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TURF CONFERENCE PROCEEDINGS

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PROCEEDINGS OF THE
1974
MIDWEST REGIONAL TURF FOUNDATION

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The 49 talks included in these Proceedings are condensations of talks by speakers before sections and divisions of the 1974 M.R.T.F. Conference. We appreciated the willingness of the speakers to participate and prepare material for your reading. Proceedings of each annual Conference since 1948 have been prepared. A limited number of 1962, 1963, 1964 and 1965 Proceedings are available at $ 1.00 per copy. Copies of 1969, 1970, 1971, 1972, and 1973 are $ 2.00 each.

A copy of these Proceedings were mailed to:
The 741 attending the Midwest Turf Conference
One person of each member organization within the Midwest Regional Turf Foundation not represented at the Conference
List of those in educational activities.

Additional copies are available at $ 2.00 each from:

W. H. Daniel, Executive Secretary
Midwest Regional Turf Foundation
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For lawns - first see articles starting on -
20, 61, 62, 65, 69, 70, 72

For sod production - first see pages -
27, 29, 48, 59, 61, 62, 65, 72

For athletic fields - first see pages -
52, 61, 69, 75, 93, 94, 95, 96, 97, 100

THE ART AND PHILOSOPHY OF ATTENDING CONFERENCES

Harold W. Glissmann, Landscape & Sales
Omaha, Nebraska

Such a subject must be broken down into five or six parts -- namely, motivation, attitudes, questions, responses, plus my own thinking and philosophy. For example, how many told the local press you would be here?

To philosophize is to explore life. It means breaking free to ask questions. It means resisting just easy answers. It is seeking in one's self the courage to ask painful questions. But, if by chance you have already asked all your questions and are satisfied with the answers, philosophizing would be a waste of your time. Philosophy is for those who are willing to be disturbed with a creative disturbance. It is for those who still have the capacity for wonder. Philosophy does not answer questions - its function is to question answers.

Motivation

What is motivation? According to Webster it is a provision of a motive or inducement. So we must have a motive or some sort of inducement. He also says that a motive is that which influences desires or incites the will in a particular direction. I can assure you that I had a motive 50 years ago when my father and I first attended my first turf short course at Iowa State University.

I attended this conference some 26 years ago. It was my good fortune to be able to sit and listen and take notes from such turf experts as Burt Musser, O. J. Noer, Fred Grau, Marshall Farnham, Carl Bretzlaff, Tom Mascaro, and the best friends the superintendent ever had, Herb and Joe Graffis. It was through this conference and others like it that I not only found the answers I was looking for and the guidance I needed to help make me a better turf man and to better serve my clients, but I also developed friendships that have lasted a lifetime.

I am sure all of you attending this conference have this same motivation. It will give you a better idea and may even influence you in other ways. All of you must have a motive or personal desire, or you must have been motivated by someone or you would not be here today.

Attitudes

Try and build a good attitude -- that of anticipation. What is anticipation? It is looking forward to something, and oftentimes, is greater than the realization. If your attitude and anticipation are to get all the answers at this or any other conference -- forget it. I always felt well repaid if I could get one definite answer. There is no way that you can go home with all the answers. If there were we would not need repeated conferences held each year.

I always feel enthused after I receive a copy of a program as I anticipate some answers to some problems, and to meet old friends, and make a few new ones. Study your conference programs. You can't listen to every speaker at a conference of this size, and that is what makes

it a great conference.

Don't be afraid to ask questions. I don't think there is such a thing as a dumb question. Questions come easy after you have been motivated or have a definite attitude within yourself. You will develop a desire to ask questions and thereby satisfy some of your desires. It will also do something else - it will let the speaker and other people know you are in attendance and interested in what is going on. That also is part of the Art of Attending Conferences.

Answers

Webster defines an answer as a reply in speech or writing, or by signal. Our tour through the greenhouses this morning may have given you some answers already. Also, I'm sure it motivated some of you and created some questions and desires that you will want to seek answers for. You may ask yourself, "I wonder how I can get the answer to some of the problems or questions that I have?" Believe me, they won't all be answered here. Attend other conferences, visit with your fellow superintendents or people that could possibly help you; subscribe to publications; visit your local County Extension Office; check with University Publications Offices, or book stores. Call or write some of the people you have listened to or heard about, or you may get the answer by trial and error. Don't forget -- you can't win them all!

My Rewards

Among many rewards the greatest are the friendships I have made. To see the tears of joy on O. J. Noer's face at his party in Houston, and the same kind of tears on the face of Burt Musser at his farewell party at Penn State. Also to receive free and postpaid autographed copies of Turf Management from Burt, and the firm hand clasp and thank you for coming was a great moment for me.

To see Sam Snead climb a tree to make a golf shot in the St.Paul Open, or the look on Hogan's face when he was tied and then defeated in San Francisco, or to witness golf's longest hour in Rochester when Middlecoff waited four hours for Julius Boros to finish and miss that 35 footer for a tie. To be invited personally years ago to Chicago to hear Dr. Richard T. White, then Executive Secretary of the American Nurserymen's Association, give his great talk - "Freedom Is Not Free."

These things would never have been possible if I had not attended conferences, or tried to be a leader in some small way. I have served on the Board of Directors of this Foundation, and as Master of Ceremonies at your banquet. It was my privilege to help organize and serve as first President of my State's G.C.S.A. A few years ago I was honored as a quarter century member of the National G.C.S.A. And when the Knights of Columbus selected me as "Man of the Year" in Omaha, that's not bad for a Shriner!

Having Musser, Noer, Watson, Grau and many others in my room to discuss and argue the merits of new programs for research, seed development, or the best way to do a certain job, or solve a problem that someone thought needed solving, means I learned a lot just by being there and listening. But, this does not always come free. Your attitude, motivation, questions and how you present yourself is all part of the game.

Give and you shall receive; be alert to what is going on around you; support your local and national leaders and programs. Know how to say "thank you". I can't stress this too much about saying "thanks." Don't be afraid to show your appreciation by word or deed to the people who help you. It's a lot of hard work to put a conference like this together.

Glissmann's Thinking

For a country boy who didn't get out of the tenth grade I have tried to develop my thinking along the lines of trying to help myself to do a better job. Also to develop my image with my customers, employees, salesmen and others I come in contact with.

I experienced a great feeling just recently when Dr. Daniel put on a workshop on fertilizers for a competitor of mine in Omaha. My competitor asked me if I would be chairman of his program. This alone made me feel that my thinking and my conduct of myself and business over the years was not all bad.

I have some very definite ideas about attending conferences. I don't think that you can be up all night shooting it up and be alert and a good attendant at the morning session. Be on time! That's the way this conference is run -- on time. I have told many others how we do it here. By being alert and on time makes your speaker feel that you are interested and will make him feel he needs to do a good job. Conference speakers have a responsibility to those listening by being well-prepared, knowing how long his presentation will last so as to be able to present it in the programmed time. Jim Holmes does a great job as a speaker, but Jim - he can't tell time - which is not all bad. A great guy! Miss him for not being here.

Be willing to give more than you receive. My grandfather told me when I was a small boy "if you never do any more than you are paid for, you will never get paid for more than you do." I have always tried to live by that little saying and am sure it has paid great dividends. Treasure your friendships; be interested in what they are doing or trying to do; be active in your home community. Your Church is a great place to start. There is a lot more to life than growing grass or trimming trees and shrubs. Reward a good job well done, and above all be honest with yourself and your fellow man.

In closing, I would like to alert you to the second and third generations of Turf Pros. The second generation must include - Bill Daniel, Elliott Roberts, Kenny Payne, Mal Shurtleff, Jack Butler, Charlie Wilson, Ray Freeborg, Jim Latham, Bill Bengeyfield - to name but a few. Then comes the new breed headed by Jim Beard of Michigan, Al Torgeon of Illinois, Bill Lobenstein of Missouri, and the Green Section youngsters, Carl and Lee. They all will be around for quite a while. They're great guys all, and I am proud to be able to call them close personal friends. If you don't know them, make an effort to meet them for they would like to know you. I heard Dr. Grau last week make the statement about hoping to meet those he didn't know.

If in some way you've had one or two thoughts or ideas, or been alerted in some way, my time in preparing this paper and the expense of traveling 1400 miles to present it will have been well spent. You may know, Bill doesn't pay too well for appearing on his programs. It

has been a great quarter-century for me, and you younger fellows with high school and college degrees here today can get the same benefits and rewards a lot easier than I did if you will put forth the effort and don't forget to say "thanks" once in a while! My only regret is that I can't be around to listen and share with the fourth and fifth generations.

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PURDUE SERVES STUDENTS

D. C. Pfendler, Associate Dean and
Associate Director of Resident Instruction
Purdue University

As a land grant college established by the Morrill Act signed in 1862 by Abraham Lincoln, Purdue is required by law to teach Agriculture, mechanic arts, and military science and tactics. The agricultural complex has a definite mission: to insure an abundant and economical supply of food, feed, and fiber to the American people, to protect and use wisely our natural resources, and to enhance the quality of living.

At the time of my original enrollment in 1925, Purdue University consisted of about 3,600 students. In September of 1973 the graduate and undergraduate students enrolled in Agriculture totaled about 3,850.

During my undergraduate program and at the time I returned to the University in 1937, the several undergraduate programs were rigidly structured with long series of departmental requirements and little opportunity for inter-disciplinary programs, or any broad base approach to training in agriculture. In about 1940, a General Agriculture option was set up by the then Dean, Harry J. Reed, to permit individual study programs that would incorporate available subject matter in a manner best calculated to meet the needs of the individual student. This plan brought relevance to the undergraduate program and resulted in strengthening the teaching program and putting a strong counseling program in place in each department.

Students graduating from programs of this type began to command attention and enrollment grew. General Agriculture permitted the exploration of new areas on an experimental basis. Among these new areas was a program in Turf Management proposed by Professor William Daniel. While this was operating under General Agriculture, it became clear that this was a program with real vitality and growth with an excellent market for graduates trained in this area. Turf Management was then set up as an individual entity, and published in the catalog as a regular option available to any interested undergraduate.

Educational programs designed to meet specific needs of the type indicated was a new approach. Numbers of students and quality of high school preparation increased. Currently approximately 50% of the students enrolled in agriculture graduated in either the first or second decile of their high school class; in 1960 about 25% came

from the two top deciles. The complexion of the undergraduate student body changed. In 1960 about 65% of the students were reared on farms; now only about 40% come from farms. In 1960 there were only a few women enrolled in agriculture; currently there are over 600 undergraduate women in agriculture.

Currently there are over 300 members of the agricultural staff, about 225 of whom are engaged in teaching one or more courses. Practically all of the teaching staff are employed to also undertake research in their area of interest. Only by active participation in research can agricultural teachers stay current in the rapidly evolving change and growth in their respective fields. This involvement with research adds immense strength to the undergraduate teaching program.

Over 50% of each beginning class has a longtime educational objective of acceptance in some type of professional program like veterinary medicine, human medicine, law, dentistry, or acceptance in a graduate program. Since all of these professional opportunities involve a screening process, a very high percentage of undergraduates are serious, determined young men and women who are earnestly making every effort to take advantage of their opportunities.

The university Office of Financial Aids is in position to offer scholarships or grants to approximately 25% of the undergraduates in the School of Agriculture to the extent of 25% of their annual cost. This means 75% of the undergraduates have no financial help, and those who do receive help must provide up to 75% of their total expenses from some other source. Rapidly escalating costs impose a serious strain on this system. At the present time, students from so called "middle class" homes are facing real problems in this area.

The university, and particularly the School of Agriculture, has always placed enormous emphasis on the counseling program for individual students. About 125 of the senior members of the staff have direct counseling responsibilities covering the range of preparation, motivation, finance, career development and such other personal problems as may arise. Many of these problems are most unusual and serious.

The undergraduate student enrolled at the present time, as compared with students of a few years ago, are much better prepared academically, are more mature emotionally and socially, and much more concerned about environment, quality of life, fair treatment, and whether democracy can be made to work. They are the finest students we have ever had.

As this conference gives attention to methods of strengthening their organization and giving professional stature to their work, help in underwriting scholarships and help in underwriting research programs certainly are appropriate. I commend these matters to your urgent attention.

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SHORTAGES ARE RELATIVE 'ROUND PLANET EARTH

R. C. Pickett, Dept. of Agronomy
Purdue University

The subject of shortages is coming up very frequently at this time in the USA in our homes as well as our businesses. It is very timely therefore to examine some of the most essential items in short supply around the world in various degrees in various places inspite of great God-given resources.

Pure drinking water is a primary shortage for a great proportion of people in the world. Over half the women of the world spend many hours a day carrying drinking water and fuel for cooking to their homes. Dependability of supply and quality is lacking in both cases. Communicable diseases and parasites are spread much wider and more frequently as a result of the poor water which, in turn, is affected commonly by poor sanitation systems (another shortage!)

Electricity is still unbelievably short in many areas, with none into remote areas of South America, Africa and Asia. There are very deficient and undependable (many "outages") supplies even in the major cities in many areas. When you consider 6% of the people of the world are here in the USA and they use over 50% of the electricity, then you begin to see the scale and dimension of the shortage of available electricity and other available energy in the least developed areas.

Lack of transportation systems can be even more crippling in certain situations, e.g., sufficient food produced in a country like Ethiopia, and even grain stored nearby but people starving due to inaccessibility. Our shortages of food in storage and breakdowns in transportation of it are also here, but again of an entirely different dimension. Basic food grains - rice, wheat, corn and others - are seasonally short and vary greatly in price according to the time of year in much of the world. To make the dietary situation worse, the major part of the world does not have effective storage of other foodstuffs, e.g., in canned goods let alone frozen foods, though a little dried food in some areas inbetween crop harvest seasons. It is really grevious to see a glut of food so many places at harvest season and then a shortage in absolute amount and very high cost of what remnant there is (usually grain) before the next harvest.

Even worse from a dietary point of view is the shortage of high protein foods to go with the cereal grains. Animal products are hopelessly short in many areas so the hope remains with the edible legumes and the vegetables - particularly green leafy ones that are the best source of protein. Improvement of forage crops is needed, and thereby improvement of livestock in South America, Africa and Asia where they are not fed special crops grown for them, but only on range land, weeds and crop residues.

There is much that can be done in this area, but so too here in the U.S. where high grain costs on the world market are going to force these into the human food category (where they really "belong"), and thereby necessitate an improvement on the amount and quality of animal products to which we have become accustomed. As income goes up here or abroad, so too does the demand for animal products so the shortage

of suitable high quality forage crops (with suitable supplements of mineral, etc.) must be corrected to correct the shortage of meat and other animal products.

The shortages of many inputs for agricultural production is now being felt in the U.S.A., e.g., high machinery costs and delays in delivery and repair parts, higher costs of insecticides and fertilizers with deficient amounts. The higher cost of the energy for the industrial production of nitrogen fertilizer is a particularly sensitive spot since it is now at much higher cost and grossly deficient according to the need of world crops, including the grass "crop" on golf courses and parks. We're all going to feel this nitrogen shortage which has always been there but is grossly exaggerated now.

Nitrogen is the most limiting factor in plant growth and must be applied by the plant grower in most cases with exceptions in the cases of newly cultivated virgin soils with high residual nitrogen, especially grasslands and in areas under legumes with symbiotic nitrogen fixation. For many crops, legumes in association or in rotation will be the best answer to an adequate nitrogen supply. In the case of pure grass cultures as on golf courses and parks, we are simply going to have to pay the higher cost for nitrogen fertilizer which reflects the higher energy cost of producing it.

Consumer goods of all type, including paper products, are in short supply to various degrees in various countries and are often quite an accurate gauge of the development of a country when both absolute cost and quality are considered.

Finally, affluence that allows for the development of adequate (though perhaps still "short" from an ideal situation) recreation areas with beautiful turf is a God-given resource that we should appreciate. It is relatively unique for the population of planet earth - we should work hard to improve it and appreciate how this conference will help.

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ENERGY: NOT A CRISIS, BUT A LONG TERM PROBLEM FOR TOMORROW

Otto C. Doering III, Agricultural Economics
Purdue University

We are now using our fossil fuels in amounts that have little relation to their abundance. Coal is by far our most plentiful fossil fuel, yet less than a fifth of the fossil fuel energy we depend upon comes from coal. Our own resources of petroleum and natural gas are much smaller than our coal resources, yet more than three quarters of the fossil energy we consume comes from petroleum products and natural gas. There is, thus, a basic imbalance between the amount of fossil resources that we have and the amounts of particular fossil resources that we have chosen to consume for a number of reasons. Based upon known reserves in 1973 we would deplete our oil and gas

resources before the year 2000 if we were to continue increasing our use of these fuels as we have in the past. Our appetite for energy is clearly greater than our own fossil resources can sustain. The "Energy Crisis" is more of a basic problem than crisis of the Mid-East oil embargo.

It is not far fetched to think of our fossil resources as the balance in a "savings account" - resources which were deposited for us some years ago. We can draw from this account, but there is no way that we can add to this store by making deposits today. Every bit we withdraw leaves less for tomorrow. We do have other forms of energy available to us which we might call "income" as they are available in amounts that do not depend upon how much we previously used. Solar energy would be one example of such energy forms as would wind and tidal energy. Every day some part of the globe receives a new supply of sun, wind and tide. Clearly if we are to continue using anything like the amount of energy we use today we must learn to use less from our "savings account" of fossil fuels.

An end to the Arab oil embargo will not solve our energy problems for a number of reasons. We face shortages of refinery capacity and transportation capacity that will result in spot shortages of fuel oil, gasoline and other finished petroleum products. We do not have the physical capacity to refine and deliver the volume of petroleum products that would have been demanded this year had there been no price increases or shortages of crude oil. We were heading for a basic shortage situation - the Arab oil embargo only hastened it. If the Arabs were willing to sell us everything we wanted at bargain prices it would be several years before our refinery and transportation capacity caught up with our appetite for petroleum products.

Remember, however, the Arab nations realize as well as anyone else that even their vast oil resources are limited. They will not be too willing to send us increasing amounts of oil and quickly dimish their only natural resource. Their best strategy is to sell moderate amounts of oil for as many years as possible and for as high a price as possible. They have successfully raised the price of crude oil many times over in the past year. When you can increase the price of your product fourfold you are still making twice as much as before even if you only sell half as much. This lesson has not been lost on the Arab States.

Given the price increases that are likely to hold for imported oil, our balance of payments cannot afford the strain of paying for an amount of oil equal to that we imported last year before the embargo. Remember that other oil producing nations have raised their prices along with the rates set by the Arab States, so our total import bill will be based uniformly on these high prices. The oil industry expected that we would be importing half of our petroleum needs by 1985 at a cost of twenty five billion dollars every year. This was before the Arab oil embargo and the resulting high prices. Such a volume of imported oil might well cost us over one hundred billion dollars every year at the present prices. There is no way our nation could afford such a bill.

What ways do we have out of this dilemma? There are certainly no easy or inexpensive ways! We can try to develop alternative energy sources. However, remember that we demand many of the fuels we use today for very good economic reasons. Alternative sources of energy are not going to be researched or actually developed if gasoline

sells again for thirty or even forty cents a gallon. The shale oils only look attractive to investors when the price of crude oil is in the five to seven dollar a barrel price range. Petroleum products may have to get even more expensive to encourage the development of solar energy. We saw such a situation at the time the petroleum industry began. This occurred because the demand for whale oil outstripped the supply of whales. The skyrocketing price of whale oil encouraged the development of petroleum.

Higher prices for petroleum products can play a number of important roles. They can encourage the production of more petroleum products. The high prices can also encourage conservation. Thus, we may have turned down our thermostats after looking at our fuel bills, not after listening to the President asking us to dial down. Finally, higher petroleum prices give the necessary incentive for developing alternative sources of energy; whether this be through better utilization of our coal resources, or developing a feasible method for using solar energy to heat homes. An electric car will not be practical with gasoline at thirty to forty cents a gallon.

In truth, all energy prices must rise to encourage both increased production and lowered demand for energy. More important,however, is the development of energy saving technologies on a national level. It has only been economic to insulate our houses and refrigerators to a certain level because energy for heating and cooling was relatively inexpensive. A low cost air-conditioner was a good buy even if its motor was inefficient because the cost of the more efficient motor was greater than the cost of the electricity to run a less efficient motor. Industrial heating processes were not designed to capture the extra heat and use it elsewhere in the plant. Fuel costs have been so low it wasn't worth it! We can only hope that higher energy costs will make it worthwhile to spend the human ingenuity necessary so that we will be able to live as well in future years while drawing considerably less from our finite energy savings account.

Finally, we worry about the effect of higher energy prices upon those in our society with limited means; the retired, low income or unemployed in our society. This is a welfare consideration and should not be confused with the basic needs for a resource policy that have been outlined above. Those with limited means are not the great users of energy in our society. We should not keep the price of energy low so that the more fortunate will be able to waste energy. If we are really concerned about those with limited means, let us devise a plan for guaranteed minimum income or "fuel stamps" to help them meet their basic needs for energy.

There is a need for a consistent and standardized system for reporting energy production, inventory and flow as a basis for national decisions on priorities and emergency allocation.

There is a need for a firm and consistent national energy policy that establishes a workable balance for society concerning the environmental and ecological needs on the one hand, and the production and technological needs on the other. The policy must establish and assure a time frame that can permit short and long-range development in the best total interests of society, on an orderly and efficient basis.

There must be a national policy of energy conservation with

sufficient incentive so that each individual will reduce, or at least not increase, his energy consumption in future years. Some processes, such as agricultural production, do not appear to offer much opportunity for large fuel savings given current technology. Other areas, such as private transportation in individual automobiles, appear to offer the opportunity for substantial energy savings on a national basis.

There should be an increased effort to inform and educate the American public at all levels about the facts and issues concerning the environment and our energy dilemma. The public needs objective information as a basis for their decisions in matters of local, state and national policy.

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FERTILIZER NOTES AS INFORMATION)
TAKEN FROM USDA NEWS, JANUARY, 1974

	Nitrogen	P_2O_5	K_2O
In 1974	8% more	8% more	5% more should be available
During 1973	4% more	4% "	2% more was used
" "	8.3	5.1	4.4 million tons used

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HIRING A NEW SUPERINTENDENT - OUR EXPERIENCE

John Foley, Green Chairman, Crooked Stick Golf Club
Indianapolis, Indiana

I would first like to thank Dr. Daniel for inviting me to be on the program today. While I don't pretend to be an expert on hiring superintendents, I am happy to relate to you my experience in interviewing and selecting a superintendent for Crooked Stick - a most difficult task, I might add, and one that I have no desire to repeat on a frequent basis.

To properly set the stage, Crooked Stick is an 18-hole private golf club located in Indianapolis and built by Pete Dye about eight years ago. It was originally conceived as a limited membership club financed through an investment by 60 individuals. The initial plan was to build the course in two stages, purchasing the land and building 9 holes with the initial funds. In the next few years as more funds became available through the addition of new investors, the second 9 and clubhouse could be completed. Unfortunately, it is an inflationary age we live in and by the time the second 9 was finished there were no funds left for a clubhouse. This caused some concern among potential members about the future of the Club and who would

provide the funds for those items that had not been covered in the initial project. No one was interested in joining only to find they were responsible for bailing the Club out.

Crooked Stick maintained this posture for 5 or 6 years with fewer than 100 members providing barely enough income to meet the yearly operating budget. Last year, however, things changed. A program of refinancing was developed along with a membership drive with a guarantee to new members that there would be no capital assessments prior to 1975. This was an important point in our subsequent search for a new superintendent. Since the financing covered the cost of a clubhouse, the response was excellent, and our present membership exceeds 200. We expect to reach our limit of 225 sometime this spring.

The undercapitalization during course construction created some problems which are still with us today. Drainage must be improved on certain holes; a few tees and bridges must be constructed; a putting green is a future necessity; a levee must be built protecting the 8th green from high water in the bordering pond; a new maintenance facility is mandatory by next year; and a new pump house and waterlines of proper size and design must be installed to accommodate an automatic irrigation system for the future. As you can imagine, even though our course was selected in the top 100 in the country by Golf Digest, much remains to be done before it can realize its true potential.

The initial concept of the Club remains unchanged - that is, to provide the finest golf facility possible for our members with a small, but functional clubhouse and a limited social program. We are not interested in swimming pools or tennis courts that might take funds precious to our golf program.

As Green Chairman I am responsible to the Board and the membership for seeing that a Job Description, Standards of Performance, and an operating budget are prepared with the superintendent. As he reports to me, I am also responsible for his employment and replacement. We involve the entire Green Committee in these functions, but only to the extent that their time permits. It is essential that golf course decisions be made on a timely and prompt basis, and I have long ago learned in business that the surest way to take the longest time in getting something done is to assign the task to a committee. Quite often time doesn't permit the luxury of a committee decision.

Last August, our superintendent advised me that he was leaving the Club to pursue another career. Realizing the problems of finding a new man, he offered his time until a replacement could be selected. I appreciated this as it relieved some of the pressure and would permit us to consider more applicants. We felt it imperative to hire a replacement before year end as it was important to maintain the positive attitude of the members created by the successful membership campaign and the fine course condition that they enjoyed last summer. Finding a superintendent was a new experience for me and I didn't know where to begin. I thought I had better determine in my own mind what we are looking for. So, I asked myself: "What is a superintendent?"

A superintendent in my opinion could be compared to the Production Manager of a manufacturing plant -- responsible for selecting, supervising, and motivating the work force; ensuring that materials

and supplies are available when needed; that machinery and equipment are properly utilized and maintained; that expenditures do not exceed the budget; and that the product, in this case a golf course, is ready on schedule and that the highest affordable quality standards are met. In addition to possessing these managerial skills,we ask him to work endless hours, be more knowledgeable than the weatherman, and have the foresight to treat his course for a potential disease before it appears. At Crooked Stick we also ask him to be an architect and construction expert as we begin the corrective programs I previously mentioned. For all his efforts he is rarely complimented, seldom appreciated, and is usually second-guessed and critized.

Now that we had an idea of what a superintendent is, we felt we needed a man with the following credentials:

1. A man who had been superintendent at a club with a good performance record. We needed the talents of an experienced man as credibility through performance would have to be established with our members if future capital requests were to be approved. We were in no position to hire an untried man.

2. One who was a graduate agronomist knowledgeable in disease prevention on both Kentucky bluegrass and bent. Our first 9 was seeded in bentgrass and the last in blue.

3. A man who had experience in golf course construction, or had taken basic engineering courses which would better qualify him to supervise the corrective work that I previously described.

4. One who appreciated the need for proper equipment maintenance and repair.

5. A man who was a good planner, scheduler of work, and supervisor. Our course, being spread over 200 acres, requires good work planning and scheduling.

6. A man who could do the job in tune with the timetable of available funds. As mentioned, it would be 1975 before the Club could turn to the membership for additional finances. It would be difficult for a superintendent who had enjoyed former luxuries, or necessities, depending on your point of view, to be patient until the time when Crooked Stick could afford them. We needed a man who would produce results in 1974 if the membership was to enthusiastically provide funds in 1975.

7. A superintendent whom we are providing a career opportunity for. We were not looking for a short-term solution to our problem. We wanted him to grow with us and be happy at Crooked Stick.

Having established what was required, I decided to call a few superintendents with a national reputation for advice. Both Bob Williams at Bob O'Link in Chicago, and Warren Bidwell at the Congressional Country Club in Washington, were known to be outstanding developers of assistant superintendents, and frequently knew of superintendents seeking a better opportunity. While each had a name or two for me to contact, both strongly recommended that I talk with the Turf Management Schools here in the Midwest. We contacted Dr. Daniel here at Purdue, and Dr. Duich at Penn State. They pro-

vided me with a number of potential candidates. I also talked with Max Hayes, President of the Local Superintendents' Association, who was also most helpful. In addition, I sought the advice of other knowledgeable superintendents in the Indianapolis area. We would have preferred to hire a local man familiar with the problems of our area if mutual opportunity was present.

As word got around, we began receiving applications and resumes. I was ready to list the position with the National and Regional Superintendents Associations, but suddenly realized that we had more applications than could be properly screened.

I would be remiss if I did not dwell for a moment on the resume. The resume is very important to the applicant. It could provide the only opportunity for the candidate to express his desire for the position. The resumes we received were as simple as a handwritten note, and as sophisticated as a commercially printed page complete with the applicant's life history ad and picture. The better resumes received the most attention. Complete resumes are most helpful in matching the abilities and experience of the man to the requirements for the job.

A well-written and comprehensive resume reveals much about the applicant and can work in his favor. Remember you are competing for the time of the interviewer, and the more that your resume reflects your personality, the better your chance of getting an interview. I was very impressed with the resume of a young applicant who very creatively sold himself, and a picture of his smiling face was ever present as you considered his talents. He was disqualified because of his age and experience, but his resume did make quite an impression.

There are two key factors in the interview and selection process. The first is time, and the second is a budget. Personally I am responsible for 5 manufacturing plants in our company, plus do considerable traveling in working with customers and suppliers. I am reluctant to take much of my remaining time away from my family to tend to the affairs of Crooked Stick. Other members of the Green Committee are in the same position. We just didn't have the time to extensively interview each applicant, thus we had to follow a procedure which would expeditiously help us find the right man.

We first reviewed the resumes and disqualified those that did not fit our superintendent profile. We attempted to interview the qualified applicants by phone, though if a man could not be reached we soon stopped calling him due to the pressures of time. We also called the USGA Green Section agronomists, the Turf Management Schools, and golf course equipment and chemical salesmen in the area to confirm the qualifications of the applicants. We then brought the applicant to our Club to be interviewed by myself and members of the committee who were available. In addition, I feel that after you have reduced your prospects to a select few that a visit be made to his club to get a feel for the kind of conditions he has faced and the standards of quality he has maintained. Certainly the time of year would influence the value of this visit.

The second factor that must be considered is the budget. How much is the club willing to spend to find a new man? Will they pay

the expenses of the committee to visit an applicant's course? How about air fare; hotels; meals, and expenses for applicant to come to our Club for the interview? If not, does he lose interest? Should all costs of the interview be at the expense of the club? These are questions each club must answer for itself. However, I bring it up only to point out that it can be an additional barrier in bringing the Green Chairman and an applicant together for an interview. I seriously doubt that many superintendents were ever hired over the phone, or by resume without a personal interview.

To summarize then, it would be ideal if each applicant was given full opportunity to compete for the job. Time and a budget are the two factors which work to the disadvantage of both parties. With this in mind, anything that you, as an applicant, can do to make it easy and inexpensive for a Green Chairman to interview will be to your advantage. If the job looks attractive, and you feel that you have a good chance of getting it, then pursue it like a salesman does in trying to sell his product. Even if it causes you temporary inconvenience the potential benefits could be most attractive.

Once you have won the chance for a personal interview, then it's just a matter of matching your desires to the club's need to determine if there is a fit. If there is, then a contract stipulating what is expected of you and what the club will provide in return should get you started off on the right foot.

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GRADUATION - A STUDENT INTERVIEWS

Mark Fields, Dec. '73
Now Ass't. Supt., Scioto C.C.,
Columbus, Ohio

Searching for a job should be an organized plan of attack. One must have a step-by-step strategy to win the job desired. This strategy should begin when you first decide to become a superintendent. I started working on a golf course at 13, but decided to pursue this as my occupation when I was 17. Therefore, I began my strategy when I was 17.

The first part of my strategy was to attend college for a two-year degree in Turfgrass Management. My second step was to, during the summer months, work for one of the top superintendents in the country.

While attending school find a job at one of the better courses and with a superintendent that has the experience and the reputation. You may not get paid as much as if you were working in some factory, but in the long run, when you graduate it will pay off. A college degree is a piece of paper with meaningless words unless it is backed with some practical experience. You can not grow fine green turf with a piece of white paper - it takes the

the green thumb of experience.

When I graduated from the two-year school I was only 19. I decided to complete my education for my Bachelor's Degree at Purdue University. This was my third step of strategy. But, while my third strategical step was still being carried out, my fourth plan of attack was in the making. Using simple observation, I noted that most golf courses do their firing and hiring in the winter months. Therefore, I timed my graduation to occur in December when the most openings are available.

I've found that the best source for job openings for the college graduate is right here at Purdue University. Dr. Daniel receives in his office a wide variety of available positions. But, if you find it necessary to seek other sources, I would highly recommend you to attend conferences, ask around, and get to know some of the salesmen and superintendents. Two of my best friends found their present positions at conferences by simply letting people know they were looking for a job. When you graduate from college the jobs don't come looking for you - you have to look for the jobs.

The third source one may try when job seeking is the numerous trade journals. The Golf Superintendent; Golfdom; Weeds Trees and Turf; and Turf-Grass Times seem to have the best classified sections for job openings.

For the college graduate seeking an assistant superintendent's position, the classified sections of the trade journals would be an excellent source. The Golf Superintendent magazine will print free of charge, in the Student Directory Section, a small resumé of the graduating student's qualifications. It's an inexpensive and time-saving way of finding an assistant superintendent's position.

A job opening through the Placement Service gave three Purdue students a real ride. We traveled 800 miles round trip to an interview at a "country club" that couldn't even afford a tractor. They had an old beat-up jeep, one set of mowers and an old chicken coop for a maintenance shop. Anyway, all was not lost - we all got some unique experience interviewing and learned a lesson.

A resumé and a job application letter is almost required by every business today. Club presidents and greens chairmen are business men and will value a business-like approach. So, a properly written resumé of your past experience is your introduction to the prospective employer and may open the door for a future interview.

The interviewing techniques of clubs varied greatly. By far the best method was used by Maketewah Country Club in Cincinnati, O. They hired one of the top superintendents in the country to screen out resumés. He was also hired to ask agronomic questions during the interview to see if the applicant had formed his own ideas about methods and techniques of golf course maintenance.

From what I have said you can readily see that a student graduating from college in Turfgrass Management has no easy task when it comes to job interviewing; in fact, there is a lot of time and money involved. I estimated that my four interviews cost me $ 83.45, that is about $ 21.00 each. Also, I estimated that my four interviews involved a total of 77 hours, that is 19.25 hours per interview.

SAMPLE LETTER

2501 Soldiers Home Rd.
W. Lafayette, Ind.47906
October 4, 1973

Frank D. Keck, Greens Chairman
Champaign Country Club
1211 South Prospect Avenue
Champaign, Illinois 61820

Dear Mr. Keck:

Dr. W. H. Daniel has informed me that you are looking for a Superintendent for Champaign Country Club.

I have completed ten summers of practical experience, and will be receiving my Bachelor's Degree in Turfgrass Management from Purdue University in December, 1973. I feel I will then be qualified to become a Golf Course Superintendent at your Club. Will you take a moment to consider my qualifications?

Five summers working on a public golf course and five summers working at a private country club has given me a wide range of experience in golf course operations. I have already completed Michigan State University's Technology School in Turfgrass Management, graduating third highest in the class of 1970.

Financial support for my education has come from part-time employment at Purdue University's turfgrass greenhouse, and a scholarship award from the Golf Course Superintendents Association of America in 1970. Every summer vacation, while at Purdue University, I worked at The Inverness Club in Toledo. Last summer I had the unique experience of assisting Mr. Wilbert Waters in organizing the crew for the successful preparation of the golf course for the 1973 U.S. National Amateur Tournament.

Mr. Waters at the Inverness Club, has trained me in all phases of golf course operations. In the fall of 1972, I had the opportunity to help the March Irrigation crew with the installation of a $100,000 Automatic Toro Moist-o-Matic irrigation system. Working five years for Mr. Waters has also given me the unique ability to mimic his marvelous method of management. He has shown me the way to make any golf course look and play like The Inverness Club.

I should be able to lower your cost of operation and still maintain the high quality the modern golfer desires by using some of the practical and technical knowledge I have gained. If I become the Golf Course Superintendent of your organization, I will work closely with the members and give the greens committee my full co-operation.

If you feel that my background qualifies me for a Superintendent's position, I shall appreciate a personal interview with the members of the greens committee. I believe such a meeting will be mutually beneficial.

Very truly yours,
Mark Fields. (Signed)

SAMPLE PERSONAL DATA SHEET

Job Address
School Address
Home Address
Date and Place of Birth
Marital Status
Physical Condition
Education
Applicable Courses
Awards, Activities, Organizations and Hobbies
Work Experience
References

SOME QUESTIONS ASKED DURING THE INTERVIEWS

AGRONOMIC

1. What type of Nitrogen would you use on greens?
2. How would you control quackgrass?
3. What are your thoughts on Poa annua?
4. What is a good chemical control for Pythium blight?
5. What major Diseases would you be concerned about in this part of the country?
6. How would you know when to fertilize?
7. What do you think of Dr. Daniel's PURR-WICK system for greens?

ROUTINE

1. What do you expect your wages to be the first year if you were superintendent?
2. What do you expect your wages to be five years from now?
3. Describe a routine days activities if you were superintendent.
4. Do you play golf?
5. From what sources would you seek your summer employees?
6. How many hours do you expect to work per week?
7. What will the crew do on rainy summer days?
8. Would you keep daily records, and if so how?
9. Do you want this job?

ICE BREAKERS

1. Are you nervous?
2. Why are you interested in this job and golf course?

AMBIGUOUS (Lack clearness)

1. How many men would it take to effectively operate this golf course?
2. How large a budget would it take to operate this golf course?
3. Describe an "ideal" Grounds Maintenance Shop.
4. How many employees will you keep hired in the winter?
5. What's the greatest problem you foresee if you were the superintendent at our club?

IRRELEVANT

1. How would you describe your family life?

QUESTIONS YOU SHOULD ASK THE CLUB

1. What are the immediate objectives of this golf course?
2. What are the long-term objectives of this golf course?
3. Request to see last year's budget. How many men?
4. Ask if you can see the maintenance building.
5. Ask for a Job Description.
6. Ask to see Organizational Chart
7. Why are they looking for a new superintendent?

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MY FIRST EXPERIENCE

James W. Uptgraft, Formerly of Turf Managers, Inc.,
Eau Claire, Wisconsin

I would like to begin by telling each of you a little about myself. I was reared on a large grain farm in the northeastern section of Indiana near Bluffton. I came to Purdue in the fall of 1969 and enrolled in Agronomy. Upon meeting Dr. Daniel I became interested in Turf Management. Like most students, I struggled along day to day with my studies. After four years of books and pushing pencils, Purdue decided I was ready to handle the problems awaiting me. However, it was after graduation and upon leaving the safe confines of Purdue, that school really began. I found myself thrown head first into the business world.

In my case, my first assignment landed me in Eau Claire, Wisconsin, with Turf Managers, Inc., a landscaping firm. Turf Managers began in the spring of 1973, following an investment from four men which totaled $ 52,000. Not an extremely large amount, but more than adequate for starting a new business.

Part of this figure was used to pay off debts which had incurred in 1972 when the Company was called Grounds Maintenance, but had to be changed because of the magazine of the same name. These old debts required about two-thirds of the $ 52,000, or around $ 30,000. The remainder of the money was used to set up a lease-purchase contract for the necessary equipment. Looking briefly at this equipment list we find:

a. Two 1973 Ford three-quarter ton, 4-wheel drive pickups
b. One 1973 Ford station wagon
c. One 1973 Greensaire II aerifier
d. One Hahn verti-cut
e. One Beck Sod-O-Matic - sodlaying device
f. One 3,000 gal. Reinco hydroseeder
g. One 500 gal. Bowie hydroseeder
h. One 1973 John Deere 401 tractor with roterra
i. One Bolens 20 hp. tractor with rotary aerifier
j. One Melroe Bobcat

In addition to this, the Company had purchased, through G.M.A.C., 2 used dump trucks. As you can see, this list hosted everything needed to do landscaping and golf course maintenance, which included aerifying, verti-cutting, and the application of snowmold control, by specializing in the tasks that were only performed once or twice a season. This service, we thought, would be most beneficial to the smaller clubs that operated on a more limited budget. For example, a course that could not afford a new greens aerifier last season would find our type of service more economical, allowing us to absorb the labor cost, operating expense and depreciation. This maintenance was also available to school and park systems.

Part of my job was to notify a superintendent that this service was available and to help him better understand its advantages. We had no problem in selling service, which seemed to catch on immediately. I'm not here today, however, to discuss aerifying

greens, or establishing a new lawn, but to share the experiences, both good and bad, that I encountered on my first job.

I feel that my contribution to this 1974 Conference is quite unique. I would like to stand here and tell all of you that the landscaping and golf course maintenance business is booming, and that everything went so smoothly this past season that I can report no problems whatsoever. Unfortunately, we all know that this is virtually impossible. Because of this and the events that followed my graduation, I learned a far better lesson than I could have if things would have gone smoothly.

In less than eight months I advanced from turf graduate to project superviser, to general manager, and then to first in line at the unemployment office. I witnessed a Company sprout from a mere idea, grow into a profit-sharing venture, and finally to bend under the weight of bankruptcy.

Let me take you back now to last May when I began my duties as project supervisor. My responsibilities included scheduling of work projects, and supervising two crews - one in landscaping, the other in golf course maintenance. As the season progressed we had to drop the latter division and concentrate on the establishment of new lawns. This decision was determined by the Board of Directors as a result of a severe financial condition. It was at this time, about mid-August, that the Company realized it had over-spent its capital investment. The two new 1973 pickups, and stationwagon, all equipped with telephones were nice, but unnecessary. The $ 52,000 investment soon dwindled to a few hundred dollars.

By cutting our golf course maintenance division and dismissing half our labor force, the Board of Directors felt that increased profits could once again be attained. During the next few weeks this method seemed as though it might lift the Company from its financial struggle. At about this time our John Deere crawler operator decided to return to his union job, so we were stuck with an $ 825.00 per month rental on a machine that was to remain idle for the remainder of the season. Because of this and other setbacks, we were forced to sell two of the used dump trucks that were needed to haul in the topsoil for the seedbed. This was a necessity on every job because the Eau Claire area is blessed with several feet of sand. By losing our trucks we were faced with yet another barrier.

As a result we had to hire trucks for this hauling service and, thus, cut our margin of profit even more. We completed the remainder of the season operating in this manner. Up to this point I had only watched the problems snowballing from afar, but that was soon to come to an end.

On October 8 I became general manager of a young Company that was struggling for existance. There were just two of us on the payroll by this time, the other fellow being a student, that only came to work in the afternoons. I began cutting corners by doing most of the grading and spreading with the Bobcat rather than the more expensive crawler that was returned to the rental firm. The black dirt was still brought in by the commercial trucks, but price adjustments were made to account for this added expense.

We began to lay sod on those lawns that the homeowners would

agree to pay the additional cost over seed. These people might have waited until next spring and had their lawns seeded, but we convinced them the sodded lawn would give them immediate coverage this fall. By so doing we generated badly needed capital. We worked hard for two months, ending the season November 15. The station wagon, telephones, all the luxuries that were not needed were dropped. And, for the first time since its origin the Company showed a profit for October and November. However, it was too late, for on January 15 I was informed by the board of investors that they were out of money and there would be no more.

Suddenly I found myself 500 miles from Indiana with a family to support and no job. What would you do? I tried to regain my composure and started doing a lot of soul searching. Fortunately, I found a construction job to help us out financially and to keep me from feeling sorry for myself. During the next few weeks that followed I was honest with myself. I asked myself what it was that I really wanted to do. I had two alternatives: I could return to Indiana and pursue a career in farming; however, that could mean uncertainty and insecurity also. Being the only son my father had offered me this opportunity several times in the past few years, or perhaps I could secure a superintendent's position and give that a whirl.

I chose to join the ranks of those who farm and sweat out a living from mother nature. Being only 22 years old it is hard to say whether or not farming will be my life's work, but right now it's the next step for me and my family.

As said earlier, I feel that mine was a valuable experience and for this reason I wanted to share it with all of you. For all the men that have experienced what I have you can identify with me. For those who had not and for those students who have yet to take their first position, I would tell you to go ahead, take that venture and to satisfy your dreams. You may reach heights you only dreamed possible, or you might fail. But in either case what you will gain cannot be read from a textbook or learned from classroom discussion. What you will gain will be experience - nothing can be more valuable.

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GOLF, TURF & PEOPLE

Fred Stewart, Midwest Consultant,
National Golf Foundation
Lafayette, Indiana

The game of golf has historically been a game of the people. The St. Andrew's Golf Course in Scotland, regarded by most people as the birthplace of the game of golf, was by 1754 a public facility. To this day two of the four 18-hole courses at St. Andrews are open to the public.

As in Scotland, the public course has a long history in the United States. The first golf course in the U.S. opened during the late 1880's. The first public course opened in 1895 in New York

City. While the history of the public golf course in the U.S. is nearly as long as that of the private club, it was not until the early 1960's that the dramatic increase in public course development became so apparent.

In 1931, the first year for which figures are available, there were 5691 golf courses in play. By 1961 the number had increased to 6623. Of this total 3348 were private, 2363 daily fee, and 912 municipal. As of September 30, 1973, National Golf Foundation statistics indicate the number of golf courses had increased to 10,871. Of these, 4825 were private, a 44% increase over the 1961 total; 4610 were daily fee, a 95% increase; and 1436 were municipal, a 57% increase. The increase in public golf courses was nearly double that of private courses. The tremendous growth in public golf courses brings clearly into focus the trend in golf course development in recent years. All indications are this trend will continue.

During the last 10 years an average of 390 new courses, or additions to existing courses opened for play. 1965 saw a high of 500 new openings, while 1972 a low of 266. In 1973, there were 208 new course openings and 114 additions to existing courses, a total of 322. With 290 new golf courses or additions now in some stage of construction, 1974 should be another normal year for golf course development. The effects of the energy crisis will have a greater impact on planned projects than those currently under construction.

A number of projects which had planned to go under construction this year are now indicating their plans are in abeyance until the full effects of the energy crisis can be determined. Those indicating their plans are in abeyance are mostly located in the distant fringe areas of large urban areas, many 40 or more miles out. Such courses obviously would be most affected by a gasoline shortage as much of their anticipated play would have come from the urban area.

The pressure of 11,000,000 golfers defined as one who plays 15 or more rounds annually, plus another 2,555,000 who play less than 15 rounds, rapidly increasing participation by women and juniors, population growth, urbanization, more leisure time, and increased personal income will continue to create a demand for new golf courses. With some 84% of the golfers playing on public courses, the demand for new public courses should continue strong for many years to come.

While the problem of weekend congestion on golf courses has received considerable attention in the industry in the past decade, another problem in the distribution of play is even more critical. Many of the same golf courses which have been unable to accommodate the crush of weekend golfers are comparatively abandoned on weekdays.

With operation and maintenance costs increasing steadily, municipal and daily fee golf courses operators face the alternatives of attracting more customers or raising fees. Since weekend capacity is a reality at most courses, increased weekday play can be an important source of new revenue. Ideally, golf courses should experience about 70% of their play on weekdays. Anything over 60% must be considered good by today's standards, but anything under 50% can mean trouble for a public course operator.

The long-promised effects of expanded leisure time, the four-day work week, early retirement and new affluence simply have not filled the weekday void for many golf courses. Enterprising course operators are no longer waiting for them. They are going out after the mid-week player with all the inducements at their command. Efforts to increase weekday play generally fall into three categories: financial considerations, changing golfers' habits, developing new players.

It has long been the practice at many public courses to offer a cheaper rate for weekday play than for weekend and holiday golf. At those clubs selling annual or monthly memberships, reduced prices may be available for weekday play only. Other clubs offer reduced rates to juniors and senior citizens on weekdays. Such rates usually apply to the morning hours when play is the lightest.

The golfer who cannot be lured to the course through weekday savings must be approached in another way. Many times the mere introduction to the pleasures of mid-week golf, uncrowded conditions on the course, in the pro shop and restaurant, is enough to coax an avid golfer into setting aside a regular weekday for his game. Certainly there are an increasing number of occupations which provide for off time during the week, and these will increase as the weekend, as we now recognize it, continues to lose its identity for many employees.

Radio advertising has also been effective in pointing out the advantages of weekday golf. One course operator has patterned his radio advertising after ski reports. The aired message mentions course conditions, green fees, lesson tee rates, lounge and dining facilities available, and updates the information by adding the waiting time, if any, a player can expect at the first tee. This, of course, is usually minimal on weekdays.

Other course operators now set aside time each day for organized activities by men's, women's, junior's or senior golf associations or leagues. Special efforts on the part of course operators and through the cultivation of active, imaginative group leaders can make these days more than just another golf date for those who take part.

Golf league activities, generally after the workday at twilight, have also proven helpful in increasing weekday traffic. A golf course with five leagues of eight four-man teams each would add 160 rounds of golf a week, or over 3,000 over a 5 month season. League play can also be developed during the daytime in metropolitan and industrial areas. Night shift workers can be organized into morning or early afternoon leagues.

Special one day golf outings can also prove to be an important source of weekday revenue at public courses. The course may be closed either a half-day or the full day, depending upon the size of the group. Using a shot-gun start with players starting at all tees simultaneously, the group can move around more quickly and finish sufficiently close together to facilitate the awarding of prizes and serving of drinks and dinner should those services be available. One midwest course reported nearly 100 such events last year.

Developing new golfers, the final and ultimately the most important of all methods of creating more play, both on weekdays and weekends, it is given priority attention by the National Golf Foundation, the USGA, the PGA, and other golf organizations. Too often it is overlooked by the public course operator. With 84% of the golfers playing on public courses, all efforts to develop new golfers will produce a direct benefit to the public course operator. Instrumental programs for women and juniors are desirable for two reasons: they are usually able to play during the weekdays when play is less heavy, and their interest in golf will help to increase participation by their husbands and fathers.

The development of new golfers can start during the winter or off-season months in adult education classes in local high schools, colleges, junior colleges or community recreation centers. Where local officials have not taken the initiative to develop such instructional programs, the alert course operator should encourage them to do so.

School officials, both high school and junior high, should be encouraged to offer golf classes to physical education students. Several excellent manuals on golf instruction are available from NCF's Chicago Office. "Golf Teaching Kit" and "Planning and Conducting Junior Golf Programs" include much valuable information for anyone planning a golf instructional program.

Golf instructional programs should be structured to teach not only the fundamentals of the golf swing, but golf etiquette, golf rules, and course rules as well. This will result in not only creating new golfers, but more importantly, educated golfers who respect and use the golf course properly.

The personal contact and rapport developed on the practice tee or in an off-season instructional program can also benefit the course operator by increased sales of golf merchandise and apparel. The effort will have a public relations benefit as well.

Recognizing the need for additional public golf courses, the National Golf Foundation initiated a program of regional public golf seminars to encourage the construction of new courses in those areas most needing them. Emphasis is placed in both daily fee and municipal courses. Individuals interested in building profit motive daily fee courses and municipal officials such as mayors, city managers, finance directors, parks and recreation department officials, members of golf associations, etc., are invited to the seminars. The seminars cover thoroughly the planning, organization and operation of public golf facilities.

Economics and practical politics indicate municipalities will have to build many of the needed new public golf courses. Land costs, development costs and operating expenses, including rising taxes, make it increasingly difficult for daily fee courses to be built, especially in the metropolitan areas where they are most needed. The problems facing the daily fee course operators will only get more serious unless our state legislators can be made to see the myopic ways of their reasoning concerning taxing golf courses and other open space areas at their highest and best use rather than at its current use.

It is a puzzling paradox when you consider that the federal government is encouraging the construction of golf courses and other open space areas through the distribution of millions of dollars annually in federal programs while, on the other hand, some state governments are threatening to put existing daily fee and private clubs out of business by taxing them at their highest use.

Current emphasis on recreation and open space has created more official and citizen support for golf-recreation complexes. Such complexes now often include, in addition to a well-designed and constructed golf course, tennis courts, swimming pools, artificial ice skating rinks, playground and picnic areas, a community center building, camping, hiking, nature study, and other appropriate areas. Such projects may be financed through general obligation bonds or revenue bonds, federal grants or assistance from the BOR (Bureau of Outdoor Recreation), Legacy of Parks-Surplus Property Program, Use of National Forests Lands, The Farmers Home Administration Loan Program, and revenue sharing funds.

An important recent trend in municipal course development is the emphasis on quality: quality design, construction and maintenance. Some of the new municipal courses will rival those of any private club or resort operation. Many municipalities were slow to learn the importance of good design, construction and maintenance to the long-run success of their course. A poorly designed, constructed, or maintained public course can only deteriorate in condition when handling the heavy play they are subject to annually.

Today's public links golfer is more sophisticated. He appreciates the aesthetics of good golf course design and the strategy behind it. He has been exposed to the pleasures of playing on lush, manicured turf through the televised PGA tour and the now common golf vacation to a golf resort. Because of this exposure, he is more discriminating about the course he plays.

Probably the most startling statistic of golf course development during the past ten years is that concerning the golf course real estate development. Real estate developers have found that golf sells. The game has been snared and used as a shill for making a buck off land. Many developers are making it big. NGF records indicate that at the beginning of 1964 only 16.3% of all the golf courses built that year were associated with land development projects. Last year that figure had soared to nearly 41% - the rate is increasing.

Of the total courses now under construction 59% are reported to be a part of real estate ventures. Arizona, Colorado, Florida and Oregon report over 80% of the courses in planning are in this category; in Alabama and California it is over 70%.

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BUILDING A COURSE - FROM DREAM TO REALITY

Don Essig, III, The Hoosier Links
New Palestine, Indiana

Shortly after Judd Negus came to Hillcrest Country Club, Indianapolis in 1969, he and I talked about building our own golf course. We felt the combination of a golf course superintendent and a golf professional would be an ideal partnership to go into such a venture. Our first step was to talk to one of the top executives of a large bank about the possibility of obtaining financing. He encouraged us to do a feasibility study, secure front money, and then come back to him.

In preparing the feasibility study we learned a great deal more about the business that we both were in. We received a great deal of help from some local people who owned their own courses. We also talked to many professionals, superintendents and the National Golf Foundation.

Obtaining the "Front" money was not as easy. After about 5/8 of it was committed we ran into a snag. It was shortly after that that many of my friends from church came to me and asked if they could invest in the project. A real answer to prayer had been seen.

We selected the Maddox Construction Company as our designer and builder. The help that we received in the early stages from them was immeasurable. After getting our selection down to five sites, Mr. Maddox, Sr. came down and looked over all of them with us. After telling a real estate agent that none of them were suitable for a golf course, he then told us (after the agent was gone) that site #1 was the best site that he had seen in over 5 years. Negotiations were then entered into to purchase this farm. When a price had finally been settled upon, the agreement was signed subject to zoning, financing and water.

The zoning was very easily obtained. The co-operation that we received from the Shelby County Planning Commission was the best I have ever seen from any governmental agency. When the hearing was held, we felt very confident when the lawyer from the Commission came in with an alligator shirt, a sun tan and a white left hand.

After hitting one dry hole when we were testing for water, the second hole showed very favorable results. A 10" well with the prescribed screen should produce 1,000 to 1,200 gal. per minute. After we purchased the property the well actually produced 115 g.p.m.Water was the one area where we over-shot our forecasts. Many "experts" were engaged in finding water, pump sizing, etc. This is the one area that we felt we really got some bad advice.

The bank decided to help us get our loan through the Small Business Administration. The education of applying for a loan through the SBA is enough to make you wonder how the government exists. It took 26 different forms, some up to 40 pages each, to apply for the loan. Had it not been for some excellent help from the SBA employees and the bank, this might have been the end of the project. After a tentative OK from the SBA and the bank, we were given the "go ahead." Actually

construction on the golf course started two months before the final papers were signed. This was not quite as bad as it sounds - the bank was advancing us money on the loan - so we were very confident that they were serious.

Mr. Maddox went to work making routings for the golf course. We told him that we wanted a golf course that could stretch from under 6,000 to over 7,000 yards, big greens, 40 - 50 traps, as many lakes as he wanted to put in, as long as the golfers did not have to hit over them, C-15 greens, and bluegrass fairways. (We used a blend of Fylking, Pennstar, Newport and Park). We also wanted 4 holes leaving and 4 holes coming back into the clubhouse as our plans call to go to 36 holes some day. We said we would like to see the clubhouse in different locations on the property.

He sent us some different routings, but always the clubhouse was located in a woods, 1/2 mile off the road. He said that it was the only place that the clubhouse would fit and still get the golf course of the quality we desired. When Chuck told us that he would build the road back to the clubhouse for no additional charge, the location of it was not nearly so objectionable. The contract was signed and construction was to start in March, 1972.

Construction was going at a good pace most of the year and things looked pretty good until a very wet fall set in. Seeding that was supposed to take place before September 15 was not done until October and later. The greens were stolonized on October 19. To say that our initial plans were set back quite a bit by this is an understatement. It continued raining all winter and well into the spring. The grass never started showing signs of growing until late April. The wet winter did show the wet spots on the course. We had numerous areas that were reworked and reseeded that spring.

On July 1 we opened the front 9 in very rough condition. It would be at times like this that you wish you were not on an unlimited budget. We felt that it was imperative to open - not only to start getting in some money to offset some of the expenses, but to let people know where we were.

The back 9 was opened August 3. Our initial comments were unanimous that the layout was great, and some day it would be a fine course. We hope that some day will not be too far in the future.

The fall weather and this winter have been as good as the last one was bad. The turf is getting better all the time so the golfers should be able to see the improvements greatly this spring.

In our final agreement with Maddox a side dump will be left over one year to help in filling washouts. This is probably the biggest visible problem we have. Our priorities for this year are greens first, then washouts.

As I stated before, our 40 traps turned into 72. It's lots of fun to kid Chuck about this, but his trap work is definitely his strong suit. The shaping and ability to use the traps as background for shots on a relatively flat course will make this into the truly "Championship" course that we wanted. At the end of the first six months of operation the dream is not a reality yet. The reality will come when the bottom line on the profit and loss will be black instead of the red that it now shows._ _ _ _

DEVELOPING A NEW COURSE

Stephen K. Gipson, Supt., TRW Colf Course,
Chesterland, Ohio

TRW began with an idea in the mid-1960's that they wanted to build a golf course for their employees. At that time there were nearly 800 employees who were playing in the Company-sponsored golf leagues, and the Chairman of the Board of Directors was an avid golfer. The Company chose Pete Dye to design the golf course, and presented several tracts of land for his inspection.

One tract had everything an architect could want: rolling topography, lake site, excellent stand of trees, easy access, few drainage problems, and a high price tag. One location had everything but a lake site necessary for irrigation. The last site had nearly everything previously mentioned, plus local lore of people vanishing on the property never to be heard from again, its own Loch Ness monster, a lifetime supply of hip boots to the new owner and a reasonable price. It was reported, although not verified, that Pete's only comment was that he could drain the Caribbean Sea if given enough time, money and men. Local legend now has it that the headless horseman now uses a golf cart and prefers Powerbilts.

And, so in February of 1969 "Victory at Sea" began. To drain the land was the prime goal at the start with the real shaping to begin later in the year. As many as 25 pieces of equipment were on hand and working at one time. The drainage progressed nicely with the addition of nearly eight miles of tile ranging in size from 3" to 24". With much of the work well towards completion and on schedule, the project was set back by a tornado on July 4, 1969. After spending some weeks cleaning up the debris, work was begun again with nearly all the holes being re-designed due to the tornado damage.

As the development continued, TRW saw the need to hire a superintendent to represent the Company's interest and help establish the various programs that would be needed to develop the course. I began in January of 1970, and due to the delay caused by the tornado, actually missed little of the construction.

Eventually the course was beginning to show its final playing characteristics. We now had to develop all of the often overlooked systems so necessary to the operation of any golf course. The most important item necessary to efficient operations is a dedicated and experienced crew. At the time we had no source from which to draw upon to form an experienced crew, and the Company was reluctant to draw upon their work force due to the fact that numbers of people would vary from day to day for the first year. It was, therefore, determined to seek a temporary help organization to supply the work force.

We began hiring people in September of 1970 to staff the golf course. These people would not be totally different faces each day, but would return each day just as your crews do. It was necessary to have some temporary people from time to time; consequently, within 2 years we had employed over 300 people to maintain a work force of 3 to 7 during the winter months, and 20 to 25 in the summer months. We still retain the labor organization that we started with; however, we now have a very stable crew of 8 in the winter and 15 to 20 during

the summer.

The crew is paid by a company other than the golf course owners, and we avoid the overhead involved in a union situation. The one bright light in the entire situation is that we have an Amish community very close to the golf course. We do have 4 Amish people working for us, and I can say without a doubt that it would be possible to reduce the crew by 30% if these people would work on Sunday, which their religion forbids. However, we can complete our needed weekend work with other people on the crew.

The initial idea was to have 36 to 54 holes of golf for TRW employees, with the initial phase to contain 27 holes. This meant that the maintenance building had to be centrally located and easily accessible to the course and to main roads. The property would also offer at a later date other recreational activities other than golf and would place additional demands upon the maintenance area, thus requiring the building be easily expandable. The site for the building is at this time somewhat removed from the 27 holes we now have, but when the decision is made to expand the course to its ultimate size we will be in the exact center of the complex.

The building is of steel construction and can be easily expanded when necessary. The interior has been designed to facilitate the repair and maintenance of all of the equipment we now have and all we expect to have when the complex has been totally developed. The key idea of the maintenance building was to make it possible to store, repair, maintain and build equipment in the easiest manner possible. Towards this goal we have incorporated some labor-saving and unique pieces. We have in our shop such items as: a gas station type floor hoist, an overhead chain fall on a tracking system, an electrically operated steam-high pressure hot water cleaner, and air operated tire changer. Many of these items were suppied by the Company from their surplus equipment.

One of the first projects I had after joining TRW was to formulate a list of equipment needed to maintain a 27-hole course and the prices for those pieces of equipment. One of the most helpful pieces of information I found was a list of equipment needed to maintain an 18-hole course in the opinion of the USGA. This list needed some revision to fit our needs, and after having revised the list in 1970, I discovered that the total cost would be $ 98,000 for only 18 holes.

Throughout the development period one thought was constant: construct a golf course that would appear as if it had been designed by Nature and still incorporate some of the modern Company and golfing themes. We tried to accomplish this by building all the bridges, shelters and privies in a rustic manner. Cart paths were kept to a minimum and in such places to be as inconspicuous as possible. The flags were of a personalized type and they were not numbered. The tee markers were chosen to reflect one of the most successful portions of the Company's business.

One of the main products of TRW is engine valves, and we discovered that the Company made valves for a large diesel engine. These valves are 6" in diameter and weigh 9½ lbs., with the stem shortened, a spike welded on and painted. These tee markers have several advantages; virtually indestructible, too heavy to be thrown or carried off, easily moved, and donated to the golf course.

All of this was done to provide the 750 golf league members and 800 additional golfers a course they could call their own. Our membership grew from 1,100 in 1972 to nearly 1,600 in 1973. The growth of the course will continue in the years to come in membership numbers and possibly number of holes.

To me developing a golf course means much more than simply building, establishing turf cover, opening the golf course to play, and finally maintenance. We must also develop the ways, means and standards by which we will accomplish our goals.

Today we have many excellent professional organizations to help guide us in our goals, such as the GCSA, the USGA, the PGA, the National Golf Foundation, the American Society of Golf Course Architects, the Golf Course Builders of America, the Sprinkler Irrigation Association, American Society of Agronomy, foundations such as the Midwest Regional Turf Foundation, and all the accredited turf schools such as those listed in the most recent edition of The Golf Superintendent. If we use these organizations wisely we can alleviate many of our problems at the start. One of my favorite expressions came from a Vice President of Firestone, who said to me one day after a particularly difficult experience - "There are never any problems, only opportunities!"

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MONITORING MODERN OPERATIONS

Julius Albaugh, Supt., Westmoreland C. C.,
Wilmette, Illinois

In the 12 short years I have been associated with golf course maintenance we have had quite an influx of technology. Technological advancements have given us better equipment, safer and longer lasting chemicals, better methods of renovation and construction,and an array of turfgrasses selected and developed for a specific use - golf courses. The development of tools and turf of our trade has been so vast in the last 10 years that many of the machines,chemicals, and grasses I studied in school and used as an assistant just 12 years ago are no longer available, or are on the verge of becoming obsolete.

A definition of monitoring, and I feel it might best apply here, is that of - watching or checking on. Monitoring as used in the title implies watching or checking on, or reviewing what is being done on modern golf courses. The need for watching and checking on the new machinery, chemicals and grasses developed as a result of technology. The need for watching and checking on our own individual operations for ways of utilizing technology. The need for watching and checking the technology being used on our golf courses as well as other golf courses.

The first step in monitoring is to watch and keep up to date with those things that are new. We may first learn of a new technological release from an advertisement in a trade magazine, a turf

conference or show, a conversation with a fellow superintendent, a turf products distributor, or even a golfer on our golf course. Once we first get wind of this new item, and if it looks or sounds good, we naturally want to know more. We may write the manufacturer for more information and ask who their local distributors are; then contact the distributor and check around among our neighboring superintendents for more information, hopeful to find someone who is already using this new item.

If the product is a pesticide or herbicide, or new variety of grass, we may want to purchase a small amount and apply or seed it in our nursery, or test area to watch it under our growing and climatic conditions before we would consider using it on our own greens or fairways. If the item is a new machine we will ask for a demonstration, or even better being able to use the machine 2 or 3 days so we can watch its actual performance on our golf course.

This leads us to our next step in monitoring our operation, to watch and check as to the need and implementation of the new product. This step requires analyzing our golf courses from tee to green and often from fence to fence. We are always looking for ways to reduce the manpower needed to perform a specific task, for ways of doing jobs in less time, for machinery that is easier and more efficient to operate, and for ways to give us better quality and control on the tasks we perform in our maintenance operations. Because every golf course is different, as to the layout of the golf course, size of tees and greens, soil types, contours, terrain, drainage, grasses,budgets and standard of maintenance, monitoring is required so that the superintendent can better determine how he can best use the new machine, fungicide or other turf product he is looking at. What works well for our neighbor on a golf course of modern design, may have limited use on our own 50 or 60 year old course.

I can illustrate this easily. When the Triplex greensmower was first introduced we all had visions of how we could benefit by its use. The Triplex greensmower was one of the first machines to come along in which we could truly visualize a way to reduce our labor force. After seeing the Triplex for the first time at the GCSA conference and show, I asked for a demonstration the following spring. After using the machine a couple of days, I decided to pass up the opportunity of being one of the first to own a Triplex greensmower. Why? Not because the machine did not cut and perform well, but because my greens were not designed for the first Triplex. This machine did well on large greens with large collars, but on my small greens, average 3,745 sq.ft., the smallest being 2,190 sq.ft., there were problems. The smaller the green the sharper the contour, the sharper the contour the more severe the bruise from the inside wheel on the perimeter cut. Also my narrow collars, on many greens 3 ft. or less in width on at least one side of the green, did not allow the machine room for turning.

For the next 4 years I watched the improvements made on the first Triplex and the release of others. Finally, in 1972 I purchased a Triplex greensmower because the design and maneuverability had improved to the point where I could benefit somewhat by purchasing one. Somewhat because in early spring and during stress periods in July and August I use the old style mowers on every other cutting to reduce the wear on the perimeter cut and on collars.

The power sand trap rake is another machine which has limited use on some older golf courses. At Westmoreland we have many green traps with steep 4 to 8 ft. faces. In many cases the use of the power sand trap rake is restricted to one-third of the trap because more labor would be gained by tossing sand back up to the faces than saved by raking by machine. These two examples demonstrate well how on older golf courses it is often difficult to gain the full benefits that technology offers us. And also the importance of monitoring the new items of technology in our own operations before purchasing.

In monitoring other golf course operations I found superintendents are using technology to:

1. Economize in golf course maintenance operations
2. Become more efficient with their labor, machinery and chemicals.
3. Reduce time in performing their tasks
4. Make golf course maintenance easier on themselves and their employees.
5. Induce more safety in their operations.
6. Lessen interference and inconvenience to their golfers
7. Establish versatility in their choice of equipment
8. Find ways of reducing the frequency of maintenance operations
9. Install, renovate or construct to improve playing conditions
10. Achieve more control over maintenance operations

The economy of the country in recent years has had a great deal of effect on golf course operations. The cost of labor, materials and equipment has continued to rise yearly. I was amazed at the rise in cost in 1970. While going through my records and discovering that my 1970 labor cost was going to be more than my entire maintenance budget for 1965. This discovery made me realize how rapidly cost had been increasing, and I decided then to put more effort on economizing. Great reductions in cost cannot be made over night if one wishes to economize and maintain, or improve the standard of maintenance and conveniences being offered to his members.

In reviewing operations in the Chicago area, I have seen gradual shift towards equipment that allows employees to do more, fungicides that offer longer protection and golf course improvements that minimize maintenance. Many golf courses over a period of two or three years have reduced their labor force by utilizing the benefits of our technology in the turf field. Triplex greensmowers, power sand trap rakes, 9- and 11-gang mowing units, automatic irrigation systems, using turf vehicles to fertilize and spray pesticides are but a few of the machines being used to reduce labor. There has been more use of systemic fungicides, growth regulators and selective herbicides. Poa annua is being stripped off of tees or collars, and new turf varieties are sodded that require less maintenance. Even with these efforts, few budgets have been less than prior years, but the rate of increase has been less.

Efficiency has increased in our operations also. More efficient use of water is made by watering later in the mornings - less water is needed this way to pull Poa annua through hot, windy days - fungicide efficiency is obtained because disease development conditions are shorter by the turf not being over-wet for longer periods during the humid-still nights. And, maintenance tasks are being varied by altering times of maintenance operations to times when a man can do more because of fewer golfers.

In monitoring modern operations I have found many superintendents utilizing technology to reduce the time required to mow, aerify, topdress and many other maintenance tasks. This is where equipment technology has really aided the superintendent. At Westmoreland Country Club over a period of 10 years aerifying time has been reduced from 6 greens per day to 18 greens in 9 hours. In 1963, the equipment consisted of 2 aerifiers of 18", 2 vertical mowers 18" Hand-pushed, 2 greensmowers with brushes, 2 drag mats hand-pulled, and a small 4 HP blower. In 1973 our equipment consisted of 3 larger aerifiers (2 borrowed) 24" wide, faster aerifying speed and transport speed - Triplex greensmower with vertical mower attachments - turf vehicle pulling 8 ft. drag mat - larger 8 HP blower. In 1973, 10 men aerified, broke up cores, drag mat and cleaned up 18 greens in one 9 hour day, an operation which once took 351 man-hours is now taking only 90 man hours.

With the help of OCHA and the EPA, much has been done in recent years to make our jobs safer. Equipment has been redesigned to provide safety for the operators, chemicals can be purchased that are safer to handle, and better protective clothing is available. More superintendents are insisting rather than recommending employees wear hard hats. The use of goggles, mask, rubber gloves and protective clothing is on the increase. Chemicals storage rooms are being built to keep pesticides behind locked doors.

Technology is reducing the interference and inconvenience to golfers. Automatic irrigation allows for several short period waterings per night, fewer or no wet spots the next morning. Quieter mufflers, less noise, less interference to golfers.

In modern operations equipment is being chosen that is more versatile. The Triplex greensmower is used to mow, verti-cut and spike. Three operations, one engine, one machine, just add the desired attachments. We have turf vehicles that are runabouts for changing cups, trucks for hauling, take off the box, add a topdress spreader or spiker, same basic vehicle totally different machine. Tractors with flotation tires, PTO and hydraulic systems offer many different uses on golf courses. Pulling mowers and trailers, PTO power for vertical mowers, sweepers, spray rigs and leaf mulchers. Hydraulic power and 3-point hitches to lift and mount tools. All for more efficient use of engines, less maintenance and lower purchase prices.

By monitoring modern operations we find products of technology being used for fewer individual operations. Systemic fungicides, longer lasting, results in fewer applications. IBDU and other slow-release fertilizer, fewer applications. Selective herbicides in flower beds - less cultivation. Growth regulators - less mowing and trimming. Just a few of the products being used to reduce the frequency of maintenance tasks.

Modern technology has given us many methods of installation renovation and construction that allows for better playing conditions and easier maintenance. The new methods of green construction, Poa annua control programs and new drainage methods all provide for better golfing, fewer days of closing the golf course, and more control over adverse weather conditions.

Probably the greatest products of technology are those that give the golf course superintendent more control. Technology has given us a lot and will continue to offer more, but control does not come until we apply the products of technology properly on our own golf course.

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THATCH - A PART OF TURF

Lee Record, Mid-Continent Director
USGA - Green Section
Crystal Lake, Illinois

Thatch and mat are terms used interchangeably to describe a condition where excessive vegetation has accumulated. These two terms relate to different conditions; however, it is possible for mat and thatch to occur together, but either of the conditions may occur singly.

Thatch is an accumulation at the soil surface of dead or undecomposed stems and leaves. Mat is the thickly overgrown and tangled mass of vegetation. In turf, the undecomposed mass of roots and stems hidden underneath the green vegetation. This is associated with sponginess or fluffiness of the turf.

Some of the first signs to look for when identifying mat are uneven mowing, scuffing and scalping of the turf. Because of the sponginess that is associated with this condition, the putting surface is not a true playing surface. Mat, therefore, is a common condition that is brought about by rapid growth due to excessive fertilization - a growth habit that produces an entanglement of prostrate stems and leaves. It may also be associated with poor mowing practices.

During the summer months, especially during periods of high humidity, greens have become spongy or fluffy, and the playing surface has been scalped. By having an excessively matted condition, fungus organisms are protected from contact fungicides and systemic fungicides may not be as effective, depending upon the pathogen. The mat itself serves as an inoculin, favoring fungus attacks. Therefore, we can conclude that a matted condition contributes greatly to an environment which encourages disease activity. Fortunately, however, mat can usually be eliminated without injuring the playing surface too drastically by the use of vertical mowing, which will remove excess vegetation and will cut or remove prostrate stems and leaves. If you prefer, brushing the greens as well as tight mowing are also sound cultural practices to follow when removing a buildup of mat.

One other important phase of your cultural program in holding mat in check is by the application of topdressing associated with a vertical mowing or a raking program. If topdressing is not worked into the mat, a layered condition can easily begin, which will impede the movement of water, and may also be associated with a very shallow root system.

I have tried to point out that mat is considered to be an accumulation of excess growth that is alive. Now we get down to thatch and that is the layer of dead, but undecomposed vegetation. How does this affect our turf management program, and what effect does it have on the game of golf?

Thatch is a much more serious problem than mat because of the difficulty associated with its removal. Thatch is beneath the living turf and consequently, when you remove thatch you are also removing some of the living turf which is lying above it. There is no question that thatch accumulation hinders plant growth, and although most turfgrass species are perennials, parts of each species in question are continually dying and are being replaced by new life. Roots of perennial grasses generally die each winter and new ones are formed with the coming spring.

With the intense management programs that we carry out today, there is no question that thatch develops quite rapidly. Any condition, then, that increases vegetative production and finally the subsequent death of the plant parts, will then favor thatch development. Any factor, therefore, that slows down organic decomposition will also favor thatch formation.

Soil types certainly have a bearing on thatch - thatch is more likely to form on a heavier clay soil than on a light-textured soil. When grass is killed through winter injury, disease, or if an insect problem has been present in the thatch or mat area, this adds to thatch accumulation. Compaction, too, plays a part as thatch will form on a compacted soil. Weeds in fairways, in roughs or even on greens, also contribute to thatch buildup. The height turf is maintained certainly has a bearing as to the amount of thatch. Excessive nitrogen will speed up thatch formation, but at the same time will promote more.

It has been pointed out recently that insecticides, too, may favor the development of thatch, particularly when using chlorinated hydrocarbons, or arsenicals for earthworm and grub control. Thatch may also occur because of an abundance of heavy clippings. This is brought about by excessive fertilization, watering practices, and to some extent, non-removal of clippings. Thatch also occurs because of the slow decay of the dead plant parts.

A frequently topdressed turf seldom produces a thatch. It is obvious that the mixture of soil with the dead vegetation contributes to a more rapid breakdown. However, there may be some other elements lacking which are necessary for decay. Could it be acidity, which could create an unfavorable balance of the appropriate micro-organisms that are necessary for decay? Could it be due to the use of fungicides, which may affect the micro-organisms? What about the lack of calcium or nitrogen, or any of the minor elements that are associated with and needed in growing healthy turf?

Thatch is important, however, in your turf management program with respect to the resiliency and cushion that is needed in greens or on fairways. Thatch helps to buffer the soil temperature from the air temperature, and thatch helps to prevent the encroachment of weeds. The optimum level of thatch on greens should fall in the neighborhood of 1/8 to 1/4" - on fairways 1/4 to 1/2" is normal. The total amount of thatch in question can be maintained and held in

check through the use of aeration, spiking, vertical mowing, top-dressing, brushing, lime applications and many other phases of your individual cultural programs. When you do not have any thatch on greens it is quite evident that there is a tendency to overwater; the end result is the encroachment of weeds, primarily Poa annua, excessive ball marks and a very poor playing surface.

Excessive thatch is undesirable. It is difficult to obtain satisfactory overseeding; management practices required to reduce thatch are expensive; dry spots develop, requiring increased attention in your water management programs; water laying within the thatch may provide a favorable environment for disease; insect activity may be stimulated; thatch can create an uneven playing surface; roots tend to develop in the thatch area and do not work their way into the soil properly, causing a drought problem during the stress periods of the year; excessive thatch brings about desiccation in early spring; fungicide and insecticide treatments are not as effective when thatch levels are excessive; aeration programs are affected by the amount of thatch, thereby limiting the productivity of your turf; water infiltration rates are affected, decreasing the efficiency of your water.

Thatch, a part of turf, certainly does play an important role in the cultural programs that are carried out to maintain optimum playing conditions for the game of golf. Fifteen years ago there was very little research being conducted investigating the development and control of thatch. Since that time, a great deal of money has been spent in research to discover what could be learned about thatch decomposition.

Engel and Alderfer of Rutgers University presented one of the first papers after a ten year study on Seaside bentgrass, dealing with the effect of cultivation, topdressing, lime, nitrogen and wetting agents on thatch development. A turf cultivation study conducted by Ledeboer at the University of Rhode Island reported that cultivation appears to increase surface decomposition. Ledeboer worked with glucose, sucrose, fertilizer, dolomitic limestone, gypsum and top-dressing combinations on thatch decomposition, and reported them unsatisfactory for increasing the rate of known thatch decomposition. Ward of Mississippi State University reported that topdressing and cultivation were deterrents to thatch in bermudagrass.

Butler at the University of Illinois worked on "Thatch: A Problem in Turf Management," where he showed thatch may be desirable, depending upon where and under what conditions the thatch exists. Butler pointed out the following benefits by having thatch:

Shading and lowering of the soil temperature - with a mulch soil temperature tends to be lower during the day and higher at night
Some protection from frost and low temperatures can be achieved from the insulation provided by thatch
Reduction of water loss - thatch may protect the soil from drying winds
Reduction of the weed problem -
Recycling of nutrients - some turf areas have looked good for many years without supplemental fertilizer.

Most of the thatch research in the past has attempted to find the best management programs and mechanical renovation procedures to reduce thatch accumulation. Today a new focus in thatch research is

directed more to the biological degradation of the thatch layer. Martin at Michigan State University investigated the total cell wall, the hemicellulose, cellulose and lignin analysis that make up the thatch layer on the leaves, stems and roots of Toronto bentgrass, Merion bluegrass and Pennlawn red fescue. He showed that lignin, the most resistant plant constituent to microbial activity, was found in greatest quantities in the thatch layer nearest the soil. Fescue contained higher percentages of lignin than either that of bluegrass or bentgrass. In comparing the living plant parts, roots have significantly higher percentages of total cell well constituents and lignin than the stems or leaves. He also concluded from his study that clippings of turfgrasses contribute very little to the thatch accumulation.

Koths of the University of Connecticut showed that although changes in the thatch micro-environment bring about quantitative changes in microbial balances, such ecological changes do not necessarily contribute to a more desirable thatch balance. A great proportion of the viable micro-flora is inactive. Increasing activity is important and can be obtained through topdressing. Changing the physical characteristics of the thatch layer to provide micro-ecological sites that promote continued activity by the resistant microflora, may be the most important attribute of topdressing.

Management programs, meeting the wishes of a golfing membership-at-large, is a very complex problem to solve. Perhaps it is best put by Otis Caldwell: "To live in a scientific age, an age of rapidly accumulating knowledge, imposes heavy obligations upon education and upon the resultant social and industrial controls. In the presence of modern science, those wo do not know cannot long survive, else they must seek the primitive places of the earth where the most elemental practices may persist for a time. Even in these primitive places, science will soon catch up and there will again recur the old biological requirement to learn, to move or to cease to exist."

Our following speakers in this program will be most exciting because they are going to be following the words of Otis Caldwell -- "To learn, to move or to cease to exist." Their lives are dedicated to providing the greatest pleasures that they can afford their golfing membership to realize the optimum playing conditions for the great game of golf.

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FAIRWAY PROBLEMS - MY "73" EXPERIENCE

Paul Morgan, Supt., Brown's Run C. C.,
Middletown, Ohio

I would like to give you a little background on the fairways to help show some of the problems. In 1964, we tried to show how a complete automatic irrigation system could help improve the turf. One fairway, tee and green was irrigated to illustrate the point. During that year of testing, every effort was made to show good results, and it worked! The following year a complete automatic system was installed, a new well was developed as our water source. The well, with

1,000 gal./min. capacity, was 137 ft. deep and 7800 ft. from the course.

The following year it was noted that the #9 fairway, the first one irrigated, was about 60-70% Poa annua. A problem? Yes! We went on a calcium arsenate program, using the recommended rate in split applications spring and fall. During the past seven years, 14.4# of actual calcium arsenate have been applied. This past summer (1973) soil tests were taken to determine the amount of arsenic present in the soil. The tests were based on 0-1 inch and 1-4 inch depths. The amount of arsenic present in the one inch level ranged from 80% to 100% control, with the 1-4 inch depth slightly lower. The test indicated that in areas where poor drainage existed the arsenic level was higher than the adjacent area where good surface drainage was present.

Early in the arsenical program it was observed that drainage was the key to eliminating the Poa annua. During the past several years, several thousand feet of drainage has been installed annually. This not only helps in the control of Poa annua, but permits regular mowing and cart traffic with very little damage in wet weather.

"The spring of '73" provided an over-abundance of rainfall to say the least. We were unable to do normal aerification; in fact, wet weather springs cropped up all over the course. These had never been a problem in the past twelve years. There was turf loss, perhaps 10 - 20% in some of the fairways, and some areas with slope suffered if thatch was heavy. The cause was too much water, combination of diseases, leafspot, dollarspot and a lack of O_2 available to the root system. There is also a possibility that the arsenicals release was greater under those conditions and, therefore, weakened the plant, making it more susceptible to diseases.

A blend of seed was selected containing Victa, Nugget and Sodco, which are improved bluegrasses all known for their color, density and disease resistance. They are also known for their tolerance to low mowing. The seedbed was established by aerifying as many as six times. A fertilizer was applied containing a little phosphorus to encourage germination and aid in early growth. The seeding was done by two methods - broadcast spreader and a slicer seeder. That was followed by rolling lightly while the soil was dry. The seeded areas were watered lightly and often to keep the soil damp. The results were very good with the seed germination well within 14 days.

I've observed several problems on other courses in the Southern Ohio area. Grub damage had destroyed fairway turf at one course. The normal application of insecticides did not seem to give complete control. I've also observed greens in Columbus, Dayton and Cincinnati area with wet wilt damage where resodding or seeding is the only solution.

In conclusion, "The Summer of '73" was a most difficult one for most golf course superintendents. Many learned how an abundance of rainfall could increase the normal problems of turf maintenance. Let's all hope that 1974 will bring more sunshine.

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FAIRWAY MANAGEMENT - UPGRADING TURF AREAS

Mel Lucas, Garden City Golf Club
Garden City, Long Island, New York

The upgrading of any golf turf area is ascomplex as the building of a golf course. To evaluate this task, we will take The Garden City Golf Club as our common dencminator. This Club was built in 1896 as a nine holer with the other 9 built in 1899.

A course of this age, when not properly cared for, creates a few more problematic situations when certain practical management techniques were not followed. A laxity of keeping up with modernization of equipment and irrigation, linked with the vast research in Agrostology from universities and the dynamic men such as Dr. Daniel here at Purdue, had also deteriorated a well-manicured course.

My first task was the control of Poa annua infestation that exceeded 80% of all fairway turf. The use of Tri-calcium arsenate was initiated and continued now for eight years with, I might add, continued success. We will not beleaguer the arsenical program for I am sure many of us have heard this topic many times. The Poa annua problem developed from the over-use of a quick coupler system that had been installed in 1958.

On Long Island we are required to submit a monthly water meter reading to the Water Resource Commission. I found that the three prior years to my becoming superintendent, excesses of 52 million gallons had been used in each one of those years. With proper water management and an automated system, we have used no more than 16 million to as low as 9 million. Needless to say, excessive water use had disturbed the soil structure to allow good root penetration. Thus, the need for much renovation and seeding was required.

As conditions improved, the problems which had been minor now became unsightly scars upon the greensward. Low-pocketed areas would first become wet, and standing water would then follow in late August. Drainage began with trenching, laying of Turfflow pipe and covered with old trap sand. The task of drainage, however, never seems to be finished. The last three inundated years we can be thankful for the past work, but we still find small areas that we drain.

The other problem was inherent in the design of this course. The weaving corridors of fairways, pot bunkers dotted within them, and the winding, jutting sand bunkers created numerous bottlenecks. Most people would change this to meet the needs of equipment. At Garden City the few changes that have been made were considered almost heresy by many of the members. Many a fine links of an architectural era that has long passed have been erased by some self-proclaimed agronomist, usually Club member status, or an over-zealous Greens Committee.

When a problem from maintenance brings about a cry for remodeling, then I feel it is time that it calls for a remodeling of equipment or the man in charge. We had many problems from compaction that resulted in turf loss, knotweed, crabgrass infestations and general overall ugly appearance in all bottleneck areas, in front of greens and around some of the pot bunkers.

The necessity was shown to re-evaluate our present mowing apparatus, this being a 7-gang hydraulic tractor. During the summer months we would do more mowing of approach areas with the 3-gang riding mowers and saw major improvements. In 1968, at a turf field day (Fenway Country Club, Mamaroneck, N.Y.) I saw the new 5-gang Toro Super Pro. The Club soon purchased one, and it worked so well that we now own three. These light units are excellent for turning, mowing near traps and general end appearance. The total cutting time has increased, but we have all fairway turf mown by noon. When the three units go out, plus the old hydraulic, it takes just two hours. The weather is never too wet to send the light units on rain-sodden turf.

I am sure we have all experienced a lost day or two from a breakdown on your one and only. The feeling of who tells who is evident many times when talking to your fairway tractor operator. His air at times might create a superiority or unreplaceable stigma during matters of wage.

We are seeing some fine types now, such as Jacobsens F 133, or the new Hahn Flex-A-Matic 140 - the need is present. At Rutgers for the last three years the UGSA Green Section Agronomists have stated that mowing has been a major problem toward turf conditions. We have also heard leaders of industry telling us that we can expect bigger and better equipment, such as 9- and even 11-gang tractor units. This seems well for parks, sod nursery areas and possibly the new monster courses being built.

In closing, I am sure that it wouldn't be suggested that every club should use a mowing approach as this. We all know that everything lies in the desires, or money of the membership. The members of Garden City still hang onto the traditions of course design and their reason for being. They constantly expect the height of cut to produce the finest playing surface for their golfing pleasures. The initiative of superintendents can produce ideals that can raise far above what any club member possibly could desire.

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TRI-CALCIUM ARSENATE - USE AND ABUSE

Mel Lucas

Poa annua? No! "Some say they can get it out of the green. I am sure that I know of no way to get rid of it except by letting the golf course go into a haymeadow for a few years." This was the last statement made in an article from the National Greenskeeper, September, 1927, and written by Mr. John McNamara, First Vice President of the National Association of Greenskeepers of America. The Yearbook of Agriculture Grass 1948 states, "Annual bluegrass: It is of little economic importance and under most conditions is considered a weedy pest, especially on lawns and golf courses."

Poa annua is a favorite subject to me. I have given a number of talks about it the past five years, and have addressed the

Investigating Committee on The Arsenic and Lead, Federal Insecticide, Fungicide and Rodenticide Act (7 U.S.C. 135 ct. seq.) held at USDA, Beltsville, Maryland on October 29, 1971.

I have been using tri-calcium arsenate for the last eight years at The Garden City Golf Club, and I might add with great success in suppression of Poa annua, crabgrass, goosegrass and the inactivity of white grubs in all areas used. My rates and application methods have varied from the use of 85% lime Tri-calcium arsenate and the 48% granular material. To this date we have applied 12# A/1000 sq.ft. to all greens and fairways. The tees vary from a low of 16# A/1,000 to as high as 45#A/1,000 sq.ft.

I don't think we should continue on the uses as per good, but an insight into abuses. I refer to abuses that the superintendent receives.

I am thinking of this past season and how well we can recall this treacherous past. I also look back on many a good superintendent and friend who succumbed to this fatal year. The possibilities were bleak for many, but the undercurrent and proclamations from many others agonized the reasons for job loss. Why during equal stress periods for everyone are the most controversial statements made about the ones on a tri-cal program, and the others who are not are overlooked. I have never seen or heard of a chemical that has been so well-proven as one of the finest tools to turf; also been used as a crutch by so many who have never used it or studied it as the final ax to condemn the individuals who have.

The vast knowledge of the management of fine turf can be heard from the local stardom of any ordinary club, the caddies, waiter, waitress, bartender, locker room and to your own help. These people are not vying for your job, but try and seek some importance for the knowledge they possess. These people have an unbelievable access to your members, whom we never meet except by that one irate moment on the course when we least are ready.

Why is it that the lowly scuttlebutt from caddy or any other type will influence the member? The reasons are communication - never involve anyone before you commit yourself to the Greens Committee bulletin board message with your signature. Secondly, the idle small talk that we readily convey toward anyone who asks for information. Later as time goes on this talk gets out of hand to the final coup-de-grace, as being our reason for failure. Any program different from the norm will always be attacked whether your turf was lost from a pump failure, vandalism, wilting, a layering problem under your turf, or even an overdose of fungicide, etc., that had created a singe. How well we become familiar with the town crier who informs everyone of someone's demise!

There has been many a fine script written in preparation for the members as to what will take place in the near future on the links, I cite a documentary that was put out by Baltusrol Golf Club, Springfield, N.J. The management of The Greenbrier, White Sulphur Springs, W.Va., had notices in all their rooms as per the Poa annua program. At Cherry Valley Club in Garden City, N.Y., a special letter was sent to every member to inform them of intent. I am sure there have been many other fine reports made for inter-club relations.

The technical side of papers and reports on tri-calcium arsenate are plentiful, from Cecil Kerr's "The Mode of Action of Arsenicals In The Soil; Arsenical Safety," and many papers he has given throughout the country; the fine research work of Drs. William Daniel, Purdue University, and Ralph Engel of Rutgers University. The practical side of research work done by Messrs. Joseph Flaherty, Baltusrol Golf Club; Thomas Rewinski of the National Golf Links, Southampton, N. Y., and so many others who have constantly spoken at turf conferences and have filled so many of the proceedings.

During my military obligation I had the pleasure of meeting Mr. Manuel Francis, then superintendent at Vesper Country Club, Tyngsboro, Mass. There I saw an amazing bentgrass golf course and learned much about tri-cal from him and Bert Fredericks, now at Vesper. The tri-cal program started 8 years ago on Long Island, and near 70% of the clubs are in some sort of a program. When I started at The Golf Club they had used 55 million gallons of water per year to grow Poa annua - we now average 14 million gallons.

The nitrogen requirements are now 2#/1,000 sq.ft. on fairways and 4#/1,000 sq.ft. on greens and tees, compared to 8#/1,000 sq.ft. that had been applied to all areas. The Golf Club had experienced loss of turf in some of the low or poorly drained sections of the course year after year. We started the applications of tri-cal, and lo and behold don't you think that the loss of grass in the same areas now was dying, as told to me by an array of authorities, because of the tri-cal. We all know that drainage is the key to success no matter what or if any program you are following.

To generalize a bit, how many past superintendents have fought Poa annua with the scorched earth policy and never batted an eye, nor did your members when all turfgrasses totally went or suffered. The advent of tri-cal has brought on a new dimension. The program starts in the spring, and before you know it August appears and the Poa annua takes its vacation. It was going to leave sometime, but why the sorrow? We look around and see a very aggressive bent and bluegrass population. Link this with a well-timed seeding and a grass cover can be established without much competition from undesirable weeds.

When this initial loss of the Poa annua happens you are suddenly an outcast closely linked to insanity, or to have committed heresy to our esteemed club. Many times we find our Greens Committee will become quite the authorities on tri-cal, and later they themselves are quoting to other club members, and also to members of other clubs. It becomes amazing that a successful and busy business man becomes so involved in the idiosyncrasies of our profession. His new knowledge earns him quite acclaim from the golfing world; thus the term, self-proclaimed agronomist comes to light which many times will make many people suffer.

I have worked closely with programs at Woodcrest Club in Syosset, Garden City Country Club and Cherry Valley Club. These clubs converted to bentgrass with much success. I do have a vivid picture of one club that would have 50% loss of Poa annua each year. The program was started - after one full season the fairways looked good. They came through a hard winter - they began a program on their putting greens. The season progressed and so did the turf cover on fairways as well as greens. They combatted automatic irrigation problems,

and as the season drew to an end the course was in fine shape. The pressures and problems that beset the individual were and are astounding - he was let go.

I would like to cite a passage from a letter I received from Major General Howard Snyder while serving at Ft. Devens - "You are fortunate to be following such an engrossing and rewarding profession. Certainly one meets a fine cross-section of Americans at any golf club, public or private." How true he is, but we should not relax any of our efforts. This profession is a great one. We are given every piece of equipment and chemicals to work with. A few of these chemicals are more critical to work with than others. The expertise on handling them is as critical as your expertise of handling that fine cross-section of people at your club.

In closing, the tri-cal program like anything else we tackle needs total support from as much golf-oriented societies, so that we may call upon them when situations get close to document our desires. We have met with the EPA and have been given professional use allowance. But, what of tomorrow - will the energy crisis, OSHA, availability of certain metals no longer can be acquired, the cost becomes prohibitive to use, or will we be forced to go backward to the philosophies of John McNamara when we have lost 47 years of highly refined tools to keep that professional image real?.

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A FAIRWAY IMPROVEMENT PROGRAM

Len Hazlett, Supt., The Country Club, Inc.,
Cleveland, Ohio

I came to The Country Club of Cleveland in February of 1958 with little or no knowledge of the condition of the golf course. As usual there was plenty of snow, and it wasn't until the latter part of March that we could see any turf showing. Much to my surprise there was snowmold over the entire golf course. Green, tees and worst of all the fairways were badly infested with snow that took its share of turf.

I was informed by the Greens Chairman that there had been considerable loss of turf the previous summer and little effort was made to seed in any bent that fall. There was little doubt in my mind that Poa annua would be the predominant grass showing in the spring. I had heard Poa called a friend and foe, and I was sure hoping it would be friendly with me until I could figure out the approach I would take to give the members a turf that they could play on without the soft, wet conditions that generally accompany Poa fairways.

I tried to live with Poa annua the first couple of years I was there, but with the thick thatch and heavy clay soils we were having our problems. I have always been a strong believer in keeping the turf on the dry side, but with Poa as your main grass this is difficult to do.

In order not to inconvenience the members we would wait until

after Labor Day each year to start aerating and seeding. By the time we were finished I felt it was too late in the season for the young bent seedlings to compete with the much stronger Poa plants. The weather many times favored the Poa and I felt our efforts were fruitless. We knew the best seeding time was in August, but our golf schedule always held priority over maintenance. We have all the conditions that favor Poa growth, except the members do not like a wet and soft golf course. Gentlemen, I must agree with them - that is when we decided to undertake the huge task of getting rid of Poa. Believe me it was a huge task and it must have the understanding and support of the entire membership.

Knowing how bad the golf course was going to look for a couple of years, I decided to let the members share some of the load. It is their golf course and I feel we must be considerate of that fact. I think sometimes we take too much on our own shoulders when we try a program like this without the support of the members. I believe good communications is 90% of any successful program.

I suggested to the Greens Committee to pick two members to accompany me to Purdue University to talk with Dr. Daniel about a Poa annua control program on our fairways. Our meeting with Dr. Daniel was very helpful in our decision to initiate a fairway improvement program over a 3 to 4 year period with the use of calcium arsenate. We thought this would be the least inconvenient to the members, and would have their support. I felt we needed to get the story of the Poa program to the entire membership.

The more I pondered the thought of writing this program out to the members the less I liked the idea. 95% o more members at any given country club don't know Poa annua when they are walking on it. I thought if we put our story in picture form it would be easier for them to understand. I borrowed every picture I could of fairway programs from making calcium arsenate applications to aerating, thatching and seeding. We put the entire picture story under glass and below each picture we wrote a short explanation. We displayed the board at #1 tee and it gave the members a chance to see what their golf course was going to look like before it actually happened. I must agree with the saying - "a picture is worth a thousand words."

Test plots were put out on several areas around the golf course ranging from 12 to 36 lbs. of calcium arsenate per 1,000 sq.ft. The results were encouraging, and we took every opportunity to show and explain to many members what we planned to do.

Our first calcium arsenate application of 4 lbs./1,000 sq.ft. was made in the fall of 1969. In 1970 we made two more 4# applications at which time we noticed little or no control of Poa annua. In the spring of 1971 another 4# application was made. We were now at 16# of material and were beginning to see signs where the Poa turned a slight yellow and was thinning out as we had planned. The weather turned hot and we applied only enough water to hold our bentgrass. We simply dried the turf out, and along with the aid of the arsenic, the Poa did not have a chance. The bentgrass was holding up fine under all this stress, which led me to believe that we need to know more about grass water requirements.

By the end of July we lost most of our Poa and felt now was the time to initiate the aerification and seeding part of our program.

The fairways were aerified 8 to 10 times over, using 1" thatch spoons. We followed up using drag mats and mowing the fairways in two different directions. The gang mowers did a fine job of cutting up the plugs, enough to separate thatch from soil.

Seed was applied just prior to mowing at 50# per acre. The seed mixture consisted of 45% Seaside, 45% Astoria and 10% Penncross. The results were good and by the end of August the fairways were beginning to fill in. Another 4# calcium arsenate was applied in September. At 20# of material we noticed the Poa was having a difficult time coming back, and our bent was beginning to spread.

In the spring of 1972 we applied once again 4# calcium arsenate per 1,000 sq.ft., which brought us up to 24#. There was a lot of bentgrass showing and the Poa looked weak. I was hoping for a dry spring, but as usual we had over the normal rainfall which made conditions unfavorable for golfing, maintenance and above all our Poa annua program. As we all know, water management is of the utmost importance, but there is nothing we can do when mother nature wants rain.

Disease was starting to move through the fairways, and with ground conditions too soft for our spray equipment I called upon a local helicopter service that we had previously used to make our spray application. We felt there was no time to lose or go into summer with a disease weakened turf. The spray application held the disease to a minimum and got us through a critical period.

As the weather returned to normal, we began to notice thinning of the turf, bent as well as Poa annua. At first we were not sure it was the heavy rainfall which caused lack of oxygen, or the combination of the arsenic levels and too much water. Everyone knowshow important drainage is to maintain quality turf. I cannot over-emphasize how important it is when you go on this type of program.

We are fortunate at The Country Club that back in 1927 when the golf course was built by Toomey & Flynn, they installed three parallel tile lines the entire length of each fairway. We simply tied into these trunk lines with gravel slit trenches, which are doing a great job of drying up many wet areas previously unknown.

The members were well aware of our problems, not only because we allowed little cart use, but by the many feet of drainage trenches that were showing around the golf course. As the weather turned hot we did lose the grass in these areas, which led us to believe it was the more available arsenics in the lower areas.

Again we started aerification with the emphasis on making as many holes as possible. We aerated the fairways until the turf started to separate from the ground. We had holes on top of holes, as we feel if you are to seed you cannot aerate too much. We noticed our seedlings were having a harder time getting started, and again felt that this was due to the arsenic. We were on a low phosphate fertilizer program so that the Poa annua plants would take up as much arsenic as possible. It was decided not to make a fall application of Chip-cal, but to hold back and see what the summer of 1973 would bring.

The spring of 1973 brought us the rain we feared we would get, but we began to reap the results of our trenching work. We decided

against any arsenic treatment in the spring for fear of the same results that we had in 1972. The weather this past summer and fall was favorable for growing good bentgrass.

Our fairways consist mostly of bent, and we find them considerably easier to maintain during these trying weather periods. This past fall we applied another 4# of calcium arsenate, which brings us up to 28# material. Our program will continue each and every year as long as we have Poa annua to fight. By maintaining toxic levels of arsenic and keeping our water practices to favor only bentgrass, I am sure we will continue to make progress.

The key to success of a fairway improvement program is to have a membership that is willing to be inconvenienced for a few years. I do hope that soon we could find a better way to rid Poa from our golf courses. Gentlemen, I cannot stand here without giving credit where credit is due and that is to my Greens Chairman. He has taken a lot of lumps. Without him standing firm I know our fairway improvement program would not have been successful.

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KEEPING POA OUT

Earl Dowell, Supt., Lafayette C. C.,
Lafayette, Indiana

Back in 1952, Dr. Bill Daniel put out plots of various chemicals on the 6th fairway at the Lafayette Country Club. Of all the materials used the arsenicals did the best job of retarding and eliminating Poa and crabgrass. This was the first time that I had seen proof that any chemical would actually do the job, but oldtimers in this business had suspected that arsenate of lead was keeping crabgrass out of their greens.

On the strength of the results show in these plots, I asked for an OK to treat areas of 10,000 sq.ft. in front of all greens, which contained about 75% Poa. This was before pelleted Chip-cal. I mixed 100 lbs. of 79% tri-calcium arsenate in 100 gals. of water, and sprayed these 10,000 sq.ft. It was a tough job!

This was the fall of 1956. It sure was a sad looking mess in the spring of '57. But, by overseeding and using plenty of low or no phosphate fertilizer these areas came back. Later on more of the fairways were treated. The main thing I learned was not to try to get rid of a heavy infestation of Poa all at one time, especially if you want to keep your job!

When we built our new 18-hole course at Battleground, there was no Poa to be seen. I thought that this was the time to keep Poa out. The course was seeded in the fall of 1966, and we started our Chip-cal program in the spring of 1967 at 5#/1,000. A few isolated spots have shown up over the years, but by spot-treating Poa has been kept out. To keep our toxicity I plan to apply another 2 - 5# of Chip-cal this fall.

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THATCH - CUT OFF AND RESEED

Leon Hartogh, Supt., Oak Park C. Club,
Oak Park, Illinois

The fairways at Oak Park have a very heavy thatch buildup with a very high percentage of Poa annua. We did not start stripping sod at first to rid us of our thatch problem, but rather to aid us with drainage. There is a creek that runs through the golf course, and when the course was constructed no allowance was made for surface run-off from the fairways. The fact the opposite was true the creek banks were built up leaving a catchbasin in the fairways.

Evidence of these being problem areas before was found when we started working the soil after the sod was stripped. There was a buildup of approximately 1-1/2" of thatch. Then there was around 2" of soil covering a 1-1/4" layer of thatch that had given someone else problems in the past. These areas were then reshaped to give us surface drainage into the creek.

After seeing the quality of turf in these areas that were reconstructed, the committee decided to start a program of stripping on a small scale, taking the problem areas first. After two years of this it was decided the best way was to split the fairway in half and do either the right or left half. This allowed the player to retrieve his ball and drop it onthe fairway area that was not torn up. This worked better than mowing down hitting areas in the rough.

After stripping and hauling away sod, the soil was disked several times with a tandem disk. We then pulled a cultipack with a harrow behind to level. After we got the area as level as we could with this combination we finished the seedbed with a power sand trap rake. We then seeded with a drop-type spreader and then lightly raked in by hand. With good weather conditions five weeks after seeding the area is rolled with a roller and mowed. It is then opened for play.

The big advantage of combating the problem this way is by picking up the sod after being cut with a sodcutter you are also picking up much of the Poa seed that is in the top layer waiting to sprout. When your new fairway is ready for play you only have 5 to 10 percent Poa instead of the reverse being true. I think if we only had 10 percent Poa in our fairways we can start a program to keep it down and possibly knock it out. I am sure we would all have much more confidence starting a Poa program if we had 90 percent bent or bluegrass to start with.

The one big disadvantage of this program is what to do with the mountain of sod that is stripped. Up until now I have been able to stockpile and then later to have it buried.

One very interesting thing I found was that there was no evidence of earthworms in these areas in the top 4" of soil. Their return was evident after these areas were completed. In the areas we have completed we are following a pre-emergence program. We are maintaining a Po-San program on all the course to keep the seedhead population down. With this combination we hope to keep the Poa down.

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FAIRWAYS - ONE CLUB'S RECORD

Steve Frazier, Supt., Meridian Hills C. C.,
Indianapolis, Indiana

Our desires for certain levels of fairway turfgrass quality at Meridian Hills Country Club are much the same as any club in our mid-west region:

1. We want to mow as low as possible and still hold the turf through periods of seasonal adversity.
2. Have a firm surface that will give firm support for a golf ball and not allow it to nestle into the turf.
3. We want to mow frequently
4. Good internal and surface drainage is desirable so that play and golf cart use is not impaired during wet periods
5. We wish to place such a premium on turf quality and maintenance that a player is truly rewarded when a ball is kept in play on the fairways.

Before relating to you the approaches we have used in managing our fairways, it would be well to explain the problems that existed and previous turf conditions.

Primarily, we have a mixed bluegrass-bent-Poa annua turf. Our soil is a silty clay to silty clay loam. Our course was constructed in 1923 and much of the original tile system is still intact, now starting to deteriorate. We have a relatively flat terrain; however, for the most part we have a good surface drainage. Internal drainage, however, in the flatter areas, ranges from good to very poor. Thatch and mat were excessive. The predominant diseases that we have are Fusarium wilt and leafspot. When we had prolonged periods of wet weather, wet areas would develop in low spots and sun scald would occur.

I would like to break our maintenance program down into several categories. These are mechanical maintenance, fertility program, fungicide program, herbicide program, irrigation, and seeding and techniques of renovation. The one facet that has helped our mechanical maintenance more than any other thing has been the ability to close our golf course on Monday morning and have only nine open Monday afternoons.

Our mowing schedule basically is four days a week - Monday, Wednesday, Friday and Saturday. We start mowing at 1" in the spring and try to work the mowers down to 5/8" by mid-summer. I believe that closer mowing allows the grass to dry faster and helps in our overall disease control program. When dew is exceptionally heavy, we drag off the dew with hoses and Cushman utility carts prior to mowing. Other mornings when we do not mow, we syringe the dew utilizing the automatic irrigation system.

In the past 5 years we have only dethatched our fairways one time. I feel that the majority of thatching that I have observed has done more harm than good. Aerifying has been very effective in helping us to control thatch. We use open tines in this procedure and, depending on soil conditions, aerify the fairway, then drag to break up soil cores, and then mow. Under certain conditions we substitute the use of a Mott Hammer Knife Mower to break up soil plugs instead of

the drag and follow the mowing with a thorough watering. We exercise caution to insure proper soil moisture, particularly in the hotter summer months, in order to minimize any damage. Over the past 5 years we have aerified as few as 6 times per season and as many as 12 times per season, again depending on the type of weather and amount of play we have during that period. We try to aerify from 2 to 4 times during the fall, and from 4 to 8 times during the spring and summer. We have spiked and sliced fairways on few occasions when soil moisture conditions were such that we were not able to aerify.

Since our course is old, each year a certain amount of tile is replaced and an effort is made to increase the ability of the golf course to drain. Whenever existing tile are located, they are inspected for condition and, if good, area drains are installed down to the tile to help increase a more rapid drainage of superfluous water. For the most part, the tile that have been installed have been of modified French drain. After digging the ditch, the bed grade is established with crushed stone. Then the plastic drain tile is installed, checked with a transit, and the ditch backfilled to the surface with crushed stone, 1/2" to 3/4" in size. This facilitates fast movement of water from the surface into the tile, and has been most effective in draining areas where water stands.

Over the past 5 years there has only been one season that we have exceeded 4½# of actual nitrogen per 1,000 sq.ft. in our fertilizing program. We have used as low as 2-3/4# of N/1,000, and have averaged 3-3/4# of N/1,000/year. Until the start of last season, we used a complete fertilizer with a ratio of 18-4-10. At the start of last season we prepared the reinstating of an arsenic program for Poa annua control. The basic fertilizer program used 2 fertilizers with ratios of 20-0-10 and 28-0-14. Again we will still continue to apply fertilizer in light frequent amounts (1/2# to 3/4# of actual N/1,000).

April	1/2#N			August	1/2#N
May	1/2#N			September	1# N
June	1/2#N or	July	1/2#N	October	1/2# N

Our intent is not to have lush turf, but to keep the potash high for disease resistance, better ball support and wear characteristics. It is most desirable to be prepared to fertilize and grow grass out of any period of disease and to keep the grass growing throughout the fall playing period until winter dormancy.

Leafspot is one of our most serious problems in the spring. Inspection during the last of February and first of March will give you how soon the first application should be applied. Lesions on old leaves don't indicate urgency, but lesions on new leaves and deep on sheaves indicate immediate action. Timely fertilizing to encourage growth -- with fungicide application.

The most effective way in which we use Acti-Dione RZ is with a combination of RZ and T.G.F. at the rate of 20 oz. RZ and 1 unit of T.G.F./acre. Daconil has worked effectively against leafspot and acts as a good cleanup fungicide for leafspot and transition into dollarspot. In the past, 1991 was used as a control over Fusarium, along with aerifying and wetting agent. Since we have recently converted to creeping bentgrass, the 1991 will serve as dollarspot control.

Tentative fungicide schedule for 1974:

Date	Per acre
Mar. 15 - 20	20 oz. Acti-Dione RZ, plus 15 oz. T.G.F.
Apr. 10 - 20	20 oz. Acti-Dione RZ, plus 15 oz. T.G.F.
May 1 - 10	20 oz. Acti-Dione RZ, plus 15 oz. T.G.F.
June 1 - 10	8 lbs. Daconil
July 1 - 10	2½ " 1991
Aug. 1 - 10	2½ " 1991
Sept. 1 - 10	20 oz. Acti-Dione R.Z., plus 15 ox. T.G.F.

In the past we have used Super-D Weedone and Banvel-D for broadleaf weed control on our fairways. The two most troublesome weeds have been white clover and knotweed. These infestations were localized. Knotweed was particularly troublesome in the late summer and early fall along the edges of fairways wherever Fusarium wilt caused a weak spot in the turf. Basically these weed sprays have been applied either in late May, early June, or in mid-September.

Balan Program

We have used Balan in the spring for crabgrass and Poa control and in the fall for Poa. Fall applications have been geared for late July or early August so that there is maximum protection during fall germination of Poa annua -- and so that the duration of material effectiveness allows fall seeding of desirable turfgrasses. We elected Balan instead of arsenic because of --

1. Poor drainage and frequent wet areas
2. Inaccurate accounting of past arsenic application
3. Too much mat and thatch
4. Cost is less per season

We shall embark on a limited arsenic program in conjunction with our fall Balan program because -

1. We have reduced thatch
2. Improved drainage
3. The Purdue test will help to give us better guidelines.
4. Have - residue Poa - that lives as a perennial

We will apply at light rates, avoid applying in known areas of poor surface and internal drainage, and be prepared to apply available phosphorus if needed.

Watering

Prior to the installation of our Toro Moist-O-Matic automatic irrigation system, we used center row - quick coupling valves and sprinklers. The night watering man could water all fairways in an evening's time, using 1 hour sets with an 808S Nelson Rainbird Sprinklers. During the summer when we experienced several days without rain, watering was on an every night basis. Now with the automatic system, we can apply light frequent amounts of water and adapt to various soil conditions.

Seeding & Preparation

The one good feature of thatching turf is exposing soil and creating a seedbed. We have tried several methods in attempting to obtain a most desirable seedbed preparation and final results. We now aerify the proposed fairway area at least twice in opposite directions. Using a disc seeder (McCormick small drain drill) we use half the amount of seed we intend to spread and disc seed either perpendicular to the fairway, or with the fairway. Then we wait approximately one week and go over the fairway in the opposite direction.

We have constantly tried to upgrade our bluegrass fairways until this year. It seems that over the past few years each of the newer bluegrass has susceptibility to one or many of the basic diseases that plague use -- this susceptibility seems to increase with age of the turf, and is particularly more noticeable when there is dominance of a species in a stand.

Pure stands seem to be hurt the most -

Merion	-	Fusarium
Windsor	-	Leafspot
Fylking	-	Fusarium
Nugget)		
Pennstar)	-	Seems to be holding well in a mix.
Baron)		

We eliminated more susceptible varieties and tried to introduce newer developments to our turf for the past four years.

This past year, 1991 was not effective against Fusarium wilt on bluegrass. Increase soil moisture was ineffective. Some scattered bent started to flourish and because of several real pluses we elected to overseed and convert our bluegras to bent. These pluses are:

1. Lower watering requirements
2. Can mow lower
3. Carts track less on hot days
4. Cost of chemical maintenance won't be appreciably more when compared to bluegrass
5. More disease resistance
6. Seems to tolerate excessive moisture.

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GOLF COURSE IRRIGATION

Mike McMullen, Eastern Rain Bird Sales Corporation
Peoria, Illinois

In the golf course irrigation field definite trends are being established that can be applied to all golf course installations.

The greens, originally as well as now, received the most attention due to their high maintenance cost and value to the golf course.

Early greens irrigation was accomplished by the use of the sod cup. The sod cup method had the disadvantages of poor water distribution since only one sprinkler was involved, the difficulty of finding the sod cup at night, and the possibility of digging up the green to repair a break in the pipe.

The next change in greens irrigation was to move the quick coupling valve from the center to just off the side of the green. Watering was then accomplished by using a roller base and hose, and moving the sprinkler to several sets each night. This method gave way to locating quick coupling valves on the perimeter of the green, usually four, and by operating different combinations of all four at once. The greens then, as well as the collar, were watered with good distribution and proper coverage.

With the advent of the underground sprinkler, the quick coupling valve and key were replaced and the green watering was controlled first by a manual valve and then finally by an automatic valve of some type. As you can see, with the exception of the very last method, all the above required labor, and since the watering was done at night, problems of control and accuracy were induced.

In the early 1960's the automatic system was developed. These first systems were generally hydraulic and had some inherent problems. The major ones were the normally open hydraulic valve, draining the tubing for winter shut-down and, in turn, getting the air out of the tubing during spring start-up, the tubing itself, filtering of the water for the hydraulic tubing network and selector valve, and the limitations of controller locations based on elevation differences.

These problems led us to the use of electricity for the control medium and the development of the fail-safe, normally closed valves. In the process, many of the aforementioned hydraulic problems were solved.

The early electric systems were wired with many valves per station to save on the number of controllers required, and these controllers were usually located at one site. This method of control created problems of long wire runs of large size wire, no visible sight control and decreased system flexibility.

To counteract these problems, we went to a single valve per station to increase system flexibility and scattered the controllers to provide visual control as well as reducing the length and size of wire required. Now, with scattered controllers, problems of controlling start-up, setting or reprogramming and rain shut-down were induced. These problems were solved by the introduction of the Master-Satellite System. The Master-Satellite System is characterized by the ability to have:

1. Central start-up and shut-down - either automatically or manually
2. A central indication of what is operating in the field
3. Syringe starts from a central point
4. Automatic rain stat control for rain shut-down
5. Visual sight control from field located satellites.

Other recent product developments include: valve-in-head sprinklers, moisture sensing devices, the use of valve boxes, con-

troller enclosures and prefabricated pumping stations.

In the future I see the refinement of the two-wire system, the possibility of a radio-controlled (no wire) system, and increased use of moisture sensors and fertilizer injectors at the golf course level. Also, due to raw material shortages (and rising costs) increased use of plastics will become evident. From a system design standpoint, fairway irrigation is now leaning towards double and multiple row systems rather than always being single row. There are numerous reasons for this occurrence.

Wider Fairway Coverage is Provided

Single row systems give an approximate wetted coverage of 180 ft. with an effective coverage of 140 ft. With double row systems, wetted coverage goes up to 200 to 220 ft., with an effective coverage in excess of 165 ft.

Reduced Application Rates Help Eliminate Drainage Problems and Surface Runoff

By using a smaller sprinkler in double row systems, the instantaneous precipitation rate is lower than that of a larger sprinkler used in a single row system. Many of our automatic irrigation system installations are on existing courses where tight soil conditions exist, as well as poor drainage systems. By going to a double row system, application rates can be reduced, thus allowing the water to infiltrate the soil with less puddling, less runoff and, therefore, fewer drainage problems.

Wind Becomes Less of a Deterrent to Uniformity

With a double row system, the sprinklers are spaced closer together and there are, therefore, more sprinklers in any one given fairway. Since the sprinklers are closer together, the wind has less area to work between sprinklers and will be less of a problem.

Uniformity of Equipment on Course and Ease of Maintenance

The smaller sprinkler used on double row systems lends itself to be used throughout the system - greens, tees and fairways. By valving the double row properly, usually 4 heads per valve, there exists a very good possibility that all control valves will be the same size. The superintendent then, by stocking a few internal assemblies and control valves, can repair any valve and sprinkler in his system.

With a double row system, it is normally possible to supply parallel fairways from the same main line. This reduces the amount of pressurized main involved in any one system, thereby reducing the probability of leaks occurring. Even when a main line cannot be shared between adjacent fairways, it will be located in the rough and, with the use of valve boxes, maintenance can be performed without damage to the turf in the major area of play, the fairway.

Double Row System Does Not Cost As Much as a Single Row System

Irrigation equipment (i.e., sprinklers, valves, controllers, wire), costs are approximately constant between a single row and a

double row system.

In designing a double row system less valves are used, thereby reducing the amount of controllers and wire required. There will be an increase in labor cost due to the increased amount of laterals used. With all the previously mentioned benefits of a double row system, the actual contractor installed cost is approximately 10% higher than a single row system.

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GETTING THE JOB DONE

James J. Kirchdorfer, Kirchdorfer Irrigation,
Louisville, Kentucky.

What does "Getting The JcB Done" mean? To me it means coordination among the people involved, working toward a master plan with dedication to achieve the goal - "The Completion." Many people believe the job "can't be done." In some cases and in some instances I have been tempted to agree. I thought it would be appropriate to list the major reasons or excuses why it can't be done:

1. Inclement weather
2. Labor problems
3. Poor coordination among contractors
4. Late delivery of materials
5. Defective material
6. Indecision
7. Construction equipment failures
8. Change in design, work, etc., causing delays
9. Unrealistic schedule
10. Bad luck.

Some of these are under our control, and some are not. However, with a good plan, with good coordination and making the proper decisions throughout as the job progresses, all can be overcome.

Enough about the negative because with this type of thinking, the job will never get done. A positive approach must always be taken. As we said before, "getting the job done" means good coordination among the people involved, working together toward a master plan.

With regard to irrigation systems - this starts with the initial thought of a new system, and continues with the decision as to the type of system, approvals from club members, Board of Directors and/or club owners, selection of equipment, contracts, financing, installation, operation and maintenance. The plan should be set out in the beginning with complete agreement of all involved, and the responsibilities of each completely defined.

In the construction of a new golf course, the irrigation system is only one part of the total construction project. It is equally important and should be well planned in the beginning. It must be well coordinated with the other construction phases. Just as the mechani-

cal contractor of a building cannot complete his phase until certain parts of the building are complete, the irrigation contractor cannot install his system until certain phases of the golf course are complete. There is always an ideal plan where the project is completed as designed. However, because of the situations mentioned earlier, this this cannot always be followed exactly. The closer this is followed the more efficient the project. Efficiency gets the project completed with less energy, which is related to time and cost. Therefore, the keys to getting the job done are:

1. Good accurate planning
2. Understanding by all involved of their responsibility and how it fits into the total project
3. Ability to adjust accurately and quickly as problems arise to fit the total project.

In addition to these, it is, of course, important to have competent construction personnel; the proper construction equipment; quality construction materials. Without the good coordination and planning in the beginning the quality of the labor, equipment, or material is meaningless.

The quality of the irrigation system is better rated by the planning than the labor, construction equipment, or construction material because the planning will set up coordination at the beginning as a guide for the installation to follow, and have procedures to keep the job progress in order.

In summary, I would like to re-emphasize the importance of getting all people involved working together, communicating, and discussing situations as they arise, keeping in mind the ultimate goal - Completing the Project. As in the case of golf course irrigation system, the project is a Better Golf Course.

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MODERNIZING IRRIGATION - I CHANGED SYSTEM

Jim Maxwell, Supt., Rail Golf Club
Springfield, Illinois

Water - a golf course's existence depends on this more than any other single item. Superintendents sit up nights worrying about water - will it rain! Should I syringe! Is my water supply adequate! Is my system functioning properly! Is the night water-man doing his job!

A water system is something that has to be lived with night and day and handled like a baby. No matter how many people are involved you, the superintendent, are the chief. The planning and operation of a successful irrigation system is the result of many hours of planning, technical knowledge, investigation, other's experiences, product information, and most important the requirements necessary to fulfill one's own situation. All revert back to you to assure the success or failure of your system.

At the Rail Golf Club, a typical Robert Trent Jones design, with large high bunkered Penncross bent greens (Avg. 9-10,000) sq. ft., long tees with Astoria bent (Avg. 8,000 sq.ft.)., with total fairway length of 7,100 yds., spread out over 240 acres. Nine holes were completed in 1970 and are operational, utilizing a hydraulic, automatic tee and green, with manual single row, quick coupler fairway system. Construction was completed on the second nine holes in the fall of 1973 with anticipated opening about May of this year.

Much thought was put into what water system would give us the total results we desired for a completely green golf course. Contact was made with numerous irrigation companies, with many conferences following, each presenting their product's designs and technical information, and most important acquiring our ultimate desires, wishes and requirements.

Since we were under contract to R. T. Jones for total course design, their irrigation specialists submitted several alternate designs for our approval. After many more long meetings with the architect, irrigation supply companies and different contractors, a definite design was decided upon. The final decision was the 2-wire Binar controlled, with Buckner valve in head, double row fairway system for the complete 18 holes.

Bids were then accepted from different companies ranging from $ 72,000 to $ 194,000. The initial bid accepted was $ 96,000, not including a new pumping station which would be necessary with the increased water demand. Since there wss a definite possibility that the actual field installation would differ from the architect's conception, an agreement was reached with the contractor that all equipment would be listed with a unit price, plus installation on the contract agreement.

Work started on the new course with the general contractor's completion of final grade levels. Trunk lines were installed first as soon as fairway grade levels were final. Tee and green lines were then run when finish grade and drains were installed. Risers and heads were installed on tees and greens just before final seedbed establishment and left extended about 10 - 12". The system was tested as installation progressed.

The old course system was converted in phases. Many things must be considered when converting an existing system. Water must be available at all times. Play must not be interrupted any more than necessary, and above all you do not want the course completely dug up. You must consider the possibilities of using existing pipe.

Fairway pipe was pulled in in 180 ft. sections along the outer borders of the fairways, parallel to the existing trunk line, which runs down the middle of the fairway. Where it was necessary trenches were used being back filled and tamped when one half full, and again when filled completely. All pipe was either pulled or laid at a 24" depth. Single row heads, from tee to first double row, are spaced 80 ft. apart, using 1/2" nozzles. Double row heads are spaced triangular on 72 ft. altitude and 90 - 95 ft. latitude to the front of greens, using a 5/8" nozzle. A total of 430 Buckner 8570 with valve in head, normal closed were used for tees, greens fairways and range.

Where pulling was possible wire was installed approximately 6 - 8" from pipe. Where trenches were used wire was laid either under or beside pipe, making sure that large loops were left at all corners and splices. A total of 130,000 ft. of wire was used. A total of 36,300 ft. of pipe was used ranging from 10" transite and 6" down to 2" PVC slip joint and solvent weld, plus an existing 14,600 ft. of pipe already underground. All wire splices and connections were soldered with screw cap insulators and sealed in epoxy packs.

Greens used a total of 81 heads, with 92 used on tees. Factors of sprinkler head placement can be a serious problem due to considerations of wind direction, tree placement, bunker locations, and other individual factors.

A new pumping station was constructed in a specially designed environmental controlled house next to our No. 4 lake. A 4 ft. wide by 12 ft. deep wet well was dug under the pump house, with direct horizontal entrance from the bottom of the lake.

Two 50 H.P. and one 20 H.P. Jockey-constant pressure pumps were installed in parallel design to start intermittantly on increased G.P.M. demands. Each pump requires three phase 240 volts with approximately 50 amps starting requirement.

A 1,000 gal. Well-X-Troll pressure tank maintains constant uniform line pressure due to distance of waterline from pumps, reducing head loss approximately 20 G.P.M. at furtherest point. With the installation of the new pumping facilities in addition to our existing facilities, we have a potential output of approximately 1500 G.P.M. The new pumping system incorporates a model 92-02 G Clayval on the downstream side to maintain a constant 110-120 P.S.I., one-way check valve, vacuum control valve for each pump, and a return line to the lake in case of micro-switch malfunction.

All risers are 3-elbow galvanized, which come off the side of the trunk lines. All turns, ends and risers 4" and larger are backed by poured cement walls, and 3" and less are backed by 16" x 4" cement blocks. All splices, decoders and R.M.C.S. are fitted in underground Amtex boxes. Valves are encased in adjustable two piece boxes with covers.

The course is set up in 9 manual gate valve zones, allowing the flexibility of isolating any two fairways independently for repairs if necessary. In addition the existing 9 holes has a manual control valve at the entrance to each green.

Our control station is identical to the pump house, centered approximately in the middle of the golf course, close to the clubhouse and my office. We utilize 8-Binar CP-1 programmers which control 8 different zones with 25-29 stations in each zone, controlling two heads per station. There are 27 remote control field stations for special or individual water requirements. An automatic syringe cycle of 3 minutes each is set for 5:00 A.M. each morning and can be manually activated for a mid-afternoon cycle.

Water supply is the biggest problem for a golf course. To purchase city water would have been quite prohibitive, so wells were the answer. It was necessary to run 6,200 ft. of 6" PVC slip joint pipe

to 2-24" cased wells we leased close to the Sangamon River. It was necessary to install 2 - 60 H.P. volume pumps with intermittant operation to provide 600 G.P.M. to maintain a constant level in our 5 lakes. An estimated cost of $ 68,000 was obtained. By doing most of the work ourselves we completed the job for approximately $ 28,000.

Problems can be encountered with any system. With so many systems on the market today, who can say which is best. Everyone has his own choice as to what he feels would satisfy his situation, and also give him peace of mind. But remember, if you are building, rebuilding, or changing your system you are the chief and should be involved more than anyone else.

In my personal opinion construction is the key word. It can make or break a system - stay on top of the complete project. Learn why, when and how they are doing every little thing - it might become a big thing later. If you disagree with something the contractor is doing, say so. I have found the contractor is willing to help make your future as trouble-free as possible. Make sure you acquire a guarantee in the contract covering the complete system. We have a 3-year guarantee covering ours.

As I mentioned earlier, the cost of actual construction can vary with actual field variations of a project. Our system increased from $ 96,000 to $ 135,000. Adding this to the cost of our lake water supply system, pumping station and control house, the total final cost will probably amount to $ 200,000.

My situation at the Rail Golf Club is probably different from most of your positions. In addition to the 18-hole golf course I have to constantly keep in mind that this system would eventually be used to irrigate 500 home lawns. The prime concern was the ultimate in an irrigation system. We are confident that we will achieve it when the project is completed.

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SERVING TURF NEEDS TODAY FROM MANUFACTURER TO OPERATOR

Johnny Bozarth, Cushman-Ryan
Shelby, N. C.

The turf industry today is made up of a very dedicated group of people representing various companies who are going all-out to provide the best possible equipment to do a better job with less labor costs.

Labor costs have risen quite a bit in the last five years. However, the cost is not always the governing factor. Labor is just not always available in some areas, so the alternative is more automated equipment. Basically the approach is to pool your resources. A lot of engineering time is required to develop and test various new ideas in turf equipment. Some products have required as much as three years to develop and test before introduction to the market.

All the major manufacturers must have this type of equipment testing to build a quality product. Engineering, and development manpower requirements and the transportation requirements a manufacturer has to solve to deliver a finished product are costly. A manufacturer must also have a good dealer organization to sell and service his products. The dealer must have a product to stay in business to sell to you; to service the product properly, and be able to stock replacement parts. Also, he is faced with supporting a good functional service department where again costs are constantly rising due to the hiring of good mechanics.

Another function a good dealer performs will be to expose the product line. To this end he will be holding field equipment demonstrations to display and demonstrate his products. You should all support these equipment displays as they will keep you abreast of all the new equipment available to you. Quite a few dealers will periodically hold service clinics to keep the user abreast of all the requirements for a good maintenance program. These are handled by qualified dealer and factory personnel.

Another function a good manufacturer must perform is to have a good factory service department to serve both the dealer and the ultimate user. Quite a few manufacturers have traveling service personnel as well as sales personnel.

Most manufacturers will have service schools to train dealer personnel and customer personnel. This service is coming into great demand. We at Outboard Marine have the schools available. Contact your local dealer for details. Costs are very nominal. Manufacturers also participate in all the leading dealer shows to better present their product lines.

Now, the next portion could be titled "Woman's Lib in the Grounds Maintenance Labor Market." We point out what Mr. Arlin Grant is doing at Innesbrook at Tarpon Springs, Florida. Arlin has a total of 60 employees maintaining three 18-hole golf courses. Out of this total amount of employees, 35 are girls. He says his best laborers are between the ages of 20 - 26 years of age with family responsibilities. They are a very neat appearing group, each wearing the same uniform. They operate all the equipment used, including tractors, mounted mowing systems, and do the various jobs necessary to a good maintenance operation.

Last, but not least, problems of procurement of maintenance equipment and replacement parts have become quite critical in the last 12 months due to shortages in items needed to complete the manufacture of the finished product. Often a local dealer might be planning to sell equipment when in reality the manufacturer does not have it available. This can be somewhat alleviated by more advanced planning on requirements. It's getting to a point now where, in all manufacturing, the anticipation of needs down the road will have to be made a lot earlier.

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MY EXPERIENCE IN TURF CARE AT PURDUE UNIVERSITY

Nick Rush, Supt., Turf Care
Purdue University

Grounds maintenance at Purdue involves the care of 650 acres, including areas around classrooms, dorms, Purdue Airport and regional farms. My particular section involves 12 full-time people in lawn construction and maintenance. Summer crews may run in excess of 40 people. Areas of responsibility include building new lawns, mowing, irrigation design and installation, lawn pest control, and consulting for regional campuses.

One thing we have recently become involved with in the Grounds Department is the PURR-WICK System, which I'm sure many of you are familiar with. The Grounds Department decided to build one as an experiment. On the north side of the new Chemistry Building we had a unique situation -- the old sidewalk was also a tunnel top. Purdue's architect felt the tunnel could withstand a constant pressure such as a mound of earth, but couldn't withstand a sudden pressure such as a fire truck.

Our past experience had taught us that problems could develop when trying to grow grass over a tunnel filled with steam pipes. We decided to insulate with styrofoam, 4' x 8' sheets, 2" thick. We used 10 mil black plastic and 2" perforated drain tile. Our sand was a #3 special. After the sand was compacted we were ready to landscape. Besides bluegrass sod we also planted barberry, purple leaf winter creeper, and rugosa rose. The planting was just completed last fall and it is too early to form any definite conclusions; however, everything looks good.

A great deal of our time and effort is involved with construction. An example of our work is the steam line which was built last year. We salvaged the sod before construction began, as we often do when practical. The contractor finished his work and left us with one foot of topsoil and a rough grade. We took it from there: finishing the grade, fertilizing, sodding and watering. Construction usually involves one eight-man crew working late March through early November, weather permitting.

Because of the volume of construction, we decided many years ago it might be advantageous to grow our own sod. We maintain a 30 acre sod nursery, using a bluegrass mix consisting of Park, Delta, Newport and Merion. We are also considering including one of the new pedigreed ryegrasses, Pennfine, in our mix. Our construction work each year requires the use of about ten acres of sod.

One of our biggest problems on campus is footpaths. Most of them can be attributed to 2 things - hurried students and poor design. After numerous studies we have found that sidewalks aren't always the best answer. Through good landscaping and proper design, paths can be controlled by extending plantings out from the edges of the buildings to the main sidewalks, as one example. Other solutions may be a curved radius rather than a squared corner, installation of fences, concrete walls, and earth mounds.

Mowing is another of our big responsibilities. We employ 20

operating everything from a 21" lawn mower to a Jacobsen F-10, to be able to mow all the lawns on a weekly basis.

One question frequently asked me is, "What do your crews do in the winter months?" One of our main responsibilities is to be prepared for snow removal. Lafayette, Indiana usually doesn't get a great deal of snow, but this year has been the exception. The 19" snowfall we had in December kept our crews working around the clock for several days, and we have had several smaller snowfalls since then. Normally we spend the winter months supplementing our regular seasonal operations, accomplishing such tasks as grubbing stumps, backfilling low spots, dormant seeding, cleaning fence rows, and even installing slit trenches in some wet areas.

Working at Purdue has given me a wealth of experience. I've been right next door to the experts, and I've had an opportunity to observe and learn from the various operations going on in other areas of the Grounds Department. The dynamic aspect of a university atmosphere provides ever-changing opportunities and challenges.

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INDUSTRIAL LAWNS & TURF TECHNOLOGY

C. Thomas Douglass, Caterpillar Tractor Co.,
Mossville, Illinois

Caterpillar, as well as many other industries, realizes the importance of a neatly groomed and well-maintained landscape. By having a nice outward appearance industry serves the community through beautification, and welcomes visitors to the facilities. Industries are now spending millions of dollars in landscape trying to achieve these goals. The advantages of these dollars are lost if areas are not properly maintained to foster their aesthetic value. This is where we, as grounds maintenance personnel, take over the task of providing plantings with the best possible care.

The area maintained in the Mossville complex is approximately 250 acres of bluegrass spread over three facilities; 45 acres are covered by fully automatic irrigation. Six thousand flowers and eight thousand bulbs are planted annually to provide color throughout the growing season. Interspersed between buildings and roadways lie two thousand trees and shrubs. Five full-time and seven part-time (summer months) employees maintain the compound on a year-round basis.

A well-rounded grounds maintenance program can be broken down into four categories: efficient and effective use of personnel, proper selection and replacement of equipment, safe and prudent use of chemicals, and good irrigation programming.

Efficient and effective use of personnel plays an even greater role in industry as Caterpillar now pays over $ 5.00 per hour for grounds labor. Caterpillar grounds work is broken down into areas of responsibility with employees maintaining one area throughout the year. This concept instills pride into workmanship for an employee can

readily identify with accomplishments and is easier to supervise for he knows his area and what is expected from him.

In making area assignments in the spring, care is taken that permanent employees are on critical equipment so yearly training on proper gang mower use and chemical application is kept to a minimum. Of the 12 people, 8 cut grass continually. These 8 are broken down into 2-man mowing crews, maintaining one given area throughout the year. A 2-man crew is further broken down into one employee trimming around trees and curbs, while the other cuts open areas with reel gang mowers. Areas are to be cut and trimmed twice weekly. One employee is to maintain flowers and bulbs throughout the complex. Another man is to care for all trees and shrubs.

Keeping rock areas and perimeter fencing weed-free, combined with chemical application, comprises another employee's responsibilities. The final employee is to do miscellaneous tasks and fill in for absent personnel. Employees are encouraged to be particular for the grounds are maintained in a formal fashion.

In the initial establishment of areas, work was laid out as 40 hours per week per area, overtime to be used to recover days lost to rain. Rock mulches around buildings, in group plantings, around tank farms and under fences reduce trimming and thus save labor. The purchase of blooming annuals in peat pots delivered and planted with bulb planters or cup cutters also saved initial planting labor costs.

Equipment plays a vital role in maintaining a well-groomed complex. The proper initial selection will pay high dividends when put to the appropriate use. Our mowing equipment was selected with the following criteria in mind: abundance of curbs, dense plantings throughout, high height of cut (approx. 2 inches), and ability to withstand continuous use over large areas. With these factors in mind, a hydraulic gang mower with blitzer units cutting in front of all wheels was selected for large areas.

To trim curbs and around trees working with the gang mowers, a 14 hp lawn and garden tractor was selected to complete a 2-man mowing crew. To retain a formal appearance, sidewalks and curbs needed to be edged. With over one mile of sidewalk and eight miles of curb, a tractor mounted curb dresser accomplished the work in one day. A gandy line tender was ideal for applying soil sterilants to building perimeters and fence lines. It gave precise metered amounts uniformly over required areas.

A dense tree population made cyclone fertilizer applications the quickest and most uniform method. When high usage is a factor, an equipment replacement program becomes essential.

Our tractor hydraulic gang mowers are traded every four years. Triplex every three, and lawn and garden tractors every year. If equipment is traded before major problems or repairs start occurring, less down time during the critical mowing season will occur. For us, down time is recovered by overtime which is paid at time and one-half. With this in mind it is essential we have the proper equipment in excellent running order.

Fertilizer is purchased in one lot for three drop shipments during the year. Plant food is applied at the rate of 5 lbs. of nitrogen per 1,000 sq.ft. to irrigated areas, and 3 lbs. nitrogen per 1,000 sq.ft. to non-irrigated ones. These applications are made in 1 lb. of

nitrogen increments with the first containing benefin for crabgrass prevention.

Broadleaf weeds are controlled by fall application of an amine form 2,4-D and dicamba. Insecticide and fungicide use are restricted to an as needed basis rather than preventative programs due to the low presence of insects and disease. As previously discussed, soil sterilants are used in rock mulches, but extreme caution has to be exercised to prevent runoff damage. All chemicals purchased are required to pass a hazardous material committee for application and storage safety. We feel chemicals used properly can be labor saving devices.

Irrigation programming is set up with criteria such as: fire protection water reserve during day shift operations, shift change times, car parking routine, pedestrian traffic and application desired. Watering during day shift is not allowed because of the insurance requirements for fire reserve. When automatic timers are set, care has to be taken so as not to have sprinklers running on sidewalks at night shift change. Watering adjacent to parking facilities is restricted to after 9:00 P.M. and before 5:00 A.M. Miscellaneous pedestrian traffic is also considered so as not soak people making routine inter-building trips. Applications desired takes into account head selection for automatic irrigation, and irrigation-type such as flower beds where soaker hose may be the best suited. Irrigation selection is accentuated because the area is extremely sandy.

Industrial grounds work has some disadvantages which might not be encountered in other areas of turf maintenance. Salt damage adjacent to sidewalks from snow removal poses a replacement or rejuvenation problem. Steam lines which keep soil temperatures too hot for bluegrass and require Zoysia plugging are a second problem.

Another is personnel turnover. At times changes in 3 to 4 employees per month is not uncommon. And finally, many other employees inquire as to what you are doing, and if they should be doing the same on their home lawn.

Industrial lawn work has its advantages too. The grounds maintained have no traffic except grounds equipment. Being a large expanse in open country keeps disease almost non-existant. Volume of irrigation water after day shift is immense. Five wells ranging from 750 gpm to over 1000 gpm provide the necessary requirements. As a backup, a well-trained and staffed maintenance department stands ready for equipment and irrigation repair.

As you can see, industrial grounds maintenance poses different approaches to different problems than most other work in the turf areas, but can prove to be very rewarding through the gracious appearance of well-maintained landscape.

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CLEAN SEED, THE HOW AND WHY

Paul Florence, Turfgrass Specialist
Marysville, Ohio

Traveling turf men visiting golf courses and sod farms encounter many interesting sights. Some may be desirable, but some are definitely not so desirable! Among the latter are the species of weed contaminents known to all, which for no reason appear in turf seeded from carefully tested seed supposedly free of the pests. We have even found annual rye in bluegrass fields. There is really no mystery - you get just what you pay for. Stringent weed control in seed fields is essential and great strides have been made, but the costs are high and many chemicals are scarce.

Visitors to the seed country may be more inspired by the bulb fields, or the scenic waterfalls along the Columbia than the farmland along the Snake River, or the Willamette. There are extreme differences in elevation and micro-climate often encountered. In the Snake River area the plateaus and slightly rolling land are ideal for seed as well as wheat. The annual precipitation is 18 inches, requiring a summer fallow program between crops, but also preventing many weeds found in the areas of higher rainfall. The rangeland can get so dry in late summer that the cows even stay in the barn!

The palouse country of Eastern Washington is noted for its moderate climate, fertile soils, and large seed or wheat farms. This is the area for large fields, 200 to 500 acres in size, and the use of large equipment - 30 ft. wide harrows, drills and spreaders pulled by crawler tractors. This is and has been for several years wheat production country. With an average rainfall of 18 inches wheat is an alternate year crop. The land is summer fallowed between crops. Bluegrass is planted using a press drill with disk openers on 3 or 4 inch centers. Squadron hitches are used to seed a swath of 30 ft. or more in width. In other areas growers may use a special planter of small vegatable drills on a small tractor and plant in 20" rows. Most fields are established with only 3 lbs. per acre seeding rate.

The first year in the life of a new field is devoted to careful fertilizing and herbicide programs. Even the W.P.A. standard, the hand-hoe, comes into use. It is not uncommon to see the entire family covering a field row by row, chopping out the off-types and the tough weeds.

As the seedheads begin to develop, his crop prospects are carefully evaluated by the farmer and his fieldmen. Crop prospects depend upon the number of plants per sq. ft., number of seedheads per plant, and the "fill" or seed set. This process is much like the soybean or corn farmer's guess in the Midwest.

In the Spokane valley area, seed growers have another problem STONES, large stones! Field surfaces may be lowered 12 to 18" by the removal of these large stones. The stones are dumped in windrows around the field border and make permanent fences. The soil, after stone removal, is still over 80% stone. That's more stone than many midwestern drives, including mine!

Weed control is important. The entire seed crop can be jeapordized by the wrong rate or the wrong timing of some herbicide, especially the phenoxy compounds. Insects are also a problem, and the damage from an alfalfa aphid or thrip is readily visible. Some insecticides have been banned, and one of the best controls, burning, will be banned after 1975.

When the seed begins to mature the farmer must keep a daily watch. With the moisture in the 20's the seed is carefully cut and placed in the swath or windrow. In south Oregon the ideal weather conditions and ample irrigation water can produce straw up to 50" in length, and clean seed yields of up to 2000 lbs. per acre. One of the climatic factors beneficial to high yields is the cool air sweeping down off the snow-capped mountains at night, moderating the temperature and humidity.

Special combines are used in the rolling country. They are the self-leveling or hillside type,capable of keeping the cylinder and straw racks level regardless of the slope. The extremely short crop this year due to the drought resulted in many fields not even being harvested. When 100 ft. of windrow is producing a ball only 24" in diameter, it isn't economical to operate the equipment. Some fields are now growing wheat, a very competitive crop at $ 6.00 per bushel. In the Spokane valley alone it is estimated that over 1000 acres of Merion have been converted to grain this fall.

After combining, the fields are burned. This is wheat country so fire is a real threat. A plow is used to make a border, then a special trailer is used to set a fire around the field. As the fire advances it creates an updraft and a 200 acre field burns very rapidly.

After the fire a man drives over the field and scatters any trash not completely burned. This is vital to ensure that no insect or disease spore survives the flames. Looking at the scorched earth it is hard to imagine anything surviving, yet after a shower and fertilizing the field is again covered with a green mantle of new growth.

It is critical that the heat not get too high or severe thinning will take place. This year, due to the drouth, many of the crowns were destroyed and the fields remained black and charred long after they should have been green. Late in the fall the growers began to plow out those fields which were still black.

Another problem arose in the fall when it became apparent that the plants were not developing the seedhead primordia as they should have. As a result, more seed fields were plowed out and planted to wheat. I don't think it's necessary to draw you a picture of the effect on seed prices resulting from this, especially if you have priced or tried to buy any seed recently. The increased use of contract production of proprietary varieties, extremely high interest rates, uncertainties in the export market, the confusion emanating from Washington piled on top of the drouth, have all combined to make this one of the strangest periods the seed industry has ever seen. The oldtime experts and the pros are all very cautious in their estimates and in their projections at this time. We know for a fact that the good lots of elite varieties are scarce and are going to be expensive.

Alternate methods of straw disposal are being studied and one potential solution is to sell it to Japan, who needs it and is willing to pay for it if we can develop an economical shipping program, such as large bales.

Farm run seed is stored in large bins until the cleaning process begins. Large trucks haul the seed to the processor, and the task of removing the clean seed from all the trash begins.

There are roughly three parts to a seedhead. The lower third emerges first and has the advantage of adequate moisture and nutrients in a normal year. The center emerges next and may be just as good if everything goes well. The upper third is last to emerge and gets shortchanged if we have a year like 1973. The crop is not only short, the quality may leave much to be desired. This year we will see more multiple florets and lower purities, for example, than normal. There can also be a problem in the germination due to the drouth at flowering time.

In summary, I can only say that my crystal ball is no better than that of many others. I do predict a bullish seed market this spring, however, with Merion going as high as $ 2.25 to $ 2.50. Fylking may increase 5¢ to 10¢ per pound, depending upon the area and the demand. The lesser known, or satillite varieties, will follow along with some increased usage, whether justified or not, due to the price adjusting ability of the owner seed house. It's always easier to peddle a dog in times of short supply, especially if you can blend it with a well-accepted variety. The commons are above a dollar a pound now and show no signs of dropping back to the 50¢ area.

Good seed is available, but expensive. Buy wisely and early!

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SPRAYING - GET THE JOB DONE QUICKLY

Larry E. Fisher, Howell, Michigan

It is most important that the chemical manufacturers instructions be followed correctly when spraying their chemicals for the various turfgrass pesticides. Correct measurements and directions must be followed by the sprayer operator when applying the necessary chemicals. We all know chemicals are expensive; over-usage causes damaged turf, and under-usage causes waste with little or no control.

The areas to be treated in turfgrass spraying may be relatively small areas, such as lawns, and large areas such as golf courses. To start our spraying job, we turfgrass spray operators must know what size areas are to be sprayed. We must measure this area before spraying. Many of these areas are irregular in shape. Many resemble a typical golf course fairway and green, while this same odd-shaped area could just as easily have been a lawn or any landscape.

Many recommendations to turf managers for use of chemicals are on a "gallons per 1,000 square feet" basis and many other recommendations are on a "gallon per acre" basis. Equally imprtant as correct measurement of area to be sprayed is correct sprayer calibration in order to get the spraying job done quickly. Sprayer calibration requires that we must know -

1. Number of gallons per acre (or number of gallons per square feet)
2. The speed (M.P.H.),
3. The amount of pressure (PSI)
4. The type of nozzles (Orifice size)
5. The height of nozzles
6. The angle and spacing of nozzles

This information is quickly taken from Spray Systems Selection Chart.

There are three ways to get the spraying job done quickly:

1. One way is by a gun sprayer.
2. Another is by the Boom sprayer
3. The third is by the Air sprayer.

The shape and type of terrain will dictate which type will get your spraying job done quickly for you. The Gun and/or Boom sprayer makes an excellent herbicide sprayer.

If you do use one sprayer for spraying herbicides, fungicides and insecticides, you must clean out the spray tank. For good sprayer maintenance we recommend you clean out the tank with ammonia or Nutsal. By all means always clean a tank when changing to a differnt type of spray solution.

For lawn establishment, and for "out of the way" spraying areas, such as spot spraying around shrubs, plants, buildings, and trees, etc., the Knapsack sprayers, which is a gun sprayer, are still the most useful, practical and ideal sprayer. Good spraying habits must be used at all times. No-drip nozzles prevent excessive spray material from dripping on turf after the sprayer has been shut off.

There are two nozzles with the following spray patterns:

Hollow cone - Preferred when spraying garden plantings, shrubs and trees. It provides a fine spray giving good penetration and coverage. Usually used for two crop insecticide spray.

Fan - The Tee Jet Nozzle Flat Spray Tips are most used on turfgrass areas causing a "broom" effect, and causing less drift than cone shape as spray particles are heavier and larger.

A good fungicide sprayer is the Air Sprayer which gets the spraying job done quickly. An excellent way is to spray one side of the fairway with an Air Sprayer, keeping the tractor on the rough. Naturally you spray fairways from both sides. The terrain does not need to be level as the Air spray follows the contour of the ground.

There are sprayers with low pressure piping systems that can be used to get operating pressures down from 200 PSI to low pressures of 20-30-50 or 60 PSI. At these low pressures you could use a boom with the air sprayer. (Maximum sprayer on pump pressures is 500 PSI, but normal air usable pressure is 200-250 PSI).

Air spraying on fairways saves time and gets the spraying done quickly. One 7-' Air blast sprayer attachment covered an 18-hole golf course spraying the fairways down one side, coming back on the other side. Also, one side spraying allows an overlap of spray in the middle of the fairway.

Early morning spraying (6:30 A.M.) allows the operator to beat the crowds of golfers, also allows the morning dew for better sticking of the chemicals. It also allows the tractor to be used for other work during the day. It is possible to spray 18 fairways in 4½ hours, including fillup time.

It is possible to nozzle to a useful spray pattern of 20 GPA, sometimes as low as 10 GPA. Another use of an Air sprayer is as an insecticide applicator. It can be used to spray small trees and shrubs. A gun can be added for spot-spraying. With correct air attachment it is possible to reach greater heights for Air spraying of shade trees.

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IBDU AND MY EXPERIENCES

Cliff Helwig, Swift & Company
Indianapolis, Indiana

IBDU is the registered trade mark for Isobutylidene Diurea, a relatively new controlled release nitrogen source. It is manufactured by combining Isobutyraldehyde and urea to yield the most effective source of water insoluble nitrogen. The analysis of IBDU is 31% nitrogen with 27.9% slow release, or water insoluble nitrogen.

How does IBDU release? Up to a point, the higher the soil moisture the further the release rate of IBDU. However, since the release rate of IBDU is limited by its solubility, it will only release at a certain maximum rate - no matter how wet the soil becomes from watering or snowfall.

Does the soil temperature affect IBDU? Unlike UF fertilizers, IBDU is not substantially affected by variations in soil temperature. There is only 25% variation in release rate with IBDU from 40° to 80° F. No bacterial activity can affect IBDU because IBDU is released by hydrolysis.

IBDU comes in different sizes. Screen sizes start at -20+50, -8+20, -6+10, -3+6, 5/8" x 1/2" x 1/4". Basically the only two sizes available are -20+50 and -8+20 screen sizes which are labeled fine and

coarse. These two sizes are also used in Par-ex mixed goods as 24-4-12, which has coarse IBDU, 20-0-16 which has fine IBDU.

In a laboratory test, a finely woven cloth was made into small bags and in each was placed equal portions of actual nitrogen (0.2 gm). The urea dissolved readily and crystalized as it dried - its normal salt effect. The Uramite shows some salt (the limited urea present) and some fines. The last dish is IBDU very little salts and fines.

In these series of slides you will see Dr. Paul Rieke point out his ratings and comparisons at Michigan State. Most striking among ratings at Michigan State is the importance of having water soluble nitrogen in fertilizer early in the season. This can be seen where 24-4-12, 24-4-8, 24-0-12 showed a lot better in the early seasons against all other slow-release nitrogens.

Dr. Rieke points out that IBDU or other slow-release nitrogens perform great later in the season. From this information I can now say that with the IBDU program you have an even fertilizer flow. There will be no dropping off if you use IBDU mix goods, and in June come back with straight IBDU.

At the Purdue football field we have used the IBDU program for three years. Here we use 3 lbs. of nitrogen in spring, with another 3 lbs. of IBDU in August. This will give us a long dark green color for late fall games.

The next unique experience was feeding new sod from the finished grade. What I did was to get the grade finished before I laid my sod. I put down 5 lbs. of N of 31-0-0 coarse, then I put my sod on top. Using this method I then laid the sod, and then topdressed with 1/2 lb. of 24-4-12. I would like to say that I did not need to fertilize this lawn for 1½ years. We then did the same thing here at Purdue, using the real large IBDU pellets - they lasted 3 years.

It was a real surprise to see a dark green turf in January in the PURR-WICK System. Because of the control slow-release of IBDU my home lawn is a dark green all year around.

In summary, I feel that we can say that IBDU is not a slow-release nitrogen but a controlled release nitrogen. The reason I say controlled release is because the rate of IBDU is so even and predictable. It is not necessary to take into consideration any interferring conditions such as temperature and weather that may alter the release of other slow-release products.

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INSECTS, TREES AND ORNAMENTALS

Prof. Donald L. Schuder, Dept. of Entomology
Purdue University

In solving insect problems on ornamentals you should follow the same procedures used by the medical doctor. First develop a case history, or maintain a log of your operations. Secondly, examine the plant attacked and study its symptoms. On the basis of the first two

procedures make a diagnosis of what is causing the problem. Describe a corrective procedure or recommendation. Apply the control. Finally follow up to be sure the problem is solved.

The common sod webworm in Indiana is the larger bluegrass webworm, Crambus trisectus. The insect is capable of destroying areas of turf because of its large numbers and the fact that each larva consumes about 18 ft. of grass stems to complete its development. When examining injured turf to determine if sod webworms are involved, always examine the edges of the damaged areas. The central denuded areas will seldom contain the larvae.

The ideal time to apply treatments to prevent sod webworm damage is between May 15 and June 15. Granular formulations in most instances are more effective than sprays. The chemicals found to be most effective in preventing sod webworm damage are Dursban, Aspon, Phosvel and Spectracide. Use 2 ozs. of actual toxicant per 1000 sq. ft.

In the fall of 1974, EPA's new label law goes into effect. After that date it will be illegal to apply any pesticide for any purpose other than listed on the label. Since turf is considered to be a minor crop, the chemical companies cannot afford the cost of labeling minor usages. It may require a lot of imagination to treat insect problems in the next few years. For example, Dursban and Aspon are not labeled for sod webworms. They are, however, labeled for ants, chinch bugs, cutworms, etc. Since some of these insects are always present in turf, you treat for them and as a side effect control the sod webworms too.

Whiteflies have become a serious problem on bedding plants the past couple of years because they have developed resistance to many insecticides formerly used in their control. Some new materials which show promise for control of this pest include: Resmethrin, Imidan and Orthene. Some of them will not have label clearance for whitefly control, but most are labeled for aphids.....there are always some plant lice on nearly any planting of bedding plants.

Cool temperatures in the early spring months have a definite effect on the performance of pesticides. Cool temperatures depress the effectiveness of phosphate insecticides such as malathion. In the early spring it would be wise to substitute a carbamate or chlorinated hydrocarbon material for early season application. The miticide Kelthane is more effective than Tedion at low temperatures. For this reason use Kelthane when treating needled evergreens for spruce mite control in April and May.

The first male Gypsy moth has been found in northwestern Indiana. It has also been found in neighboring states. This insect in the caterpillar stage is a serious defoliator of both deciduous and evergreen trees. Evergreens can be killed in one year while oaks and other trees may survive for three years of defoliation. The larvae are quite distinctive. There are two rows of colored dots down the back. The first five dots are blue and the last six are red. Be sure to report any such caterpillars to the nearest County Agent, state or federal inspector. The chemicals labeled for use against the Gypsy moth are Sevin, Imidan, Gardona, Dylox and the bacterial preparation Thuricide.

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RESEEDING AND ROUNDUP HERBICIDE

R. P. Freeborg, Dept. of Agronomy,
Purdue University

Roundup herbicide (Isoprophylamine salt of Glyphosate) developed by Monsanto has great potential in the turfgrass industry. It is a water-soluble non-selective herbicide. Its greatest value may be in turf renovation, especially where populations of perennial weedy grasses, such as tall fescue, nimblewill, bermuda, etc., predominate. This herbicide is of special interest for two reasons:

1. It is translocated through the plant into roots, rhizomes and tubers
2. A rapid inactivation in the soil occurs so there is no residual to prevent germination of overseeded desirable species.

There is special interest in the development of acceptable overseeding practices following application of Glyphosate. The questions presented are:

1. What rate should be used?
2. How soon, after treatment, should overseeding be done?

In 1972, and again in 1973, we looked at rates of Glyphosate including: 0.5 lbs. ai/A, 0.75, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5, 5.0, 5.5 to 6.0 lbs. ai/A. These rates were applied to perennial weedy grasses and deep-rooted broadleaved weeds. Optimum rates in the range of 1.5 to 3.0 lbs. ai/A of 4 lbs. active ingredient/gal. Glyphosate.

With this background an overseeding experiment was developed as follows:

1. Rate of Glyphosate were 1.5 and 3.0 lbs. ai/A
2. Applications were made to a bluegrass turf infested with Zoysia and bentgrass on August 21. 1973.
3. Overseeding started Aug. 22, one day after, and 3, 6, and 10 days after treatment
4. Seed was planted as follows:
   a. A Henderson Contour mower was used to loosen and thin out excess thatch. Seed was then spread by hand, followed with the contour mower again to cover seed lightly.

   b. Rogers-Jacobsen 598 seeder set to cut into the soil 1/2 inch.
5. Poa pratensis, 'Fylking', and Lolium perenne, 'Manhattan' ryegrass were planted.
6. Siduron (Tupersan) was applied at 4.5 lbs. ai/A immediately after seeding and watered in.
7. Germination counts were taken 42 and 62 days after seeding.

Results at 62 days after seeding showed very little germination of Fylking bluegrass. The reason for this is not known. Manhattan ryegrass germination was 75% when seeded one day after treatment at 1.5 lbs. ai/A, and 90% when seeded 3 days after treatment.

With treatment at 3.0 lbs. ai/A germination was 90% when seeded ten days after treatment. There was no difference between seeding with the Jacobsen 598 or Henderson contour mower.

Procedures suggested for use of Glyphosate for turf renovation include:

a. Apply Roundup herbicide (Glyphosate) when there is adequate foliage to absorb. The best rates are between 1.5 and 3.0 lbs. ai/A. This should give total non-seledtive control of all existing growth.

Three days after treatment the treated turf should be overseeded. Then when existing weedy turf begins to turn brown the new seed is germinating and will begin to give green color. Thus, the transition from one turf to another will not be so objectionable.

Seeding can be with either the vertical cutting mowers, such as the Henderson Contour mower, or the Ryan Mat-a-way, or with the Jacobsen 'Rogers' seeder, or similar. When either the Henderson or Mat-a-way type vertical mower is used it is recommended that the seed be spread prior to use of the unit. The Jacobsen unit cuts the soil and directly deposits seed into the slits. The treated grass should be showing discoloration at seven days.

b. If rapid germination for early green color is desired, then presoak seed for 24 hours prior to seeding. After soaking, dry seed until slightly moist; then mix with either calcined clay, sand, or Milorganite to make seed more spreadable, and to absorb some of the moisture. Mix seed and calcined clay, etc., at about 50-50, or until seed and mix is dry enough to spread uniformly.

c. Other potential uses of Roundup herbicide include:

1. Edging control of fence rows, walks, gardens, turf plots, etc.
2. Spot treatment for non-selective control of small weedy turf areas. After treated areas turn brown and grass weeds begin to dry, then hand rake and overseed. Some soil should be loose to establish a good seedbed. Mix seed and soil and dead grass, and lightly press the area with a tamper, or by stamping. Keep moist.

3. For the professional turf manager:
   a) To kill existing growth on topdressing piles. Since Roundup herbicide is rapidly inactivated in soil, subsequent use of the treated soil should not be hazardous.

4. Selective bentgrass control in bluegrass turfs. This possibility is currently under investigation. Procedures are:
   a) Treat both bentgrass and bluegrass with Roundup herbicide with very low rates. We are working with rates ranging from 0.1, 0.25 and 0.33 lbs. acid equivalent/A. Repeat applications may be necessary.

The above procedure can be used to set bentgrass back, thus permitting germination and early competition of overseeded grasses before the bentgrass recovers. Recovery of bent will then give some additional color. Repeat treatments in spring and fall can be used to further reduce bentgrass populations.

d) Roundup herbicide - overseeding in spring or early summer, when crabgrass has the potential to germinate, should be treated with Siduron at no more than 4.5 lbs. ai/Acre to reduce crabgrass infestation.

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MY LOG - IT SOLVED A COMPLAINT WITH EPA

H. F. Carroll, Foxcroft Sod Farm
Crystal Lake, Illinois

This is the story of our experiences with the Illinois State Environmental Protection Agency.

We operate a sod nursery of some 600 acres near the town of Crystal Lake, Illinois. 200 acres of this operation are on leased land bordering the town. An open drainage ditch runs through our land and flows into the 240 acre recreational lake known as Crystal Lake. This supply of water is the main supply of the lake.

We dormant seeded 80 acres of the 200 acres in late fall of 1971. Since we were only 1,000 ft. from the lake, we knew certain citizens would be concerned about the effect of our operations.

We met with the Park Department Board and informed them fully of what we were doing. In spite of these precautions certain boating interests, the Audubon Society, the Defenders of the Lake became hysterical over our operations and started writing letters to the County Health Department, the Environmental Protection Agency, and the newspapers.

The Environmental Protection Agency then moved in to see what we were doing and to make water tests. For the last 5 years we have kept careful records of all fertilizer and herbicide applications. These records appeared to impress the EPA and convinced them we were being careful. It opened the way for a full discussion and agreement on water testing sites that not only would show the quality being discharged from our fields, but also the quality entering our fields from upstream.

EPA kept taking samples at intervals during 1973. At the end of the season the EPA acknowledged our sod operation was not affecting the water quality. The water quality discharged from our fields was well within standards established for surface drainage water. No more has been heard from our critics.

We learned three important things from this water quality examination:

1. Keep a good log of every pound of fertilizer and herbicide application. Have at least two people sign the log.

2. Be sure samples for testing are taken from every known inlet in your property, as well as the outlet. Upstream quality could affect your outlet quality. Without proof of origin you could be blamed for something beyond your control.

3. The normal quantities of chemical applications for good turf growth, at least on our land the first year, has no effect on the drainage water quality.

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PROPER PLANT MAINTENANCE AS A PREVENTATIVE TO DISEASE CONTROL

Dr. Paul Pecknold, Plant Pathologist,
Purdue University

The most effective way to control diseases of trees and woody ornamentals is through the use of proper cultural practices and planting resistant varieties. This is especially true today with the increased limitations on the use of effective fungicides for the control of landscape plant diseases.

Ultimately the most successful long-term method for the control of any plant disease is through the use of resistant varieties. Some trees and shrubs show resistance to certain of the more serious tree diseases. Others are relatively free from major disease problems under growing conditions found in the Midwest. It is advisable to always select trees which may be substituted for trees which are undesirable because of their susceptibility to diseases.

A healthy vigorous growing plant is much more resistant to possible disease attack than a plant in a state of stress. Diseases will often appear on plants which are weakened or under some type of stress. Outbreaks of stem cankers, die backs and certain root rots have been associated with prolonged drought, rapid freezing, flooding, soil compaction and defoliation. Maintaining plants in a healthy condition through proper and timely watering and fertilization will do much to avoid stress conditions and consequently avoid diseases. Vigorous plants not only are better able to ward off attack from "weak-pathogens" - they also recover more quickly from disease infection.

In the landscape industries, a large percentage of plant mortality due to diseases occurs following transplanting, when plants are under stress due to transplanting "shock." Extra care must be given to the proper planting and maintenance of newly planted trees and shrubbery to insure against such disease infection.

Many diseases endemic to the Midwest, such as sycamore anthracnose and apple scab, occur without fail every year. Chemical control is often impractical in controlling such diseases on a golf course due to the requirement of numerous spray applications at a prohibitive expense. Deciduous trees - not evergreens - can withstand one or two years of defoliation without severe stress resulting. Thus, the best control for such endemic diseases would be to maintain plants in a state of vigor with a minimum of timely protective chemical applications.

Proper timing is the most important factor in the application of protective chemicals. Each disease causing organism has its own unique, individual life cycle. The time of spore discharge and plant infection, and the most optimum environmental conditions for infection to occur are different for each disease. It is, therefore, critical that the proper fungicide be applied at the proper time.

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SELLING GOOD TURF - MY EXPERIENCE

Harry Murray, Sales, Century Toro Distributors, Inc.,
Cincinnati, Ohio

With the turn to urban living the demand by homeowners for more information about lawns has increased. This is also true within the turfgrass industry, golf courses, sod growers, parks, schools, cemeteries - to name only a few, are requiring a better quality turfgrass.

Many new products have been introduced. Keeping up requires more education. Attending turfgrass conferences such as that at Purdue University, or the one in your own state, or a national conference, can help you receive the latest information.

Equipment has changed. For example, the golf courses have gone from hand-push greens mowers to the riding Triplex greens mowers. Ten years ago no one would have believed we would be riding across the green. But, who's to say what will happen in the next ten years!

Once a golf course owner in Ohio wanted to put bent stolons on his new greens. The custom was to put them on by hand. Time and man hours made this way very costly. He solved his problem by hydro-stolonization of the greens. Two men and a hydro-seeder did a 9 hole course in two days.

We have seen the use of nursery-grown sod grow and expand to the point today where it is not considered a luxury to have a lawn sodded. Both the homeowners and builders know the value of not having dust or mud around a new complex.

Our sod growers also have seen changes. Sod cutting crews have been reduced from ten to four men with the introduction of the sod harvester. The use of pallets allows for faster loading and unloading of trucks.

The method of laying sod hasn't changed much. But, I am sure someone will develop a sod laying machine. Of course, we have seen the one that rolls sod up in a large ball. It is then transported to the job and unrolled. This is excellent for large areas, but what about the smaller ones?

With the shortages of chemicals, raw materials and with labor cost going up every day, we will all be looking for a better way to get the job done.

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THE PUTTING GREEN - CURRENT SPECIFICATIONS

Carl Schwartzkopf, USGA, Green Section
Crystal Lake, Illinois

After years of research, the USGA Green Section published its"Specifications for a Method of Putting Green Construction." This method of construction was first announced in 1961 and refined in 1973. It was a significant change from the old 1/3 sand, 1/3 peat, 1/3 soil mix.

The new method of construction uses much more sand in the topsoil mixture in order to resist compaction and provide good drainage. The new method of construction uses a layering principle that creates a limited "perched water table" which insures a reserve water supply that is thought to be optimum for plant life. As before, it is vital and recommended that all mixtures be tested and analyzed at a designated laboratory to determine particle size distribution, infiltration rates and percent capillary and non-capillary pore space. Thirteen years ago when this method was released, it was backed by solid research. However, it was slow to be accepted.

Since 1961, a substantial number of greens have been successfully constructed to these specifications. During the last ten years new questions arose that resulted in additional research to further improve the original technique. Some of the questions that arose were:

1. Was the 1-1/2 to 2 inch sand layer necessary.
2. Some questioned the original water infiltration rate as being inadequate for their part of the country.
3. Others questioned the establishment of turf that provides playing resiliency.

To these questions and others, the Green Section responded by granting funds for research projects designed to provide additional information. As a result of this research, the original specifications have now been refined. These refinements or current specifications include:

1. Increased water infiltration capacity from the earlier range of 1/2 to 1-1/2 inches to currently between 4 and 6 inches per hour.

2. Increased amounts of sand and the use of finer textured sand. Sand of the brick or mason type is preferred. Ideal particle size would be as follows:

	100% below 16 mesh (1.0 mm)
at least	35% below 32 mesh (.50 mm)
at least	15% below 60 mesh (.25 mm)
and	5% below 160 mesh (.06 mm)

3. Less than 5% clay or 8% silt and clay should be present in final mix.

4. The elimination of the 1-1/2 to 2 inch sand layer is still to be resolved through additional research. For the present we recommend it be retained.

5. The collar area preferably should be included as part of the putting green and should be constructed exactly as the green.

The above five items mentioned are the most recent and significant changes in construction a putting green to USGA Green Section Specifications.

Editor's Note: W. B. Davis in Calif. Turfgrass Culture, Summer,'73 adds these comments as part of discussion:

"Basically the mix is still a sandy loam and can be compacted, thus requiring more frequent aeration (cultivation) under heavy traffic. (The clay and silt will press in between the sand and cause hardness when dry. Extra peat, raked into the surface at seeding, may improve early resiliency). 'A poor' USGA green may be due to failure to adhere to:

1. The completemethod of construction
2. Quality control of 'sand' and 'soil' during construction
3. Proper mixing of sand, soil and organic matter.
4. Good management early."

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A SURVEY OF SANDS

William B. Davis, University of California
Davis, California

In the short term almost any soil, sand, or organic matter, short of a subsoil, can be worked and formed into a green. With careful watering and proper nutrition it will grow grass, and weather permitting we can mow it into a putting surface. We don't find out whether or not we have a good putting green mix until we subject it to the stress of our climate and the traffic of equipment and golfers.

Our field experience has told us a great deal about soils and the addition of organic amendments. As we all know, sands drain well, are easy to work and they are droughty. We know that clays become very hard when dry, are difficult to work when wet, and that they drain very slowly. Loam retains water, while at the same time drains fairly well. As for organic amendments, we know they act as a diluent to make clays and loams easier to work, and that they help sands to hold more moisture. We also know that when organic matter breaks down it helps to cement the clay and silt particles together into larger aggregates, giving us a more friable soil. So, we ask for a loam, or sandy loam, or loamy sand and think we have an excellent growing medium for putting greens. Unfortunately when we use these putting greens we subject them to traffic. These loams fail in direct relationship to the amount of traffic on them.

The unique character of a putting green is that it cannot serve its function properly unless it is mowed frequently, and its nitrogen nutrition is maintained at a relatively high level. The close frequent mowing and the higher nitrogen fertilization produce a restricted root zone. This, in turn, calls for frequent irrigation to maintain a proper water balance in the root zone. We can ill afford to further stress turfgrass plants by allowing them to compete for water so we tend to always water well ahead of potential water stress. So, our putting green mix is always moist and traffic can now destroy any aggregation of the very small silt and clay particles. These small soil separates can then freely move inbetween the finer sands that have themselves fitted inbetween the larger sand particles to reduce the larger pore spaces.

This is a long way of explaining compaction. But, the mix does become compacted and retains too much water relative to the solids and the air-filled spaces between them. This water drains slowly as well. What was once a well-structured loam is now a compacted dense loam that needs frequent aeration, or reduced traffic and precise regulation of water if we are not to lose the turf.

What we want is a mix that keeps a good structure even under the conditions imposed upon it in a putting green. This is possible if we can rely on the texture to actually produce a stable structure. All soils and sands are made up of a combination of different particle sizes or textures. Individual clay particles range from .002 and smaller, while a very coarse sand particle ranges from 1 mm to 2 mm in diameter. A single soil separate, such as medium sand (.25 mm to .5 mm in diameter) uncompacted, has an infiltration rate of approximately 65" an hour. Under the severest compaction this individual soil separate still maintains an infiltration rate of approximately 64" per hour. Because the individual soil separates are nearly all the same size, they do not compact. In mixed sizes of soil separates under compaction the infiltration rate becomes much lower, excess water drains from their pores much more slowly and retains more water.

There are many ways of looking at some of the physical characteristics of putting green soils that can help us understand or evaluate various sands and/or mixes. One of the most useful procedures is plotting the moisture-release curve which shows the relationship between the water and air in any mix at different tensions, or at different mix depths. Since we are concerned with the most active

root zone of a putting green mix, we should be primarily concerned with the air and water relationships in the surface 3". With increasing depth of a mix, there is a corresponding increase of water tension at the surface of that mix. As the depth of the mix increases, more water is released from smaller and smaller pore spaces between the solids. A study of the moisture release curves, therefore, shows how much water is retained at a particular depth of the mix. A mix that has good drainage and water retention properties at a 12" depth may retain too much water at 6 to 8", or be too droughty at 16 to 18".

All sands, soils, and/or mixes hold more water at any tension than it is possible for the grass plant to extract from it. This unavailable water is quite important in evaluating different sands and mixes. Some amendments used to produce a mix often increase the water holding capacity, but this water may not be available to the plant.

Another extremely important physical characteristic of a putting green mix is its water infiltration rate. When it rains there is no control over the amount of water, or the rate of application. When we irrigate, even with the best of irrigation systems, some portions of the green must be overwatered to get enough water to the entire green. If the green is to be usable soon after irrigation, its infiltration rate should equal or exceed the application rate. The infiltration rates on many problem greens range from .01" to just over 1" an hour, while those on many excellent greens are from approximately 1" an hour to an excessive 25" per hour. Laboratory infiltration rates of less than 2" an hour are questionably low, but infiltration rates that exceed 10" per hour are unnecessary.

Air-fill porosity of a mix is merely a reciprocal of the total water curve, or moisture release curve. As tension increases with depth and water is released, the spaces left between the solids fill with air. For the best root growth of turfgrasses 12 to 18% air-fill porosity is desirable. As the roots of the grass plant remove water, air occupies the spaces between the solids; good root activity depends on this oxygen in the root zone.

Because of the many sources and wide varieties of sands available in California, we have concentrated our research on sands which we can use unamended. Some of these sands are natural deposits, while some can be produced with proper screening. Table 1 gives the particle size distribution of gravels through silt and clay, and the range of which we feel is most suitable for high trafficked turfgrass areas. Note that the key fraction is medium sand 0.50 mm to 0.25 mm which should be 60% or greater. Our best sand also has less than 2% greater than 1.00, and 5% or less smaller than 0.1. This means that 92 to 96% of the sand range is between 1.00 mm and 0.1 mm.

These very uniform sands, when settled, are already compacted. Because of their very uniform and narrow range of particle sizes, they form a uniform stable pore. They are not a typical droughty-type sand except in the surface 1/4 to 1/2". Work done in our evaluation of amendments has shown that for most commercial available materials we would need to amend from 30 to 60% in order to predominate over the physical characteristics of most sands. Where possible why not select a sand which doesn't need amending.

Short of a sandy loam green mix nutrients are poorly held by putting green mixes. We have found that nutrition management is easier and less costly than maintaining proper soil physical relationships on the putting green. Once established our experiences with these uniform, finer sands have shown that between 12 and 15# of N/1,000/annually has been giving us excellent growth and color. These sands also give us the opportunity to topdress lightly and frequently for control of thatch, and with no interference with the golfer and his putting surface.

There is more than one system of construction method which may be right for your course and your local conditions. The best green for your course is the one which is highly playable rain or shine, and which needs only reasonable maintenance to keep it that way.

Table 1. U.S. Sieve Series and Tyler Equivalents.

Sieve Nos. Old U.S. series as opening/ inch.	Size of Openings Old U.S. inches	Size of Openings Metric millimeters	U. S. D. A. Description	Suggested range where compacted	Best sand located
.530	.53	13.5			
1/2	.50	12.7			
7/16	.43	11.2			
3/8	.37	9.5			
5/16	.31	8.0	GRAVEL		
.265	.26	6.7			
1/4	.25	6.3			
3 1/2 number	.22	5.7			
4	.18	4.8		0%	0%
5	.15	4.0			
6	.13	3.4			
7	.11	2.8			
8	.093	2.4	FINE GRAVEL		
10	.078	2.0			
12	.066	1.7			
14	.055	1.4	VERY		
16	.046	1.2	COARSE SAND	0-10%	2%
18	.039	1.0			
20	.033	.84			
25	.027	.70			
30	.023	.60	COARSE SAND		
35	.019	.50			
40	.016	.42			
45	.013	.35			
50	.011	.30	MEDIUM SAND 60%+	85-95%	93%
60	.009	.25			
70	.008	.21			
80	.007	.18			
100	.006	.15	FINE SAND		
120	.005	.12			
140	.004	.10			
170	.0035	.09			
200	-	.07	VERY FINE SAND		
230	.0025	.06			
270	-	.05			
325	-	.04	SILT	2 - 8%	5%
400	.0015	.03			
		.002	CLAY		

AN EXPERIMENTAL GREEN IN CALIFORNIA

William B. Davis

The film, "Your Experimental Green," was produced as a documentary of an experimental green constructed in 1970 on the University of California at Davis Campus. The primary use of the film has been as an educational tool to illustrate different construction methods. The purpose in constructing the green was to evaluate the different construction methods from the standpoint of a year around putting surface, ease of management, and the response of the green to different management practices.

The green has three different drainage systems underlying different surface mixes so that 6 individual drainage cells terminate into the inspection sumps. The rate of flow and water quality coming from the perched water table below the green mixes for each drainage cell are easily monitored.

Three "excellent" green mixes were selected to be placed at random over each of the 6 drainage cells. -

Mix (A) is Dillon Beach Sand unamended (a very uniform, relatively fine sand having 68 to 72% of its sand particles from 0.50 mm to 0.25 mm.)
Mix(B) is Robertson sand with only the surface 4" amended with 15% by volume vermiculite.
Mix (C) consisted of 5 parts Robertson sand (uniform grade of plaster sand), 3 parts Yolo sandy loam, and 2 parts sphagnum peatmoss. The ratio was recommended by a California Lab which at the time was authorized to make U.S.G.A.Putting Green Analyses.

The mixes are separated by 1" x 12" redwood partitions. After all mixes were in place and compacted, the surface 3" of the partitions were removed so that a uniform putting surface could be maintained.

This green is mowed three times a week at 1/4" height. It is open to anyone and is set up with 18 holes for practice putting. To increase compaction the green was rolled with a 600 lb. roller twice a week for the first two years. Some of the most important observations to date -

1. All the tile lines are open and functioning.

2. The upper tile lines on 10 ft. centers only discharge water during periods of high rainfall or excessive over-irrigation.

3. Under normal summer irrigation application, only the (C) drainage system discharges any water from the tile lines.

4. No difference in puttability, rate of growth, or removal of water from the mixes has been attributed to the different drainage systems.

5. Mix B (Robertson sand) is more prone to develop hydrophobic dry spots, but they can also develop in mixes A and C.

6. During periods of normally hot summers the irrigation on a 48 hr. interval results in drouth symptoms by mid-morning of the second day on Mix B (30 hours). Mix C will show drouth only on plots with southwest exposure in late afternoon of the second day. Mix A experiences no drouth, but becomes quite hard by noon on the second day.

7. Surface run-off from irrigation applied at 0.5 to 0.75" per hour occurs in 15 minutes on Mix A. Even at rates exceeding 2" per hour, mixes B and C do not experience any surface run-off.

8. After a normal irrigation Mix B and C are immediately playable (free of surface water). Mix A is free of excess surface water within one hour. Even with excessive irrigation Mix B and C are playable within 10 minutes, while Mix A will be soft and spongy for a period of 2 to 4 hours.

9. All mixes can be maintained with satisfactory growth and color with 12# of nitrogen per year. Mix A retains the best color during periods of excess leaching when fertilizer is applied on a calendar basis.

Regardless of how you rebuild your greens, this film should help you to challenge your previous methods and stimulate your thinking so as to produce the best green for your golfers.

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SAND PERCOLATION RESEARCH

Alan Nees, Turf Major
Purdue University

The use of sand instead of soil in the construction of golf courses and athletic fields has seen a rapid increase in PURR-WICK greens, and USGA-type greens. However, I will discuss the role of sand in drainage applications.

This past semester I worked on some research concerning water movement through porous profiles, and what happens when this water comes in contact with an interface. (An interface is a common boundary between two different materials). Past recommendations for laying drainage tile in a golf course situation have been to place gravel below and above a drain pipe; then add a finer porous material, such as sand. Here I'd like to present a different, and perhaps less expensive, approach to drainage of turf areas based on water movement through sands and gravel.

In this study all materials were screened to give uniform diameter of each. Plexiglass cylinders 50 cm. in height and 10 cm. in diameter, with numerous narrow slits in the bottom were used. Each material was put in the cylinders to a constant height of 30 cm (12 inches), and packed to simulate field conditions. Then a screen was used to minimize effect of water pouring onto sand. Then, 500 ml

of water was applied. The time for both infiltration and percolation of the added water was recorded. Then, I constructed 12 interfaces with the materials:

INFILTRATION AND PERCOLATION FOR 12" OF MATERIALS

Nees Purdue '74

Data

Particle size	mm	Size	Infiltration seconds	Percolation time seconds
Retained on	8.0	Stone - S	8	11
	4.0	Pea gravel - P	15	19
	1.0	Very corase sand	30	39
	0.5	Coarse "	72	89
	0.25	Medium "	110	142
	0.125	Fine "	189	236

Interfaces

6" over 6"		
Very coarse over stone	32	35
" " " pea gravel	31	35
Coarse over P. gravel	76	104
" " V. coarse	76	101
Very" " stone	75	97
Medium over stone	110	158
" " pea gravel	104	152
" " very coarse	102	146
" " coarse	95	128
Fine over pea gravel	175	259
" " very coarse	171	252
" " coarse	168	241

As expected, infiltration and percolation rates decreased as the diameter of materials decreased, so stone was the fastest, and very fine sand the slowest.

Consistently, the percolation rates were faster when the two materials under consideration were closer in diameter and thus in pore space. For example, when a medium sand was placed over a coarse sand, water moved through the entire matrix faster than it did when the same medium sand was above pea gravel or stone. The same was true with fine sand over medium as compared to fine sand over a much coarser material.

Now, what does this mean to turf managers? Many subsurface drainage systems presently consist of clay or plastic tile surrounded by pea gravel or stone. This gravel creates an interface between itself and the overlying layer which usually has a much smaller pore space. When water is saturated, flow comes in contact with this interface - it will not move into the underlying layer until a hydrostatic head is built up sufficient enough to push the water into the larger pores of the gravel.

From this study it is apparent that the less the difference of pore space, the less the head required. Thus, if a material, which has a smaller pore space such as coarse sand, is placed around a drainage pipe with narrow slits, it should be easier to remove excess water from a profile.

I have found that coarse or medium sands are generally cheaper than pea gravel or coarser stone on a tonnage basis. In Lafayette sands which are medium or coarse range from 90¢/T to $1.20/T and increase in price with finer sands. Pea gravel ranges from $1.20 to $1.30/T, and stone 1/2 inch diameter is over $ 2.00/T. Thus, using sands can also significantly cut down on budgeting.

To summarize, in the long run it may be more advantageous to use a medium or coarse sand above narrow slits drainage pipes than to use gravel.

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PURR-WICK - THE START

W. H. Daniel, Dept. of Agronomy
Purdue University

Somewhere leading up to early 1966, the idea developed of an impermeable barrier underlying a compacted sand would be a way to have golf greens. In 1974, the PURR-WICK concept (Plastic Under Reservoir Rootzone) is evident as over 240 greens, 120 tees, and 60 roof gardens, flower beds and planter areas are scattered over 19 states and Canada. At least 12 of these are for research and demonstrations.

David Bingaman did laboratory research for his M.S. thesis in '66 - '68, and proved the range in depth was from 12 to 20 inches, depending on particle size. Further, he proved size was over 90% of effect, and shape (sharp, rough, round) was less than 10% of effect.

David Ralston in his M.S. and Ph.D. thesis reinforced this, and using regulated constant water tables under turf, proved that 50 cm (20") of fine sand (.25 to .1 mm) with water table at 40 cm (16") was best for his test.

In 1966, along the north portion of the experimental green at Purdue, we put in a total of 41 different rootzone mixes as 72 plots in 5 areas. In general the best (easiest to maintain and use) has been the finer fractions (.25 to .1 mm) of dune sand. Surface additives in the top 2 inches (such as 30% peat) have given some more cup edge stability, and made mowing during establishment easier.

The first model green was built in the fall of 1968 at L & N Golf Course near Louisville. Since 1969 our MRTC Proceedings include reports of installers. Their material costs have been surprisingly low. Most have used more labor than future installations would require.

The retention of water above the barrier, accompanied by the wick action of water when at low tension in the compacted sand is the key. Since 1966 much progress has been made. The concepts are valid.

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PURR-WICK - REACHING FOR RESULTS

Larry Runyan, Supt. Dept. of Parks & Recreation
Kansas City, Mo.

Kansas City is known as one of the "flower cities" of the United States. We have over 240 flower beds scattered throughout the city, and only approximately 1% of these flower beds have water available. We took the amount of gallons of water being put on the beds on a weekly basis with a water truck and found that the beds were receiving only approximately 1/10" of moisture for every 7 days.

It was about this time that we introduced PURR-WICK greens to Kansas City on a new 27-hole golf complex. It occurred to me that a PURR-WICK flower bed would help solve the major water problem. In 1972, I decided to put 5 experimental flower beds at Minor Park Golf Course. The flower beds were watered three times after the initial planting, which consisted of cannas with coleus borders. The plants were not watered extensively for the rest of the growing season. The root development after a two month period was 3 - 4 times greater than a check on a standard flower bed. Blooming was in some cases two-thirds greater. Weeds were no problem even though the beds were not treated for weeds. In the check bed, which had to receive water on an average of three times per week, weeds were a major problem.

Through these initial efforts we have since added numerous flower beds to the other two golf courses. At the end of 1974 we will have approximately 47 PURR-WICK flower beds. These flower beds are located in areas that help divert traffic, such as along tees and walkways. We took the toughest plant to maintain in the Kansas City area, which were alternanthera. This plant was thriving right along with the cannas and coleus, required no additional water throughout the growing season. The only preparation once the bed is established was an application of IBDU slow release fertilizer and a light application of peat directly on top of the sand to keep the plants from drying out shortly after planting.

We have also experimented with growing vegetables right in the flower beds. The average weight of the potatoes has been 3½ lbs. per potato. Carrots have been running between 4 - 6" in diameter. In a test with no fertilizer the carrots grew to an enormous size, but were pithy and hollow inside.

Next summer we are going to plant the beds with yucca. This will help keep the area beautiful 12 months out of the year, and will stop the golfers from pulling their golf carts across the flower beds.

We have found that the ease of planting, due to the pure sand, is using a fraction of the time compared to digging in soil. Also, in removal of bulbs for winter a fraction of the time is spent compared to that spent on a regular flower bed.

It is my firm conviction that the PURR-WICK method of growing things with large scale farming in areas where water supply is a problem may be the answer to feeding the world in future generations.

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MY GOLFERS AND PURR-WICK

Warren Keil, Highview Hills C. C.,
Washington, Illinois

I want to thank Dr. Daniel and Purdue for the research and development that have gone into PURR-WICK. (As far as the PAT System is concerned, I think there will be a strong demand for PAT athletic fields.)

Our Country Club consists of 152 acres. We have a large club house and lake. In the spring of '74 we are finishing the back nine. The front nine have been played for a whole year now. We are satisfied with it. It seems to wear well. Of course, we have not had the heavy play the municipal course has, but it seems like nothing hurts it. You may not believe this, but our practice green was less than a year old when a car crossed from the blacktop road and spun out right on that green. After three mowings you couldn't tell a car had been on it. It was less than a year old. So, we think these PURR-WICKS are real tough.

About four years ago, during the Midwest Turf Conference, I listened to Bill Story telling about the new PURR-WICK green at Carmi County Club. So, all the way back home in the car my good friend and I had meetings and decided this was the way we should go. Then we went down about the first of April to Carmi Country Club and found Bill Story well relaxed there in the Club, waiting for the weather to clear for it was very muddy. The ground had thawed out, so mushed out to a regular green. We didn't walk on it very far for it was real soft. Then, we toptoed down the fairway to that new PURR-WICK. That Bill Story must take dancing lessons down in Carmi the way he was dancing around on that green, and pretty soon there were three of us dancing on it.

The main thing I remember about our conversation is what I am supposed to talk about today - what people think about a PURR-WICK green. Bill said his members at Carmi always remarked when they got to that green, "When are you going to build more PURR-WICKS?" Now I have a few letters from my members which tell what they think of a PURR-WICK.

"Mr. Warren Keil, Highview Country Club February 21, 1974

Re: Golf course and PURR-WICK greens

Amazing! The course responded very well to tender loving care.

Although the course did not receive extremely heavy play, there was at no time evidence of damage from normal play. The Par 3 greens that receive the heavy hits did not show signs of ball damage. Compared to other area greens at any time during the season, PURR-WICK have to be rated better for holding shots and for handling play without damage. Probably the most noticeable was the ball marks being dents rather than popping out pieces of the greens.

From a playing standpoint, perhaps they putt a bit slower and are not affected by slope as much as others. I am assuming this is due to more rapid growth of grasses. I wouldn't say they are the best greens I've played, but in time they might be.

Gary D. Smith"

Incidentally, they are harder to get in initial shape for use.

"Warren, February 21, 1974

As a member of Highview Hills Country Club, I would like to express my thoughts and views on the greens at the Club.

I must say after having played at numerous country clubs and public courses across the country, the overall rating of the Highview greens must be rated excellent. I do believe, however, the greens could be improved by more contouring. Other than this I would say the greens are the best I have every played.

Neal Rose"

Our first nine greens are contoured some, but I wish they had more. The second nine will be more contoured.

"Warren Keil, Highview Hills Country Club February 22, 1974

I would like to take this opportunity to tell you what a fine job I think you have done the past year on the development of the first 9 holes of the Club course. If the back 9 holes develop as rapidly as the first 9, this should be a great golf year at Highview Hills C.C.

Had I not followed closely the progress of the front 9, it would be hard for me to believe that 1973 was the first year for those fairways and greens. The fairways, early in the season, were a little rough, but from the very beginning the greens were really great. Through all the rain, wind and hot weather they remained thick and green. They putted well all season and never became dry and hard. I played several courses in the area last summer, and on greens that had been established several years, but I will have to say that the greens at Highview Hills were second to none. I believe the PURR-WICK green has found its place in the sun. Here's hoping the back 9 will be as fine and challenging as the front 9 has proven to be. Good luck!

G. W. Clemens"

Now I agree with Larry Runyan about building these greens. We have found that using a backhoe to shape them out is excellent - as the operator forms edges he can drop down and level easily. If you have any questions I will be glad to answer.

Q. What's the cost?
A. The cost depends on how scroungy you are and how you can get things. We happened to find sand about 5 miles away, and it was excellent. The fellow that owns the sand has a ridge of it, and I dug down below the surface and there was real nice white sand. We sent a sample to Purdue and got the report back that it was suitable for PURR-WICK.

We have our own tandem axle truck and loader. We used about 40 tandem loads of 14 tons each, or over 500 tons per green. So, figure what the sand will cost, and then throw in another $ 600 or so for plastic barrier, drain tubing and accessories, and then your digging, and you will pretty well have the cost of the PURR-WICK green. This is not counting irrigation, of course. The sand will be the main cost, so check locally.

Q. What is the over-all depth of your sand?
A. Varies from 14 - 20 inches deep.

Q. What water level do you keep?
A. The maximum is 4 - 6" reserve. We found that it varies and water wicks in all directions. We try to avoid overflow by less irrigation.

Q. How did you handle the drain tile?
A. We have individual outlets from each elevation or tier coming to a central pit, and have our overflow standpipes according to the maximum water level for each one.

Our tees are all PURR-WICK tees, each 40' x 100', and I believe we have more comments on that than on the greens. We used Fylking bluegrass sod. They are beautiful tees. They repair easily, look nice and green all the time.

I think sometimes the golf course builders are slow taking hold of this. People are just going to demand this kind of green, just like in a few years after a few college teams have played on the PAT System they will just not go into a stadium with artificial turf.

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Surface was seeded with Penncross bentgrass at rate of 1-1/2# per 1,000 sq.ft. A single sprinkler was sufficient to cover the green and collar areas. Good germination was experienced in about 8 days, and first cutting was at 3 weeks. Koban was applied on 3 occasions in August and September. Additional fertilizer was applied as required. Excellent turf became established in 8 to 10 weeks with rootzone well established.

Material for 1900 sq.ft. experimental green:

Sand - 142 tons delivered about $ 4.00/ton	$ 553.80
Plastic sheet and tape, including repair	99.86
Drain tube - 140 ft.	21.00
Pipe fittings	15.00
Total	$ 689.66
Cost for materials per square foot	.36

After sand fill it was noticed that the upper tier was not holding water at a consistent level in the standpipe, which suggested leaks in the plastic sheet underlay, probably at the internal tier edge. Sand was removed and leaks were occurring where insufficient plastic was left over the vertical internal divider. The plastic had separated at the top edge - upper tier side - in several places. To correct this, sand was removed from the upper tier and a complete overlay placed. This was flood tested and refilled with sand and rootzone material.

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PURR WICK-ROOTZONES
After Eight Years Research and Use

W. H. Daniel, Turf Specialist,
Purdue University

The office list shows as already constructed: 240 greens, 120 tees, 60 flower beds and root boxes. At least 10 of these are for further research. They are located in 19 states and Canada. Thus, it appears the PURR-WICK (Plastic Under Reservoir Rootzone with Wick Action) as conceived and first tested in 1966 has advanced well.

But, wait! Which Golf Course Architects have included it in their current specs? What writeups have the USGA Green Section carried? Have the thought leaders among Golf Course Superintendents Associations pushed the idea.

Often the novice, the inexperienced have been the most interested in PURR-WICK usage. After all, the success of the existing is a strong deterrent to change.

Roof Gardens

The slitted tube drainage, plus light weight particles peat, dialoam, vermiculite, perlite, maybe some sand with little or no soil (thus dry bulk densities under 50 lbs./cu.ft.) can be most useful in a light roof load. Even 6 inches may be adequate for turf with higher mounds, thus deeper areas for trees and shrubs.

Planter Boxes

Larry Runyan of Kansas City Parks has led the way for these. Here again the conservation of water by side outlet control offers reduced irrigation. For example, 4' x 8" x 2' deep shrub boxes on a garage roof for three years now have an annual fertilizing and trimming, then the custodian checks the water supply every Friday (during the summer). It's easy to transplant into the sandy matrix, and weeding is minimal. Careful fertilizing would be expected.

Golf Tees

Firm, dry, easy to insert tee, always able to mow, always ready for play! Since most tees are level construction has been simple. Just create ample berm or side slopes, then fill the PURR-WICK to grade. Usually sodding is preferred; then Greensairing and topdressing provides stability for golfer shoes and mowing equipment. One outlet per tee seems enough. Where existing trees and roots are a problem, the plastic barrier can isolate the turf. One course, King's Island, Ohio, has rebuilt 34 tees to PURR-WICKS.

Golf Greens

Of course, the design for the challenge, picture and conformation should be normal and EXACT for each green. Then, like in fields of rice paddies, the internal vertical dividers (on 6" contours) make compartments which regulate moisture for uniformity at the surface.

Each unit has its own exit and drain control. Each green is individually considered. I've seen from 1 to 9 internal dividers used in the various greens (240) reported. An average green may need 4 - 6 dividers. Be ample, plan well, and install carefully. After all your foundation for grass growing must serve for 20 - 30 years. So, poor or careless construction is quite stupid!

Fortunately corrections, if needed, can be done. One course opened the drains more; another repeatedly topdressed to get drier front edges; another installed an additional outlet to one tier. And, a new golf committee ordered a PURR-WICK green taken out and replaced (not what the superintendent wanted).

Ahead is the potential of large area construction for special crop use in special climates. The unit of construction is one piece of plastic and one slitted drain tube, plus control to carry out the PURR-WICK design.

Already 400 copies of Leaflet No. 40, first printed in 1970 and 3000 copies as revised in March '72 have been distributed. The new revision of April '74, plus a new leaflet MT-41 will be available by June '74.

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THE PAT SYSTEM
(Prescription Athletic Turf)

W. H. Daniel

Just turn on the suction pumps - if it rains during a game! Suck the raindrops down before mud forms! Give the players the firmness for running, resiliency for falling, and traction for turning. Give the coach, the players on the bench, and the spectators a better view by having a flat field. For baseball - help the front office minimize rain checks; keep drier base paths by suction. A new concept in athletic turf is now a reality!

Remember When?

Rain meant MUD! Because the extra water at the surface during rain (regardless of construction) would cause surface wetness -- slippery playing conditions. It was true, crowning the field limited the size of puddles; that tile drains helped in springtime dry-out - and sandy soils are preferred over clay soils. BUT, in common, all are too wet at the surface when rain falls during the game. AND, that's why the PAT System is NOT AN ADDITIVE - it is a REPLACEMENT! Now the architect can specify; the contractor can comply; the inspector can approve; then the field manager can MANAGE! All for the players' benefit!

The Idea and The Ideal

During December 1970, the idea crystalized - create a uniform suction at the surface by putting pumps onto drains - to pull raindrops down. We first tested a 10 sq. ft. area in the greenhouse, and later a 400 sq. ft. area outside. The vacuum pump developed (4-6"Hg.) rapidly stripping water and air through sandy subgrade and playing surfaces. In field tests (Goshen) excessive surface water (from hose) would be removed within 10 minutes...

Then, based on turf research and wide observations, a System evolved including -

12 ITEMS which combined can make	9 FEATURES
Suction pumps	Uniform surface suction
Collector drains	Level fields - water moves down
Plastic sheeting	Water conservation - outflow control
Sand	Nutrient conservation - above plastic
Peat	Automatic subsurface watering
Calcined aggregates	Porous rootzone - ample air at roots
Slow release fertilizers	Heat adding - keep soil thawed
Automatic moisture control - Soil sensing	Heat conservation - reduce frost action
Soil heating cables	Wear resistant - increased growth
Vented plastic covers	
Power rollers	
Vigorous disease tolerant grasses	

These combined as needed can give improved playability. And their use COUNTERACTS the very wet, very cold, very dry and very hot conditions which may occur.

Cost Estimates

It is estimated ready-for-use costs will range from $ 1.50 to $ 3.00 per sq. ft., depending on location, delivered sand costs, overhead, etc. Although the question of "How much cost?" is always important, the BIG questions are - "How well can it be constructed?", and "What level of turf maintenance can be developed to assure good, healthy turf?"

THE PAT SYSTEM is based on patent application No. 263,434 dated June 16, 1972, as filed by Purdue Research Foundation, entitled "Combination Turf Drainage and Irrigation System."

A national license has been assigned by PRF to a newly formed company:

Prescription Athletic Turf, Inc.,
705 East Oakland Avenue
Lansing, MI. 48905
Phone: 517-485-3128

Assuming that - based on information and observations - YOU are interested in a PAT System for your field, how do you proceed?

First, share information with the architect or designer for your organization. Consider what is possible for scheduling of construction between uses. Also, you are encouraged to go see models already installed. The exact specifications, list of materials, and specifics of constructing, and arrangements for site connections (electric, water, drains) elevations, etc., are to be arranged by PAT, INC. in cooperation with contractors.

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PURDUE INSTALLS A PAT SYSTEM

Melvin Robey, Supt. of Athletic Facilities
Purdue University

Construction of a model field was started by April 1, 1974. As this is written (May 1, 1974) it is anticipated all work will be done by June 1, 1974.

The specifications established the elevation of the flat field as same as past sidelines. The excavation extends goalpost to goalpost and 6' outside each sideline.

A contractor's bid covers all water control features, and the Athletic Department finishes the soil warming, sod laying and Greensairing and topdressing.

The model field will have a window for profile observation. Soil moisture sensing will give automatic sub-irrigation control. A 16 mm movie is being prepared covering the model installation.

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-PAT, INC., FOR BUILDING-

Robert Linton, Lansing, Michigan

I would like to begin with a brief explanation of our organization, its responsibilities and progress to date. As some of you may already know, our Company was formed last year with Mr. Frank Stallings and Mr. John Demmer, Co-owers of P.A.T., and myself, Bob Linton, Vice President/General Manager. Through an agreement with the Purdue Research Foundation, Purdue University, we are exclusive license holders in the United States and Canada to plan and construct the PAT System. Our role in performing this function is primarily that of Designers, Construction Managers and Maintenance Consultants. Labor and materials to construct a project would be obtained through local sub-contractors. All construction would, however, be performed under the direction of a full-time P.A.T. field superintendent. We feel that our primary responsibility is to ensure consistent, high quality installations.

We are, of course, very delighted that Purdue University is underway with plans to have Ross-Ade Stadium ready this fall as a full P.A.T. installation. Our efforts have been rewarded for in less than one year we have the following to report:

The New York Giants new home stadium which will be known as the New Jersey Sports Authority Complex has been specified to have P.A.T. on the entire Stadium floor. We have been recently told that bidding for this project will begin around mid-March, 1974 for installation in 1975 or '76.

The R. F. Kennedy Stadium, Washington, D.C. wanted to have their P.A.T. installation in 1974, but this has been held until 1975.

Evansville, Indiana School System voted to have the System in their Reitz Bowl High School Field, and depending on financing scheduling hope to have theirs completed during 1974.

The turf field at the Milwaukee Campus of the University of Wisconsin at Milwaukee is bidding for '74 construction.

We are presently working with several other groups who have expressed interest, and thus are very optimistic for the future. We would ask that you join with us in our efforts to show people that there does exist in the P.A.T. concept an excellent alternative to traditional mud and barren fields, as well as synthetic turf playing fields.

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THE PAT SYSTEM AT GOSHEN, INDIANA

Richard Kercher, Installer
Goshen, Ind.

The second season for the Goshen High School PAT System proved to be as exciting to observe as our first season. A quick review of the 1972 highlights of the Goshen PAT System for those of you who were not present last year at the Turf Conference.

1. Construction was started May 12, 1972, and the final sod laid on July 14, a period of two months.
2. Field was first used 2 months later on September 15, and used during that season a total of 26 times. This included all junior high and high school home games, as well as band practice once a week.

3. During this first season we experienced 5" of rainfall in the preceding 48 hours before the first home game. This was just part of the 13¼" rainfall recorded at Goshen during September and October of that year.

4. During the varsity games we averaged 20 divots per game where the root crown had been pulled loose.

5. This first season we recorded an average root depth of 6" - 7".

Our second year was another season of trial and error. As an example, we discovered that although the school system had some very willing and cooperative employees, I still had to make twice-a-week observations of the field or else some management problem would turn up. For example, neglecting to see that the turf was watered when it started to wilt, or not mowing soon enough and having excess clippings. In 1974, the installation of moisture sensors and electric valves, which makes the watering fully automatic, can lighten the management load.

During the past season we almost doubled our activity on the field. The field was used a total of 45 times during the 1973 season as compared to 26 times in 1972. This again included junior high, high school and band activities.

Even with this increased activity we averaged only 5 divots per game. One game was played during a rain with the pump being started shortly after the opening kickoff and running the entire game. The usual muddy football uniforms when a game is played in that kind of weather were absent.

During the 1973 season the turf root depth was visible from 9 - 10" below the surface - an increase of approximately 3" in root depth from the preceding year.

Football injuries on the PAT System have always been of interest to all concerned with football playing surfaces. The first year the team physician reported only 2 hyper-extended knees as the most serious. Both players involved were able to participate in the next game.

During 1973, for football injuries there was a total of one ankle sprain, mild enough that the player missed no games, one sprain causing the player to miss only the second half of the game, one knee injured by a block from the side, and another injury from a clip on the playing area outside the PAT System. Although the injuries shown in only two playing seasons is not sufficient data to say the PAT System is going to eliminate many injuries, it does at this time appear to be a big plus factor.

This past year one of the highlights which you may be interested in was a field day with 12 ex-Michigan State football players going through a series of drills to test the footing under wet and dry conditions. These drills were performed under the direction of Duffy Daugherty, former Michigan State Coach. Those participating commented that they felt the footing was excellent. Like many planned demonstrations, you sometimes receive a fringe benefit you hadn't counted on. This time we did only there were no visitors present to observe it.

After everyone had left a school employee fully opened the underground water valve (which was only partially open) thinking he was closing it, and then left for the day. The following morning (after 15 hours of full sub-irrigation) the school called and said the football field was flooded, and sure enough 2 - 3" of water covered almost the entire field. At 1 P.M. that day the city's elementary 5th and 6th grades were going to have their annual track and field day on the field - they did! The pump was started and within 1 hour no water was visible, and within 2 hours I believe Purdue and Notre Dame could have played with no more than normal damage. Fortunately, or unfortunately, the high school swimming pool was also having some problems, so the authorities were never sure why that month's water bill was so high.

Last year when I reported on the Goshen field, I mentioned that Goshen's varsity opponents all found they could out-score Goshen on the field. This year it went better and Goshen found one opponent whom they could out-score.

The visitors to the Goshen field in 1973 have been many with representatives coming from Washington, D.C., Ottawa, Canada, San Diego, New York, Chicago, and Portland, Oregon, to name just a few. We in Goshen are very proud of our PAT, the first in the nation, and are always happy to show it to any interested visitors.

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SAND FOOTBALL FIELDS

William B. Davis, University of California
Davis, California

Few of our highly trafficked football fields will give us a satisfactory playing field through the football season. When the rains come and play thins the turf, we find ourselves playing in the mud. Many turf managers, school officials and coaches have given up and gone the route of artificial turf. Why not a sand field? We all

know sands are not muddy when wet as they are very low in clay and silt. But, can a sand field grow a good stand of turf? Will it afford a base for proper execution of football, soccer, and other contact sports played on turf? We believe the answers to these questions are "yes" based on several fields which have been installed during the past three years.

Certainly there must be some problems with a sand football field. Every turfgrass area has some problems, and it is the problems associated with sand athletic areas which we have been studying. What are the problems we build into a sand field, and what maintenance practices reduce its potential? This is the area which I wish to stress in this paper as our experience has proven that the sand field is a workable solution if properly constructed and managed.

The secret is the type of sand used and the depth to which it is placed. The type and depth of sand have been covered in the paper, "A Survey of Sands," so I will not repeat that information here.

Our first and most important problem is determining the availability of the "correct sand" needed to build the field. This is not a serious problem in many areas of the Pacific Coast as we have many natural deposits which need little, if any, processing to meet the uniformity standards we have developed. The problem is getting people to understand that not all sands are acceptable, and that the closest sand and gravel company may not be able to supply the "correct sand." In the areas where we presently have 3 football fields, two park sites and several putting greens, the availability and cost of "correct sand" was considerably less expensive than local top soils and/or special mixes.

Once we have the "correct sand" and have placed it at the right depth, our problems should be solved. Unfortunately someone can always find a way to create problems and one of the most serious is laying sod on top of the sand field. All the physical soil characteristics for which we selected a sand field are then all to no avail. The 1/4 to 3/4 of an inch of soil brought in as part of the sod now controls the infiltration rate. The silt and clay retain water in the surface and we are again playing in the mud.

Where sand fields have not been planned with adequate time to produce a turf from seed, sod has been used. If such is the case we must start an immediate program to dilute and open this thin layer of soil if the sand field is to function as designed. Repeated frequent aeration with removal of the "soil" cores, plus topdressing, is the only answer. We still run the risk that there will be a silt and clay contamination of the surface sand which may never be completely corrected.

With the "correct sand" at the right depth infiltration and rapid conduction of excess moisture through the sand profile to the parent or base soil should not be a problem. Problems can arise if the base soil is too slow to take excess water, if we have a poorly designed tile system, and/or a poorly constructed system. In some sites we have soils which will take water at a reasonable rate (.25 inches per hour or greater) when not subject to surface compaction.

While a temporary perched water table will develop at the interface between the sand and the base soil, this could be short in duration. In most cases a tile system is in order as the base soil usually has poor drainage capabilities. Water flows into a tile at zero tension. Water does not flow uphill, so tile lines must have a fall. Also, there must be an outlet for the flowing water. This sounds very elementary, but many tile systems fail because of reversed gradients and no outlet either through lack of design or poor construction.

Perhaps one of the most serious problems in tile line installation is the mishandling of the loose soil removed from the trench. This soil should be removed from the site, or at least graded to the center between tile lines, settled and compacted. In most cases the trench is oversized in both depth and width. Excess tile trenches can also lead to settling problems above the tile line.

Tile spacing is always a problem. As we are dealing with tile lines 12" to 18" below the surface, 30' center can be too far, but closer than 10' is too costly. Between the tile lines the perched water table will rise above the depth of the tile and we may have saturation of the sand to the surface for a period of time. How important this is to a particular field, and how fast we must remove the excess water will govern the width of spacing.

The last problem of major concern is nutritional management. Some say we have traded physical soil problems for nutritional soil problems. If such is the case, the trade is all in favor of reduced physical soil problems. "Sands are nearly inert and have little ability to hold nutrients and moisture essential for good plant growth." The parent rock source, age and location of sands vary so that the above generalization does not hold true for all sands.

Of the 40 California sands we have tested, all needed nitrogen for survival past the seedling germination. Half also needed sulfur. Most sands were deficient in potassium and phosphorous, but not all. Of the 6 most "correct sands" which have been field-tested, all have produced excellent turf with a high starter application of potassium and phosphorous, followed with light, frequent applications of ammonium sulfate. To date we have not exceeded 12 lbs. of nitrogen per year. If there is a nutritional problem, it is the failure of the contractor or supervisor to maintain an adequate level of nitrogen until a well-established sod is produced. Soluble fertilizers are easily leached so heavy applications are of little benefit. Where slow released fertilizers are used, the fertilizer rate must be higher than normal in order to release adequate nutrients during the establishment period.

Some problems have been encountered when sewage sludge has been used to supply nutrients. Some sources are relatively high in colloidal materials (silts, clays, etc.) and they tend to seal up the surface sands. When high applications are made, an objectionable organic, black surface is produced which makes football uniforms just as dirty as playing on a muddy field.

Sand fields don't make grass resist wear, and over-use of any field can result in a loss of turf. But, turf or no turf, moist sand is not mud. Rain or shine the field is playable. There is no waiting for the field to dry out. Mowing, fertilization, aerating, topdressing, overseeding, or making repairs to the field can be accomplished between rains. - - - - - - - -

FIELD MANAGEMENT FOR BAND & FOOTBALL

George Gumm, O. M. Scott Company,
Carmel, Indiana

As a football coach or the band director, you want a close cut, firm and solid turf on the area. And, it has to be maintained correctly if it is to have turf on it to play or march on.

Overseeding

Starting in late March or early April on a field that was torn up very badly in the fall, and on which bad weather set in before any renovation was done:

First, spread the seed - to fill in the thin or bare spots! Use an improved bluegrass, and I would also suggest the addition of one of the new improved ryegrass strains. The drop-type spreader is preferred over the rotary type for seeding due to the distribution of seed. The bluegrass seed is 1/6th the size of the ryegrass and lighter, so even distribution is best obtained by the drop-type spreader.

Next, use a core-type aerifier and go over the area at least 4 times to loosen the compacted soil. Also, this will give you a seed bed, and the plant can receive oxygen, nutrients and moisture to form an extensive root system. Remember - go over the area 4 times. The aerifier holes make the finest bed for seed to lodge and assure excellent germination and growth. Drag the area following the seeding to break up the aerifier cores, and this will provide a light topdressing for the seed.

Actually the finest tool I have used is the Rogers AeroSeeder which thatches, seeds and breaks up the aerifier cores in one operation. This machine slices the thatch or soil and deposits the seed at the proper depth in contact with the soil. It also thatches the turf and keeps the bluegrass making new tillers and rhizomes.

Before most home games spread seed over the center of the field. Put down the mixture of 50% improved bluegrass and 50% improved ryegrass at 1 - 2 lbs. per 1,000 sq.ft., and let the players plant it with their spikes.

Fertilizing

Then, apply a turf-type fertilizer with a slow-release type of nitrogen combined with siduron, a pre-emergence control for crabgrass, foxtail and various other type weeds. This chemical is compatible with the grass seed.

You can use water soluble sources of nitrogen, such as urea, ammonium nitrate, or various agriculture-type fertilizers, combining one or more of these, and they will last about 3 weeks. The best buy is the use of slow-release forms of nitrogen which will give you 6 - 7 weeks of controlled growth.

A basic fertilization program on an improved bluegrass field will require around 5 lbs. of actual nitrogen per 1,000 sq.ft. in 5 applications, with 3 of these being in combination with a specific pesticide.

Weed control can be applied following 3 cuttings. A combination of a complete fertilizer with a slow-release nitrogen and containing 2,4-D and Dicamba. I wouldn't recommend using a herbicide within 6 weeks of seeding as the herbicide residues in the soil can inhibit germination.

Mowing of the turf is best done with a sharp rotary mower set at 2½". A field under good nutrition and moisture should be cut twice weekly. The length of the clipping should not be longer than the height of cut. If you can't set up a frequent schedule as mentioned, I would recommend a sweeper or vacuum attachment on the mower to remove the clippings. Let's face it, the turf would be better cut often.

Disease control. Probably the main disease on a football field is leafspot. If I wanted a showplace field of excellent quality turf, I would make an application of granule PCNB in combination with a complete fertilizer. For a few extra dollars it would keep you from the devastation of crown root rot. This is best applied in March and October as it works as a systemic. It is also excellent on snowmold and stripe smut.

Insects - If you have been using chlordane or Bandane, you shouldn't be troubled with grubs. But, surface feeders, such as sod webworms, could be troublesome. Use of Sevin, Dursban or Diazinon in the granular form have been very effective.

As a team doesn't just call off plays, but has a specific game plan and is flexible enough to adjust slightly to meet a specific weakness, your fertilization and pesticide applications should be planned for best results. Like the teams, the plan is basic, but has flexibility on the application schedule.

On high school fields, I feel that 75% of the poor turf conditions is due to the fact that the proper products are not applied on a schedule, but are left "in the barn." The field needs attention! It takes hard work and planning. Schools should assign a responsible person to maintain or supervise the maintenance. Even with the improved construction and drainage the following speakers will elaborate on, if you aren't going to follow a maintenance schedule, you will only waste your money.

If you have a question, or run into a problem on your field, or grounds maintenance, don't be hesitant to ask for help. Many commercial firms have qualified Technical Representatives who will provide advice on a no charge basis. Your local Extension and university turf personnel are anxious to lend assistance.

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