of course, in terms of pesticides.

6. Is pesticide research "dead"? Maybe not quite, but it's rapidly approaching that intolerable condition. When I talked several years back with Dr. John Shred, the famous entomologist at the University of Connecticut, at a March

turf conference in the Northeast, he told me that at that time of year just several years before, he had been in the year's first quarter, screening some hundreds of compounds as candidate insecticides. During the current quarter, he told me he had received from chemical companies only two candidate compounds. See how strongly this reinforces the conviction that chemical firms will simply not invest time, money or effort in any project that has practically no chance for commercial success -- this being especially true these days as regards pesticides.

7. Over-reaction has also made itself felt at the state level. More and more states, primarily because of pressure from small "environmentalist" groups, are introducing their own state bans on pesticides, whether there is real basis for this action or not, and are imposing almost intolerable regulations and restrictions. An example is the state of California, where anyone who even "recommends" the use of a pesticide must have a permit or license -- not only for the state itself, but in every county of the state in which that pesticide is sold and/or recommendations made! Can you imagine the horrendous load of work this type of regulation puts on a user, a seller or a "recommender"? It's just about enough to "turn off" everyone, forget pesticides and let the pests "take over" by default.

8. Another part of the untenable present pesticide situation is the practically impossible registration procedure. As you know, whereas formerly all pesticides had to be registered with the USDA, the key agency is now the EPA. Undoubtedly the EPA has great intentions of making the current laws and regulations work for everyone, with the health and safety of the people in mind. However, whereas it was formerly a good possibility that a new pesticide could achieve registration in just a couple of weeks or so after submission, any company trying now for a registration can figure it will take a year or more, and possibly three or four attempts, with many "dotted i's and crossed t's" checked through by all kinds of people in a number of government agencies, for a given pesticide registration to mature and become a fact. Such items as "a statement of environmental impact" -- and vast "residue studies" -- and "feeding studies" over several years (when edible crops are involved), "establishment numbers" on labels -- and other time-

consuming details are now just about standard in the registration of any pesticide -- enough to scare away all but the most tenacious and persevering companies wishing to serve the agricultural and turf industries. When you hear of increased prices, from here one, applied to your pesticides, you might remember that while part of them may be increased labor or raw material costs, the greatest part is the tremendous expense of getting and maintaining registration, with attendant frequent trips, phone calls, correspondence, etc., to and with Washington, as well as the various individual states.

9. The great lessening of pesticide research was mentioned earlier. The true extent of this reduction can only be realized when you begin hearing that a company, here and there, is completely abolishing their pesticide research facilities and terminating their people, and that a number of experiment stations, formerly very strong in agricultural and turf pesticide research, have either cut back or eliminated this from their programs.

10. Again, a persistent reason given for removing from the market many of the major pesticides that have served well over the years is the fact that such materials are either potentially carcinogenic ("might" -- not "will" result in possible malignancies) or will have an adverse effect on the "environment," possibly getting into "the food chain" (another favorite phrase of the environmentalists). Most people will admit, I think, that indiscriminate airplane spraying of toxic substances over wide areas can pose potentially serious problems. But this is entirely different from (for example) a qualified turf manager spraying a few ounces of a mercurial fungicide on a putting green where it has actually been proved that mercurial cannot move in any direction but downward (never laterally) so that there can be no probability of pollution of nearby waters, cannot get into the "food chain" via lateral movement into a pond or stream, and certainly cannot be ingested by people, because no people I know of have ever been found eating grass -- particularly that cut at a 3/16 inch height on a putting green.

Now, where does all this find us at present, with respect to those pesticides we need to manage fine turf? Several conclusions are pretty obvious:

1. Look for very few new pesticides over the next several years, at least.

2. Look for the loss of a large number of the pesticides you've been accustomed to use routinely. In October of 1976, all federal registrations of pesticides will expire, as I understand it, and all new registrations will have to be submitted. You can bet your bottom dollar that the EPA intends to eliminate all those that they feel are not needed, or that a few pseudo-ecologists feel are not needed, simply by refusing to renew their registrations after October 1976. What you need, or what you deem necessary for your operation, appears to be of little significance.

3. Be prepared to "get by" with a much smaller choice of pesticides than you've ever had before. You'll be expected to "take what you can get" -- and be satisfied with that. No matter that what you use just might not work.

4. Watch for alternative methods of disease, insect and weed control. The era of "biological controls" may be close at hand -- or perhaps control of pests with sophisticated electronic devices not yet even foreseen.

5. Pests likely will increase their activity to where, perhaps, intolerable conditions for the public may force a change in government thinking to the point where they'll really have to decide whether to control pests, or choose the alternative of letting the pests overwhelm people.

(Slides were shown)

It has been found that if the average superintendent has to make a choice of eliminating from his arsenal of management "tools" one or the other of the maintenance items he now has to work with, the last thing he would stop using would be his pesticides. He can always make a greens or fairway mower last another year via judicious maintenance and repairs -- he can always let his turf get less thrifty with fewer fertilizer applications -- he can always "live with" less well-mowed turf, particularly in out-of-the-way parts of his roughs and some fairways. But he simply cannot maintain fine turf, particularly putting greens, without good pesticides -- at least as of now.

What's to be done? That part is largely up to you. You can either "hold still" and put up with whatever restrictions

or regulations are thrown at you, OR you can DO SOMETHING ABOUT IT! Write your congressman! Write your senator! Work through your association, and its fine membership, to let the "powers that be" know that in order to pursue your very rewarding career you need good "tools" -- especially your pesticides! Just because something "might," at some future date, cause some sort of problem, is no reason to ban it or deny future registration, when the product in question might be one that has been performing as a pesticide for over 50 years, with excellent results -- and having caused NO PROBLEMS UP TO NOW! The mercurial fungicides are a prime example of this. On the other hand, a number of routine items of commerce, readily available over the counter to anyone, at any age, appear to be far more dangerous. It has been said, for example, that ordinary aspirin causes more deaths every year than all pesticides combined, for any purpose whatever.

Officials often will ban a pesticide, or something else, because it has the potential to "pullute" the atmosphere. Reducing auto exhaust emission with expensive devices is a prime example of this philosophy. When one really does some objective thinking, he begins to realize that what man can do to pollute the atmosphere is infinitesimal, compared with what can be -- and is -- by natural forces. In an article I read recently, the author, in speaking of atmosphere pollution, asserted that back in the 1880's, when the volcano, Mount Krakatoa, exploded and the entire island sank below the sea, it threw into the atmosphere more particulate pollutants than has all of mankind since the world began! Add to that one incident the volcanoes that continue erupting around the world every day, the frequent dust storms and sand storms, the forest fires that are almost constant over the globe, and you'll readily see that man's impact is literally non-existant. You'll also see why the article in question carried the very provocative title, "THE EARTH IS ITS OWN WORST POLLUTER."

Why do I contend that you are the key to the future of good pesticides? Because you are the ones the officials will listen to -- as you are the ones most adversely affected by the potential absence of your important pesticides. A company like ours can make little impact. We can, and do, collect and present what facts we can, and as objectively as possible. Right now we're trying hard to maintain the important mercurials

for you by appealing for their continuance in turf use during numerous trips to the EPA. But, by and large, if there are to be continuing good pesticides available to you, and more important, if commercial companies are to start again investing in research toward better pesticides for the future, and other more sophisticated pest controls, it is YOU who must generate action -- because it is you whose careers are at stake -- and therefore you who have most to gain by good pesticides -- and most to lose by their absence!

LEAF AND TILLER GROWTH OF GRASSES AS AFFECTED BY TEMPERATURE MOWING AND OTHER PRACTICES[1]

Victor B. Youngner[2]

If we are to understand how various management practices and environmental factors affect turfgrass growth we must first know something about the vegetative structures of the grass plant. Compared to many higher plants the grasses are simple in structure and organization. Nevertheless, they are adapted to a wide range of conditions and have a broader distribution than any other family of flowering plants.

In the vegetative phase the grass shoot apex is located above a short, extremely compact, stem at or just above the soil surface. At this stage the stem consists of a series of nodes from which the leaves arise; the internodes elongate only when the plant enters the reproductive phase. Of course, many grasses also have horizontal or creeping stems with elongated internodes (rhizomes or stolons) which makes them especially valuable for turf. These horizontal stems may turn up at the tip to form a new leafy shoot as do the rhizomes of Kentucky bluegrass, or they may give rise to new vertical shoots at their nodes as do the stolons and rhizomes of bermudagrass.

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2/ Professor of Agronomy, University of California, Riverside, California

Young leaves on the shoot apex appear as a series of concentric ridges. As these ridges elongate into leaves they separate into two parts -- the blade and sheath. The blade and sheath each have at their bases a meristematic region in which growth occurs by cell division. Buds which form in the axils of the leaves develop into new shoots or tillers. Each tiller can give rise to additional tillers in turn until a dense clump is formed. Many such clumps close together form a sod or turf.

These characteristics -- the location of the shoot apex, the method of leaf growth and the spread by tillering -- are the ones that make grasses our most valuable turf plants and permit us to mow them closely time after time.

A primary function of turf management is to regulate cultural practices in accordance with other environmental factors to maintain healthy vigorous plants that can withstand frequent and heavy use. In order to do so the turf manager must know how these practices affect growth under various environmental conditions.

Tillering

Tiller buds are initiated in the axils of leaves at an early age. Initiation of the bud appears to be influenced only slightly, if at all, by environmental conditions in most grasses. Usually one or more buds are formed in the axil of each leaf. However, subsequent development of the bud into a tiller, rhizome or stolon is affected by a number of factors. Under unfavorable conditions many buds will never develop into tillers.

Tillering of cool season grasses is favored by short to medium daylengths (10-12 hours) and moderate temperatures (60-75°F). Therefore, in most regions maximum tillering will occur during spring and fall. The precise optimum temperatures will vary according to genotype or strain. For example, Newport Kentucky bluegrass, selected along the cool Oregon Coast, has a considerably lower optimum than such strains as Merion and Fylking. During periods of very high temperatures, well above the optimum, tillering of cool season grasses may nearly cease.

Soil temperature, distinct from air temperature, also affects tillering rates. The optimum soil temperatures for tillering of the grasses studied are several degrees lower than the optimum air temperatures.

High light intensity favors a high tillering rate. For this reason turf density is usually lower under shade than in areas of full sunlight. Shade-tolerant grasses such as the red fescues have a lower optimum light intensity than do Kentucky bluegrasses or ryegrasses.

Nutrient supply strongly affects tillering, nitrogen generally being of much greater importance than phosphorus or potash. Studies on some non-turf grasses have shown that at low nitrogen levels the proportion of buds developing into rhizomes in contrast to tillers was much greater than at high nitrogen levels. Although, to my knowledge, this has not been investigated in the turf grasses, such a relationship if it exists could be of considerable significance. There is no doubt that high turf density from tillers and rhizomes is dependent upon adequate levels of nitrogen. However, there is some evidence that very high nitrogen levels will reduce the production of rhizomes and tillers; perhaps an incipient salinity effect.

The management practice most dramatically affecting tillering and growth in general is mowing. The repeated removal of leaf tissue usually has an adverse effect not only on tillering rate but on total dry matter production, root growth and soluble carbohydrate levels as well. Most studies have shown that growth declines directly with increased frequency or increased severity (closeness) of mowing. An exception to this rule is found when elongated stems (stolons or flowering culms) are removed. Tillering or stolon branching is usually stimulated in these cases, apparently resulting from a removal of inhibitors found in the shoot apex which has been clipped off. Kentucky bluegrass cultivars have been shown to differ in their tolerance to mowing even where the same proportions of leaf tissue were removed. This has been attributed to differences in photosynthetic activity especially in the leaf sheath.

In evaluating the significance of these environmental effects to a turf management program several points must be considered. Individual tillers behave to a great extent like individual plants even though they are interconnected. Each tiller has its own root system which supplies it with water and nutrients. Translocation of water, nutrients or the carbohydrates synthesized in the leaves from one tiller to another is not free but usually occurs only under rather specific conditions. In rather unscientific terms, we can say that each tiller attempts

to satisfy all its own needs before giving anything to other tillers. The primary exception to this is that translocation to young tillers from the parent tiller takes place readily until the young tiller is able to survive alone. Thus, we have within a clump of grass intense intertiller competition for light, water and nutrients.

The environmental management factors we have discussed do not act on the plant alone or singly. Instead they play upon the plant simultaneously and interact with each other. Thus, one factor will either mitigate or intensify the effects of another, as the case might be. For example, the growth depressing effects of a given mowing height will be intensified as temperatures increase. On the other hand, as temperatures increase in the summer the harmful effects of the high temperatures can be reduced by raising the height of cut. If the turf is shaded the temperature mowing effects will be further modified.

Leaf Growth

The rate at which leaves appear on a single grass shoot varies with the genotype of the plant and with environment. However, for any given genotype under constant environmental conditions the rate will be constant. Although for the most part they are as yet poorly defined, every grass species or variety has an optimum set of conditions for maximum rate of leaf emergence. The same factor interaction effect mentioned previously also applies to leaf emergence and leaf growth.

Leaf growth following emergence can be measured in terms of leaf width, length, weight or area. A common measure is the total leaf area per shoot (tiller). On many grasses leaf length increases with increasing daylength. On the other hand, leaf length may also increase with decreasing light intensity.

Nitrogen fertility profoundly affects leaf growth producing longer and wider leaves and a higher rate of leaf emergence. Thus nitrogen is one of the most important factors in increasing total leaf area per shoot.

Studies on Kentucky bluegrass cultivars have shown that mowing intensity has much less effect on leaf emergence rates than it does on tiller emergence rates. Of course, total leaf area per shoot will decrease as the proportion removed from each leaf is increased. The decrease in total leaf area per

plant may be made even greater by a decrease in leaf width with increased mowing intensity that we have observed on many species.

On an individual grass shoot the first formed leaves began to die after a certain number appear and under constant conditions leaf death occurs at the same rate as leaf emergence. Thus, under constant conditions there will be a specific number of leaves per shoot that will be characteristic for a variety or genotype. Since factors such as light and temperature affect both the rate of leaf emergence and leaf death as well as the rate of tiller development the total leaf area per unit area of ground may change dramatically from spring to summer.

Root Growth

Brief mention of root growth must be made since the condition of a turf's root system will strongly affect top growth and thus the quality of the turf. Optimum temperatures for root growth generally are considerably below the optimums for top growth. This is true whether we are considering air temperature or soil temperature. Root growth has been observed on some grasses when temperatures were too low for any measurable top growth. Conversely, as temperatures increase, root growth of many cool season grasses may cease long before any pronounced reduction of top growth can be observed. Under very high temperatures root dieback may occur.

Mowing has a dramatic affect on root growth -- even more pronounced than its affect on leaf and tiller development. Since root growth is dependent upon the carbohydrates synthesized in the tops, the greater the reduction in leaf area the weaker will be the root system. The interaction between temperature and mowing is pronounced. Intense leaf removal during hot weather can stop all root growth or cause severe dieback. The end result may often be a thinning or complete loss of turf.

Nitrogen fertilization while it stimulates leaf and tiller growth may often retard root growth thus increasing the shoot to root ratio. It is clearly evident then that the turf's root system can be protected during hot weather by reducing nitrogen levels and increasing the mowing height. Doing the opposite may be fatal to the turf.

BUDGETING FOR PARKS AND GOLF COURSES[1]

Albert D. Angove[2]

I'm not sure what it means to be on the program at 8:30 a.m. Either one of two things, "He is a dynamic speaker and everyone will be out of bed for his presentation," or "He is an abstainer so we know he will stay sober and not have a hangover." One quick look around and I can see which is true.

Because budgets are economics, I believe we should look at some economic facts:

1. Labor prices are up.

2. Inflation, althqugh leveling off somewhat, is still rising.

3. Materials, especially those of underground extraction, are becoming scarce.

4. And, as gas becomes more expensive, the need for local services will increase.

1/ To be presented at the 29th Annual Northwest Turfgrass Association Conference, Yakima, Washington, September 17 - 19, 1975

2/ Director of Parks and Recreation, Spokane, Washington

What does this mean? It means when you and I are making out a budget request for 1976, we will have to look at some of these economic facts. Your 1975 dollar has less purchasing power and things do not look much brighter for 1976. I am sure all of you realize this already. And, what can we do about it?

We are going to have to take a hard, honest look at the budget and list each item in the order of importance to the operation. Beginning with personnel, take a good realistic look at the number of people you employ, justify each man by his duties and performance and the real value that person contributes to your operation. It's very easy to fall into the "I need another man" trap, when what you really need is to reorganize your way of doing things, or get rid of the non-producers.

If you are going to control finances, you need to start with the largest expenditure - labor - the number of manhours it takes to perform the task needed. I am stressing manpower because this is generally 60 to 80% of your budget.

Equipment falls under the same category; we all like a shop full of up-to-date equipment, but how much of it really pays for itself in the reduction of manhours?

At this point you are saying, "All this is well and good, but how do we really do the budget justification he is talking about," or "We've been doing this same thing for years." I am sure this talk is like another on top dressing, you know all the techniques but just may have forgotten one or two things.

How do we do a justification of a budget?

Using an old cliche, we take pen and paper in hand and write out what each employee does, including your job, and how many hours it takes to perform each task, i.e., greens mowing, number of men x time x hour wage = total cost per job. For equipment, take the cost of the machine, such as a greensmower or a triplex: greensmower - 6 needed @ $600 each = $3600, with a life span of 5 years; triplex - 1 needed @ $5000 each with a life span of 5 years.

Discounting the quality of the cut, since people disagree on this, and maintenance factors for now, let's look at the cost benefit of the above equipment. For example, it takes 3 people 4 hours to mow 18 greens and the wage is $2.00 per hour; the total cost of greens mowing is determined by 3x4x$2 = $24 = $1.33 per hole each day. If you use a triplex, it's 1 man x 2.5 hours x $5 per 18 holes or approximately 27¢ per hole a day. Multiply the number of days you cut greens x the cost and you will have an approximate total yearly cost. Add the average maintenance cost of your mowers, assuming you keep records of maintenance, - if you don't, you should - and this will tell you and your greens committee the true cost of operation. In my opinion, one of the real problems of budgeting is obtaining the true cost of the services your budget is to provide.

Each job you do on the golf course or park can be figured in this manner. Then, when your budget is ready for presentation to the board, or whoever approves your budget, and you must make cuts, you and your board will know where those cuts can be made in the budget and what services will be affected. I believe this is what we are really talking about, what services can be reduced or increased and how much is that phase of the operation going to cost.

The landscaping around the clubhouse with the bulbs and the annuals may be very beautiful, but also very expensive to maintain. When the breakdown cost of maintaining the landscaping is provided and it is balanced against the cost of fertilizer for the greens, it well may be the maintenance landscaping will have to be changed to cut the cost and provide the fertilizer.

This type of decision cannot be made unless the alternatives are presented and the cost of these alternatives are expressed in their true value. One serious mistake we are all making is trying to provide constant service on a reduced budget. When you have the true cost of each service, then you can have the budget approvees make the choice of services to be rendered. Your job is to provide a well-designed budget and give them the opportunity to make the choice.

WATER MANAGEMENT TO MEET CURRENT NEED[1]

V. B. Youngner[2]

Irrigation is the most critical of turf management practices and, yet, the one for which firm rules and recommendations are most difficult to give since conditions vary from place to place and from day to day. Years ago we thought we had the problem solved with such rules-of-thumb as water "deeply and infrequently" or "don't water until the grass shows the first signs of wilting." We know now that these statements were over-simplifications at best and under some conditions absolutely incorrect. Regular deep watering often may be wasteful, and even brief periods of water stress can be as harmful as excess water to some grasses.

The advent of the automatic controller seemed to be a big step towards good turf water management. And indeed it was, as it permitted watering during early morning hours, precise control of the irrigation period, repeated cycles of irrigation for minimum run-off, and many other objectives previously difficult to attain.

However, the automatic systems, like older manual systems will provide good irrigation only if properly operated. The most frequent and most serious mistake made in the operation of automatic systems is to set the controls and leave them unchanged for days, weeks or months at a time. Water requirements of turf depend upon many factors, most of which are in constant flux. The turf manager must understand these factors, must observe them carefully, and interpret them in terms of irrigation schedules which he regulates by frequent changes in controller settings.

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2/ Professor of Agronomy, Department of Plant Sciences, University of California, Riverside

A good irrigation system will be designed to provide for approximately the heaviest anticipated water demand, a need which may be rarely reached. A turf manager with a new system must study his situation, make what he believe to be the best settings, and then observe turf response and make any necessary adjustments.

Turfgrass water requirements are affected by soil characteristics, species or variety of grass, the seasons, weather changes age of the turf, management practices and changes in the soil. Interactions among these factors create an even more complex situation.

Soil Characteristics

Soil texture is the principal factor determining water infiltration rate. In general, the coarser the texture, the higher the infiltration rate. Infiltration rates will range from less than 0.10 inches per hour for clay to over 20 inches per hour for coarse sand. These rates can be modified by organic matter, which in general reduces the rates for sands but often increases them for clay. Some organic soils may become highly hydrophobic if allowed to become dry. If water application rates exceed the infiltration rate of the soil, run-off and ponding will occur, an especially serious problem on rolling terrain.

Soil water-holding capacity is also related to soil texture. In general, the finer the texture, the greater the amount of water held by the soil and also the greater the proportion that is held so tightly that it is unavailable to the plant (Table 1). If organic matter is added, the amount of available water will generally be increased, especially in sandy soils.

If this were all that there were to it, the problem would be fairly simple: determine the infiltration rate and the available water held by the soil and irrigate accordingly. But these characteristics do not remain constant. Soil compaction, which is almost certain to occur to some extent, will decrease the water infiltration rate and change the waterholding capacity in time. Organic matter may decompose, or roots and other plant parts may add more. In either case, soil-water characteristics may change.

Aerification, if sufficiently frequent, will help maintain satisfactory infiltration rates. However, several studies indicate that the effects of aerification are short-lived. One or two per year will have little long-term effects. Even where aerification is frequent, soil compaction will slowly develop below the zone of spoon or tine penetration (the surface 2-4 inches).

What, then, is the answer? The turf manager must observe the turf, examine the soil with a soil tube, and adjust the irrigation schedule as indicated.

Turfgrass Species

All dense turfs, regardless of species, will use approximately the same amount of water under any given environmental condition. In other words, all turfgrasses will use water in a direct relationship to climatic conditions. The differences among turfgrass species is in their ability to extract water from the soil -- the volume of soil that they can draw upon to meet their water needs. This is determined by the root mass produced by each species and, especially, the depth of rooting. Table 2 shows the approximate rooting depth of the common turfgrass species. Obviously, it would be foolish to water regularly to a depth of two feet if the maximum depth of the root system is only one foot. On the other hand, if watering is to one foot but the grass will produce roots to four feet or more, the full potential of the grass is not being utilized.

Many factors modify rooting depth. Usually grasses will produce a deeper root system in coarse textured soils than in fine textured. Soil compaction may severely restrict root development, which can be only partially remedied by aerification.

Heavy nitrogen fertilization will often reduce root growth while greatly increasing top growth. Thus, with regular heavy use of nitrogen fertilizer a large shoot:root ratio will result.

Mowing has a more restrictive effect on the grass root system than any other turf management practice. The grass root system will be reduced directly in proportion to the reduction in mowing height or the increase in mowing frequency, i.e., the more severe the mowing treatment, the shorter the root system.

Table 1. Available and unavailable water per foot of soil.

Soil Texture	Inches water per foot	
	Available	Unavailable
Sand	0.4 - 1.0	0.2 - 0.8
Sandy loam	0.9 - 1.3	0.9 - 1.4
Loam	1.3 - 2.0	1.4 - 2.0
Silt loam	2.0 - 2.1	2.0 - 2.4
Clay loam	1.8 - 2.1	2.4 - 2.7
Clay	1.8 - 1.9	2.7 - 2.9

Table 2. Comparative rooting depths of turfgrass species.

Actual depth will vary according to many factors.

Shallow (1-8 inches)	Medium (8-18 inches)	Deep (18 inches-5 feet)
Annual bluegrass	Red fescue	Tall fescue
Creeping bentgrass	Kentucky bluegrass	Bermudagrass
Colonial bentgrass	St. Augustinegrass	Zoysiagrass
	Dichondra	
	Annual ryegrass	
	Perennial ryegrass	

Therefore, the actual root system developing on any species of grass will be dependent upon environmental conditions and the management practices being followed. Any time the turf manager changes his management practices, he should be aware of possible changes in the root system and adjust his irrigation schedules accordingly. A soil-sampling tube is a useful instrument for determining root depth as well as soil moisture.

The Changing Seasons and Weather Conditions

Turfgrass water use changes with the seasons and with major weather changes. This is principally a function of changes in evapotranspiration (evaporation and transpiration) rates. During the long, hot summer months evapotranspiration rates will be much higher than during the shorter, cooler months of fall, winter and spring. These rates will be approximately 75-85% of the evaporation from a Bureau of Plant Industries evaporation pan. Therefore, for each inch of water evaporated from the pan, .75 to .85 inches must be applied as irrigation water to the turf. The actual amount of water which must be provided may be 5 to 10 times greater in the summer than in the lowest winter period.

However, another factor must be considered as it relates to seasonal water use. Grass growth, especially that of the root system, also changes over the seasons. Most root growth of both warm-season and cool-season grasses occurs during the spring and fall. In an established turf little root growth can be observed on cool-season grasses during hot summer weather, and there is evidence that often there may be death of existing roots. Thus, as summer weather increases the water requirements of the turf, there may be an accompanying decrease in the grass's ability to extract water from the soil. If this occurs, irrigation programs must be changed in respect to the amount of water per application and the frequency of application as well as in the total amount of water being applied.

Weather changes of shorter duration will also necessitate irrigation schedule changes. Hot, dry winds, such as the Santa Ana of southern California, periods of fog or other overcast, periods of unusual temperatures, and rainstorms, may all change water requirements for brief periods. Because of differences in evapotranspiration rates, irrigation may not be needed for many days following a winter rain but may be needed within a day or two after a summer rain.

Age of the Turf

As a turf becomes older, water requirements will change. This is primarily the result of factors already discussed. Soil compaction, grass rooting depth, soil organic matter content, and other factors may change with time and in turn affect irrigation programs. Thatch accumulation reduces water infiltration rates while often increasing the amount of water held at or above the soil surface.

Conclusion

In summary, many factors affect turfgrass irrigation rates and programs. These interact with each other and vary from place to place. Therefore, broad exact irrigation recommendations are not possible. Irrigation practices must be determined for each individual site and changed as necessary from year to year, season to season and day to day.

The turf manager is responsible for determining the practices to be followed on his turf areas. He can do this by learning the factors involved in turfgrass water use, determining the soil, grass and climatic characteristics of his location, and above all watching closely the short-term and long-term changes that will occur. He must not set the controls for programs suggested for him or which he thinks are right and then forget them. That is certain to lead to turf problems and possibly to turf failure.

DEVELOPING NEW PARK AND RECREATION AREAS[1]

Robert Warren Bignold[2]

Upon receiving the conference program, my first step was to review the topics of other speakers for a clue as to which direction my talk should take. I found experts talking on pesticides, leaf and tiller growth of turfgrasses, budgeting for parks and golf courses, and irrigation management, all subjects that a speaker could really get his teeth into; and then I came to my subject, "Developing New Parks and Recreation Areas". Developing new parks and recreation areas was, in my mind at least, so broad that it encompassed most of the topics discussed thus far during the conference, and many of which would not be discussed at all. Do they really want me to cover that broad a subject, I asked. Well, common sense said no, at least not in one hour! In fact, I am totally incapable of doing justice to such a broad subject. As a matter of fact, I soon realized that such a broad title was a blessing in disguise. It gave me the opportunity to discuss the design of new park and recreation areas utilizing my favorite formula, "The Plan "C" Approach". Now what the devil is the Plan "C" approach, you ask? I'll tell you about that in just a moment, but one thing is certain. You may never have seen the Plan "C" approach before because few designers use it. Why? Because it is the most difficult method, the one that requires judgment and decision. So like many speakers before me, I am going to redesign the title of my speech.

1/ To be presented at the 29th Annual Northwest Turfgrass Association Conference, Yakima, Washington, September 17-19, 1975.

2/ President, ORB Architects-Planners-Engineers, Renton, WA.

The new title is "Developing New Park and Recreation Areas With the Plan "C" Approach". Now you are all pragmatic, down-to-earth individuals, and you're going to like the Plan "C" approach; but frankly you're going to find that there is no easy way to develop new park and recreation areas. Like everything else worth doing, it takes years of experience and constant persistent effort. There are, however, some easy methods of design that give the impression of accomplishing their goal, particularly in the early years of a project, before wear and tear begin to take their toll.

Plan "A"

The first, and perhaps the easiest, (let's call it Plan "A") is the concept of utilizing the least expensive materials and construction methods, and designing the simplest configuration or utilizing the easiest methods of constructing facilities. This type of design is easy because it requires little judgment. We simply decide which item or which method is least expensive and include them in our design.

Plan "B"

The second method (let's call it Plan "B") requires that we merely select the most expensive, maintenance-free materials and equipment available. Since money is of no significance, we can often design highly elaborate parks or recreation structures with exotic shapes and layouts, slanted, angled and cantilevered facilities, real design competition winners. While it is expensive, it is easy. Again, it takes no real judgment. We simply determine the best and use it, and that type of design doesn't take much effort.

It is my observation that in the design profession, as in other professions, we tend to take the easy road, the one that satisfies the designer's own biased view of the world. We make many decisions in the name of realism, when actually the determining factor is simply an unwillingness to face up to the sacrifices, hard work, and sweat that significant design achievements require.

Plan "C"

The most difficult, but without a doubt the best method of design (let's call it Plan "C") is one that selects each item of material and each piece of equipment or each type of construction on the basis of its special use or need. It is possible in my opinion to create an attractive vandal-resistant design without the use of high cost, first-class materials and equipment. How? By selecting and designing with a real knowledge of the actual use problems.

Does Plan "A", "the least expensive" test, or Plan "B", "the most expensive" test seem like unreal methods to you? Believe me, many designers have reduced their decision-making process to just such a simple rule of thumb approach. Always use wood, the natural material; or perhaps they always design their own play equipment because kids don't like that standard steel stuff. Whatever the rule of thumb, it's wrong, at least part of the time. Each design decision must consider the location, the climate, the owner, the user, and a number of other variables. Design decisions require common sense judgment; they require a design with Plan "C" methods.

A Case for Meticulous Design Decisions

Several years ago ORB was retained to design a married student housing project for Central Washington State College. The College staff made it clear that they wanted to develop a low-cost housing project. They even asked us to look at mobile homes! We knew, of course, that we could design a low-cost project, but wouldn't the maintenance cost, over the years, eat the College up? We thought so, and we set out to prove it. Our training as architects had prepared us to think in terms of lower cost materials causing higher future maintenance costs. But, try as we might, we simply could not find any real evidence of such higher maintenance figures in our investigations of other low-cost housing projects. In fact, our research found a surprising lack of difference in overall maintenance costs between all building types. For example, a 1967 Institute of Real Estate Management survey indicated only an 8% increase in the maintenance and repair expenses of buildings constructed between 1946 and 1960, as compared to those constructed between

1961 and 1967. It also indicated only a 9% increase in the maintenance and operating expense of buildings constructed between 1921 and 1930 over those constructed between 1961 and 1967. We also found the range of extremes in maintenance and repair costs to be a relatively small percentage of the total operating cost.

We weren't satisfied, so we kept looking. We collected costs from a number of government housing agencies and private developers but we simply could not support our pre-conceived notion that low-cost housing was more expensive to maintain than expensive housing. What we found was that elaborate structures constructed with expensive materials and delicate landscaping were usually maintained at a higher level than low-cost structures. If you think back on the parks in your own City's system, I am sure that you can find facilities which will verify our findings.

As an example, let's take a simple, inexpensive bathhouse and swimming pool in a small eastern Washington town and compare it with an elaborately designed, expensive bathhouse and pool located in a large city such as Seattle. The small town pool has a simple rectangular concrete block bathhouse with flat roof, a pointed concrete pool tank, painted pipe deck equipment, and manually operated pool equipment.

The large city pool has an elaborately designed bathhouse with angled brick walls, special skylights, plastered pool tank, tile trim and stainless steel deck equipment. It also has automated pool equipment.

My guess is the expensive structure will cost much more to maintain. True, it is maintained much better than the inexpensive structure, but my point is that its fine quality of design requires it to be; the public demands it.

Value Analysis, The Best Method of Design

Now let's digress back to that housing project I spoke of earlier. I think it may be easier to make my point utilizing an example outside of your area of expertise and then come back to illustrate how it applies to your business. On the C.W.S.C.

project, rather than designing cheap or expensive, we accomplished a thorough value analysis on each item selected for the design. In the case of the housing project, we had a large number of repetitive units, we could afford a thorough project analysis within the design fee, and that is important as it allowed us to concentrate our efforts on the problem of first-cost versus maintenance cost. As an example, one of the items we looked at was door hardware. The College's design standard called for the best grade of commercial hardware to be used in the construction of student housing. Why? Because, the locks on student housing had been a constant maintenance problem. Dormitory rooms with an average of four students each, coming and going to breakfast, classes, lunch, dinner, library, etc., caused the lock to be utilized as much as 16 to 20 or more times per day. Heavy usage required heavy duty locks, the most expensive kind. But we reasoned, why should a married student apartment get that type of usage? Generally, the young housewife stayed home, and even if she didn't, both the man and wife would commute to campus where they would attend classes and spend the time between classes in the library or study area, because of the remoteness of the housing. Why couldn't we utilize normal residential hardware, perhaps a medium grade of hardware on the exterior doors and bathrooms, we reasoned, and in the bedrooms the least expensive hardware; a cost savings of nearly 50 percent on the project, and to this day the inexpensive hardware has performed well on the job.

When we analyzed floor coverings for the student apartments, we found that in the past the College had utilized rugs in all student apartments. One of the primary reasons for the use of rugs was that the cleaning costs of rugs were thought to be significantly less expensive than those for resilient flooring.

We found that many studies had been made over the years comparing the cleaning costs of carpets versus resilient flooring. While not all studies agreed on exact costs, there was general agreement that carpet maintenance was less expensive in terms of labor and supplies than the maintenance of resilient flooring. Estimates ran from 20 to 50 percent less. Basically, the daily cost of cleaning each type of floor was

the same depending upon the appearance level desired; however, the big difference came in the necessity for mopping, machine stripping and refinishing of resilient floors. An independent study of cleaning frequencies by the Port of New York Authority showed that from 5 to 22 hours of cleaning time savings annually per 1000 sq. ft. of floor in favor of carpeting. However, when we compared the first cost of carpeting versus vinyl asbestos tile and considered the annual replacement cost, we found that the first cost of tile was only 15% that of carpet.

Since cleaning is accomplished by the married student tenant, the annual replacement cost of vinyl asbestos tile was of more interest to the College than the cost of cleaning. It was also apparent that the average married student could better afford to sweep and damp mop a resilient floor than to vacuum and shampoo a carpet. To this day the Housing Office has not received a single complaint dealing with the use of resilient flooring rather than carpet.

Keep in mind that one must make different design decisions under different conditions; for instance, if the floors were maintained by a paid maintenance staff, carpets would have easily won over the resilient floor.

Apartment houses, you say, are different than park facilities. They are well managed and well supervised and in addition they often charge the tenants damage deposits.

That's all true, of course, but the same design principles utilized in our C.W.S.C. housing project should and can be applied to your park and recreation facilities.

The proper design of parks and recreation areas is a great deal more complex than just selecting better materials or more expensive equipment.

Like every skill, the proper design of park and recreation areas and facilities is harder to accomplish than to talk about. Each of you has a different maintenance philosophy, and that makes it difficult for me to cover the type of items which would be of interest to each of you. In fact, I would

guess that many of you practice a different level of maintenance between different types of park facilities. For instance, a City Department may maintain the Mayor's City Hall flower bed at a very high standard, and the small neighborhood park in the underpriveleged district of town at a much lower standard, not that that's necessarily bad; in fact, I think it makes good sense. Some afternoon you should sit down and write out specific goals and objectives for the level of maintenance that yourstaff should apply to each type of park area or facility. It will be a tremendous guide to them, and will help you to justify different maintenance standards for different areas or facilities.

Now I don't want to confuse you. If high design and better quality materials are required of your project, as they may be in many cases, they need not raise your maintenance cost out of reason. Once you have accepted the fact that a beautifully designed swimming pool must be maintained at a high level, it is then our task to try and hold the maintenance cost as low as possible by careful planning and design, (Plan "C"). We can simplify the cleaning of the pool deck, provide better distribution by the fresh water inlets to reduce algae growth, or provide proper design of the pool's landscape planting and grass areas to simplify cutting and trimming operations.

At ORB we have never had a project where the client did not want to design a structure utilizing maintenance-free materials and self-maintaining or automatic maintenance-free equipment. That's just human nature; but if every client wants such designs, why don't we give them to him? The largest single reason we don't is the lack of money, both for design and for construction.

In design, money means time and good design requires enough time to make the proper value judgment to select the proper materials and equipment. Standard design fees don't always allow sufficient time for these tasks. That is why it is so important for you to select a designer with a depth of background and experience on projects similar to yours. A good project requires enough money to select a material or piece of equipment which will do the job required of it.

Value analysis (design time spent in checking value judgments) ensures that the lowest cost item of equipment which will do the required job has been selected by the designer.

True value analysis looks beyond first-cost to future maintenance and operating costs, and even life expectancy.

The client's aspirations for automated systems which exhibit low operating cost, low maintenance cost facilities may bring with them new and often unanticipated costs. When we utilize sophisticated equipment, we may eliminate the need for non-skilled labor, which nearly always increases the need for highly trained technicians to maintain the automated equipment. A good example is a city which irrigates its parks by the use of manually placed hose-mounted sprinklers. Such a system requires many manhours of labor to move sprinklers, turn them on and off, etc. After a series of convincing arguments, you finally get your Council or your management's approval, and after a large investment of capital dollars, an automated irrigation system is installed in every park in town. Now you find that you must convince your management that your pay scale needs upgrading, as your park maintenance personnel require additional training and a higher level of skill in order that they can repair the automatic heads and sprinkler controllers which are constantly needing repair and adjustment. The same situation occurs with the installation of coin-operated (automatic) lockers, automatic chlorinator systems, or complex heating and air conditioning equipment. In a large park system, where specialists can be trained and maintained, the automated systems will no doubt pay handsome future savings, but in the small town or small park system, especially those isolated from the large metropolitan areas, such equipment could well cause you a deluge of future maintenance headaches.

Supervised or Unsupervised Facilities

We generally think of our park and recreation facilities in two categories, those under close staff supervision and those which are isolated and without supervision.

A well supervised facility might be a swimming pool with locker rooms, restrooms and shower area. Such a facility always has a ticket attendant close by, several lifeguards on duty, and may be easily monitored by way of mirrors, P.A. system listening devices, or just the nearness of attendants to the area. In such a facility, vandalism is more easily controlled. Here, less expensive plumbing and electrical fixtures can be utilized, and designers need not be as concerned with preventive design.

A non-supervised facility might be a neighborhood park without a full-time attendant, isolated from supervision except for visual inspection by the surrounding neighborhood. Just to give you an idea how we at ORB have applied the value analysis approach to our park and recreational design, let's look at our checklist for the design of a non-supervised restroom.

ORB CHECKLIST FOR NON-SUPERVISED RESTROOM DESIGN

1. Orientation:

    a. Are the doors of the restroom oriented toward a roadway or adjacent housing, etc. --- Can a person attempting to break in the structure be seen?

    b. Is the building located in an open area of the park where it can be seen by cars driving by, local residents, etc.?

    c. Do vandal-proof lighting fixtures illuminate all doors?

2. Exterior Construction:

    a. Have we utilized masonry or concrete exterior walls? (Utilize wood frame only when directed to do so by the client.)

    b. Is the insect screen backed and secured properly so that it cannot be pushed up?

c. Are wood handrails, fascias, etc., exposed to the public specified of at least 2 inch thick material?

d. Are all structural timber members exposed to the public specified of at least 4 inch thick material?

e. Is the wood roof decking exposed to the public at least 2 inches thick material? (If lighter decking is used a soffit shall be added to prevent damage.)

3. Interior Construction:

a. Are interior partitions masonry or concrete? (Utilize wood frame only when directed to do so by client.)

b. Are all floors sloped to drain? Is the slope at least 1 inch in 4 feet?

c. Have wall vents been installed between the pipe chase and the heated toilet room?

d. Have we provided grab bars for the handicapped?

e. Can a person in a wheelchair get through the toilet partition door?

f. Is the ceiling 5/8 inch plasterboard to give a one hour fire protection? Is it backed by 3/8 inch plywood to keep vandals from punching holes in it? Use plywood backing in unattended, unsupervised areas. (Note: the plywood without plasterboard allows ceilings to be carved, chipped, and are subject to destruction by fire. Several years ago a vandal set a fire in a waste basket of a small restroom in our Kirkland Marina Park with such a ceiling, the only damage was a scorched area in the paint. If the structure had been a wood frame, or a wood ceiling, the entire structure would have been destroyed. The plasterboard, which acts as a facing material for the plywood backing can be repaired easily by spackle and paint. The plywood backing is required to prevent vandals from breaking through the plasterboard.)

g. Are the toilet partitions and urinal screens floor-to-ceiling supported? Are they shown and specified?

h. Does the Park Department (client) have a standard type of towel and tissue dispenser? Have we specified it?

4. Electrical (Exterior):

a. Are all light fixtures exposed to the public ORB approved for use in unattended, unsupervised facilities?

b. Is the photo-electric cell controlling the outside lights mounted high on the roof out of reach of vandals and temptation?

c. Has the electrical service been sized to adequately provide for future growth? Have we provided spare conduit stubbed outside the building for future service to:

Ballfield?
Tennis Courts?
Site Area Lighting?
Parking Lots?

5. Electrical (Interior):

a. Light switches for lighting fixtures should never be located in public areas. Locate all switches in storage room, or locked panel box.

b. Is the ceiling light fixture an ORB approved vandal-proof fixture for use in unattended, unsupervised facilities?

c. Has a waterproof type duplex receptacle been provided (for maintenance use, mount 7'-0" high to reduce vandalism)?

6. Plumbing (Exterior):

   a. Has the water meter been sized for the proper flow and pressure? Have we verified the water pressure to be sufficient to operate flush valves?

   b. Are the drinking fountains and exterior hose bibs frost-proof type?

   c. Are all landscape irrigation lines sloped for automatic drainage?

7. Plumbing (Interior):

   a. Are vandal-proof plumbing fixtures utilized? (Prison type fixtures with valves, flush valves and operating equipment mounted in plumbing chase or storage area for unsupervised restrooms.)

   b. Are floor drains provided in toilet room areas?

   c. Is all piping sloped to drain for easy winterization?

   d. Provide a hose bib in storage room.

   e. Install a 1/2 inch loose key stop hose bib below each lavatory.

While it is somewhat out of context, an interesting point which I would like to mention here is the use of color. Nearly seven years ago one of our architects painted the interior of a bathhouse with brilliant greens, blues and oranges; so bright that I feared heavy criticism by the general public. The criticism didn't materialize and neither did vandalism or graffitti. The same phenomenon that we had experienced in our bathhouse. Why it works we don't know, but it works and that's all we're concerned about.

Park areas Require the Same Design Philosophy

Thus far many of my remarks have been oriented toward park

structures, but much the same design philosophy is easily applied to the natural park areas.

Let's take a look at a playing field area. Over the years we have found that the single most important factor in the design of a playing field is the drainage (perhaps because much of our work is in western Washington). In western Washington heavy rains demand slopes of from 1 to 1-1/2 percent across a playfield. If the sub-surface consists of fine tight silts or clay soils into which the rain water will not rapidly percolate, it may be necessary to install a grid of perforated plastic drain tile to assure rapid drainage of surface water. In some areas, where rainfall is not heavy, a sufficient holding reservoir may be obtained by merely spreading a layer of sand and gravel below the topsoil. If the sub-surface is more porous, however, a 5 to 6 inch layer of sandy topsoil may be quite sufficient to handle all but the heaviest of rains.

While good drainage makes for a very playable ballfield, it does increase the need for fertilizer. Unfortunately the drainage system which carries away the water also does a tremendous job of carrying away the nutrients. Thus, another sophisticated system has increased our maintenance work at least as far as fertilizer is concerned. If, however, it is your policy to maintain the ballfield in a very high state of repair, this same drainage will keep heavy play from tearing up the turf, which in itself will save a great deal of maintenance.

In ballfield areas a skinned infield is easier to maintain than a grass infield. It can be dragged and smoothed by participating teams on off-duty hours. In such cases it saves the community time and money. If however, you are a university where maintenance is by high paid groundskeepers, then a grass infield may be your answer.

Slopes in all grass areas of the park can also cause some real maintenance headaches if improperly handled. As a rule of thumb, grass areas should never exceed 3:1 and changes in slope should be rounded gently and smoothly to allow easy cutting with large gang mowers. Walkways or curbs should have adjacent grass areas planted level to the top of the curb so that the mower may easily trim while it is cutting.

Planting beds of trees should be grouped and clustered if possible to add to ease of mowing. Free stands of trees surrounded by grass in the park should be spaced far enough apart so that a gang mower will easily pass between without hitting and barking the trees.

Grouping of similar and compatible activities in parks has a tendency to reduce maintenance because like activities usually have similar maintenance chores.

Location of maintenance areas in parks close to major use areas also saves cost, but must be screened for visual compatibility with the use areas.

For large open areas a coarse grass turf is the best surfacing both for maintenance and for the flexibility of activities.

In many cases, a misconception exists that large groundcover areas or shrub planting areas reduce maintenance, watering, and like activities. Grass areas in park settings are usually much easier to maintain than plantings. Shrubs and groundcover require weeding, watering, spraying, pruning. They require plant replacement when plants become overgrown or when they are killed during unusual cold spells, or due to lack of maintenance. The planting areas also catch papers and other trash which cannot be easily picked up by mechanical sweepers, thus increasing hand work.

Many shrubs and trees require a minimum of spraying, pruning, and watering and by proper planting design maintenance costs can be kept to a minimum with little sacrifice of aesthetic considerations.

The selection of plant materials to complement the soil conditions can reduce original installation costs as well as on-going maintenance costs. As an example, in areas of a park which have a tendency to be wet from bad drainage or high ground water and which cannot readily be drained and will not support heavy use, consideration might be given to planting such trees as Poplars, which will survive in the wet conditions

and will have a tendency to dry up the area of excess water by their ability to absorb a great quantity of moisture in their normal growing habits.

Surface materials can cut down maintenance costs significantly. In high use areas, especially game areas such as volleyball, badminton and like activities, a hard asphalt surface may become the most practical.

As mentioned earlier, standard design fees rarely allow a designer to exercise a complete value analysis on each new project, particularly small projects (below $200,000). At ORB we have attempted to solve that problem by specializing our services into a very narrow field of park and recreation facilities, and also by initiating a small amount of value analysis on each project. We have been able to develop a number of design solutions which are value engineered. We then store and retain the lessons learned in the form of standards and check lists. To our value analysis studies, we add experience (our mistakes) from our field inspectors and from reports and talks with people like yourselves who use and maintain our facilities. Each project also has what we call an autopsy report or analysis of things we should do differently. In this way, we don't always re-invent the wheel on each project, although I admit we re-invented it often enough.

Herein lies our problem and your problem; how do we collect and disseminate past experience, past successes, and failures to others. Sure you know most or many of the design principals or concepts I used today as examples. But how in the world do you pass them on to your new in-house landscape architect or perhaps your new consultant. Or more important, does your new man or your new firm have the proper level of experience. Here's what we do at ORB. Our senior people are generally the men with the "in-depth know how". We use these people as project directors to control the technical direction of the design. We try not to burden these men with the everyday financial duties, and client contact, etc. They concentrate on the technical details. Are the tennis courts or ballfields oriented correctly? Are they

drained properly? In this way, they are able to handle a large number of projects and gradually train our younger, less experienced staff in the proper principals of design. I am convinced there is no short cut to success. Each individual in our business must take the long hard road. Vicarious experience of others can, however, soften the blows that fate has in store for us -- and that is what we try to do at ORB.

Another way we pass on our knowledge is by the use of our Standards Committee. This committee consists of four senior individuals: our President, myself; our Office Manager, Mr. Lowell Erickson; our Senior Recreational Designer, Mr. Le Roy Charf; and our Senior Construction Manager, Mr. Ray Jessen -- all men with from 10 to 25 years experience. No standard detail or criteria is used on our projects without the review and approval of this group. We "value engineer" each design criteria or detail. Since our catalogue of design criteria or details has been developed over a period of many years and is often used on several projects, we can generally "value engineer" our projects within the standard fee structure. Because we specialize in recreational facilities, we can even spend more time and effort on a particular project than our fee. Why? Because we know we can utilize the knowledge gained again and again eventually recouping our losses. With proper organization, each of you can accomplish the same results with your own in-house staff if you develop a system for eliminating mistakes before they happen (Project Director, and Standard Committee Reviews) and analyzing and correcting mistakes once they occur (Project Autopsy Reports) and constantly passing on your experience and knowledge (training - both formal and on-the-job by experienced senior personnel).

Hard work? Continuing unrelenting responsibility? you bet it is. It requires that you manage the routine routinely, and that's our toughest job.

This talk and the time and effort I have put into it will be worth every minute of it if you remember just five things:

1. Throw away your old cliches and rules of thumb designed to provide easy answers to the development of park and recreation areas.

2. Rely upon the "Plan C" approach -- make individual value judgments based upon each project, each site, each problem. Value engineer your development.

3. Establish a procedure within your organization which relies upon constant feedback of actual operating and maintenance experience to correct past mistakes.

4. Develop a continuous persistent program for training and retraining your design and operating staff to pass on and update the knowledge and experience you have gained so expensively.

5. Write in an indelible pencil in your memory that significant achievements in any field requires sacrifices and hard work. The only place that success comes before work is in the dictionary.

CARE AND OPERATION OF TURFGRASS MAINTENANCE EQUIPMENT[1]

Babe Brinkworth[2]

Grass is one of the most widespread crops that man cultivates. It has substantial economic value, and provides 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 that 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.

The size of mowing equipment has grown from a 14-inch hand push to a tractor driven model of over 18 feet in width.

Grass is mowed in numerous ways. The condition of the turf and its use dictate the type of mowing equipment that may be the most efficient, also how economical it may be to use a particular unit.

A reel type lawn mower is the best selection when a formal well groomed appearance is desired. The height of cut and the frequency of clip are the two most important factors to consider when making your selection of a reel mower. When the clip

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1/ To be presented at the 29th Annual Northwest Turfgrass Association Conference, Yakima, Washington, September 17-19, 1975.

2/ Toro Manufacturing Company, Cupertino, California.

equals or is less than the height of cut, the overall appearance is smooth and acceptable. An excellent stand of grass may be acceptably cut at a shorter clip if no more than 1/3 of the leaf structure is removed. A poor, straggly stand of grass is best cut when the clip equals or even exceeds the height of cut because fewer blades of grass support each other and the time between reel blade passage is greater. A 1-1/2 inch clip and a height of cut of 1-1/2 inches is acceptable, but a 1-1/2 inch clip and a 3/4 inch height of cut is unacceptable. There are visible corrugations. To correct, use a 3/4 inch clip and the 3/4 inch height cut is acceptable.

As mentioned earlier, a number of things must happen to grass before it is cut: Renovation, aeration, grass aeration, fairway aeration, matting or shredding of aerated plugs or topdressing, proper mix of topdressing material is essential, topdressing a golf green, spraying a fairway for weeds, greens sprayed for insects, as well as disease, fertilization, cleaning and vacuuming and renovating, and proper watering.

In the mowing operation, the final test must be appearance; how well or how poor does the grass look. A planned mowing pattern, the correct mower and a careful operator are the important ingredients that produce this result. Good operators make sure the finished job on fine turf has a very eye appealing look.

The golf course superintendent frequently must plan several heights of cut to accentuate the beauty of an area. The fifth hole at the Columbia Edgewater Golf Course in Portland, Oregon is a good example. A rough area surrounds a teeing area, and then the fairway and rough are maintained at several different heights of cut. This accentuates the target and makes the hole really stand out.

The use of a mower with good side hill stability, good traction, and the proper frequency of clip for the height of cut is necessary on steep terrain. Maneuverability plays a strong part when mowing around the sculptured edges of a trap and lake.

Speed and the width of cut play a very important role in paring the budget and saving on costs.

So many times a beautiful stand of grass is mutilated by a poorly adjusted mower and its careless operation. Bentgrass should be maintained at a low height of cut. It must be cut with a mower having enough reel blades to produce a frequency of clip to match the height of cut.

DO NOT -- and I emphasize DO NOT -- take reel mowers into areas where it is rough and where stones and debris will damage the reel.

Maintenance of the grass cutting equipment is very important in good turf management. Good turf management means the keeping of daily records necessary in order to stay on top of how your equipment is performing. We suggest a simple formula of records. Make them simple so that your operators can provide you with vital information on the equipment. Maintenance charts are available at no charge from TORO.

It is important to point out what a good daily record will provide for you:

1. Operation costs.

2. The amount of down time on the mower.

3. Serves as a replacement guide for new equipment.

4. Provides a service guide for your people to work with.

A careful check of each working part of the mower can save valuable dollars. Downtime will be shortened and a high quality of performance will be assured.

It may prevent a machine being worked to death without repairs. Proper records will give long life to your equipment, as well as assure good performance.

Here are some of the essentials of a good maintenance program. Maintain a clean, neat repair shop. Your repair and storage shop should be centrally located to your operation.

Proper tools, a well lighted workshop, clean, neat and orderly, and most important a knowledgeable mechanic in charge is most essential. The mechanic must have knowledge of the methods and techniques used to grind and sharpen a mower, how to maintain and adjust air cooled engines, to adjust the mower correctly for the type of grass the machine is involved in cutting. This man should be kept aware of all changes of servicing techniques and the operational procedures required for each piece of equipment he maintains. In addition, he should train operators on all equipment. To have to post signs to remind your people to do their job is not usually the best way. The man has to be a tidy thinker, a clean, efficient worker to keep equipment running properly. The superintendent must see that this work is accomplished.

Store the small equipment away from the tractors and larger mowing units. Damage to smaller mowers by the larger units often happens. Keep it dry, clean, and supervise the area. Your men will take pride in where they work, if they have a first class clean maintenance and storage area for the mowers they use.

Tractor-drawn equipment should be stored separately. Large units backing in or driving into a storage area where smaller machines are stored may cause damage to small mowers. Locked doors control vandalism and theft.

A place for everything and everything out of place seems to be in order at times, and usually a maintenance or corporation yard maintained in such a manner says clearly that all of the jobs are not being done and, finding an area like this will indicate other shortcomings of the superintendent in other areas around the golf course.

Letting your personnel clutter an area may be hazardous from many angles -- a slip and fall accident, tripping over obstacles, fire -- just a lack of care by your employees can let a mess grow.

Oil, insecticides, pipe and mowers are obviously not compatible from a storage standpoint. Mowers, fertilizers, fungicides, signs, etc. are out of place stored together.

Repaired mowers stored incorrectly can cost many dollars before they are operable. Daily cleaning is certainly one of the most important maintenance functions you will perform.

A good, clean facility that will handle the larger pieces of equipment, and proper sumps to catch the grass clippings and dirt that are washed from the equipment are most important. Most maintenance areas require a good wash rack to encourage the operators to clean their equipment.

One superintendent felt his washing area was adequate. But, one could see where the water had rotted the wood on the doors and had made a quagmire right in front of the equipment entrance to the storage area. It was certainly convenient! And, no wonder the superintendent was replaced!

Where compressed air is available it helps to use it after washing to make sure that the excess water is blown from the bearing and seal areas. Some superintendents prefer to use no water -- just air for cleaning their equipment. Air will remove the grass clippings, but does not do a good job removing dirt and grit.

Maintenance shops are operated by our distributors. Many times they receive dirty, misused equipment to be repaired. When the bill is presented upon completion of the repair work, cleaning is one of the items some customers will object to. Nevertheless, we have standard operating procedures that state all equipment must be steamed and cleaned before we work on it. This among other things permits us to find any defective components on the mowers.

The engine is the most vital part of any piece of mowing equipment, and sometimes it is the most frequently neglected in all maintenance operations. One of the areas most often neglected is the blower housing. As mentioned earlier, mowing is a dirty job. The accumulation of dehydrated grass on the intake screen of the blower housing shuts off the circulation of air that cools the engine. Air cooled engines have carefully designed blower housings, so that it forces a maximum amount of air over the head and past the spark plug to cool the engine. Most automobile engines normally run between 160 and 180 degrees fahrenheit. Air cooled engines run at temperatures much higher.

Normal is from 180° to 480°, depending on the outside temperature. Blocking the air circulation may raise the head temperature well over 700 degrees. I asked one operator about his schedule of maintenance for cleaning the grass and debris from the intake of the blower housing. He said when he started to see the dehydrated grass showing up around the spark plug he knew it was time to stop and clean it. He had run much too hot and much too long, and he wore out his engine prematurely.

The air cleaner should be maintained in a rigid, supervised schedule. The frequency of servicing should be tied in to the type of use for the unit. If it is a dirty, dry, dusty condition, then the air cleaner should be cleaned very frequently. I think it is up to the superintendent to determine by inspection what type of hourly maintenance should be performed on his equipment's air cleaners. This is the only entry for dirt into the crankcase, and if the air cleaner is allowed to get into a very dirty condition, premature wear of the internal engine parts will certainly result.

The operating manual says clean and refill at least every 25 operating hours. This should be the maximum amount of time that any air cleaner should be let run. When you do service the air cleaner, clean thoroughly and refill with an SAE 30 grade oil.

LUBRICATION

Proper lubricating should be done with the owner's manual being closely consulted to make sure that the proper lubrication at the proper points is made at the proper time interval. Each piece of equipment has a maintenance chart recommending what parts should be maintained at different hourly intervals. Study it carefully and make sure that it is made available to your personnel. Make up your own schedule to fit your locality.

Don't leave dirty and old grease filled with debris right at the bearing area. Wipe it off, so that the dirt will not work back into the bearing.

Daily or hourly checks, depending on the condition of the engine, should be made of the crankcase oil. Oil should be

changed frequently to a good grade of 30 SAE oil, and proper levels maintained. Changing oil often is a good money saver, as it prolongs the life of the engine.

Gear cases need close attention on a program of maintenance. Do not let gear case oil get dirty or the level get below normal. Dirt and sand and oil make an abrasive mixture, as in the case of this mower. One operator chose to disregard a hole in the gear case that could have been welded closed for two or three dollars. He continued to ignore the condition until dirt and debris filled the gear case. The compound ground off the sprocket from the reel shaft, needing over $100 to replace the reel and drive components and building up at least five days of down time while in for repairs. It is very easy to recognize how fast costs grow when maintenance is minimized.

REEL MOWER MAINTENANCE

Reel mower maintenance must first be preceded with a condition check of the mower. A simple condition check would be:

1. Check the reel bearings for excess wear.

2. Check the reel blades for tight rivets in the spiders and end play in the bearings.

3. Make sure the reel spiders are riveted to the reel shaft and in position.

4. Make sure the rollers and the roller bearings are properly adjusted for the correct height and the proper torque on the bearings.

5. Make certain that the frame is not misaligned.

6. Make sure that you have enough material left on the edge of the bed knife that you are going to work with.

The reel to bed knife adjustment is the most important adjustment that you will make on a reel type mower. If this adjustment is made incorrectly, a great number of things can malfunction.

1. If this adjustment is too tight, it can rifle the bed knife.

2. Put undue stress and strain on the reel bearings.

3. Overload the counter shaft assemblies.

4. Accelerate wear on belts and chains.

5. Overwork the engine to where it will overheat and wear prematurely.

So , you see how important it is to get a correct adjustment on the reel. I think the most important difference an incorrect adjustment can make is how the grass areas will look after the reel mower has passed over it. If it is not cut correctly, it will show up very quickly in the quality of cut that it has performed. Starting with a sharp mower, properly ground, so that all reel blades contact evenly across the bed knife, the mower should be lapped to give an air gap between the reel and the bed knife of about 1 mil, or the thickness of a newspaper. I try to get a definite crease in newspaper rather than have it cut the newspaper. In doing this I know that if it doesn't cut the newspaper, I have this air gap; but it can be too tight and still cut paper. Make sure that the adjustment is constant throughout the width of the bed knife, and on however many reel blades are in your reel. Make the crease six times at each end and in the middle on all six blades in the reel unit.

In sharpening the reel it is wise to use a reel grinding gauge. In using a gauge in the grinder it will enable you to set up your mower correctly so that correct grinding procedures can be followed. This gauge will eliminate any possible chance to grind your reel "cone shaped".

All measurements in setup should be made from the reel shaft and not the lead edge of the reel blade.

Good grinding equipment is essential, and a good mechanic who understands this equipment fully.

There are several good makes of grinders available on the market, and I certainly would like to praise the European manufacturers of grinding equipment as being some of the best that I have seen.

After grinding it is always advisable to lap the reel to make sure that the reel and bed knife are properly seated.

Sam Zook, a very fine superintendent, takes great care in maintaining his equipment, but even the best of us can make a mistake. He removed his reels to make sure they were properly ground, but the reel was installed backwards, due to an oversight of his mechanic. He wondered why the reel would not cut. I was called in to make a service call, and found this glaring mistake. Even the best of us can make errors.

A large company in the United States performed a sharp mower vs. a dull mower test. The dark area that you see in the slide was cut every day with a lapped and sharp mower. The rest of the area was maintained with a mower that had started sharp and had been allowed to become dull. It is quite easy to see that a sharp mower will perform an agronomy task of making a clean cut, whereby the grass heals quickly and continues to grow. The dull mower rubs the grass off, shocking a large portion of the leaf area to where the recovery is slower. Some of us could reason that in order to get out of mowing we could use a dull mower to slow up the grass growth, but this is against all good agronomy practices. Slow growth tends to weaken the grass plant, and weeds and other undesirable plants inhabit the area. To keep your grass growing vigorous and healthy, it is advisable to use a sharp mower.

Damage to reel mowers can definitely be considerable if careless operation is practiced. An operator banged a tree trying to get too close in the trimming operation. Damage not only occurs to the mower, but also to the growing tree. In this particular case this mower had over $100 worth of damage done in one contact with the big tree.

A first class way to damage and overburden specific mowing equipment is to misuse it. A particular tractor was designed as a mowing unit. All cutting units were hydraulically raised and lowered and engineered to do just a mowing job. In one

case a superintendent used it as a spray tank and general truck for carrying all sorts of equipment. I wonder how well it cut grass.

There was a case of a TORO 76" mower - redesigned by a user to try to fill the many needs that he had for it. The owner did not like to see his workmen sitting down, so he redesigned the unit so that they could stand and ride on the little two-wheel truck. He put a catcher on the front of the mower to pick up debris during the mowing operation. It put the mower completely out of balance. He didn't like our steering handle bars and installed a steering wheel. Some engineering and some ideas are good. TORO welcomes good ideas -- I think the gentleman went too far with his ideas.

ROTARY MOWER MAINTENANCE

Rotary mowing in the United States has grown by leaps and bounds, and so has the accident rate. Many accidents that happen are caused by minimal maintenance these mowers receive. Mowers should not be used with out-of-balance blades. In one case, a portion of the blade had been broken off, setting up a high vibration which shook the engine right through the deck of the mower. To illustrate the cost involved on this unit, the blade could have been discarded and replaced for $4.50. The operator chose to keep running. He ran less than an hour with part of the blade missing, and damaged a $52 housing beyond repair. He came close to causing a bad accident. What if the motor had broken completely off and had hit his feet?

All rotary blades should be balanced and sharpened regularly, and if high vibration is felt, the mower should be taken out of service. If a nick or a piece of blade is knocked off one side, then the opposite end should be ground until the blade balances on a blade balancing tool. Don't run rotary mowers until they fall apart through vibration.

A good mowing program needs four ingredients:

1. The right machine.
2. A trained operator.
3. A good maintenance program.
4. A good safety inspection.

Canada has found that training girl operators has proven to be profitable.

The penny wise and pound foolish maintenance program can certainly prove to be costly.

A safety program is something that should be built into every mowing operation. The National Safety Council reports injuries from accidents with machinery cost $1,360,000,000 in 1960, and have grown to almost twice this amount in the past ten years.

I saw a man practicing safety with his left hand, disengaging the spark plug, but putting his right hand under the machine before the blade has stopped. It is easy to do, and happens much too frequently.

"Be a real pro driver and never get caught off guard" is the safety banner at the Long Beach Park Department. Keep reminding your staff to work safely.

Drive only on approved surfaces of the road. Don't jump curbs with equipment, because an operator can be thrown off and badly injured.

Keys for large equipment should always be taken from the machine when the operator is not with the mower. Coffee breaks, lunches, etc. leave unattended units. Children have been known to turn keys and get hurt seriously fram a piece of mowing equipment.

Mechanics grinding mowers should wear protective eyeglasses. Riding mowing units into transport vehicles is dangerous practice. The mowers should be walked up the loading planks into the conveyance.

Safe, proper operation by the crew man should be used at all times. People with little knowledge of the operation of a piece of equipment can end up getting hurt. Make sure your operators know how to run and understand the equipment.

Some accidents can be expensive. An operator was careless in installing the oil plug to the crankcase after checking the oil. He arrived at his first green to be mowed when it vibrated out of position, and he spilled the oil all the way across the green.

The superintendent, anxious to cover up the operator's mistake, ran for some green foliant dye and applied it without giving it much thought. The brand name of the foliant dye was "Green Stuff", so naturally the superintendent thought it would look good on the green grass and cover the black oil. The result was not good.

Gasoline certainly can wipe out turf in a hurry and for a long time. An operator had a leaking can and he walked out and serviced a mower in one location and another in another location, and his trail could be followed by the gas leaking from the can.

Hydraulic mowers with minimal inspection and maintenance can spring leaks on turf. One operator panicked . . . . and ran for the closest exit, leaving a trail of oil everywhere he went. He should have been instructed to shut down the motor and take the unit out of gear as quickly as possible, because it is easier to re-sod or clean the area in one spot than over several hundred feet of greens and rough area.

The subjects I have reviewed covered a lot of departments, but I am sure that if some of the suggestions that I have made are adhered to we can certainly come up with four definite bonuses for your club:

1. With proper maintenance we can decrease down time.

2. We can most certainly reduce parts and repair costs.

3. Increase equipment life.

4. Most important, provide a continuous quality cut.

A LOOK AT TURFGRASS EQUIPMENT TODAY[1]

Ned Brinkman[2]

The need for larger, faster and better equipment has been emphasized in the last few years because of high labor costs and a definite shortage of labor in the field of turf maintenance. Growth in all the various markets has been fantastic! Golf courses alone have increased from 4,800 in 1945 to over 12,000 here in the United States. Parks and Recreation areas have almost doubled in the past ten years. Now, labor costs have risen from 10% to 25% in four years; operating costs have risen nearly 65%! These costs will probably be rising at a rate of approximately 5% per year, so improved technology for management and equipment are necessary to keep costs somewhere in sight.

What can we do about these rising costs? Well, we have to take a good long look at:

1. The conditions under which we must work, such as the areas to be maintained, the amount of travel between jobs and precisely the degree of maintenance required.

2. We must analyze our schedules to see if some work can be automated or improved by changing the job.

3. We must analyze our equipment, and possibly purchase new, modern machinery to take advantage of the improvements coming out every year.

1/ To be presented to the 29th Annual Northwest Turfgrass Association Conference, Yakima, Washington, September 16 - 19, 1975

2/ Jacobsen Manufacturing Co., Racine, Wisconsin

Since equipment is becoming wider, bigger access areas will be needed and, of course, a good study of all existing equipment in the field is necessary.

What can we look forward to in the future? Well, it all starts in someone's engineering department. In discussing this element with our competitors, we came to the conclusion that there are nearly 200 engineers among four companies working especially to solve the problems we are discussing today. Testing procedures have to be stepped up faster than ever before. We simply cannot wait for five or ten years while testing a product. Chains, belts, bearings and batteries all must be involved in the tests. Possibly the whole area of power must be analyzed and improved.

The field of hydraulics is becoming so large that all of us here today are going to be required to make a special effort to get extensive training just to learn how to handle the equipment.

We must think in terms of wider areas for equipment to pass and riding equipment everywhere. Ten years ago this was a forbidden practice to ride any vehicle on the green, or in a trap, or over tees. Now, everyone wants to ride everywhere and, obviously the tire companies have a real challenge to provide better floatation for equipment. For you, this means more storage space required for equipment. Since bigger equipment is being developed, that is wider in all respects, better start planning for some larger doorways.

In the future, there are bound to be ways for easier removal of thatch, and possibly some form of control would do away with all the unusual dethatching machines. There's got to be an easier method of not only the slicing of turf, but the pick-up of dead material. Faster ways to spike are now available by the use of a complete riding unit that can be taken on the green. It is faster now so we can spike more often and obtain better results with less work.

Yes, there will be inventions, gadgets, gimmicks or systems to change the technique of performing a job, or change the job itself. Some will work; and some won't.

The entire field of material handling is being reviewed by every company involved in the turf business. Just look what the sod growers have done in terms of material handling with sod-harvesting equipment. I am told by businesses producing sod harvesters there still is no general agreement on whether the sod should be palletized, flat, or in rolls, and in each section of the country, the practices are far from standardized.

The entire field of aerating must be studied. Who can say five to ten years from now what the thinking will be with regard to hole punching, slicing, renovating, sub-airing, subsoil feeding and watering, as well as vertical mowing, spiking, cross mowing, etc. Seeders and spreaders do leave a lot of room for improvement. We must be able to handle barren turf with machines that will plant grass and get a quick recovery in an area without resodding.

We know too, that it is most important as manufacturers to improve our services.

1. As equipment becomes more sophisticated in terms of repair and service, manufacturers will have to provide more training.

2. Because of the variety of parts, we are going to have to work more closely with our distributors to avoid shortages.

3. We must analyze existing equipment and utilize some of the same parts for new equipment so that part stocks do not become uncontrollable.

4. We must continue to develop products which pass along to you the service of reducing maintenance costs, either through a labor-saving or a quality-product approach.

Yes, remember how simple life used to be; well, those days are gone forever. We are now in the era known as the "surging seventies" and by no means will this be a smooth upward climb, but it will be a series of movements. You will be required to provide superior turf because you are the experts. You can expect help from a multitude of products, in the irrigation field, in the mowing field, in the aeration field, as well as items from the fertilizer and chemical companies.

Each of us here must accept the responsibility to train new people coming into the field and, most of all, we must set aside our reluctance to change. We must try new equipment, and on an experimental basis, try new methods in order to evaluate them and make progress.

Progress is often measured in terms of change, so without change we may not have progress. If we will all attempt to look forward for the next five to ten years, by anticipating our needs by making suggestions for product improvement or new products to manufacturers, also by requesting information from the universities and by helping others solve their problems, there will be waiting for us the most exciting and rewarding period of our lifetime. Yes, bigger, better ard broader horizons are in our future if we will only work and plan to achieve them.

CHEMICAL COMPATIBILITY FOR TURFGRASSES[1]

Roy L. Goss[2]

Compatibility of chemicals when used in combination to remedy turfgrass problems does not at first appear to be such a great problem with which to come to grips. When visiting with research personnel, practitioners in the field, commercial research and development representatives and others, we seem to hear many statements regarding compatibilities. However, when it comes to putting all of this down in a neat little package on a compatibility chart, most of our sources dry up completely while others are reasonably non-commital. There are many good reasons for this. Two chemicals that may be compatible under any one given set of environmental conditions may not be compatible when only one of these variables is changed in another situation. The variables that effect compatibility may be related to the chemistry of two or more compounds when added together to affect physical incompatibility, to incompatibilities causing injury to the plant (phytotoxicity), or to incompatibilities destroying the effectiveness of one or more chemicals. In addition, such factors as hardness of water, wettable powders, emulsifiable concentrates, acid formulations, temperatures, spray adjutants, and a number of other factors can affect chemical compatibility. One can hardly blame the experts, then, for not being commital with respect to compatibilities when all of these variables are not known.

This paper will attempt to define compatibilities and to point out some guidelines for determining compatibility of various chemicals and fertilizers when used together.

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2/ Agronomist/Extension Agronomist, Western Washington Research & Extension Center, Washington State University Puyallup, WA

The reasons for combining chemicals are very obvious when two or more materials should be applied to a turfgrass area within the same period of time. Obviously, if you have 25 or more acres of turfgrass to spray or to treat, much time and energy is saved if treatments can be combined and applied in one application to say nothing of the proper timing which may be critical for the control of certain plant pests or the proper timing of fertilizer applications.

MULTIPLE PESTICIDE COMBINATIONS

In recent years, chemical tools for better crop production have become essential items in the tool box of the professional agriculture and homeowner. Modern chemical pesticides for disease, weed and insect control are enormously better than they were prior to 1950. Today we have effective specific safe and relatively inexpensive compounds to do the job of removing unwanted weeds, plant diseases and other pests. If these chemicals are used in the proper way, at the right time, and in proper amounts, they will do the job for which they are designed. Failure to observe precautions on the package label will usually get the operator into hot water in a hurry.

The reason for the economics in the use of multiple combinations of pesticides is desirable in some instances. The combinations of chemicals may be listed as follows:

1. Fungicides alone
2. Fungicides plus fungicides
3. Fungicides plus insecticides
4. Fungicides plus herbicides
5. Fungicides plus insecticides plus herbicides
6. Fungicides plus growth regulators
7. Fungicides plus insecticides plus growth regulators
8. Fungicides plus insecticides plus liquid nutrients and minor elements

COMPATIBILITY

When pesticide chemicals are used in combinations or in mixtures, numerous problems may arise. In such cases, the components of the mixture are said to be compatible or incompatible.

Compatibility is the ability of two or more components of a mixture to be used in combination without impairment of toxicity, physical properties or plant safety. For example, peaches and cream, beer and pretzels, corned beef and cabbage, and two Republicans in the same voting booth are said to be "compatible." They get along together.

Incompatibility is a condition that may occur when two or more pesticides are used in combination with resultant loss or impairment of effectiveness of either component, with the development of undesirable physical properties or the initiation of plant injury responses (phytotoxicity). As an example, ice cream and ketchup, stewed prunes and horseradish, kippers and custard, a coon dog and a bobcat in the back seat of a station wagon, and a Republican and a Democrat in the same voting booth are incompatible. They just don't get along together.

PHYSICAL INCOMPATIBILITY

When two or more pesticides are mixed together with the resultant production of an unstable mixture, the production of excessive foaming or soapy flocculates they are said to be physically incompatible. Thus talcum powder is physically incompatible with water, since like oil and water, they do not mix together. Most organic fungicides are formulated with wetting agents or other conditioning materials. When such materials are forced through a screen with a high pressure stream of water they will occasionally separate or "butter out" and become physically incompatible. It is for this reason that most modern wettable fungicides should be prewet with a small quantity of water before adding to the spray tank.

Frequently physical incompatibility results when hard water from deep wells or other sources is used for the spray mixture. In such cases a fungicide may tend to separate and fall out of suspension. This can be corrected, however, with the use of soft water or the addition of commercial surfactants available on the market.

CHEMICAL INCOMPATIBILITY

When two or more pesticides are mixed together with resultant loss or reduction of effectiveness of one or all components, they are said to be chemically incompatible. Thus most organic fungicides and insecticides should not be combined with alkaline compounds with a pH higher than 7.0. Alkaline reactions will significantly reduce the fungitoxicity of carbamate fungicides and the insecticidal value of compounds such as Aramite, Lindane, Parathion and Malathion.

For this reason, lime should never be used in combination with maneb fungicides such as Fore, Manzate or Dithane M22. This is also true for the fungicides Dyrene, zineb, thiram, captan and most organic insecticides.

Mercury fungicides are incompatible with carbamate fungicides and should be used with caution with malathion, parathion, morocide, trithion and EPN.

Chemical incompatibility is frequently the cause of poor performance of multiple pesticide combinations. Before combining any pesticide with another compound, it is important to read the label on the package or container. If information on compatibility is not specified, it is wise to avoid combination of such products.

PHYTOTOXIC INCOMPATIBILITY

When two or more compounds used in combination result in plant injury, they are said to be incompatible by virtue of phytotoxic effects. They may be perfectly safe when used alone, but injurious in combination. For example, the organic mercury fungicides may cause injury when used in combination with emulsifiable concentrate formulations of insecticides. This is especially true of those EC insecticide formulations using xylene as a solvent. When combining fungicides with liquid insecticides, check the label for compatibility and avoid problems with plant injury. When combining pesticides of unknown compatibility, it is always a good suggestion to try them first on a non-essential or expendable turf area before general use on indispensable areas such as putting greens.

Phytotoxic reactions have also been experienced when two materials are not applied from the same tank, but one material followed by another within a short time interval, perhaps one to three days. Organic mercurials such as PMAS applied to areas treated with DCPA (Dacthal) have caused severe injury on bentgrasses.

PLACEMENT INCOMPATIBILITY

Incorrect placement of pesticides is frequently the explanation for poor disease and insect control. Placement incompatibility is less obvious and sometimes overlooked by maintenance personnel. When two or more chemicals are used in combination and applied in one operation, each must end up in the same place if it is to do the job for which it is intended. Thus, some fungicides are protectants and must be uniformly distributed over the leaf surfaces to protect against invasion of certain plant diseases, such as *Helminthosporium* leaf spot and *Fusarium* patch disease. Failure to establish and maintain a foliar blanket of fungicide protection will inevitably result in outbreaks of destructive turfgrass diseases.

Some fungicides must be applied to crowns and roots of turfgrasses for effectiveness. If these materials are sprayed only on the leaf surfaces, control may be poor or not at all. In the same manner, certain insecticides for the control of sod webworm may be ineffective if applied as foliar surface protectants and must be placed where they will destroy larval stages of the insect before emergence. Combinations of fungicides for the control of *Fusarium* patch disease and chlordane for sod webworm control would be ineffective because of placement incompatibility.

Sometimes placement incompatibility can result in phytotoxicity to turfgrasses. If weed and feed formulations contain sufficient quantities of soluble nitrogen and soluble potassium to produce desirable growth responses, burning of the turf may result if not removed from the leaf blades. Likewise, if the material is washed from the leaf blade, then the herbicide included in the weed and feed will be out of place and essentially incompatible.

GENERAL PRECAUTIONS (1)

1. Do not mix organic fungicides with alkaline compounds.
2. Do not mix organic fungicides with insecticide formulations using xylene as a solvent.
3. Use fungicide - EC insecticide formulations with caution.
4. Nutrient sprays containing boron, magnesium, manganese, iron, zinc and urea should be applied separately. Compatibility of these materials with fungicides and insecticides is not known.
5. Growth regulators such as NAA, 2,4-D, 2,4,5-T, MH and Gibrel are physically and chemically compatible with most fungicides.
6. When in doubt - DO NOT USE COMBINATIONS OF PESTICIDES.

SURVEY RESULTS

In an effort to obtain the best thinking of a large number of knowledgeable individuals, invitations were sent out to about 40 chemical companies and researchers. The responses, which were few, ranked about as follows:

1. Our company does not deal with the products listed on the compatibility chart.
2. We have no data as to how our product will combine with other company's formulations.
3. The ones who did fill in the chart indicated that most combinations were or would be incompatible.
4. Others simply replied that there were just too many variables which have been discussed above in this paper that affect incompatibility and it would be a monumental task to arrive at any definite conclusions for a compatibility chart.
5. Finally, a number of "congratulations and compliments to you for undertaking such a worthwhile project. We wish you the best of luck and please send us a copy of the chart when you get it finished."

All of us know, and sometimes by bitter experience, that certain materials are definitely incompatible. I would like to invite any of you who have had experiences with incompatibility or compatibility with chemicals or fertilizers commonly used in the turfgrass industry to drop a note in the mail to my attention, and these comments will be placed on file and added

to the compatibility chart. It is hoped that within a period of one or two years we could obtain enough positive information to compile a chart that will at least show which materials can possibly be combined for single application.

At the present time, it would be wise to follow the manufacturer's recommendation or try a small quantity on expendable turfgrass areas and wait for results or play safe and apply these materials singly.

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TURF SEED QUALITY[1]

Alvin G. Law[2]

Since before the beginning of the present century there have been state and federal laws that were designed to regulate the quality of seed that could be offered for sale in the United States. These standards were designed primarily to provide protection to the farmer as he went about his business of producing food, feed and fiber.

In Washington the Seed Division, State Department of Agriculture, headquartered at Yakima, Washington is responsible for enforcing the state seed laws.

Basically, the following information about each seed lot offered for sale must be listed on the label or somewhere on the container:

1. The name of the seller
2. The seed variety
3. A lot number
4. The percent by weight of purity
5. The percent by weight of inert
6. The percent germination
7. The date of the last germination test
8. The percent of crop seed in the lot
9. The percent of weed seed in the lot
10. The noxious weeds by name and number per pound

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2/ Professor, Agronomy and Soils Department, Washington State University, Pullman, Washington

Farmers who sell or exchange seed with their neighbors are not responsible to conform to these seed labeling requirements but this is the only exception.

These are all important items to know about a lot of seed but some of them may conceal more than they tell about the important factors of quality. They deal largely with what can be termed the mechanical quality of the seed lot, an important item to be sure. Let us examine some of the factors in some detail.

Purity seems to be a straightforward term, yet, it is only an indication of the quality of seeds in the lot. Thus, 99% Pure seems to be an indication of good quality but in turf seed we need to know more. How much of the 99%-pure seeds will grow? Thus we arrive at a new term, "pure-live seeds," which is simply the % purity x the percent germination. Thus, if there is a 99% purity and 85% germination on the label, we find the L.P.S. = 94% and there is actually 6 pounds of material in each 100# bag that is only filler. In using the concept L.P.S., do not fall into the trap of replacing the individual purity and germination data with a single L.P.S. enumeration. The L.P.S. provides a handy way to compare quality and value of seed lots but it has certain weaknesses.

	% Pure	% Germ		LPS
Lot A	99	90	=	89.1
Lot B	90	99	=	89

In lot A there is 1% of something other than seed, but in lot B there is 10%. If the 1 or 10 is weed seeds in both cases, you can easily see which is the best buy. But you must know what the non-pure portion consists of; it could be weed seed, other crop or inert. The actual inert material, which by common practice seldom exceeds 2 or 3 percent even in turf seed lots, is usually chaff, broken stems, broken seeds, etc. Only rarely will you find a so-called "bargain package" with added inert material, such as ground corn cobs or chaff, to increase the volume.

Percent germination as listed on the label is not always a straightforward term. Some grasses have a dormancy characteristic and the laboratory germination technique has been developed to overcome this factor so the reported germination may be higher than you will encounter in the field. Moreover, most legumes have a "hard" seed characteristic, so you may find two items listed on the germination of white Dutch clover -- strong sprouts and hard seed. These "hard" seeds are viable but do not absorb water readily and thus may be slow to germinate, so when you see a label thatsays strong sprouts 37%, hard seed 53%, for a total germination of 90%, you should ask the company to scarify the clover seed before you buy it.

"Other crop" is often the most troublesome part of the grass seed lot. Up to 5% of the lot may be "other crop" without any further identification required. In turfgrass se other crops can be Timothy, orchardgrass, tall fescue, smooth brome, intermediate wheatgrass and any other pasture or hay grass commonly used in the United States. Other crop in bluegrass could include all of these and also bentgrass, a most undesirable mixture in bluegrass for most turf uses.

It is important to remember that the label gives the percent of other crop or the percent of weed seed in the lot when what you need to know is the actual number of seeds per pound of the contaminating crops or weeds. To arrive at this latter figure (number of seeds per pound), you need to multiply the percent of the contaminant by the number of seeds per pound of the contaminant. The following table gives the approximate number of seeds per pound for a selected list of grass and weed seeds.

Table 1. Number of Seeds per pound of selected grasses[1/]

Variety	Approx. # of Seeds per lb
Bentgrasses	
Highland *Agrostis tenuis*	5,740,000
Colonial and Creeping bent	6,200,000
Astoria	5,800,000
Penncross *Agrostis* spp.	5,800,000
Velvet *Agrostis canina*	8,200,000
Red Top *Agrostis alba*	4,800,000

Bluegrasses

Canada blue *Poa compressa*	2,500,000
Merion blue *Poa pratensis*	2,200,000
Kentucky blue *Poa pratensis*	2,177,000
Annual blue *Poa annua*	1,200,000
Rough blue (shadyland blue) *Poa trivialis*	2,500,000

Fescues

Creeping red-chewings *Festuca rubra*	545,000
Hard fescue *Festuca ovina*	550,000
Tall, Meadow Alta *Festuca arundinacea*	227,000

Ryegrasses

Annual, Perennial *Lolium perenne*	227,000
Orchardgrass *Dactylis glomerata*	465,000
Smooth brome *Bromis inermis*	113,000
Timothy *Phleum pratense*	1,200,000

White Clover *Trifolium repens*	680,000

Weeds

Hairgrass *Festuca capillata*	1,450,000
Black medic *Medicago lupulina*	265,000
Velvetgrass *Holcus lanatus*	1,520,000

1/ Adapted from WSU Seed Testing Laboratory and from O. M. Scott Proturf Professional Seminar 1974

How does this all go together? Look at a recommended mixture for western Washington lawn turf.

Recommended seeding rate

lb/1000 sq ft	Variety	% of mix by weight
2.5	Kentucky blue	62
1.0	Red fescue	25
.5	Bentgrass	12

Rec. Seeding %		No. Seed per lb				Actual Seed count %
62	x	2,177,000	=	1,349,740	=	52 K.B.
25	x	545,000	=	136,250	=	05 R.F.
12	x	9,000,000	=	1,080,000	=	43 Bent
				2,565,990		

Thus, instead of 12% bent, you are actually planting 43% bentgrass based on number of seeds per pound.

Let us turn our attention from the mechanical purity of seed, i.e., the percent purity % weeds, and % germination -- to a somewhat different concept, that of genetic purity. Actually, genetic purity refers to the varietal purity. If you want Merion or Fylking bluegrass, you should be able to be sure that is what you are buying and not an inferior variety turfwise. There is no easy way you can look at the seed and tell if the variety is Merion. You cannot tell the difference between the seed of Colonial and Seaside bentgrass. Seeds of Koket creeping red are indistinguishable from those of Checker or Olds, creeping red fescue. The certification program was developed in the U.S. to provide a pedigree system of record keeping, plus a field and processing plant supervision program that will insure a high level of variety purity. Thus, if it is important to you to have the performance of a known and recommended variety, you should add the requirement of variety certification for genetic purity to that of the mechanical purity required by state and federal seed laws. Most of the superior varieties are now available as certified seed.

In Washington there is a truly elite seed quality now available called "sod quality" seed. This is seed produced under standards of purity, germination and certification designed to satisfy the sod grower. Amongst important standards for sod-quality bluegrass, red fescue and chewing fescue is that the seed must be free of ryegrass, orchard, timothy, bentgrass, Canada blue, rough bluegrass, smooth brome, tall fescue, reed canary grass and clover. Weed seeds prohibited include annual blue, chickweed, plantain, dock, crabgrass and all noxious weeds. There are several leading seed companies who handle sod quality seed.

One additional program you should know about is the annual bluegrass quarantine area whereby all grass seed stocks brought into eastern Washington must be sampled and tested by the Washington State Department of Agriculture Seed Division officials and found to be free of *Poa annua* prior to planting for seed production. This procedure is important in keeping annual bluegrass out of the seed-producing fields in this area, and it is an essential link in the effort to keep the seed industry producing high quality seed. This, coupled with the expanded *Poa annua* control program of Dr. Goss and Mr. Cook, which can be applied not only to turf on golf courses but also to seed fields of turf grasses, will insure top quality seed from the Washington Seed Industry.

YOU — YOUR GOLF COURSE — [1] AND THE TURFGRASS CONSULTANT

W. H. Bengeyfield[2]

There is an old English proverb which goes:

"If I give you a penny and you give me a penny -- neither of us will be any richer. But if you give me an idea and I give you an idea -- then we are both richer!"

And so consulting had this meager beginning.

There are times when the golf course superintendent today receives more advice than he can possibly handle. All 500 members know more about growing grass on the course than he does. The club manager, the golf professional, the salesman, his wife, the conferences, the university, the Green Section,-- everyone is in the game! But a wise man once said, "advice is only as good as its source," and that immediately eliminates a lot of people.

Recently this illustration of the value of a good consultant came to my attention. It seems a consulting engineer was called in, for $100, by a manufacturer to solve the problem of a balky but essential piece of machinery on the assembly line. Finally, after looking at the idle machine for a few minutes,

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2/ Western Director, United States Golf Association, Green Section, Tustin, CA.

the engineer picked up a hammer and gave it 2 or 3 terrific blows. It immediately worked! The plant manager, thinking $100 was an awful lot of money for such a simple task, asked the consultant to itemize his bill. Within a few days it arrived:

For hitting machine with hammer	$10
For knowing WHERE to hit machine with hammer	$90

We assume the plant manager paid off.

IN THE BEGINNING

Turfgrass consultants are the product of today's technology and golfer demands. At the turn of the century, grazing sheep were still used for mowing and nuturing the grass on golf courses. The lawnmower may have been invented in England in the 1830's, but it was slow in being accepted and adopted to horse drawn equipment. Besides, it was too expensive. Golf as a pastoral game. Then, two explosions occurred in the early 1900's that would change golf forever.

An obscure caddy in Massachusetts by the name of Francis Ouimet beat the world's greatest golfers of the day, Englishmen Vardon and Ray, in the U. S. Open Championship in 1913! The popularity of golf in the United States soared.

About the same time, agricultural science had budded and was about to bloom. The USGA, a non-profit organization started in 1894, sponsored publication of a new book in 1917, "Turf for Golf Courses" by Drs. Piper and Oakley of the United States Department of Agriculture. These men were not only scientists, but golfers as well. Throughout the country, golfers recognized the need for better, more dependable playing surfaces. Agricultural science would now serve golf.

The first consulting service, indeed the fist advisory and scientific agency in turfgrass management was formed in November, 1920. It was called the Green Section of the United States Golf Association. Today, the USGA Green Section remains the only agency in the country devoted solely to golf course turf, its playing conditions and its management. It was and still is a leader in its field.

From the beginning, the Green Section has been involved in turfgrass advancements and direct assistance to the golf superintendent. Since World War II, over one million dollars has been devoted to turfgrass research by this agency! Herb Graffis, former Owner and Editor of Golfdom magazine has said, "The USGA's Green Section is the biggest bargain any sports organization--amateur or professional--gives its players and public." Some of the major accomplishments to date include:

-- Effective and safe control of devastating turfgrass diseases. Although developed in the late 1920's and 1930's, these methods are still in use today.

-- Selection and development of improved turfgrasses including Merion bluegrass, the "C" strains of bentgrass, Meyers zoysia and many bermudas.

-- Researched 2,4-D as a material for broadleaf weed control on golf courses.

-- Pioneered a method of putting green construction and physical soil analysis now in worldwide use.

-- Supported research in the techniques and machinery to minimize soil compaction.

-- Since the early 1930's, has supported continual research in turfgrass nutritional requirements.

-- Published the first book in the field of "Turf Management."

-- Turfgrass wear and traffic studies have been initiated including those caused by the golf shoe spike.

-- Supported basic studies on *Poa annua*.

-- Continual support of turfgrass breeding projects particularly in bluegrasses, bentgrasses and bermudas.

-- Renovation techniques for greens, tees and fairways.

Through the 1940's and 1950's, the Green Section urged state universities and experiment stations to offer courses and conferences and undertake research in turfgrass management. The University Extension Service was encouraged to become involved with the dissemination of turfgrass facts and late research information. With growing technical knowledge, there was a need to share and exchange information among all of those interested in professional turfgrass advancement. The truism, "no one has all the answers" is just as applicable today as it was when the cave man first emerged.

FOR THE PRESENT

Because so much technical information was available and not being widely used in the field, Green Section emphasis switched in 1950 from direct research and emergency visits to a regular consultation service available to USGA Member Clubs. Consultation is not new; professionals have always consulted with one another including doctors, lawyers, businessmen, farmers and even golf professionals.

Today, the Green Section staff consists of 8 nationwide agronomists visiting over 900 golf courses annually.

If "advice is only as good as its source", then this staff offers a limitless reservoir of information gleaned from background, experience and performance. Happily, it has nothing to sell; no axes to grind. It is an independent agency completely free of commercial bias. For less than 1/3 of 1% of most maintenance budgets today, ($360 for an 18- to 27-hole course) the Green Section Service is available to all interested clubs. In many instances, one bit of Green Section advice has saved a club many times the cost of the Service. It has helped advance the cause of quality turf for golf over the years and by utilizing its services, any club can improve its golf course and its playing conditions.

But what of the private consultant? He is slowly but surely coming on the scene. At the moment, Florida is his most active ground. The private consultant is usually a retired golf course superintendent, a golf professional or, increasingly, a commercial representative given a title such as "Field Service

Specialist", "Counsellor", "Agronomist", -- anything but "salesman". Nevertheless, he is basically representing a commercial enterprise.

Some private consultants come from university life. Active as well as retired university people have found the practice of consulting an interesting and rewarding career.

The fees charged by the private consultant are extremely variable. They range from $300 to $5000 or even $10,000 depending on the services performed.

The Extension Service offered by state universities is another source of consultation assistance. County Agricultural Agents are available in most counties and can offer sound, solid information in many scientific turfgrass management areas and there is no charge for their services.

SOME TOUGH QUESTIONS AND TOUGH ANSWERS ON THE SUBJECT OF CONSULTANTS

Q: With so many specialists available from all sources, why should a club spend money for a consultant?

A: We think we may have already answered part of this question, i.e., "Good advice is only as good as its source". Many specialists are available today not only from state universities but from commercial firms, turf products salesmen, trade journals and scientific magazines. This is all to the good. Indeed, the more factual information one has, the better he will perform.

Q: What can a consultant do? What are his limitations?

A: A consultant can only be as effective as you permit him to be. Without your interest and good intentions, he can only fail. Both the club and the superintendent must have a desire to "move ahead" and achieve certain goals. When oriented to improvement and success, a good consultant can contribute immeasurably to their program. When teamed with the superintendent, he can strengthen the hand of the entire turf management operation. He can be "used" to gain goals unobtainable by any other means. Perhaps the best summation comes from a quotation of J. W. Jenks:

"The inlet of a man's mind is what he learns; the outlet is what he accomplishes. If his mind is not fed by a continued supply of ideas which he puts to work with purpose, and if there is no outlet in action, his mind becomes stagnant. Such a mind is a danger to the individual who owns it and is useless to the community."

Q: Who should request the services of a consultant?

A: Hopefully, the superintendent! Calling on the services of a qualified consultant should never be inferred as a sign of incompetence. No one has a monopoly on knowledge or ideas. If the consultant is good, any club can benefit from his experience and ideas. Rather than a sign of incompetence, the services of a consultant prove a progressive and professional attitude on the part of the superintendent making the request.

Q: What are the types of relationships which should be developed between the superintendent, club officials and the consultant?

A: The ideal relationship is one of teamwork, cooperation and a mutual desire to achieve certain goals. There must be a desire on the part of all concerned to produce the best possible golf course with the funds available. There must be a dissatisfaction with mediocrity.

Q: What can a superintendent do to help the consultant help him?

A: The consultant carries with him a vast reservoir of ideas and experiences. However, he should not be the only source of ideas nor the only motivating factor. Basically, the superintendent should know what problems are the most important ones on his course and should have his own ideas for corrective action. Then, he should expect the consultant to comment, offer his experiences and suggestions and what he has seen others accomplish in this regard. There is nothing more defeating for a consultant to visit a course and have the superintendent say, "well, what do you want to see today?" The

superintendent should be the leader. He should have his own ideas of what needs to be accomplished. Then he can effectively "use" the consultant to gain these objectives in the most efficient and effective manner possible.

Q: What should you expect from a consultant; at least from a USGA Green Section consultant?

A: You should expect to be a better superintendent and have a better golf course within 2 or 3 years. You should expect to be kept up to date on research and program review. After all, two heads are better than one. You should expect honesty, new ideas, openness, unbiased recommendations, support, understanding and fairness, encouragement and professionalism.

You should not expect to be second-guessed, embarrassed or to receive phony praise. Honest praise, yes! Manufactured praise -- NO!

Q: What can a superintendent do when a consultant is called in without his okay?

A: The first thing I would do would be to ask myself, "how did this situation develop in the first place?" The answer often lies in the fact that something has gone wrong with turf management operations. At times a superior feels the need for additional information or possibly different results on the golf course. He is looking for a new approach, another evaluation perhaps and the wise superintendent will use the situation to his own ultimate benefit. Remember, the consultant is not after the superintendent's job. He is not interested in holding your salary down. His progress and effectiveness comes only from helping you do the best possible job under your conditions.

Q: How about a "do-it-yourself" program; i.e., a Consulting Committee from the local Superintendent Association Chapter?

A: Many Superintendent Associations have tried this approach only to find it ineffective and a thankless task for those members on the Committee. Unfortunately, club officials see such a committee as a biased one primarily interested in "saving" the superintendent's image rather than "saving" the golf course. Personalities and politics are also involved.

Q: Do you really need a consultant?

A: It depends on what you mean by "need". If we are talking about basic needs, i.e., survival, all anyone really "needs" is food, fibre and shelter. You surely don't "need" a turfgrass consultant. In fact, we don't "need" golf courses in this situation.

But in the normal run of things, a good consultant can be one of the most valuable professional tools in anyone's arsenal. He can be a positive force. He can be used effectively in innumerable ways in order to achieve your objectives and your goals. He can help make you more valuable to your club by contributing to your program.

PUTTING IT ON THE LINE

Like golf cars, whether you like them or not, consultants are a fact of life! Indeed, they grow in numbers with each passing year. Some are good. Some are bad. Some have ulterior motives. Some do not. Some are effective while others fail. But consultants--like them or not--seem here to stay. It is the wise man who will use them to his advantage.

SNOW MOLD CONTROL WITH FUNGICIDES[1]

D. K. Taylor[2]

After four years of trials on at least three golf courses in the B.C. Interior, single late October applications of three fungicides have been particularly promising for *Typhula* spp. control. With one exception, Caloclor at 5 oz/M has given excellent control at a rather heavy rate, which does result in slight temporary injury to the turf in early spring. Of the non-mercurials, Tersan SP (chloroneb) at 9 oz/M has been the most effective fungicide at five out of six locations where the trials have been located. The 9 oz rate gave more complete control than the 6 oz rate in the 1974-75 trial at Trail, but the 6 oz rate was equally effective at the Vernon and Revelstoke locations. Chloroneb applied in the granular form at a rate equal to the 9 oz/M Tersan SP was equally effective to the spray application.

The other promising fungicide has been Terraclor (PCNB) which approaches Tersan SP in effectiveness at most locations but the control is seldom as complete. In the 1974-75 trials, the best results with this fungicide were obtained at the 10 oz/M rate. In 1971-72 at 108 Mile the most northerly test location, it was the only effective fungicide tested, including Caloclor. Fertilizers containing PCNB have given similar results to spray applications at the same rate of fungicide application. In addition, Terraclor can be recommended as an economical spray for the reduction of snow mold in areas surrounding the green.

1/ To be presented at the 29th Annual Northwest Turfgrass Association Conference, Yakima, Washington, September 17 - 19, 1975

2/ Head, Crop Science Section, Canada Department of Agriculture, Agassiz, B.C., Canada

Mixtures of Tersan SP and Terraclor at half rates have given good results particularly at 108 Mile but on the average not better than Tersan SP at the 9 oz/M rate at other locations. Tersan 1991 applied at the end of October was effective for *Typhula* control only at one location in one year. Control of *Fusarium nivale* by this fungicide was marginal at all locations in 1974-75 and less effective than most of the other trial fungicides.

Varietal differences in snow mold severity were evident in 1974-75 trial at Trail where the test involved two varieties. Penncross had a higher and more severe incidence of *Typhula* snow mold that was more difficult to control than Old Shaughnessy. However, the opposite response prevailed for *Fusarium* which was more difficult to control on the Old Shaughnessy variety.

Percentage snowmold at Trail, B.C. 1974-75

	Penncross	Old Shaughnessy
Typhula		
Check	60.0	45.0
Mean all treatments	16.4	2.2
Fusarium		
Check	20.5	20.0
Mean all treatments	0.0	3.7

IDAHO TURFGRASS OBSERVATIONAL TRIALS[1]

Ron Ensign[2]

Plantings of 46 bluegrasses, 12 fine leaf fescues, 4 perennial ryegrasses, 2 turf timothy, and 6 bentgrasses were made in 1972 and 1973 in 5' x 15' plots. The grasses, with the exception of the bents, have been clipped at 2-inch and 3-inch heights to conform with good lawn mowing practices. The bentgrasses were all mowed at 3/4" level. Recommended turfgrass nutrition levels were applied. Frequent notes have been taken on spring regrowth, color, overall quality and diseases for the past three seasons.

The following is a summary of some outstanding features of these observation plots:

Spring Regrowth for Bluegrasses

Early Green Up	Late Green Up
Adelphi	Nugget
Arboretum	Cougar
Delta	Fylking
Garfield	Pennstar
Park	Prato
Sydsport	
P. 142 (Touchdown)	
P. 164	

1/ To be presented to the 29th Annual Northwest Turfgrass Association Conference, Yakima, Washington September 17 - 19, 1975

2/ Professor of Agronomy (Forages & Turf), University of Idaho, Moscow, Idaho

The fine leaf fescues green up similar to the early bluegrass varieties and the perennial ryegrass vary but are slightly later than the early bluegrasses. The Nugget variety is exceptionally late in greening up and thus retains a light brown color into mid-April at this location.

Color May-Sept.

Darker Green	Lighter Green
Adelphi	Arboretum
Glade (P-29)	Delta
Nugget	Warren's A-34
P-142	Kenblue
Ram #1	Park
Aquilla	K-1-139
Continental	K-1-155
Galaxy	P-59
Sodco	Parade
Bonnieblue	Six
	Troy
	K2-100

Ryegrass and bentgrasses are relatively lighter green color especially in the early part of the season. Canada bluegrasses, *Poa trivialis*, and the timothy varieties all produce poor color appearance when managed at these mowing heights. The fine leaf fescues have medium color appearances with C-26 hard fescue giving the best dark green color.

Overall Quality (Color & Texture)

2" Mowing	3" Mowing
Glade	Aquilla
Newport	Baron
Nugget	Cougar
Pennstar	Fylking
Ram #1	Glade
Continental	Nugget
Galaxy	Ram #1
Majestic	Continental
	Galaxy
	Sodco
	Majestic

Diseases

Helminthosporium vagans - Leafspot - Fall 1974

No or Low Infection	Moderately-High Infection
Adelphi	Arboretum
Baron	Common
Bonnieblue	Cougar
Fylking	Delta
Galaxy	Kenblue
Glade	Newport
Majestic	Park
Merion	Prato
Nugget	Six
Pennstar	Troy
P-142	
Sydsport	
Victa	

Rust

Leaf rust has been noted generally on the grasses but due to a rather dry fall in 1974 there was not adequate differentiation among varieties to note resistance or susceptibility.

TURFGRASS SNOWMOLD TEST — 1975[1]

Ron Ensign[2]

During the past three years "Snowmold" research has been conducted on bentgrass greens in northern Idaho and eastern Washington. This research has been a cooperative program among the Idaho and Washington Experiment Stations, golf course superintendents and fungicide companies. Numerous fungicides and combinations have been applied at various times in the fall and early spring to evaluate their effectiveness for *Fusarium* and *Typhula* control. Five locations were utilized in 1972-73 and in 1973-74. Results of these tests have been reported by Dr. Chuck Gould and others.

During 1974-75 additional tests were established at Moscow, Idaho involving some of the most superior fungicides and rates of previous experiments. In addition a number of experimental formulations were supplied by the Mallinckrodt Chemical Works who assisted financially in the program for the past two years.

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2/ Professor of Agronomy (Forages & Turf), University of Idaho, Moscow, Idaho

These plots were established on the University of Idaho Golf Course, Green #12. This green had not been previously treated with fungicides in 1974. The turf was Seaside bentgrass. The early and also late fall was quite dry and no disease was evident until the fungicides were applied on November 8, 1974. Thus, only one late fall application was given. Treatments were applied with a small fungicide sprayer at 40 psi supplied from CO_2 cylinders. The plots were 5' x 20' and four replications of each treatment were applied.

The treatments and rates were as follows:

Treatments No.	Product	Rate/1000 ft^2	
1	MF-582*	6	oz
2	MF-582	9	oz
3	MF-582	12	oz
4	MF-594	5	lb
5	MF-594	7.5	lb
6	MF-594	10	lb
7	CalClor	4	oz
8	1991 +	2	oz
	SP	8	oz
9	DSB + Fert	9	lb
10	Fore +	8	oz
	SP	8	oz
11	Daconil	12	oz
12	Terraclor	9	oz
13	Check	0	
14	Fungo 50	8	oz

*MF signifies Mallinckrodt

Results

The first significant fall moisture was received on November 6-7. The temperatures were cool and generally above freezing until late December. *Fusarium nivale* (*Fusarium* Patch) infection was very light; not sufficient enough to make comparisons. Snow was received on December 26 and remained on the turf surface until March 2, a period of 68 days. As soon as the snow melted and it appeared fungi damage was about as complete as it was going to develop, the readings were taken on March 4, 1975 and then again on March 22, 1975. These recordings are reported in Table 1.

Table 1. Percent total plot infected with *Fusarium nivale* and *Typhula incarnata*; Seaside bentgrass, Moscow, Idaho 1975

	Treatment		Percentage of Area Infected[1/] *Fusarium*	*Typhula*	All Disease[2/]	Comments
1	MF-582	6 oz	4.7	8.5	6.2	Slightly bleached
2	MF-582	9 oz	3.7	3.7	4.2	
3	MF-582	12 oz	4.2	7.0	2.2	Slightly bleached
4	MF-594	5 lb	4.0	5.5	12.2	
5	MF-594	7.5lb	2.0	6.7	14.7	
6	MF-594	10 lb	5.0	17.5	12.5	Darker green
7	CalClor	4 oz	11.2	1.2	6.7	Early green-up Dark green
8	1991 + SP	2 oz 8 oz	7.5	8.0	5.0	
9	DSB + Fert	9 lb	6.2	12.5	10.0	Darker green
10	Fore + SP	8 oz 8 oz	1.2	3.7	2.2	Slightly bleached
11	Daconil	12 oz	14.2	8.8	11.2	
12	Terraclor	9 oz	5.0	3.8	4.7	
13	Check	0	75.0	80.0	77.5	Severe infection
14	Fungo 50	8 oz	5.0	8.0	10.0	

1/ Average of two readings on March 4 and March 22, 1975

2/ Independent readings on March 22, 1975

In previous years two fall applications of Tersan 1991 at two ounces appeared to give excellent *Fusarium* control. Thus, the single two-ounce rate may not have been sufficient to prevent early infection, although infection was light. Distinguishing between the infection caused by the two "snowmold" organisms was more difficult immediately after the snow melted. However, after a few days the characteristic pink tinge with *Fusarium* infection and the light bleached areas plus pink sclerotia developed with *Typhula* infection.

Infection of both *Typhula* and *Fusarium* appeared somewhat less severe on most of the fungicide plots in comparison to infection on the check plots. Grass recovery was much faster on treated plots but by May 1, 1975 the untreated check plots still showed serious damage from both of the organisms.

The remainder of the golf greens were treated three times, before snow, with PMAS at the regular rate. But infection on these greens was generally more serious (60 - 85%) than on any treated plots of the experiment.

Fungicides are available for satisfactory control of *Fusarium* and *Typhula* in this area when used properly.

Acknowledgements

Special thanks to Dr. William Small of Mallinckrodts for some financial assistance in support of the research; to Dr. Chuck Gould for counsel on fungicide treatments and note taking; Mr. Fred Hall, superintendent of the University of Idaho Golf Course, for assistance, and graduate students in the Department of Plant Science for assistance in applying fungicides.

MINOR ELEMENT NUTRITION ON TURFGRASSES[1]

Ron D. Ensign and Richard D. Johnson[2]

Chlorosis or yellowing is a major problem in grass culture on most calcareous soils of southern Idaho and other western arid regions under irrigated conditions. Chlorosis not only affects the general appearance of the grass but undoubtedly affects the health, tolerance to stress and durability of the turf.

Research was initiated in 1974 and continued in 1975 to evaluate the effects of several minor and major elements on the prevention of chlorosis in turf. In addition the study was set up to develop a model for predicting the chlorosis by analyzing tissue levels for plant nutrients.

The research was conducted in cooperation with personnel from the Highland Golf Course in Pocatello, Idaho and from the Ortho Division of the Chevron Chemical Company.

The following minor elements and combination of minor elements were applied in mid-June 1974 to 5' x 5' replicated plots on a bluegrass fairway located on the Highland Golf Course. The area had undergone extensive leveling that resulted in removal of topsoil exposing a calcareous sub-soil with pH range of 7.5-8.0. The treatments were:

1/ To be presented to the 29th Annual Northwest Turfgrass Conference, Yakima, Washington, September 16 - 19, 1975

2/ Professor of Agronomy (Forage-Turf) and Assistant Professor and Extension Soil Specialist, University of Idaho, Moscow, Idaho, respectively

Zinc Sulfate - 1 lb*
Zinc Sulfate - 1 lb + Ferrous Ammonium Sulfate - 0.63 lb
Ferric Sulfate - 0.63 lb and 0.40 lb
Ferrous Ammonium Sulfate - 0.63 lb and 0.40 lb
Manganese Sulfate - 0.63 lb and 0.43 lb
Manganese Sulfate - 1 lb + Zinc Sulfate - 1 lb
Manganese Sulfate - 1 lb + Ferrous Ammonium Sulfate - 0.63 lb
Manganese Sulfate - 1 lb + Ferrous Ammonium Sulfate - 0.63 lb
+ Zinc Sulfate - 1 lb
Sesquestrene (0.6 lb Fe)

*rate per 1000 sq ft

In addition to these combinations, all plots received equal applications of nitrogen and sulfur as ammonium sulfate at rate of 1 lb/1000 sq ft/month.

A complete soil analysis was made from random samples taken from the test site. Plant tissue samples were taken prior to treatment and again in August and September. Analysis for total Zinc, Managanese and Iron, -2% acetic acid soluble nitrate -N and phosphorus, and protein were conducted on tissue samples.

Several visual readings were made during July and August, the period of greatest chlorosis expression, using a relative scale of 1 to 10 based on shade of color and deepness of color. To establish the proper time for reading turf color, several readings were made during the day on the July reading date. The August readings were read using the best reading time as determined. In addition, an August reading was made using a Munsel Color Chart reading both green and dried tissues.

Results

1. The time of day or the incidence of light rays upon the grass has considerable influence upon the green or yellow reflection color characteristics of the turfgrass. Early morning or late afternoon seem to be the most desirable for taking the chlorosis readings at this location.

2. The most favorable greening responses were observed in plots treated with the higher rates (0.63 lb per/100 ft^2) of ferrous ammonium sulfate.

3. Ferric forms of iron produced somewhat more chlorotic turf than that observed with the ferrous forms.

4. Zinc sulfate or manganese sulfate alone did not correct the chlorosis.

5. The tissue test for iron, manganese and zinc correlated well with the treatment. In addition, correlations of the means for visual colors vs. tissue tests shows that color is correlated with phosphorous levels in the tissue but not to micronutrient levels in the tissue.

6. Models for the prediction of chlorosis using Backward Elimination Procedures and Stepwise Regression Procedures are based on tissue concentration one month preceding color reading show that the "best" 1, 2, 3 and 4 variables for prediction of chlorosis by maximum R-square improvements are phosphorous, phosphorous + reciprocal of nitrate-N, reciprocal of zinc + reciprocal of manganese + log zinc, and iron + reciprocal zinc + reciprocal manganese + log zinc, respectively.

The model holds true for all color combinations as shown in the following table.

Table 1. Maximum R-Square Improvement for Dependent Variables Color (C), Reciprocal of Color (RC), Log of Color (LC), Square Root of Color (SC)

Best Predictive Tissue Test Variable	R-Square Value C	RC	LC	SC
Phosphorous	0.16	0.15	0.15	0.16
Phosphorous + reciprocal of Nitrate-N	0.24	0.25	0.24	0.24
Reciprocal of Zinc + reciprocal of Manganese + Log of Zinc	0.48	0.50	0.49	0.49
Iron + reciprocal zinc + reciprocal of Manganese + Log of Zinc	0.60	0.60	0.61	0.60

7. There were good correlations from the study, especially in the color readings. The ability to read colors is very difficult. It is relatively easy to distinguish between degrees of darkness (value), or green and yellow (chroma), but becomes increasingly difficult to read combinations of value and chroma. The study indicates that the time of day is very important in reading colors. It is possible that when reading color in the

A.M. or P.M., with the sun behind you at right angles, reflected colors are read; whereas, when reading color looking into the sun, transmitted colors are read. The value and chroma will differ as a result of translucence of the grass blade change due to blade density and chloroplast density.

8. The use of tissue test as a variable for prediction of chlorosis is feasible. However, further refinement will be necessary.

9. The preliminary trials indicate that a combination of ferrous ammonium sulfate and an adequate fertility level of major elements are necessary to correct the nutrition of bluegrass turf under these soil conditions. Thus, a second set of plots have been established for the 1975 season to assure the affect of several minor elements when superimposed upon rates of N, P and S. Data are being collected now and will be subject for analysis in early fall 1975.

10. Fertility recommendations to prevent or reduce chlorosis on turf are needed to enhance the appearance and utility of grass on golf courses, parks and home lawns.

BLUEGRASS, RESCUE AND RYEGRASS VARIETY EVALUATION FOR TURF[1]

Stanton E. Breauen[2]

Selections and varieties of these three groups of grasses were continued in evaluation trials at Puyallup. These trials serve widely to provide initial adaptability, disease and quality information to grass breeders, seed suppliers, turf specialists and turf users. Of course, only several years of observation, evaluation and concomitant use plus seed yield record will ultimately determine the most economic, adapted and persistent varieties for any region. Thus, initial evaluations are tentative. They serve as guidelines upon which wider and more detailed evaluation or use may be made. It is very common for turf selections which have the most promising quality and adaptability characteristics to be below average seed producers.

It will not come as a surprise to you when I say there are probably no varieties or selections among these 270 or more types that meet all of the turf quality standards we would like them to meet. Yet, there are some that apparently meet many of these standards.

1/ To be presented to the 29th Annual Northwest Turfgrass Association Conference, Yakima, Washington September 17 - 19, 1975

2/ Associate Agronomist and Extension Agronomist, Western Washington Research and Extension Center, Washington State University, Puyallup, Washington

BLUEGRASS

For west of the Cascades, breakdown to disease and loss of color and density in winter are most serious problems. Many types retain good to excellent summer quality while many sustain bad to severe winter diseases and reduced quality.

Good resistance to rust is not apparent although some apparently have fair resistance to *Helminthosporium* leaf spot. The necrotic development of leaf and stem tissue during winter is not well correlated with *Helminthosporium* leaf spot ratings obtained during other parts of the year. In short, no bluegrass varieties or selections rate excellent in year-round performance. Some rate good, but they have some quality shortcomings during a portion of the year.

Winter turf quality of bluegrasses is generally poorer with short cut grasses than with higher cut grasses. In contrast, early summer quality is often higher under shorter cutting with many types. The following list identifies some varieties or selections that have performed best when all seasons and quality characteristics are considered:

Kimono	Nugget*	HV-44
Sydsport	NJE-P59	EVB 1994
Birka	Bonnieblue	K1-131
Enoble	Majestic	K1-133
EVB 1128	Glade	K1-143
EVB 1912	Galaxy	Ag 412
Baron	A-34	Victa
Adelphi	Parade	

*Winter dormant type

The following list identifies those varieties or selections that have generally lower ratings when all seasons and quality characteristics are considered:

Vantage	Troy	Barones	Palouse
Olymprisp	Wepal	Holt	Campus
Cougar	Prato	Kenblue	Spaths Hohenhiem
Captan	Emprima	RAM 1-A	Arboretum
Belturf	Delft	Windsor	Canon
Six	Arena	Delta	Civa
Silo	Sobra	Newport	Park
Nudwarf	Baronie	Arista	Transilvania

FESCUE

Several fine fescues have been performing well in these evaluations. All varieties lack good winter color and quality. There appears to be wide differences in susceptibility to red thread disease with fair resistance appearing in Waldorf, Wintergreen, Sonate and others. Roadside evaluation of fescues for persistence and low maintenance is continuing but these evaluations are too new for specific comment. The following types have rated well the first two years in turf evaluations:

351 Daehnfeldt	Halifax	Menuet
Atlanta	Checker	Polar
Wintergreen	Highlight	Jade
Oasis	SVR-006	Dawson
SVR-007	HF-11	Barfalla
Sonate	Lifalla	

Lower over-all ratings have been recorded for the following fescues:

Durar	Agio	Barok
Renova	Rapid	Boreal
Roland 21	Echo	Illahee
Tjelvar	Felia	Olds
Bargena	Ru-65	Clatsop
Rubin	Cascade	Argenta
Duraturf	Roda	PURF-1
Charming	Sabanna	

RYEGRASS

Few differences were apparent among perennial ryegrass during the first year. Throughout the second year major differences have developed among varieties, particularly for density and cutting quality and leaf texture. The following types have rated well:

EER-7	Pelo	Manhattan
Yorktown	N7-157	Pennfine
ERG-3	ERG-4	EER-88

Types receiving lower ratings were:

Kent	Gazon	Combi
Aberystwyth 523	NFG	Sportiva
S-321	I.B.S.D.	Patora
Ba 8674	Odstein	Paj 2/72
Linn	Castria	Odengrun
	Endura	

Project cooperators are Dr. R. L. Goss, Dr. C. J. Gould and Mr. Tom Cook. Financial assistance from the Northwest Turfgrass Association in 1974 was greatly appreciated.

DISEASES OF TURFGRASS[1] PROGRESS REPORT

Charles J. Gould[2]

Fusarium Patch - Thanks to a very severe outbreak of *F. nivale* during the winter of 1974/75, we obtained some of the best data we have had in recent years on fungicidal control of this disease. Two new types of fungicides gave outstanding results. These are Rhodia's RP 26019 and Chemagro's Bay Meb 6447. Disease control was excellent with these during the very severe outbreak of *Fusarium* from November to March. In addition, both of these compounds produced dense turf with good color. Additional tests with both are planned for 1975/76. Unfortunately, neither product is likely to be on the market for at least another year. One of the best fungicidal mixtures tested was Mallinckrodt's MF-573. It, too, gave good disease control and produced green dense turf. In general, most of the benzimidazoles used alone or in alternating programs were not as effective as in previous years. Perhaps benzimidazole-resistant strains are developing. These results are being prepared for publication.

Corticium Red Thread - Tersan 75 (@ 8 oz), Dyrene (@ 8 oz) and Daconil (@ 8 oz) all gave good control of Red Thread in a test last year. Tersan 75 at 4 oz was less effective than at

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1/ To be presented at the 29th Annual Northwest Turfgrass Association Conference, September 17 - 19, 1975, Yakima, WA.

2/ Plant Pathologist, Western Washington Research and Extension Center, Washington State University, Puyallup, WA.

8 oz. Dyrene and Tersan 75 produced turf with the best density and color. Red Thread also appeared in two other areas where fungicides were being applied. Good control and good quality grass were obtained with mixtures containing one or more of the fungicides listed above. In addition, both RP 26019 and Bay Meb 6447 gave good control of Red Thread.

Snowmold - The data from the 1973/74 tests have all been summarized and an article on these is nearly ready for publication. Best control was obtained when a fungicide (such as Fore or a benzimidazole) was applied in early fall to control *Fusarium*, followed by another application just before snowfall of a mixture of either chloroneb or Daconil (to control *Typhula*) plus a fungicide to control *Fusarium* (Fore or a benzimidazole).

NUTRITIONAL TESTS

Snowmold *Typhula incarnata* and *F. nivale* - These tests, which were started in the fall of 1974 at the Spokane Golf Club, involve various sources of nitrogen and different levels of N, P and K applied at different times, with and without sulfur and minor elements. The best overall results (disease control plus grass color and density) so far have been obtained with Milorganite, but the experiment must continue for at least another year before we can obtain conclusive results.

Fusarium Patch - *F. nivale* developed abundantly in a test plot where various nutritional programs were being tested for their effect on another disease. The least *Fusarium* patch appeared where Milorganite was being used. The Milorganite plots also had the darkest color. The next best color was produced by ammonium sulfate and urea plus sulfur. However, more bentgrass was present in the ammonium sulfate plots than in any other plot.

DISEASE RESISTANCE

Bentgrasses (159 varieties)

Fusarium Patch - This is a continuing test with new varieties being added each year and poorer varieties reduced in numbers of replications. We recently planted the 159th variety, which will be the last one for at least two years. Some of the varieties

which previously appeared to be very resistant, have fallen by the wayside, while a few, which earlier did not look so good, have apparently developed some resistance, perhaps by natural selection of clones. Some of the more promising (disease resistance + color + density) varieties or clones this past year were: Agrettina, Avanta, Barbella, Congressional, Dudecks ARC-1, Evansville, Huffine's MCC-3, Keen's #22, Kingstown, Ligrette and Toronto. Several others also look good and later may prove to be as useful as the above varieties. A mimeographed report on the tests for 1974/75 will be sent upon request.

The above tests are run on 5' x 5' plots maintained under uniform management conditions. The more promising varieties are next planted at our Farm 5 in larger plots maintained under two levels of nitrogen with and without fungicides. See Dr. Goss's report for additional details.

Snowmold (primarily *Typhula incarnata*) - A severe attack of snowmold occurred in our plots at Hangman Golf Club during the winter of 1974/75. The disease was almost entirely caused by *Typhula*. In general, the stolonized varieties were much more susceptible than the seeded types. Among these, the following were among the most promising when disease resistance, plus good color and quality were considered: Enate, Tracenta, Ligrette, Hummel, Saboval and MOM AT4. Three of the most disease susceptible were: Arrowwood, Evansville and Seaside. These tests are continuing.

BLUEGRASSES

Rust (*Puccinia rubigo-vera*) - Of the 120 varieties in this test, several appeared to have some resistance. Two of the best were Bonnieblue and Majestic. Others included: Banff, EVB 1939 and 2104, Fylking, Galaxy, Geronimo, Glade, K1-131, NJE P59, Parade and SVP-006. Ones that were particularly susceptible were Emprima, EVB 532, Vantage and Arista.

Corticium fuciforme - Captan, Cougar, Monopoly and RAM 1 were the most resistant, while Kimono was quite susceptible.

Fusarium nivale - Most varieties appeared to be fairly resistant to this pathogen, but both Golf and Sydsport were quite susceptible.

Helminthosporium vagans leaf spot - This disease has been quite severe during the past two winters. Only a few varieties appear to have reasonable resistance. These include Belturf, Nugget, several of the EVB series (1405, 1224, 1912 and 1942) and Hg 7217. Among the very susceptible lines are Arboretum, Cougar, Delta, Kenblue, Parade, Park and Transilvania.

FESCUES

Corticium fuciforme - This is the most serious disease of fescues in the Pacific Northwest. None of the 93 varieties were immune, but some were much more resistant than others. Among the most resistant varieties were: Daehnfeldt 351, Marga, Trol, Waldorf, Scaldis, Barok and C-26. Some of the more susceptible varieties were: Echo, Ruby, Rapid, Roda, Olds, Cottage and Durlawn.

Fusarium nivale invaded the plots during the winter. Most varieties were either resistant or escaped attack. The following however, were rather severely infected: Argenta, Barok, Erika and S70-2. Ones of moderate susceptibility included Marga, Waldorf, Polar, Encota and Wintergreen.

RYEGRASSES

Corticium Red Thread - None of the 59 ryegrasses showed much resistance, but some of the better ones were Ensporta, Lynn, Odstein, Diana, Pennfine and a few numbered selections. Some of the most susceptible were: Angela, Springfield, Combi, and Norlea.

COOPERATORS

All of this research has been carried on in cooperation with Dr. R. L. Goss and, in part, with Dr. S. E. Brauen (Variety testing), and Prof. Al Law (Snowmold research) to whom I express my appreciation. We are very grateful to Bud Ashworth (Supt., Hangman Valley Golf Club) and Norris Beardsley (Supt., Spokane Golf Club) for their assistance with the snow-mold research.

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PUBLICATIONS DURING THE PAST YEAR (COPIES AVAILABLE)

Disease Control in Putting Turf. WSU EM 2050 (Rev 1975) Gould and Goss.

Disease Control in Lawn Turf. WSU EM 2049 (Rev 1975) Gould and Goss.

Results of Fungicidal Tests on Bentgrass Turf During 1974/75. July 17, 1975. Gould and Goss (WWREC) Mimeo.

Progress Report on Testing of Agrostis Cultivars for Disease Resistance. May 29, 1975. Gould, Goss and Brauen. (WWREC) Mimeo.

Comparison of light-frequent, heavy-infrequent and alternating applications of fungicides to control *Fusarium* Patch. Proc. 2nd Int'l. Turf Res. Conf. 1974 pp. 339-343. Gould and Goss.

Turfgrass Pathologists' Newsletter, Vol. I, No. 1. Gould, Editor. July, 1975 (Mimeo.)

1975 POA ANNUA SURVEY[1]

Thomas W. Cook[2]

During the spring of 1975 *Poa annua* samples were collected from putting greens at 31 golf courses in Washington, Oregon and Idaho. Samples were allowed to grow to maturity in a greenhouse and examined for variations in morphology, growth and seeding habit. Most selections can be placed in the following categories:

1. Erect growing, few to several secondary tillers, leaves generally coarse textured, generally heavy seed producers.

2. Decumbent growing, many secondary tillers, some short stolons, leaves generally fine textured, seed production variable from light to heavy.

3. Decumbent growing, many secondary tillers, spreads vigorously from stolons, leaf texture variable from coarse to fine, seed production variable from none to heavy.

Not all samples can be easily placed in the above categories and in some cases intermediate forms were noted. Samples collected in eastern Washington contained mostly erect growing types and very few of the stoloniferous types, while all types were common in western Washington. Old, mostly *Poa annua* greens yielded more decumbent types than greens at new golf courses. In fact, new

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1/ To be presented at the 29th Annual Northwest Turfgrass Association Conference, Yakima, Washington, September 17 - 19, 1975

2/ Turfgrass Research Associate, Western Washington Research & Extension Center, Washington State University, Puyallup, WA

greens at new courses often contained only erect growing types. New greens at old courses often contained types from all three categories.

Attempts have been made to classify *Poa annua* to annual or perennial subspecies using predetermined morphological markers (Gibeault, 1972). Annual types are reported to have culms with six or less nodes, one or less secondary tiller, one or less adventitious root, and post harvest seed germination of 10% or less. Perennial types have culms with many nodes, many secondary tillers, many adventitious roots, and a high percentage of post harvest seed germination.

Based on morphology alone, all samples collected this past spring would fit into the perennial subspecies classification. However, detailed germination studies have not been completed at this time. To determine if morphological variation actually influences longevity under mowed and unmowed conditions, samples representing a broad range of morphological types are being prepared for placement in nursery rows and in putting turf. Samples will be rated on survival, rate of spread and seeding habits.

In addition to *Poa annua* samples, soil samples were taken from new and old greens at most courses. New greens were considered to be those constructed from sand or sand-soil mixtures while old greens were those constructed from native soils. Samples were subjected to sieve analysis and results compared to our current specifications which require that no more than 15 - 20% of the particles be larger than 1 mm and no more than 10 - 15% be finer than 0.20 mm.

As might be expected, all old greens contained excessive fine particles. Some were surprisingly close to being acceptable possibly due to longstanding sand topdressing programs. Results of sieve analysis of composite samples from new greens on 15 golf courses were disappointing. Of the 15 samples, only 7 fell within acceptable limits while 5 contained too many fine particles and 3 contained excess coarse particles. Several new greens actually contained a greater percentage of fine particles than many old greens. Perhaps this can help explain the poor drainage properties exhibited by some supposedly sand greens.

One additional observation in this survey seems noteworthy. On golf courses sampled, well over 50% of the greens were built from native soils. With this in mind, it appears that work done at the WWREC on native sandy loam soil can often be directly applied to many putting green management programs.

REFERENCES

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CONTROL OF POA ANNUA[1]

Thomas W. Cook

Research conducted at the WWREC in Puyallup since 1970 indicates strongly that *Poa annua* control with pre-emergence chemicals can be successful. Nevertheless, the transition from research to popular acceptance in the field has been negligible. In fact, of the golf courses sampled this spring, only three reported any serious attempts at *Poa annua* control. Two gave up after one to two years while the other reported encouraging results.

Success with a pre-emergence program requires a thorough understanding of the chemicals being used and knowledge of the growth habit of *Poa annua*. For instance, Dr. Goss has found that bensulide used annually in the fall at 15 lb active ingredient per acre was ineffective in controlling *Poa annua* while bensulide applied annually in the fall at 12 lb active ingredient per acre plus 3 lb active ingredient per acre every three months was very effective. This might be explained by the observation this summer that *Poa annua* germination occurs all summer long in our Puyallup test plots. Since repeat applications maintained toxic levels through the year, control was better than the single fall application which lost residual activity by the following summer.

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Even under good conditions, pre-emergence control of *Poa annua* is not without problems. For example, overseeding with improved bentgrasses while on a pre-emergent program is difficult since most chemicals effective against *Poa annua* are also effective against bentgrasses. Also, conversion to bentgrass is slow and it may take several years before there is a noticeable decrease in *Poa annua*.

At the WWREC we are attempting to develop an integrated program for *Poa annua* control in both bentgrass and bluegrass-fescue turf. The program will incorporate the best of what we know about pre-emergence control and effects of plant nutrition, with modified maintenance practices and selective post-emergence herbicidal treatments.

Of immediate interest is development of a selective post-emergence herbicide. Among chemicals being tested, Endothal and Amitrol-T both look promising on Colonial bentgrass putting turf. Tests have been conducted to determine the following:

1. Tolerance to a wide range of rates.

2. Effects of repeat applications on *Poa annua* control and survival of bentgrass.

3. Influence of timing on control of *Poa annua* and survival of bentgrass.

Mild weather and lack of any extended stress periods have undoubtedly influenced results thus far. In general on putting turf results have been very encouraging. Timing and frequency of application in the case of Endothal appears to be very important. With Amitrol rates are very important and much more work is scheduled. Evaluation of control with these chemicals was hindered in early trials due to the flush of *Poa annua* germination following initial kill of established plants. This observation will aid in planning future experiments and stresses the importance of integrated control using both pre- and post-emergence chemicals.

Future testing will utilize other promising chemicals and refinements based on work in progress. By next season our new putting green should be ready for experimental use and will help answer several questions that have been raised concerning rate effects on sand greens.

Tests using Endothal for *Poa annua* eradication in mixed stands of bluegrass and red fescue have been inconclusive. Spring applications caused severe injury to the red fescue and some thinning to the bluegrass with variable *Poa annua* control. Recent summer applications have shown greater selectivity but with variable *Poa annua* control. Much more testing is scheduled for bluegrass-red fescue stands.

All work concerning post-emergence control of *Poa annua* is in progress and at this time NO recommendations can be made concerning any test chemicals. We are looking forward to the day when a safe and effective program can be offered for your use.

PRE-EMERGENCE SCREENING TRIALS

A modified version of the 1974 pre-emergence test has been put out on putting turf and will be evaluated through next spring. This test includes several promising experimental materials and Bensulide. Materials are being evaluated at several rates and application schedules on mowed turf and bare soil seeded with both Colonial bentgrass 'Highland' and *Poa annua*.

ACKNOWLEDGEMENTS

The expanded *Poa annua* control work could not have been attempted without the financial assistance of the Northwest Turfgrass Association. We are very grateful for this support which we feel will allow us to expand our program to answer this and other difficult problems.

AGRONOMIC RESEARCH REPORT[1]

Roy L. Goss[2]

I. NUTRITION STUDIES

A. Responses to N, P, K and S in 1975 were similar to those reported in 1974. Plots receiving sulfur still exhibit significant responses with regard to color and texture. Nutritional responses can be summarized as follows:

1. *Poa annua*. All plots receiving 3-1/2 lb of sulfur per 1000 ft^2 per year are still maintaining purity of bentgrass stand with little or no intrusion of *Poa annua*. In plots receiving four different rates of sulfur (0, 1.15, 2.3 and 4.6 lb of S) show variable response to *Poa annua* invasion. No *Poa annua* plants are to be found in any plots regardless of nitrogen levels at 4.9 lb S per 1000 ft^2 per year. Plots receiving 2.3 lb S per 1000 ft^2 per year are virtually *Poa*-free with only a few plants being found in plots receiving 20 lb of N or plots receiving the high level of N and those receiving phosphorus. Plots receiving 1.15 lb S contain high populations of *Poa annua*, however, the turfgrass is stimulated in color response from S applications. The check strip receiving no sulfur has very high populations of *Poa annua* and the plots are off-color - yellow.

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2/ Agronomist/Extension Agronomist, Western Washington Research and Extension Center, Washington State University, Puyallup, WA.

2. *Fusarium* patch disease. Ratings were made of the plots in the fall of 1974 and spring and summer of 1975, and all plots and strips receiving sulfur have significantly less *Fusarium* patch disease than plots not receiving sulfur.

3. Growth responses. Growth rate is accellerated in plots receiving 12 and 20 lb of nitrogen, respectively, without regard to P and K where S is applied. Little growth differences were observed in S treated plots where nitrogen levels were 6 lb per 1000 ft^2 per year. Some scalping of plots receiving sulfur at the high nitrogen treatment was experienced again in 1975. This is due to excessive growth and has resulted in some scalping.

4. From indications over the past few years, it would appear that 6 lb of nitrogen, 5 lb of K_2O potassium, and 3.5 lb of sulfur per 1000 ft^2 per year may be a viable program under many circumstances. Winter color will be poor although spring and summer color is quite satisfactory. The turf, of course, will have to receive some phosphorus and it is predicted at this point that perhaps one lb. or slightly less of P_2O_5 phosphorus per 1000 ft^2 will be adequate to maintain the turf. Under field conditions, light applications of ferrous ammonium sulfate may enhance winter color sufficiently to get by with this low rate of nitrogen for the Pacific Northwest.

5. *Ophiobolus* patch disease. No *Ophiobolus* rings are to be found in any of the S treated plots.

6. pH. Some reduction in pH has been recorded at the highest rate of sulfur, but they are not significantly lower than other plots. The pH has been depressed at the highest at about .7 on the pH scale. No lime has been applied to these plots for the past 16 years.

B. Plots were established in April, 1975 to study the effects of Gold-N (32% nitrogen), IBDU (32% nitrogen),

urea formaldehyde (38% nitrogen), and ammonium sulfate. Ammonium sulfate and urea formaldehyde were included to serve as checks against IBDU and Gold-N for this area. We have sufficient data on urea formaldehyde and ammonium sulfate to make reliable comparisons with the effects of Gold-N and IBDU.

Gold-N is a sulfur-coated urea, and we need to know more about this particular product under the conditions of the Pacific Northwest. We feel that sulfur coating will be one means of maintaining adequate sulfur levels, and of course, the sulfur coating does create a slow release factor without any burn. This work is being supported in part by ICI (International Chemical Industry of England) and ICI-US. At the present time, Gold-N has produced turf with quality equal to the best of other fertility treatments. It is too early to tell yet what the carryover effect will be in the spring of 1976 or the effect of the sulfur contribution. More information will be reported as it is developed.

II. TOPDRESSING PROGRAM

Light, frequent topdressings have been carried out on an experimental green at the research station at Puyallup for 15 months to date. Eighteen topdressings have been applied to date at the rate of 3 cu. ft. per 1000 ft^2. The plots have been overseeded with the topdressing program with the exception of very late fall and very early spring. The results of this test can be summarized as follows:

A. Improved surface. Surface conditions as related to putting greens has significantly improved. The surface is extremely smooth and would enhance putting significantly.

B. Uniform profile. Approximately 3/4 inch of new profile has been created to date, and the uniformity of the profile is near perfect. There is absolutely no evidence of layering and roots, stems, crowns are uniformly mingled with the stand.

C. Bentgrass populations. It is questionable as to the increase in bentgrass populations during this past year. There appears to be some increase in bent, but we are too young in the program to assess this factor yet.

D. *Poa annua*. I would say at this time that there has been no reduction in *Poa annua* by carrying out this program for a little over one year. We, of course, will not assess any *Poa annua* factors until this project has been carried to completion at the end of three years.

In the summer of 1975 we began applications of sulfur on one-half of this topdressed area to determine the compatibility of high levels of sulfur with the fertility program and the topdressing program being practiced. This area is constructed on sand and should give us some significant indications of the effect of sulfur with this regard.

III. BENTGRASS ADVANCED MANAGEMENT PLOTS

These plots are being maintained in the same manner as most golf course putting greens. They are mowed at 1/4 inch, fertilized regularly and topdressed. They receive two levels of nitrogen, 12 lb and 5 lb per 1000 ft^2, respectively, from complete fertilizer formulas used on golf courses. The results to date can be summarized as follows:

A. The effects of N. The highest level of nitrogen, in general, has produced plots with the best texture and color. This was especially apparent during the spring and early summer, but these differences have largely disappeared since the low nitrogen plots have received regular applications of nitrogen throughout the late spring and summer. I would expect these differences to reappear this fall when the low nitrogen plots once again will have no applications of N.

B. Scalping. Some of the plots tended to scalp worse than others, and the greatest amount of scalping occurred under high nitrogen treatments. These points are summarized in the table accompanying this article.

C. *Poa annua*. In most of the plots, *Poa annua* has increased more under high nitrogen than under low nitrogen; however, some of the plots show little difference in *Poa annua* invasion due to nitrogen treatments and results are shown in the table.

D. Varietal response to *Fusarium*. This information is being presented by C. J. Gould as part of his disease research report.

IV. MOSS CONTROL

Moss control studies were conducted during late winter and early spring of 1975 to test various compounds for their effectiveness in reducing lawn moss. This project was in cooperation with Chevron Chemical Company, Ortho Division, and was partially supported through a grant-in-aid from that company. In general, the medium to high applications of experimental iron compounds produced best results as compared to all other treatments. Other treatments included moss control materials formulated by local companies and by O. M. Scott Company. It is not known currently when Ortho will market these ferrous compounds. They are a granular material, easy to apply, and will be adaptable to many other turfgrass areas other than for the control of lawn moss.

V. NUTRITION TESTS AT SPOKANE GOLF AND COUNTRY CLUB

A nutrition test was established at the Spokane Golf and Country Club on a practice putting green to study the effects of various sources of nitrogen as well as rates and timing to determine their effect on snowmold development and *Fusarium* patch disease. Sulfur and micronutrients were also included in these tests to obtain more information from the Inland Empire area. In general, Milorganite and ammonium sulfate produced the better appearing plots from spring evaluations and the same two materials produced turf with the least amount of disease. Additional information regarding the disease factor will be presented by C. J. Gould. We intend to continue applications for a period of at least 3 years, and we feel that information gained in the winter of 1975-76 will be more than what we have learned during the first year.

VI. BENTGRASS VARIETY PLOTS AT HANGMAN VALLEY GOLF COURSE

These variety plots have undergone their second winter since establishment and none of the varieties show complete resistance to snowmold attack although four varieties, HV-TC-4, HV-T-3, URI AC-5 and Kingstown, had less than 25% of the area infected by snowmold. Some of the varieties were attacked up to 90% or better by this disease. Color, texture, density and general appearance ratings have been maintained for a period of two years and the following varieties exhibit best color when rated on a 1 to 10 basis. Ten is best color, one is brown. No variety that rated less than 7.5 in color is included in this report.

Seeded varieties included: Boral, Bardot, Tracenta, MOM AT4, Ohl. OE332, Atella, Norfel, Penncross, Scotts A-75, Barbinet, Tendenz, Strandhem, Enate and Ligrette. Most of the stolonized varieties had 7.5 color rating and over, but three URI selections had ratings of 9 and one Florida (Dud. ARC-1), Ferg. 63-10 and Twin Orchards rated 8.5.

With regard to texture, the following varieties rated best (1 to 10, 10 being very fine, even textured, and one being very coarse, lacking density, etc.):

Waukanda, Keen's 22 and 28, Washington, Ferg. 67-9, URI APN-3, Dud (ARC-1), MOM AT4 and Kingstown rated 9.0 or better. A large number rated 8.0 and better, a few of which are Boral Novobent, Penncross, Bardot, Toronto, Ferg. 63-10, Twin Orchards, Hayden Lake, Morrissey and Scotts A-75 and A-74.

It is interesting to note that a number of the same varieties do exhibit both characteristics of color and texture, and this, of course, is one factor we are looking for. Unfortunately, only two of all of these varieties have ratings of 40% or less snowmold attack. The varieties registering less than 25% snowmold did not rate significantly high in color and texture to be included in the color-texture list. We will reevaluate our data and if they were excluded from the list only because of color but have acceptable texture, these more highly resistant snowmold varieties could possibly become good varieties for the snowmold region if they continue to exhibit this characteristic.

We are grateful for the assistance provided by Bud Ashworth and his crew at Hangman Valley in maintaining these plots. This work is being carried out in cooperation with C. J. Gould, A. G. Law and S. E. Brauen.

Reports concerning bentgrass varietal responses at Puyallup as well as the Bluegrass, Fescue and Ryegrass trials will be reported more in detail by Drs. C. J. Gould and S. E. Brauen.

VII. *Poa annua* CONTROL

A five year test of pre-emergence *Poa annua* control was terminated in July, 1975. In summary, Bensulide applied at 15 lb per acre annually with 3 lb per acre added every three months subsequently resulted in plots with over 95% bentgrass purity. Less than 2% of the plot was infected with *Poa annua*. Plots receiving Bensulide at 15 lb per acre once annually showed no reduction in *Poa annua* as compared to the check. Plots receiving applications of tricalcium arsenate over this period of time were 100% free of *Poa annua*. Since tricalcium arsenate is no longer available on the market, this information is after the fact. However, our results with Bensulide are significant enough to indicate that *Poa annua* can be controlled if the turfgrass manager maintains a diligent program in management and use of this chemical.

Other cooperative research with regard to the control of *Poa annua*, both pre- and post-emergently and nutritionally is ongoing with Tom Cook, and his report will carry more detailed information with this regard.