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TURF CONFERENCE PROCEEDINGS

Sponsored by the

MIDWEST REGIONAL TURF FOUNDATION

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PROCEEDINGS OF THE
1975
MIDWEST REGIONAL TURF FOUNDATION

The 46 talks included in these Proceedings are condensations of talks by speakers before sections and divisions of the 1975 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 1970, 1971, 1972, 1973 and 1974 Proceedings are available at $ 2.00 per copy.

A copy of these Proceedings were mailed to:

The 748 attending the 1975 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
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For Lawns - first see articles starting on pages -

14, 28, 35, 42, 62, 64, 67, 71, 72, 74, 75, 78, 84, 96, 99, 110, 111

For Sod Production - first see pages -

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For Golf Courses - all including

Soils 14-46 Management 64-99

PRESIDENT'S REPORT

O. Lee Redman, Supt., Bellerive Country Club
Creve Coeur, Missouri

The Purdue Turf Conference is a good way to keep abreast of the heartbeat of the rapidly changing turf industry. Our attendance has been over 700 these past few years, but yet about one-fourth of the attendance each year continues to be new faces.

Before the conference I read over the Proceedings from twenty years ago and then compared the topics with the many various subjects we will have discussed on this program. The story is obviously told in the fact that there were 15 different speakers twenty years ago, and at this conference in 1975 we have 52 speakers scheduled. More people, yes, but the variety of subject matter says that we are interested in the many facited profession of growing finer turf.

The most provoking problem in our immediate future appears to be with the spiraling cost of most everything. As in past years, many cost saving advancements have been developed through research, such as we help to support here at Purdue. The Midwest Regional Turf Foundation has been one of the leaders in the advancement. I urge you as members to promote the Midwest Regional Turf Foundation whenever the opportunity arises.

A sincere thanks to Dr. Bill Daniel and his staff who are always willing to help us solve any of our arising problems. To the Board of Directors, a special vote of thanks for they have contributed not only the chairing of the programs during the conference, but in discussing the development of programs and maintaining of contact within their local areas. It has been an honor and privilege to have served the Midwest Regional Turf Foundation as its President this past year.

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SECRETARY'S NOTES

W. H. Daniel, Purdue

Your Executive Secretary wishes to express appreciation for the fine work of Jo Horn, who has taken Kaye House's secretarial position. She's made it a smooth transfer of responsibilities.

Bob Seager will be retiring as technician by 31 May '75. His willing and enthusiastic work during the 17 years with the turf program has endeared him to all who know him. His dependable assistance will be much missed by Ray Freeborg and myself.

Our student enrollment in our four year turf program has reached over 50. Fifteen are graduating in '74-'75. So, our time for teaching has expanded. In current curriculum a sophomore course, a senior course, a seminar each spring and special senior projects give a good

turf polish to a strong science base.

Your support in membership and in attendance is appreciated. The local association's sending surplus or available dollars greatly helps our support and training of students through student labor. Our policy has been any turf major can work in our research projects. It has meant 13 were actively working during the last semester. It tries our planning, but it helps the students.

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DEFINING SUCCESS WITH TURF

Fred V. Grau, President, Musser International Turf Foundation
College Park, Md.

Bill called me last night and said, "You're going on tomorrow in the place of Harold Glissmann. What I did is just write down a few words. I've known Harold a long time. I knew his father, Henry Glissmann; I know his brothers. I helped his father, Henry, get started in the Zoysia business in Omaha. I visited Henry and went over to see one Arlington bent green when he was superintendent, so I've known the Glissmann family a long time. So, it's really an honor to take Harold Glissman's place. I am going to give you a few of my thoughts about success in turf. But first, I think all of you should look at last year's MRTF Proceedings and read Harold's message. I read it again last night, and it's just full of good,sound, basic philosophy.

The first word that I have under "Success in Turf" is attitude. Unless you have the proper attitude you're not going to go very far. You've got to want to succeed. You've got to want to do something so badly, so desperately that you're going to make it succeed. And then, dedication. Turf is not a nine to five job. It's overtime. I've known men, who at the stroke of five quit, went home, had a drink, something. But, the dedicated persons stayed there if something extra had to be done. Now, that's dedication.

Observation. Many people can see perfectly, but they don't see that they're seeing. If you get what I mean. I trained under a man in Nebraska, Dr. Keim, one of the greatest teachers of men I've ever known. And Dr. Glenn Burton, whom I visited on the way up from Florida, says exactly the same thing. He was not a great research man, but he was a dedicated man and one who motivated people. He motivated me. He motivated Dr. Burton, Dr. Gerald Mott, and many others. And, he taught me to see things. Called it a "windshield survey." Driving through the sand hills of Nebraska in a Model T Ford, 15 mph, "What's that plant, Fred?" "I don't know." Well, that's ?soledego something or other." A few miles farther, "What's that plant?" But, the third time I knew that plant and never forgot it. Now, that's seeing what you're seeing.

The inquiring mind. Asking questions. Harold Glissmann dwelled on that in his paper last year. Ask questions. Don't be afraid to ask/people because who know are complimented that you ask, and they will take the time to answer, or they will help you find the answer. My father

never finished the sixth grade, yet he was one of the best educated men I've ever known because he asked questions and he read, and he trained himself. He had an inquiring mind.

Helpfulness. Lend a hand. I had the pleasure of sitting next to one of the students at lunch this noon, and we had a fine conversation. And I could lend a hand to that boy. After lunch I talked to someone who needed a helping hand on some problems he wasn't quite able to cope with because he didn't have the answers. That's what we of the older generation are here for. We want to extend the experience that we've had and help the younger, the next generation.

Involvement. Be involved in things. I just learned about the formation of the Kentucky Turfgrass Council. As you heard, I am Executive Director of the Pennsylvania Turfgrass Council, a life member of the Virginia Turfgrass Council, a member of the Maryland Turfgrass Council, and well, I think you get the impression that I like to be involved. But I saw involvement in New Orleans and I was very proud. It was a Penn State alumni club. There are some 420 turfgrass students who have earned their degrees, either two year or four year at Penn State and they have become organized. They have dues, and what's left over, after minimal expenses are met, are sent to Penn State for research. Every single one of these young men is involved. And it was a wonderful thing to see. Now, when you help somebody, go the second mile if it's necessary. I walk with a walker. I can get along by myself, but it's sure fun to have somebody helping me. And this, believe me, is tremendously appreciated. So, when one of your fellow men needs help, go the second mile. I have seen Bill Lyons do that - he's a tremendous man.

Tell someone you love him. Nobody is going to criticize you for telling another person you love him - you make him feel appreciated. I have a friend who came down from Alaska to New Orleans. I was so glad to see him that instinctively I kissed his cheek - I love him. He's a great person. I started working with him in 1935 in Pennsylvania, and we have had a lot of laughs about our experiences there. When you like somebody real well don't hesitate to tell him.

Continue to learn. Continue to learn from others. Get the experience of others. I've quoted this many times from a book of quotations. "Don't be afraid to make mistakes, and learn from others' mistakes because you'll never live long enough to make them all yourself." I've made some mistakes and they have been dillies, but I've learned from them.

Read. A man in New Orleans said, "I've been reading your articles in Golfdom." I said, "I don't write for Golfdom any more." He said, "Well, I'm reading your articles from three and four years ago. I just got around to them. I have a stack of articles like that, and I'm going through them systematically." So, apparently some of the stuff we've written in years past still holds. There have been changes, of course. Don't be afraid to write. I get some of your newsletters from around the United States and Canada and I see in them the constant plea - please send in something to the newsletter. Why are so many of you so afraid to write something? Are you afraid you can't write, put your thoughts into words?

Well, write somebody a card. I get post cards from Bill Lyons, and it's wonderful to hear from people. I get a little disappointed with some directors of our Pennsylvania Turfgrass Council. I write

to them but they don't write back. But I keep on writing to them - in the first place I like to write, maybe I can get a message across to them, and maybe some day they will sit down and write me a note.

Study history. This is all part of success in turf. Mel Robey was sitting on my left at lunch today, and going back into history of aerification, and I was telling the graduate student on my right about the early days when I was an Extension Agronomist in Pennsylvania. Every spring the greenskeepers would use a wheel barrow seeder to sow on top of the ground common Kentucky bluegrass without aerification because we did not have it then, without fertilization because they did not even know what to use. The ground was hard and compact, and if one seed out of 10,000 grew into a plant they would still have lousy turf because crabgrass predominated in the summer.

But this is part of history, and there is so much in the background that I think every student should know if he's going to become a success in turf. He ought to know what was the beginning of this particular machine, or this particular practice, or this particular grass. See, I've been in this business almost fifty years. I started out in 1927 working on turf. There have been so many changes that if you start from right now and don't know what went on before you're not fully informed.

Share with others. My goodness! Do you remember the day when every greenskeeper held all his secrets closely guarded because he did not want anyone else to find out how he topdressed his greens, or what he put into his compost mixture? He was afraid to share, afraid somebody would steal his secrets. Today we are more gregarious, we share broadly because of the training we've been given. People like Bill Daniel, Jim Beard, right on down the line. We've learned to share. I certainly learned it in Extension, probably to my financial distress because I learned to give things away. Well, I'm going to keep right on doing it just as long as I'm around.

Be a good listener. Be attentive. I have been in meetings, I know one person who will be leaning over talking half the time, even when I'm talking. I glare at him - it doesn't do much good - he just keeps right on talking. He is not attentive, and as a result he has not come a long way. Now, I don't know the exact quotation, but it comes from an Indian, and an Indian wouldn't criticize another Indian because before I'd do that I'd have to talk a mile in his shoes. Put yourself in the other fellow's place and find out what his problems have been. If you would criticize anybody first walk a mile in his shoes.

You've got to be a doer. And take notes. The late Professor Musser used to ask me, "Fred, what in the hell are you going to do with all those notes you take?" "Well," I said, "I'm going to put them away and some day I'll read them again." And I have! I've been going through some of my notes that I took 40 years ago. It's surprising what I learned from them.

I don't have to say to you, attend conferences! You're here to learn.

And again, make something happen. This, to me, is part of the real success in turf. You people are making something happen. I've been following the success story of the PAT System for athletic fields, and I am glad that at one time I had a little bit of a hand in helping

Bill Daniel get started in his career. And he has made a tremendous success of it. Back in 1946 I had a hand in getting Jim Watson started under Professor Musser for his Ph.D. degree studying how to water grass. Nobody had ever done it before. Look at the success Jim Watson made of his career! These are the things that makes one real proud to have helped somebody become a success in turf and in life. Turf isn't everything - turf is people. So, success in turf is success with your fellow man.

And last, nothing great was ever achieved without enthusiasm. This morning during registration I stood and talked with Dave Bingaman, Lou Miller and several others, and the enthusiasm in those boys was just tremendous. It made me kind of glow with pride just to know people who can emote with such enthusiasm. They're enthused with their work, their friends, their lives, everything.

I'm awfully glad to be asked to take Harold Glissmann's place. I'm sorry that he couldn't be here.

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JUST REFLECTIONS

Fred V. Grau, College Park, Maryland

The word "reflections" carries me back to New Orleans a few short days ago when Bill Daniel, Ray Gerber and I received the GCSAA Distinguished Service Award. I remarked that in the polished face of the plaque I would henceforth see the faces of my turf friends reflected back at me. Here today I will reflect briefly on some of the outstanding recollections of events and people who have helped me on the road to success.

First, my mother, who impressed upon us six children the value of an education. She was a school teacher on the Sisseton Indian Reservation in South Dakota. The use of good English was a must in our home.

Next, my father, who was a fanatic on quality. We won many prizes at county and state fairs with our exhibits of corn, small grain, vegetables and wild grasses that we collected along Nebraska roadsides. The grasses had to be perfect, neatly bunched, and tied with a purple ribbon. The lessons that I had in quality never will leave me.

Dr. Howard Sprague was working for his Ph.D. degree at the University of Nebraska in 1919 when I finished 12th grades at the old School of Agriculture on the Ag campus. Howard was my first teacher and a good one because he had trained under the foremost of Ag teachers, the renowned Dr. F. D. Keim. Many will remember Dr. Sprague from his turf work at Rutgers where he and Dr. Glenn Burton published a bulletin on Poa annua in 1930. It was so good (quality again) that very little new has been added since.

Dr. Keim motivated many young men and helped to guide them into brilliant careers. Some of his students were Sprague, Burton, Mott, Engel, Skrdla and Grau. I was privileged to be one who baby-sat with the Keim children. Dr. Wayn Keim, their youngest, is here on the Purdue campus, training young men in the fine tradition of his father.

Part of my education was taking care of the unique Living Plant Museum. It covered several acres and was devoted to raising every economic and exotic crop that could be grown in that climate. It was my job to plant and cultivate the rod rows of crops, then harvest them at the right state of maturity, store and label them, and ship them worldwide for crops judging teams. We had speltz, einkhorn, emmer, pod corn, cotton, peanuts, milo, sorghum and so on, ad infinitum. It was a tremendous education based on hard work and preservation of the highest quality in every thing.

Dr. John Monteith was another who had a hand in shaping my future. In 1927, as Director of the U. S. Golf Association Green Section, he established a $300-a-year grant with Dr. Keim for work on turf. I was chosen to mow and take care of the plots, apply the cotton-seed meal, bone meal and sulfate of ammonia, and to dig and weigh the weeds to see which fertilizer produced the smallest weight of green weeds. He helped me to secure a fellowship at the University of Rhode Island. I was scheduled to start my Master's work in the fall

of 1931. That summer, after being graduated, I was asked to help with the turf plots at the Midwest Turf Gardens on the A. D. Lasker estate. After a month I was called to Washington, D.C., to help edit the Green Section Bulletin. At that time, the Arlington Turf Gardens were on the bank of the Potomac where now the Pentagon stands.

Kenneth Welton was a Green Section employee then. We played golf together quite a bit. He was one who put together the Purdue Golf Course.

Dr. Mary Reid was another with whom I was privileged to work. She determined that turfgrasses grew as well at pH 4.5 as at pH 8.5 so long as they received adequate nutrients. This was the era when the influence of day length on flowering was just beginning to be known and appreciated.

Dr. Arnold Dahl and I used to roll the lumps out of calomel and bichloride of mercury, then mix them with sand for spreading on greens for disease control. We determined that evening watering encouraged more brown-patch than morning watering.

In the meantime I was busy applying sodium arsenite and other chemicals for weed control at the Arlington Gardens and on the campus of the University of Maryland. At that time the campus was separated from U.S. 1 highway by a cruddy barb wire fence. The great depression hit just as I was about to embark on my Ph.D. studies. With the help of Dr. R. P. Thomas and Dr. Jacob Metzger, and by living free in a greenhouse headhouse for taking care of the plants, I struggled through doctorate work. A Model A roadster carried me to every county in Maryland studying pastures, soils, vegetation and related aspects of agriculture. To analyze my soil samples I had to establish a soil testing system, the first in Maryland -- still in use today, with improvements. My thesis was a station bulletin. Getting a Ph.D. with no money wasn't easy. I even had to wear a second-hand suit to graduation exercises. It was of good quality cloth, but too long in the legs -- which had to be rolled up.

Charles Hallowell, Marshall Farnham and Joe Valentine had been calling on the "brass" at Penn State and had persuaded them to hire an extension agronomist for work in turf. I got the call and started work February 15, 1935. Thus it was that I became the first extension agronomist in turf in the United States. Because of my background, I worked with farmers' pastures in addition to visiting nearly all the golf courses, many lawns, athletic fields, cemeteries and highways. With C. N. (Doc) Keyser we put together a "Rube Goldberg" machine for grinding and mixing soil, lime, organic matter, seed and fertilizer. I termed the mixture "floss." We rigged up a Gunite machine to spray the dry mix and a stream of water out of two adjacent nozzles. Thus, we became the first to hydroseed slopes. This was on the original section of the old Pennsylvania Turnpike between Carlisle and Sideling Mountain. It worked! I was responsible for specifying the seed and fertilizer for the Turnpike slopes.

I neglected to say that, between high school and college (six years) I spent half the time growing corn on rented land. The proceeds purchased my first insurance policy and a Model T. The rest of the time I helped to build highways in Iowa, Kansas and Nebraska. We graveled the last 10-mile stretch of the Lincoln Highway between

Gibbon and Grand Island, laid the first concrete pavement in Kansas just west of Perry, and helped get Iowa out of the mud. During the winter of 1926-27 the Mississippi froze over solid. We were then hauling gravel out of a wet pit. When the trucks reached the dumping area, at 10 below zero, they had a solid five-ton block of gravel that had to be chipped out of the bed. The company lost its shirt and I lost my job and all the money that my truck drivers had borrowed from me. Fortunately I was drawn on the jury at District Court in Omaha and there I visited daily with Earl G. Maxwell, Douglas County Agent, who had been a good friend of our family for years. It was he who persuaded me to enter college and, since I had no money, to work my way through. That is just that I did starting in June, 1927.

The most notable happening in 1935, my first year at Penn State, was my discovery of crownvetch on the farm of Robert Gift near Virginville, Pa. I am still convinced that it was divine guidance that led me to the spot. I was traveling from Allentown to Reading and had an hour to spare. I came to the intersection at Moselem Springs and elected to play hooky. Had I turned left I would have missed my destiny, but I turned right. In about a mile there was a fork in the road, so I turned right again. As I crossed Maiden Creek, another fork said "turn left." There, up a steep winding hill, was a steep shale slope ablaze with blossoms of a plant I did not know. I was entranced. I stopped and hunted up the farmer, Mr. Gift, who called it "dot veed" because it interferred with his method of farming. In the fall I went back to hand-harvest some of the seeds of the plant that, by now, we know as crownvetch. Dr. Stanley Cobb helped me to run it down in a botanical key. More on this later.

In 1937 there was excitement over the fourth International Grasslands Congress to be held in England, Wales, the Scandanavian countries and on the Continent, mostly in France and Germany. Both crossings were made from Montreal in the Empress of Britain, which later was sunk by the Germans. Dr. Monteith and I played on some of the most famous courses in Scotland and England, sometimes where the grass was mowed by sheep.

That fall, Eberhard Steiniger and I traveled south from Pittsburgh down to Mobile Bay, through Louisiana and on to Texas, playing golf every day. We shot about the same in those days and it was fun. In Texas we laid the foundation for future developments in turf, then went on through Oklahoma and Kansas to spend the holidays with my family in Nebraska. We attended the AAAS meetings in Indianapolis on the way home, tarrying for New Year's Eve celebration in Zanesville, Ohio. But that is another story.

The year 1938 was a significant one. Prof. Frank Fagan at Penn State shared my enthusiasm for crownvetch, he for his orchards, I for erosion control. He had a daughter, Anne, who became Mrs. Grau in December, 1938. She, too, shared my love for crownvetch, never realizing what she was getting into. When I failed to convince farmers that they should plant crownvetch (I knew it had a future), Anne and I bought two run-down, worn-out farms and started to grow it on our own. It was uphill work with no guidelines. On every hand our fellow-workers would try to discourage us saying, "If it was any good, someone else would have done it already," and "cows won't eat it

and it's poisonous so it's no good for cattle feed." We kept on and six years after we planted the seed we harvested a small crop (1946). Then we didn't know what to do with it. There was no market and the seed had to be processed. We got some help from Prof. Musser, who subsequently published a bulletin. When we finally had some seed to sell, the state and federal agencies said, "We can't buy from you because you have a monopoly." So we had to set up our own competition.

It wasn't easy keeping the farms going, holding down a job so that we could afford the "luxury" of founding a new agricultural industry, and keeping the family going.

During the war I worked with Dr. Monteith and Prof. Musser on dust and erosion control on airfields and other military establishments. These were not easy times either. We had an infant daughter and wartime life on a farm wasn't easy for Anne. After the war it wasn't long until the U.S. Golf Association began to look around for a director of their Green Section which, by now, had located with the USDA at Beltsville, Md. They chose me and, on August 1, 1945,we moved to Greenbelt in temporary housing until we could find a home. Now travel began in earnest in the U. S. and Canada.

When I started to look around at Beltsville, several very important people sprang into prominence regarding two highly significant projects that were to leave a permanent impression on all turf everywhere. Mitchell and Marth had started experiments on 2,4-D along with Dr. Fanny-Fern Davis, who was then acting director of the Green Section. Their work was widely publicized and we don't have to be reminded of the value of 2,4-D for turf. Dr. Davis was given the USGA Green Section award this year in New York at the USGA annual meeting.

The other project was under the guidance of Dr. K. G. Clarke, who was the "father" of ureaform. After a series of greenhouse tests I was privileged to be the first to apply UF on alta fescue turf on the front lawn of the Plant Industry Station. Later on I was to have a hand in telling people about the advantages of UF on turf.

Two people who were largely responsible for my becoming engaged in national turf affairs were Fielding Wallace, a true Southern gentleman, and Dick Tufts of Pinehurst. Both were chairmen of the USGA Green Section Committee, and true friends they were.

Tom and Tony Mascaro came to visit me at Beltsville in the fall of 1945 and there the basics of soil cultivation were outlined and a crude drawing of the "spoon" was made. This was the start of aerification as we know it today. The FG Aerifier was built and tested in 1947, and a great day for turf it was. 1945 saw the start of the Midwest Regional Turf Foundation and I was on the original Board of Directors.

Meanwhile, I had been busy writing letters to every turf-minded worker in the country, asking for support for a turf committee in the American Society of Agronomy. The letters were overwhelmingly favorable and we were granted a tentative place in the ASA. I was named chairman, a position I held for eight years. In 1946, at the Fontanelle Hotel in Omaha, the turf commitee held its first official pro-

gram. As you know, turf has become an integral part of the Society. This recognition gave turf a standing among Land Grant Colleges and we were accepted as part of agriculture.

In 1946 saw another memorable development. Dr. O.S. Aamodt, USDA at Beltsville, and I drove to Florida to talk turf and, on the way back, we stopped at Tifton, Ga., to see Dr. Glenn Burton. The upshot was that both of us made a modest grant of money and Burton was given permission to devote part of his time to turf. That was the start of something great for the South and for all turf everywhere.

In the same year I had helped Texas with their first turf conference. There I met a young student by the name of James Watson. I learned that he was interested in turf and that he wanted to pursue an advanced degree. I telephoned Prof. Musser at Penn State and asked if he would take Jim on as a grad student. He said, "Yes, but where's the money?" I furnished the money and Jim became the first Ph.D. in turf. The money came from the Green Section Service Subscription Fund which developed from members other than USGA member clubs. We welcomed firms, parks, individuals and clubs that were not eligible to join USGA. The fee was $35 a year. We accumulated enough capital to give other students a start in turf, one of whom was Bill Daniel.

At Beltsville, I had a loyal crew. There was Marvin Ferguson, who got his Ph.D. at Maryland. Also Al Radko, now research director of the USGA Green Section, and Charlie Wilson, now from Milwaukee. Some of you may have seen the color spread in the August, '53 National Geographic where Al Radko and I were trying to pull apart a sod of Merion bluegrass and Meyer zoysia blended. In the background was a field of zoysia cut for seed, drying in the sun. We did a lot of work on zoysia. We grew seedlings and sent them all over the U.S. We released Meyer (Z-52) zoysia for vegetative propagation and tried to encourage commercial seed production.

Charles Hallowell had found a patch of bentgrass on a green at the LuLu Temple Country Club near Philadelphia. He sent it to Penn State where Prof. Musser "married" it to two other vegetative strains and evolved the great seeded bent we know today as Penncross. The components were tested at Beltsville under considerable stress to make sure they could "take it." Penncross was released in 1953.

At Beltsville I worked with Dr. Roger Humbert, USDA, who was interested in the physical makeup of putting green soils. We collected cup-cutter plugs from putting greens all over the U.S. from 1) greens that were "easy to keep," and 2) greens that were "hard to keep." Results published in the USGA Journal said that the higher sand content characterized those that were easy to keep. That started the chain of events that led to the high sand greens we know today.

"Grass," the 1948 USDA Yearbook was one of the most popular of the series. The "separate" (reprint) on "Lawns" by Ferguson and Grau was reprinted many times. This is one of the classics in turfgrass history.

The years 1950-51-52 brought significant developments. We

conducted national coordinated trials on crabgrass control and on Merion bluegrass. We held national turfgrass field days at Beltsville and had professional golfers and college football players test various turf areas. U-3 bermudagrass ranked high at that time. Merion was released and it created a sensation. It was the first improved bluegrass that could be established from seed and come true to the type. The principle is "apomixis." Merion seed was sent to Australia where it was disappointing when it did not receive the amount of nitrogen it required. Today it is one of their favorite grasses.

My "Turf Roundup" in Golfdom in these years tried to cite every project, every grad student and many of the findings in research. They were complete. Today such a roundup would be voluminous because of the proliferation of projects and workers in the U.S., Canada and elsewhere.

The Sixth International Grasslands Congress was held at Penn State in 1952. Until this time, turf had not been recognized by this body. I was invited to present a paper at a plenary session. The title was "Turf--A World Concept." It was published in the Proceedings.

In 1953 the CGSAA held its conference and show in Atlantic City where it was announced that I had left the USGA. After a brief fling at growing grass commercially, I joined the staff of West Point Products and plunged headlong into the selling game. Actually, selling was simply part of the educational process. It was challenging and exciting. We organized tours and schools, and published turf conference proceedings. I can still see the looks of amazement on superintendents' faces when we would aerify a strip across a sloping green, then let water from a hose run across the green. When it came to the aerified strip the water simply disappeared. A point had been made!

James O'Donnell of Woonsocket, R.I., was one who took a tip from Dr. K. G. Clarke and began to make ureaform which he called Nitroform. I was asked to come to the plant and to consider a position as salesman. When I saw the blue flakes of material coming off the reactor belt I thought "Blue Chip," which became the official name of the UF fertilizer. Four happy years were spent telling the story of ureaform, lecturing at conferences and traveling widely.

In 1960, right after the GCSAA Conference in Houston, where I headed a panel on "Let's Build it Right the First Time," or "Built-in Headaches," I flew to Seattle for another conference. There I became ill and, on my return home, discovered something wrong with my back. All that summer I lay on my back in a full body cast in the hospital, letting my fused backbone heal. I continued to write for Golfdom lying on my back. What a summer! During this time, Hercules, Inc., purchased the rights to Nitroform and I became Hercules' consultant. This continued until 1965, when I began to devote full-time to private consulting and to Penngift crownvetch. There had been many weekend commuting trips to Pennsylvania to keep track of the crownvetch seed production operations which had been sadly neglected.

Tragedy struck in 1967 when we lost our daughter Barbie. It struck again in 1968 when Anne died. Going on alone was a bleak existence. Work and more work helped to ease the pain. A friend

recommended me for an Air Force consulting job in Vietnam which I fulfilled. Then another friend invited me to come to South Africa, where I saw turf work, golf courses and farms filled with wild game. I helped the Killarney golf course with the Penncross bent on their greens. While I was in Vietnam I was given the USGA Green Section Award which later was presented to me at Penn State by Al Radko.

In 1973 I sat at dinner one evening with a lady whom I had known as a girl and whom I used to date before we were graduated together from the University of Nebraska in 1931. Both of us had raised our familes and had lost our mates. It was only natural that we should go on together. So it was, on July 7, 1973, Frances and I were married. She was with me on February 5 when the Nursery Marketing Council at State College, Pa., awarded me a plaque for my 40 years of work with crownvetch. She was in New Orleans when Ray Gerber, Bill Daniel and I received our GCSAA plaques for Distinguished Service. We were together last October when we drove to Manhattan, Kan., for the 25th anniversary of the start of their turf program and the founding of the Central Plains Turfgrass Foundation, Last week, coming from Florida, we visited with Glenn and Helen Burton at Tifton, Ga. As a result, I am to be the banquet speaker in 1976 at their 30th conference, another memorable celebration.

Through these years of progress, discovery and development I have tried to teach others, but I have been the one who gained the most because I have learned so much from each of you. No longer can I tramp your fairways and inspect your greens, but I shall remain active in reading, writing, learning and speaking so long as I am able. By maintaining close contact with the young people in this profession, I can keep young along with them. My work largely has been turned over to the younger generation, which is the way it should be. My son, Fred Jr., now operates our crownvetch farms in Pennsylvania. He had four years here at Purdue, studying chemistry. In New Orleans I saw youth in action at the Penn State Alumni Club. Turf students from all over the U.S. have banded together to raise funds to maintain the vigor of the turf program of their Alma Mater.

My thanks to all of you for being here. May good health and success be with each of you.

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INTERPRETING THE MISINTERPRETED ABOUT PESTICIDES

Walter Weber, Indiana Farm Bureau Cooperative
Indianapolis, Indiana

Are you an ecologist, or are you in favor of pesticides? Just how would you have answered that question? It was raised by a high school student as he was arranging the silverware while I was setting up my projector. I had been invited to be the after dinner speaker.

My answer was yes. Yes, I am an ecologist. Yes, I am in favor of pesticides. I hastily added that my reference to pesticides

was with the understanding that they were properly applied pesticides used according to directions. I then explained the true meaning of the word Ecology which refers to the interrelation of all living organisms and their environment. This includes air, water and soil. This automatically makes almost everyone an ecologist. I also explained that this word ecology is not new. The word was originiated by Dr. Haeckel of Germany in 1869, so has been in use over a hundred years. It is not some new science that has suddenly developed since we started using modern pesticides. The proper use of appropriate pesticides certainly improves the encironment for beneficial plants, animals and people. These pesticides contribute to an abundant supply of nourishing food and the control of annoying pests.

The folks who have been using pesticides in their intended manner have certainly been interested in ecology many years before the word became so significant in the eyes of the general public. People only hear the words they understand. Many people are exposed to the word ecology every day, but do they understand what it means?

"But what about all this DDT in our bodies?" That was his second question. He was a very alert young man who gave the impression of being very conscientious. I liked his type of question since it gave me an opportunity to draw his attention to some of the misinformation that has been disseminated about this excellent product.

I explained the fallacy in the banning of DDT. There was overwhelming evidence of DDT's direct benefits by killing insects that are responsible for transmitting diseases as malaria and yellow fever without any indication that the small deposits within our body would cause any harm. This banning was an excellent example of a decision being made on political expediency, unsupported assumptions, and emotional reaction rather than scientific facts. It was a typical example of where some people just won't listen even when one gives them the facts. In this particular case there were thin egg shells when 100 ppm of DDT was added to the ration and the calcium was reduced to 0.5%. On the other hand, the shells were normal when 2.5% calcium (normal) was used and 100 ppm DDT was added.

"But, that's not what our teachers tell us." This was an excellent example where his particular teacher had been misinformed. This is understandable, since so much misinformation has been disseminated. An excellent example can be seen in the May 10, 1972 copy of the fifth grade edition of "My Weekly Reader," where the question for a crossword puzzle was the initial of a dangerous insecticide. The answer provided was DDT.

Today we are bombarded with many undefined terms. To be specific, I saw a roadside sign featuring "organic grown." I asked the lady what she meant by organically grown? She said they used lots of humus and mulch. I asked her how they controlled the insects. Her answer was, "We use Sevin, it does a good job and doesn't hurt anything." Apparently she hadn't heard about the toxicity to bees.

We also hear many high sounding, impressive words as being associated with pesticides. You will read about carcinogenesis, teratogenesis, and mutagenesis. None of these are related to the

book of Genesis in the bible. However, if you read certain articles you would almost conclude that pesticides are the cause of all three, even though there is not scientific proof when those pesticides are used in the proper manner.

You know that God created the world in six days. He probably couldn't have done it if Ralph Nader had been looking over his shoulder. In the first place, God would have had to file an environmental impact statement with the E.P.A. Then there would probably have been a class action suit to see that the earth would be free from pollution. God would probably not have been able to provide adequate reasoning for being creative. How would He explain the source of light? Would it come from the result of strip mining? Would there be thermal pollution? Would there be any air pollution? It would probably take a minimum of three months to review the environmental impact statement even if there were no other applications on file. Then there would probably have been a public hearing in about 10 to 12 months, even to receive a temporary permit. I don't know what OSHA would have wanted to add.

Today so many people are willing to accept food and enjoy the beauty of nature without understanding why plants grow or fail to grow, and with no concept of the importance of properly used pesticides. Many people fit into Mark Twain's philosophy when he said that "It's not that people know too much, but they know so much that ain't so."

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"THE NOBODY-GIVES-A-DAMN SYNDROME"

Dr. Jim L. Windle, Dept. of Supervision,
Purdue University

Several months ago Bill Daniel called me and asked if I could speak to your group today, and I asked him, "Speak to the group about what?" He said, "Oh, speak to them about worker motivation, productivity, and the Nobody-Gives-A-Damn Syndrome." I said, "OK", and was about to hang up the phone when Bill said, "And by the way, all we hear on the news today is bad news, so say something about what it takes to be happy." So, I am here today to speak briefly about worker motivation, productivity, the Nobody-Gives-A-Damn Syndrome--and at the same time to say something about what it takes to be happy.

You know there are a lot of people in this world who don't seem to be very happy. I travel a lot around this great country of ours, and as I walk down the streets of many towns, I see people who have long faces. Granted, the economy is not as strong as it has been. But, these people have given up on life. They have read too much of the "doomsday press." Instead of the news media telling the public that 92% of 86 million Americans are working--they shout about 8% being unemployed. During the best times we have always had 4% to 5% unemployed and perhaps always will. So, actually we have only had about a 3% to 4% increase in unemployment.

"Doomsday" reporting causes people to give up. A cartoon on the front page of a recent issue of the Wall Street Journal illustrated this point. The cartoon showed a middle class husband and wife sitting in their comfortable iving room and he is saying to her: "True, we do live extremely well. But I will say to hell with everything." We don't need people like that--we need happy people in this country.

Recently, President Ford urged Americans not to give in to "self-defeating pessimism. We need people who have hope and faith. I feel sorry for people who don't have the strength to maintain a positive attitude. The Bible says, "Know thyself." It doesn't say, "Snow thyself." And, some people have snowed themselves into believing that they cannot be happy and successful.

It seems to me that if there is a problem we must first decide if it is our fault or not. And this is a big step! The Lord asked Adam why he ate the apple. And Adam said, "It's not my fault, she made me eat it." If we can admit that it is our fault, then we are on our way to happiness and success.

Let me test you on this last point by asking you to consider this question: "Are you contributing to poor work performance in America?" In the national news we hear about poor work performance in terms of the productivity gap between the United States and our foreign competitors. For example, we hear about how the Japanese, Germans, and others have been able to out-produce us--not only in quantity, but also in quality.

Advances in productivity are responsible for a large share of the economic growth in the United States. But, increased costs of wages and employee benefits, plus a decline in productivity and quality, cause serious economic problems. Poor work performance and poor product performance contribute to the rising costs of our products and our services, ie., they contribute to INFLATION. Inflation results when increases in compensation are not offset by gains in productivity, and sellers pass on the higher costs of raising prices. Recession results when people cannot afford to pay (or will not pay) these higher prices.

Some people are not buying cars today because they are fed up with paying for the auto worker's welfare program. As you know, the auto workers receive 95% of their weekly pay while they are not working! If you are put out of work tomorrow, will you receive 95% of your weekly pay? Why of course not! When are American workers going to accept the fact that there "ain't no such thing as a free lunch!"

Productivity gains in the United States are the worst of any major free-world nation. In a recent broadcast, Paul Harvey states that the United States is in a downhill race for second place."It's people are letting it down," he added. The United States used to make 76% of the world's automobiles--now we make 33% (when we are making them). We used to produce 47% of the world's steel--now we produce 19%. In the fifties we built most of the world's merchant ships-now we build only 2%. We used to lead the world as a builder of machine tools--now we are third. The sewing machine was "all-American" for generations--now only one company makes them in this country. 40% of all Americans wear shoes made outside the United States.

Why is our nation a lesser competitor in the world market place? Simply because too many Americans have turned their backs on work. There are people working today who feel like they have been "screwed" because they were not laid off so they could collect unemployment. There are "reverse" seniority clauses in union contracts that allow workers with the most seniority to get laid off first so that they can collect 95% of their pay. While we are producing poorer products and demanding higher wages, shorter work weeks, earlier retirement, more benefits, and pay for not working--the hard-working Japanese and oil-rich Arabs are about to buy us out with our own worthless dollars!

It is important to note that there are some people in government, organized labor, and some universities that claim that our economic problems are due to job boredom. However, there is much evidence which does not support their claim. I have evidence which indicates that "goldbrickers" (i.e., people who are loafing on the job) are causing economic problems. For example, it has been reported that wasted and "stolen" time is costing the American economy something on the order of $50-billion a year. "Theft of time" by employees may be costing the country more than organized crime. To "WIN" the fight against inflation and recession, organized labor and management must put an end to wasteful, restrictive practices that reduce productivity.

One of the great pleasures of traveling is meeting Americans who have positive attitudes. I recently met such a man on an airplane. I said, "Sir, I have to give a presentation to a group of young people at an Eastern university. Would you mind telling me what you think has been the most important event in your life?" He said, "Not at all, it was something that happened to me 46 years ago. My daddy set me down (I was 16 years old) and he said, 'Son, I don't have any money to give you, but I am going to give you a piece of advice, and if you heed it, I guarantee you it will stand you in good stead the rest of your life. Son, if you ain't a-gonna work, don't hire out.'" Now that is not grammatically correct, but it is good advice, and it reflects a positive value system and a positive attitude that many people don't seem to have today.

As I mentioned earlier, the issue of job boredom as "the" cause of lower worker motivation and productivity has been receiving a lot of attention. The attention is presently a little dormant--but it will flare up again as soon as economic conditions improve.

I should point out that I am not trying to worry you about something you should not be worried about. In fact, this situation reminds me of a statement made by the greatest football quarterback of all times--Johnny Unitas. He once said, "Don't worry about things you have no control over."

The importance of the motivation-productivity-job boredom issue to you as consumers, taxpayers, citizens, employers, professionals, and parents may not be obvious--but it is something you do have control over. The stakes are high; in fact, our very way of life is at stake. Therefore, you should have a good understanding of motivation and productivity and how we can deal with them.

Everywhere I go I tell young people and adults not to give up on American business and industry just because they are reading and

hearing bad things. The adage of the news business is this: bad news is good news, and good news is bad news, and the only thing worse than that is no news. But, don't worry about the day when there is no news because that day they will create some.

There has been a lot of "creative writing" about job satisfaction that says that workers are dissatisfied with their jobs. However, the facts about job satisfaction are based on the data from 7 national studies which were conducted between 1958 and 1973 which show that the percentage of satisfied workers is actually increasing. In 1958, 81% of the working males were satisfied, and in 1973 the figure had risen to 91%.

As the data indicate, most workers are not dissatisfied with their jobs. However, I believe that even though they are not dissatisfied with their jobs, many workers do not care how they do their jobs. Contrary to what some people say about the lack of worker motivation, I strongly feel that much of the problem is brought about by the "Nobody-Gives-A-Damn Syndrome" (or NGAD Syndrome).

So that no one will be offended, I am not using the word "damn" as a curse. I am using it as defined in the American Heritage Dictionary of the English Language. "Damn" (as I am using it) is used to describe "the smallest bit." And believe me, the way many people behave today they don't care the "smallest bit"!)

Not long ago, Paul Harvey picked up one of my articles from the Chicago Tribune and had a news program on it (the program I referred to earlier). He stated that I felt that the economy was being snafued by goldbrickers, by a 24-karat I-don't-give-a-damn syndrome that is sweeping the nation. He went on to explain what I meant, and that is simply this: we see the results of the NGAD syndrome (or disease) all around us. In fact, the sickness seems to be national in scope. And, it spreads like cancer. If you think about it, each of us feels more and more abandoned by our fellowmen. With this feeling, we begin to live only for ourselves.

There are people who do not care about public parks and roadways--they just throw litter down all over the place. They open up car doors into the car next to them, or back into another car and damage it and simply drive away. They smoke in places where it says "no smoking" and they walk on public grass even with a sidewalk close at hand. Women get molested in public parks as people walk casually by. There are more and more people receiving unemployment benefits, welfare, and food stamps--when they know they do not qualify. You see, more and more nobody gives a damn.

In business and industry the effects of the symdrome are not limited to the often-blamed boring, routine and unchallenging jobs--as some people want us to believe. For example, services are deteriorating. It is almost impossible to find a repairman who will do a good job the first time--or even the second or third time. Expensive new products fall apart like cheap junk. Waiters act as if they are doing you a favor to wait on you. Sales people stand around and gossip while you wait. Cleaners either fail to get your clothes clean, or they end up losing them. Airlines misdirect thousands of bags. Department stores cannot straighten out your billings. Magazines foul up on subscriptions, and you get letters demanding payment for copies you did not receive. This list could go on with even more specific examples.

I will admit that good services and products can still be found, but it is something to talk about when it happens. We are overjoyed when a mechanic fixes our car the first time, or when a product works properly when we take it home.

Taken alone, each failure is a mere annoyance. But when you add them all up, they are destructive to the individual and to our nation. You see, no one can live without caring. He loses his drive to be responsible and his competence declines. In fact, he ends up without pride or purpose. Mutual concern and cooperation are the adhesives of society. Without them no society can solve its problems, build a healthy future, gain the respect of its young--indeed, survive.

I continually receive letters from all over the country that support my position. One of the letters I received was from a man in Cleveland, Ohio who had been employed by General Motors for 45 years. During that time he was located at various plants throughout the mid-west, and had worked his way up from an assembly-line worker to plant manager. He said that based on his many years of experience with thousands of production workers, he would categorize them like this: 25% are very concerned about the product, its quality and the company; 25% are passively concerned about the product, its quality and the company; 35% live from hour to hour doing as little as they can; 10% don't-give-a-damn about the product, quality, the company, or fellow employees; and 5% are guilty of sabotage on a daily basis. This man noted that Americans are killing the goose that laid the Golden Egg.

So, you say, what can be done about America's work problems and don't-give-a-damn behavior? Although I must say that I do not have all of the answers, I am certain that much of the solution lies with the individual. Everyone (blue-collar and white-collar workers alike) must strive to get back their sense of personal worth--that feeling that their job counts for something and that their life counts for something. The way to do this is by getting to know yourself.

One aspect of getting to know yourself is developing a positive attitude (as I mentioned earlier). You see, it is our attitude toward life that will deteremine life's attitude toward us. Attitude is the reflection of a person. What is going on on the inside shows on the outside.

Think about this: Our environment is really a mirror of our mental attitude. If we do not like our environment we must first change our attitude. The world plays no favorites--it is impersonal. It does not care who succeeds and who fails. It does not care if we change or not.

Our attitude toward life does not affect the world and the people in it nearly as much as it affects us. It would be impossible to estimate the number of jobs which have been lost, the number of promotions missed, the number of sales not made, the number of marriages ruined, and the number of supervisors and managers who did not succeed because of poor attitude. There are thousands of people who held jobs which they dislike, and marriages which are tolerated, but unhappy--all because of people who are waiting for the world and other people to change before they will change.

Another aspect of getting to know yourself might be described as the "other, better side of the fence." Frequently many individuals

feel that things would be much better if they were on the "other, better side of the fence." "Things would be better if I were working with something else other than turf." "Things would be better if I had a different boss." There is a country and western song that says: "Everybody has to be somebody--why can't somebody else be me? Everybody must be some place--find me a better place to be." In other words: "Things would be better if I were on the other side of the fence."

You see, things always look "better" on the other side of the fence. Or, to put it in your language, the turf always looks greener on the other side of the fence. The fact of the matter is that we are probably standing on the better side of the fence now. If we will only explore our present activity, we will usually find it contains the things we are seeking. Before we jump over to the other side of the fence, let's make sure that the side we are now on is not the better side. You see, while we are looking at somebody else's side of the fence, they are looking at ours.

In closing, remember that next year this great country of ours will celebrate its 200th birthday. We have a lot of sacred heritage to uphold--heritage that was built by our productive forefathers. This sacred heritage of ours was not built by such unproductive things as abusive welfare and food stamps programs, a guaranteed annual income, wages for not working, shoddy work, and absenteeism. And, these things will not uphold sacred heritage.

Productivity Upholds Sacred Heritage, i.e., PUSH as shown on my lapel button. Our challenge is to remember PUSH and do everything we can to help alleviate the Nobody-Gives-A-Damn Syndrome. Also remember that you have several choices: you can be a tremendous success or dismal failure; you can be happy or unhappy. Be optimistic, be enthusiastic, be full of vigor, realizing that you can make another person's life a little richer for having touched yours for just a little while.

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A TOUR OF TURF - AFRICA AND SPAIN

Warren Bidwell, Supt., Congressional Country Club
Bethesda, Md.

My golf course safari that touched bases in Spain, Morocco, South Africa, Rhodesia and Rio De Janeiro was designed to see how some of our counterparts were doing abroad, take a look at bentgrass greens, where bent is known as the Evergreen grass. And, perhaps have a better understanding of how the rest of the world looks, sometimes known as a vacation here in the states, but better known abroad as a holiday.

When you are about to travel abroad for the first time, you are quite likely to form a few pre-conceived ideas, many of which will be wrong. You had best have an understanding with yourself: that you will probably make a few mistakes, spend a few bucks foolishly, and

hopefully be the wiser for the second time around, if and when the occasion comes your way again. After having had a three week golf safari last November covering 12,00 miles, I know this to be true.

Through the good offices of Dr. Fred Grau, I was introduced to Mr. Sidney Brick, chairman of the greens committee, the Killarney Golf Club, Johannesburg, South Africa. Mr. Brick returns to Washington annually to visit with his two sisters and elects to visit me at Congressional to talk turf during this period. We have a fine relationship, one that I shall forever be grateful for. We discuss turf and golf related problems as though he were my chairman: I speak freely, and he does likewise--as chairman and superintendents should do. Mr. Brick is an experienced green chairman, having served the Killarney Club for a number of years. and, above all, he is also very practical.

Because of a major highway construction project going through the middle of the former location, the Killarney Club was forced by condemnation proceedings to make complete changes in all of their playing facilities. The clubhouse was abandoned for a new location, the 8 bowling greens were moved, new land was available for new holes, and a totally new routing of the layout was necessary. With such a massive undertaking up for consideration, it was agreed to call in the best known golf architect in the world today, R. Trent Jones. While the Board of Killarney failed to reach an agreement with Trent Jones on design fees and turned down his proposal, they did remember some of his suggestions as to basic soil requirements and choice of grass for the greens.

With international travel being the name of the game in the world of business and leisure, a number of the members of Killarney had been in the states. Many had tried their skills on our bent greens which they call the Evergreen grass. Evergreen because, unlike the Bermuda, at their 6000 ft. elevation, the bent does not completely lose color in the Johannesburg climate, where they get sufficient frost in July and August to turn their Bermuda brown, yet never a hard freeze such as we had last month.

Faced with extensive changes involving construction and an almost total disruption of all facilities, wasn't this the time to consider the Evergreen grass, Penncross bent, as Trent Jones had suggested? The decision was made to go USGA specs and Evergreen grass. Today the Killarney has the only 18 holes of bent in the country. Under the steady hand and guidance of Mr. Brick, son John who is now permanent green chairman: and, having taken some sound advice from Dr. Grau relative to the agronomic practices necessary, the Killarney Club can be justifiably proud of their accomplishment.

I do not think it would be fair,however, to evaluate the success at Killarney without giving due recognition to their greenkeeper, Fred Frederickson, a former professional gardener--a man long associated with the soil; one thoroughly knowledgeable with the world of plant life and growing things, and dedicated to his own world, that of Killarney. I am convinced that without Fred or his equivalent the Evergreen grass would be waiting in the wings for someone to lead it down the road called success.

Most fairways of the area clubs are Bermuda; a few are Kikuyugrass. Both are cut very short to induce density. The nitrogen

level on these fairways is much lower than we use on either warm- or cool-season turf. Mind you though, their winter months are never as severe as ours and, therefore, the demands to get the grass growing following their so-called winter never compares with our situation either.

The Bermuda of South Africa, regardless of use on tees, greens or fairways, offer a wide range of varieties, color, fineness and cold tolerance as do our older Seaside greens. There are those that green early with only the slightest encouragement from nature, while others are very coarse and slow to green until the late spring brings about sustained warm days and nights.

The South Africa PGA Championship was played during the week of November 12. I was privileged to see the final day which pitted Gary Player against another native lad, Hayes. I was astounded when I saw the lackof grass and almost total lack of color on the Bermuda greens. As the story unfolded later, there had been severe criticism from the Pros on the speed of the greens. Spring had been a little late in arriving this year ('74) and consequently the grass wasn't growing well--some of the mixed varieties were green, others mostly dormant. Dick Adderley, Greenkeeper of the Wanderers Club,who attended our GCSA conference in New Orleans recently, was hosting the PGA event, was so frustrated with all the gripes, he agreed to shave the greens for the spoiled sports just to get them off his back. They looked like hell.

In Capetown, the Cape of Good Hope area, where the Atlantic and Indian Oceans meet; the Indian having 18 - 24 degrees warmer currents than those of the Atlantic, golf courses are surviving on frugal budgets more in keeping with the traditional beginnings of golf in Scotland than is to be found anywhere else in the world. Austerity is evident at every turn. Some fairway irrigation is practiced with above ground portable pipe to assist in the release of a very skimpy fairway fertilization that had just been applied to their very sandy soils.

The climate is not one that encourages the production of bent or bluegrass turf. The temperature gets in the 115 degree range, accompanied by 80% humidity over lengthy periods of time. Aside from turf production, it was interesting to listen to the conversations about how they erect shark nets to protect the very fine beaches along the Indian Ocean. When I wandered into the nature preserve to take a picture of the national flower, the protea, I was cautioned to be careful that the cobra lived among the rocks. Needless to say I was satisfied with only one picture.

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ENERGY AND ITS RELATION TO TURF MANAGEMENT

J. R. Watson, Vice President, Toro Co.,
Bloomington, Minn.

The energy crisis, together with the current economic dilemma as a result of inflation and a deepening recession, provides a unique opportunity for those of us involved in the turfgrass industry. In spite of the inconveniences and sacrifices we all are learning to cope with because of the energy problem and the gloomy economy, it is becoming evident that opportunities exist for turfgrass managers to develop and to demonstrate their superior managerial skills.

It seems to me that the green areas close to home -- the parks, golf courses, the playgrounds and the home lawn -- are now, and will continue to get the brunt of recreational traffic. Heavier play will put greater stress on tees, fairways, greens, playgrounds and parks. This can only be countered with good maintenance practices and careful planning of all operational activity. This is where the opportunity exists for everyone involved in the turfgrass industry. We must provide more service than ever before to the members and users of all turfgrass facilities.

Managers of turfgrass facilities must realize that maintenance of turfgrass areas is more important than ever -- not only on the golf course but in municipal recreation areas as well. Maintenance must be extensive not only to ensure the best possible conditions for recreational activity, but to also protect the heavy investment in property values that individuals, municipalities and club members have made. The turfgrass manager must now utilize his managerial skills to analyze each facet of his job function, the performance of his equipment, his operating procedures, his maintenance programs and his personnel policies -- to ensure efficiency at all levels.

From an energy standpoint we must first assess the short term implications and direct our attention to measuring the problems with which we are now confronted. This approach will help provide a base for the preparation and development of proposals for long range solutions. Shortages always force new thought and I have confidence in the long range solutions of today's problems.

Equipment. A short term approach to coping with, if not solving the energy crisis, is energy conservation. For those of us in the turfgrass industry I believe adhering to five steps or programs will not only conserve fuel but also enable turfgrass managers to continue to provide quality turf. These are:

(1) Select the most efficient piece of equipment for each job. Generally, reel mowers are more efficient than rotary or flail mowers. The scissors action of the reel mower not only cuts better but requires less power, consequently consuming less fuel. With the same mowing speed, reel mowers will use up to 50% less fuel per acre of cut grass than rotary mowers. Data developed by Toro's engineering division indicates several significant points with regard to equipment selection and fuel consumption. For example, our 70 inch Professional which is a triplex reel mower is capable of cutting a 70

inch swath of grass with a 6.25 horsepower engine, while a Trojan - which is a rotary - has a 14 horsepower engine for a 60 inch width of cut. The 70 inch unit cannot be used for all trimming operations, but where fuel supplies are critical, it makes good sense to use the smaller engine wherever possible.

When you are purchasing turf equipment you should keep in mind that the number of blades in a reel not only affects the quality of cut but also the fuel consumption. A five-bladed reel will use 8 to 12% less power and fuel than a six-bladed reel. However, determing the quality of cut for a given area is something only the turfgrass manager or superintendent can do, so it is up to him to decide if he can take advantage of this fuel saving opportunity by using fewer blades on the reels.

(2) The use of diesel fuel, rather than gasoline, is my second suggestion for fuel conservation. Diesel fuel generally costs less than gasoline and the diesel engine has proved itself to be from twenty to twenty-five percent more efficient than the gasoline engine. This means fewer gallons to perform a given task. This increase in efficiency may be sufficient reason to consider diesel power when purchasing new equipment.

I would be remiss though, if I neglected to indicate to you that, according to many golf course superintendents, fuel costs now represent only TWO TO THREE percent of the total maintenance budget at most golf courses. Over the last several years, the most rapidly rising cost factor on the golf course has been labor. In 1972 alone, this cost component rose 12%. This is why I stress the point that proper turf equipment must be utilized at all times.

(3) James Fischer, Director of Marketing, Turf Products from my company recently addressed himself to the subject of the relationship of labor to turf equipment. Fischer suggests that since labor comprises a large part of the total budget, and that the costs for labor are increasing as fast as or faster than that of equipment, many turf managers are allocating more of their funds for the purchase of higher capacity, labor-saving equipment.

(4) Clean and properly adjusted equipment requires less power and therefore less fuel. Proper adjustment of belts, bearings, chains and shafts can reduce the friction within the machine allowing for more power for work output. Frequent lubrication of vital parts will also reduce friction.

The tire pressure of any machine should also be maintained at proper pressure to reduce the rolling resistance of the machine.

With reel mowers, the bedknife adjustment is critical. Overtightening the bedknife wastes power, and an insufficient bedknife contact will not maintain the slight wear essential to maintaining sharp edges. A sharp reel mower will improve the quality of cut which, in turn, could prolong the mowing interval in some areas. Sharp edges will also allow reduction of engine RPM while maintaining good cutting quality.

The proper maintenance of the vital parts of any machine is important not only in the effort to conserve fuel, but also in extending the functional life span of the machine. But no part of the machine is

as critical as the engine in achieving fuel economy. Just as with your automobile, a properly maintained, well-tuned engine can conserve fuel. Several steps that should be followed concerning the engine include adjusting the carburetor to provide maximum fuel-to-air ratio. Checking the ignition system to ensure clean points and plugs, and timing, to provide maximum power. The engine air cleaner is crucial to its durability. A clogged air cleaner can change the air-to-fuel ratio and use excessive amounts of fuel. Proper adjustments and maintenance in the combustion chamber are important to extend engine life.

(5) Mowing practices, my fifth suggestion, can also be a means of saving fuel. Some examples of how adjustments in your mowing practices can conserve fuel include:

.. planning mowing patterns that require the least amount of transport between locations.

.. using the least amount of overlap consistent with the skills of your operators.

.. selecting the height of cut best suited for each area -- you may be able to increase heights -- particularly in the roughs — and thereby add one or two days to your mowing cycle.

.. where possible eliminate mowing of steep slopes.

A reduction in maintenance due to a shortage in the supply of energy or a strict conservation program may mean longer roughs, hairy bunkers and longer grass around trees and shrubs, but maintaining normal maintenance procedures on tees, greens and fairways will not adversely affect the play on your course.

Cultural Practices. The impact of cultural practices on energy and turf management are apparent. In addition to mowing practices discussed early, two other major areas need consideration.

Irrigation and Fertilization. You may have seen several suggestions in recent editions of the Golf Superintendent. The suggestions include:

.. using minimal amounts of water whenever possible

.. cultivate (aerate) to insure movement of water (infiltration) and fertilizer into the soil

.. irrigating turf areas during evening hours to minimize evaporation

.. inspecting valves, pump impeller, bolts, motors and sprinkler nozzles frequently

.. convert to automatic systems -- this will conserve water and places control in the hands of the turf manager -- the best qualified individual.

It should be kept in mind here that water practices and fertilization affect growth directly. Thus, the frequency of mowing is affected by these practices. Obtaining an analysis of the soil may

not only save expenditures for fertilizer, but will provide you with a better foundation on which to base your fertilizer program. In the long run, you may be able to reduce your mowing frequency and still maintain good growth and color in your turf.

It would seem that careful review and study of all cultural techniques applicable to your particular turfgrass facility would pay dividends. For, many programs were devised before today's problems arose. And, if they are reviewed on a periodic and regular basis, the turfgrass manager may be able to make slight changes and modifications which could contribute to greater efficiency.

Personnel Policies and Energy. Good supervision is one of the keys to satisfactory crew relationships and is one of the major factors contributing to crew motivation. Ten points are frequently cited as supervisory responsibilities:

1. Build employee job satisfaction.
   .. not job-happy, but job-satisfied.

2. Provide development and growth chances for employees.
   .. develop individual talents - point toward promotion

3. Treat employees with complete fairness.
   .. consistency, impartiality.

4. Cultivate proper work atmosphere
   .. efficient, business-like, but pleasant - good comaradie - good fellowship - take crew on a picnic or a fishing trip.

5. Deal effectively with all gripes, no matter how small, and all grievances.
   ..handle promptly and completely no matter how simple you may may think the problem to be -- remember it is very important to your employee.

6. Protect employees' physical well-being.
   .. check on safety aspects -- daily health habits -- OSHA and similar organizations are demanding compliance.

7. Develop employees
   .. through training, coaching, motivating, personal supervision.

8. Promote upward communication
   .. listen to gripes, grievances and suggestions - involve the crew individually and collectively in performance and job critiques.

9. Promote downward communication
   .. pass on all company factual data pertinent to employees and work -- also compliments on jobs well done.

10. Take personal interest in employees.

Among the other more significant factors that may help to motivate the crew are those that treat him as an individual. For example, provide an environment at the facility conducive to good working habits. Keep the shop clean inside and out, keep the tools in place and organized to do an effective job. Provide shower facilities and

a place for the crew to have lunch. This same room may be used for training sessions or as a conference room. Bringing the crew together for discussion will help to instill a sense of "belonging."

Provide opportunities for training and education. Remember the crew member who performs poorly may not understand his job or his equipment -- he may not appreciate his role or his importance in the overall organizational structure. Remember that "school" or educational opportunity may have a different meaning to different crew members -- school to one may mean an opportunity to finish high school, to another an opportunity to attend a turf conference or a factory training program. Know your people, understand their basic needs, call them by name, discuss their job and give praise when it is deserved and take corrective action when needed, but do your reprimanding in private with the individual, not in a group discussion or in critiques.

Finally, although job security in times of recession may be sufficient to keep an employee performing in an exceptional manner, in the final analysis you, your crew, and your organization are better off with satisfied employees who feel they belong and that they contribute to the beauty and recreational value of your turf facility.

Summary. Despite the energy crisis, combined with the current gloomy economic situation, there is opportunity for each of us to continue providing the public with fine turf areas for recreation of all sorts.

As a consequence of the two factors of an energy shortage and prolonged economic adversity, we should anticipate a strong increase in the use of green areas in and near our heavily populated areas. We should also expect some changes in our life style, some, I believe, are already apparent. We are a people in love with travel and movement, in fact, some states in this great country depend on the mobility of Americans for their economic well being; and if our access to free wheeling cars and a sky full of planes is diminshed, I believe we will have a renaissance of hiking and hosteling and cross-country skiing. Look also for more lawn games and perhaps the return of bowling greens to our towns.

We are truly fortunate to have in the United States more than 11,000 golf courses and vast acreages devoted to lawns, parks, schoolgrounds, highways, airports and other types of turfgrass. That network is, in my opinion, a national treasure; one that will increase in importance to the people of this country as we move further into the new age of shortages.

As the demand on these facilities grows, we will have to keep pace with new turf management techniques and with new products. The turfgrass industry has a proud record of accomplishment for the past one-half century. We have seen such developments as new warm- and cool-season turfgrasses, new fertilizers, new pesticides-fungicides, insecticides and herbicides -- and new maintenance equipment. And, I believe it is the kind of development work that will ensure the availability of satisfactory turfgrass facilities.

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PRINCIPLES OF SOIL PHYSICAL AMENDMENT

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Introduction

Water is quantitatively the most important nutrient required for plant growth and survival. Actively growing grass tissue consists of about 90% water by weight. Plant not only contain large quantities of water, they also usually require hundreds of times this amount during growth. This enormous amount of water contained and used by plants is more than just an inert filler, probably every plant growth activity is directly or indirectly affected by water. All of this water is absorbed from the soil through the plant's root system. Since water is very essential for plant growth, and since all of the water used by plants comes from the soil, any factor affecting the absorption of water will, therefore, probably affect plant growth.

A number of biological, chemical and physical factors directly and indirectly affect either soil water retention and movement, or plant root growth and absorption. The primary soil physical factors affecting plant water absorption are soil water content and soil aeration. Water content is important because it indicates how much water is potentially available for plant use and soil aeration (the exchange of oxygen and carbon dioxide between the soil and above-ground atmosphere) is important in maintaining a constant supply of the oxygen required for good root growth and absorption. Both aeration and water retention depend primarily on soil structure or the kind and arrangement of particles in the soil.

Most golf greens have two important features which distinguish them from other golf course turf areas:

1. They are subject to severe foot and mower traffic, and
2. They are drained.

The effects of the traffic are obvious (soil compaction, poor root growth and absorption); however, the effects of the shallow drainage (excess soil water content, poor soil aeration) are less obvious but are generalized in Figure 1. A perched water table forms at the drainage level in such a green following irrigation and drainage (1). Under these circumstances, any good, medium-textured natural soil will likely be saturated throughout (Fig. 1-B) and grass growth will probably be poor. Both problems are minimized in practice by amending the soil with coarse-textured materials (e.g. bark, calcined clay, gravel, perlite, sand, scoria, vermiculite, etc.) to increase the soil's resistance to compaction and to increase the amount of large or aeration pores which drain despite thewater table (2). Unfortunately, "too little" amendment reduces both soil aeration and soil water retention without increasing the soil's resistance to compaction and "too much" reduces water retention excessively. The "optimum amount" of soil amendment should maximize soil compaction resistance and at the same time provide soil aeration and soil water retention which closely match those required for good turfgrass growth and water absorption.

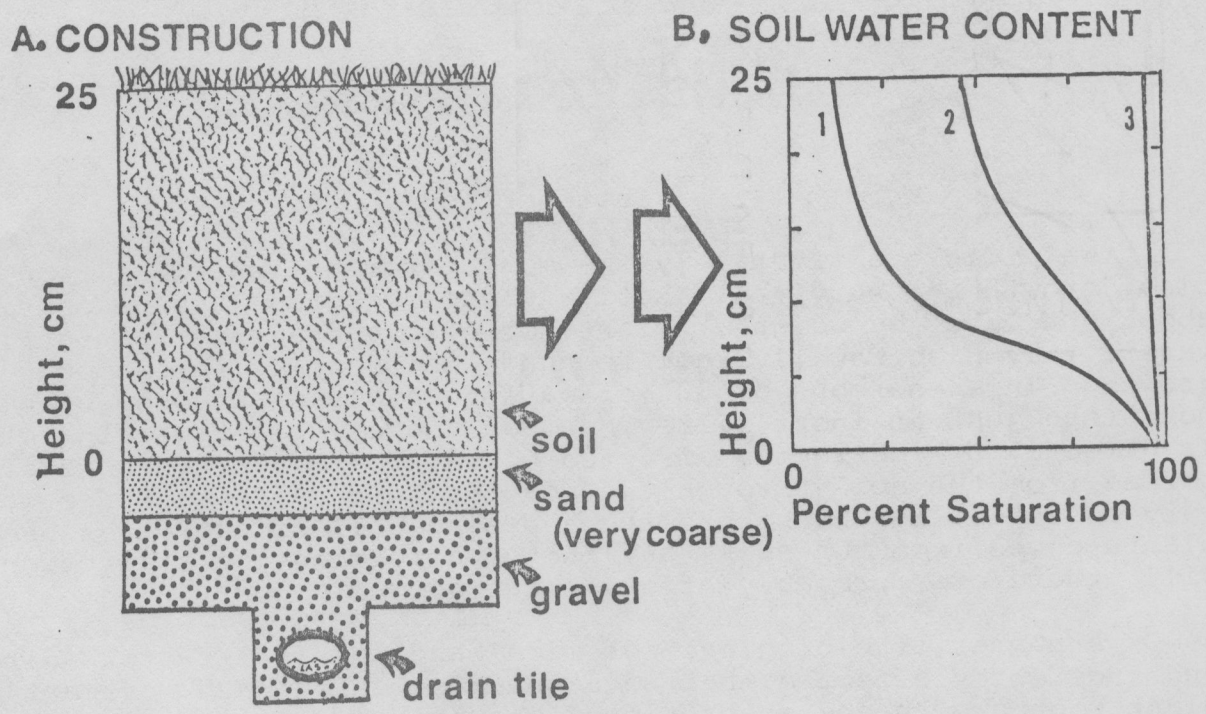


Figure 1. Water distribution pattern (B) for 3 different soils in a typical drained putting green (A). Soil 1 = coarse-textured sand: 2 = fine-textured sand; 3 = silty clay loam. All 3 soils are saturated at the drainage level (perched water table) and water content decreases with height above this level.

This article briefly discusses the changes in soil physical properties when natural soils are amended with coarse-textured materials.

SOIL AMENDMENT - SOIL PHYSICAL CHANGES

Figure 2 "pictures" what happens as a coarse-textured amendment is mixed with soil in increasing proportions. Since soil mixtures are usually prepared from bulk quantities (e.g. bu, ft^3, lit, m^3, yd^3, etc.),,component and mixture quantities are herein expressed as bulk volumes. Bulk volume equals the total volume (solid + pore volumes). Beginning with 100% soil (10 yd^3), mixture porosity first decreases then increases with the addition of sand in increasing proportions. Porosity initially decreases because the sand floats in the soil or excludes soil and soil porosity without adding any large pores. The minimum porosity occurs at the threshold proportion which is the mixture in which the "mixing bin" is exactly full of sand and the large pores between the sand particles are exactly full of soil. In other words, the threshold proportion is determined primarily from the amendment's interporosity (Table 1). This is called the threshold proportion because it delimits the minimum proportion of sand amendment required before further amendment begins to improve soil aeration. Since at the threshold proportion the amendment particles first exhibit particle-particle contact, this also delimits the amount of amendment required to improve the soil's resistance to compaction. As the proportion of sand is increased beyond the threshold, the large pores between the sand particles (amendment interporosity) become voided of

AMOUNT (bulk volume) OF SAND & SOIL mixture

Soil	10.0	7.7	5.5	3.6	2.5	1.5	0.0
Sand	0.0	3.5	7.0	10.0	10.0	10.0	10.0
Pores	5.0	3.9	2.8	1.8	2.4	2.9	3.6

Figure 2. Microscopic "picture" of what happens to soil porosity as a coarse-textured amendment such as sand is added to the soil in increasing proportions.

soil and both total and aeration porosity increase. A simple mathematical model can be used to predict mixture total and aeration porosities. This theoretical model is compared with actual total and aeration porosities of selected sand-soil mixtures in Figure 3. This data demonstrates that the theory accurately predicts mixture physical properties.

A simple graphical method for predicting soil total and aeration porosities from component individual porosities and bulk volumes is illustrated and explained in Figure 4. The effect of pore size on soil water distribution in a drained putting green is illustrated in Figure 1-B.

Table 1. Mathematical prediction of soil mixtures total and aeration porosities.

$_{a}V_{b}$ less than threshold proportion:

$$E_m = [{}_{m}V_b - {}_{a}V_b \ (1-E_a)] \ [E_s] + {}_{a}V_b \ [E_a^*]$$

$$E_A = 0$$

${}_{a}V_{b}$ greater than threshold proportion:

$$E_m = {}_{m}V_b - [{}_{s}V_b \ (1-E_s) + {}_{a}V_b \ (1-E_a)] + {}_{a}V_b \ [E_a^*]$$

$$E_A = E_m - [{}_{s}V_b \ (E_s) + {}_{a}V_b \ (E_a^*)]$$

E_A = Aeration porosity

E_a = Amendment interporosity (between particles)

E_a^* = Amendment intraporosity (within particles) porous amendments)

E_m = Mixture porosity

E_s = Soil porosity

${}_{a}V_{b}$ = Amendment bulk volume

${}_{m}V_{b}$ = Mixture bulk volume

${}_{s}V_{b}$ = Soil bulk volume

In general, soils with smaller pores (soil) retain more water in the upper levels than those with larger pores (sand). The effect of different amounts of soil amendment on soil water distribution in a drained area is illustrated in Figure 5. The addition or amendment (sand) up to the threshold proportion has no effect on the water distribution pattern, it merely decreases the total porosity. However, when more amendment than the threshold is added, the water distribution pattern changes to that typical of the sand indicating that large pores have been formed and that aeration should increase. As amendment particle size decreases, the soil water distribution pattern shifts towards the upper soil levels. When selecting an amendment, it is usually best to use one which has a relatively narrow range of particle sizes. Well-graded amendments with large amounts of fine-textured particles should be avoided because they are generally less efficient (larger amounts are usually required to produce soil physical improvement). Particle shape also affects amendment efficiency, but is much less important than size and size distribution.

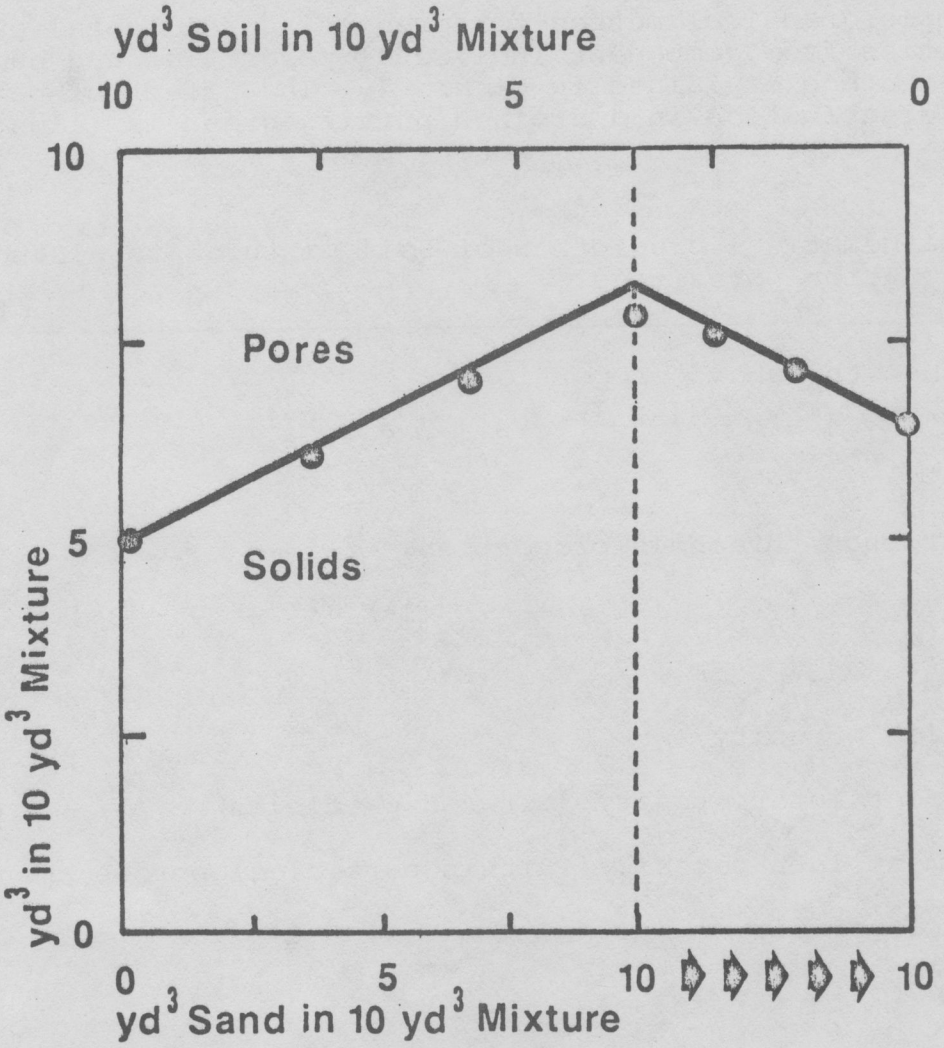


Figure 3. Theoretical (Table 1) and actual porosity in soil mixtures containing different amounts of sand.

Conclusion

This article does not recommend any specific putting green soil mixture, but briefly describes what happens when an amendment such as sand is added to a soil. The "take-home" lesson is that a certain minimum proportion of amendment, the threshold proportion, is required before soil physical improvement is affected and this amount is usally quite high (75-90% of the total bulk volume of components). The optimum soil mixture depends on soil, amendment, climate, drainage depth and plant species and is therefore difficult to determine without professional assistance.

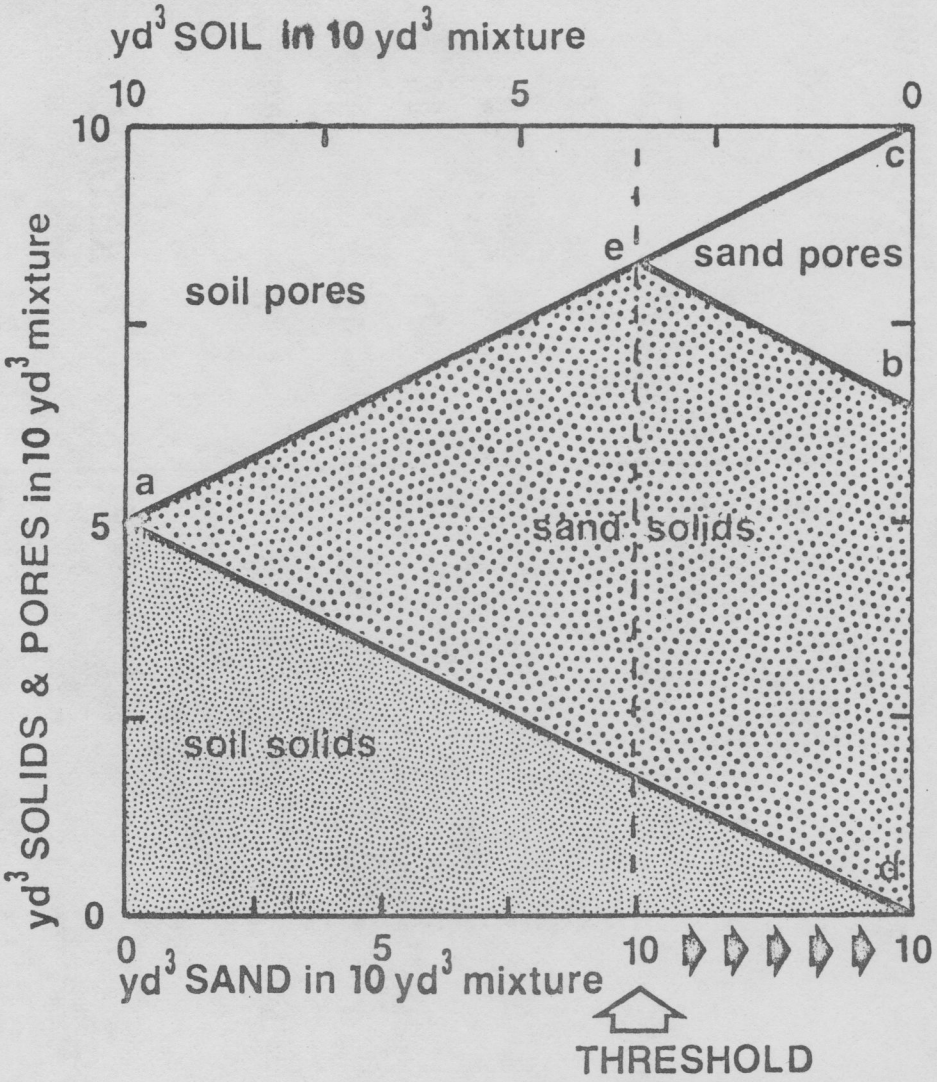
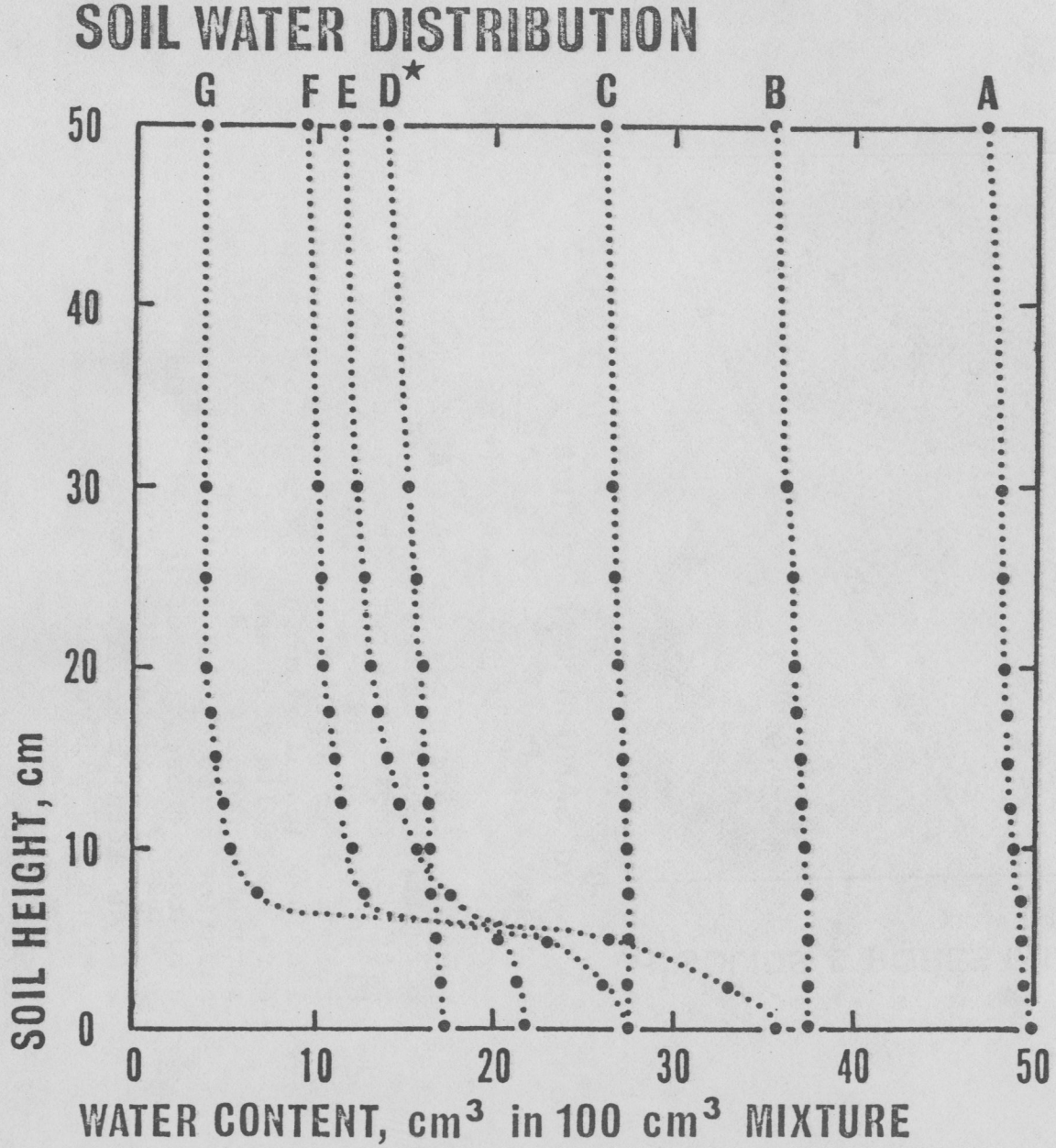


Figure 4. Graphical estimation of amended soil porosity from measurement of soil (a) and amendment (b) individual porosities and bulk volumes. Biagonals a-c and a-d delineate the soil's contribution to mixture pore and solid volumes and line b-e (parallel to a-d) delineates amendment pore and solid volumes. Soil pore volume = water retention porosity and amendment pore volume = aeration porosity (in the mixture). For example, a mixture consisting of 10 yd^3 of this sand, plus 2.5 yd^3 of soil results in 10 yd^3 mixture with 2.3 yd^3 total porosity of which 1.2 yd^3 is water retention and 1.1 yd^3 is aeration porosity.



BULK VOLUME, cm^3 in 100 cm^3 MIX

soil	sand	pores	mix.
100	0	50	A
77	35	39	B
55	70	28	C
36	100	18	D*
25	100	24	E
15	100	29	F
0	100	36	G

*THRESHOLD

Figure 5. Water distribution patterns of different sand-soil mixtures in a drained putting green.

CONTAINER SOILS ARE DIFFERENT

L. Art Spomer

Most horticultural plants are propagated from seeds or cuttings and grown in containers until large enough to transplant into ground beds in our gardens or yards. House plants and an increasing number of landscape plants in urban areas are grown exclusively in containers. What is a container? A container is any receptacle filled with soil or other growth media in which plants are grown. Commonly used containers include pots, flats, planters, cans, boxes, cartons, greenhouse benches, baskets, and others. All of us grow plants in containers, but few of us realize that an excellent garden soil may make a very poor container soil. The purpose of this article is to briefly explain why CONTAINER SOILS ARE DIFFERENT.

The soil is a semi-rigid mass composed of minute solid particles and permeated by a network of inter-connected pores in which water, mineral nutrients, and air move and are retained. The soil acts as a kind of reservoir storing the water and mineral nutrients essential for plant growth and survival. Container soils have two important characteristics distinguishing them from ground bed soils; they are (1) small and (2) shallow. The effect of smallness is obvious. The water and mineral reservoir available to container plants is much less than to those growing in ground beds and this reservoir must therefore be frequently replenished by irrigation and fertilization to maintain equivalent growth in containers.

The effect of container shallowness is less obvious; however,it can be easily demonstrated with an ordinary flat cellulose sponge.The sponge is placed flat on the level, spread fingers of one hand and saturated by pouring water on it until water drips from its bottom side. The sponge, like the soil, is permeated by pores which are full of water when the sponge is saturated. If, after water ceases to drip from the sponge, it is stood on edge, more water drips from it (its water content decreases). If, after water ceases dripping from the sponge a second time, it is stood on end, still more water drips from it (its water content decreases further). Both the water content and depth of the sponge changed from side to edge to end. In other words, the deeper the sponge, the lesser its water content.

This same principle holds true for container soils; the shallower the container, the wetter its soil following irrigation. Actually a perched water table forms at the container bottom even though it has a drainage hole and, like any water table, the deeper it is, the drier the soil above it. Because of this effect of shallowness, an excellent garden soil placed into a container will probably be too wet for good plant growth.

The effects of container smallness and shallowness create the dilemma of a soil which contains an inadequate supply of water and minerals; yet, this same soil may be too wet for the plant to absorb even this inadequate supply. The effects of smallness are remedied by frequent irrigation and fertilization and the effects of shallowness are remedied by incorporating coarse-textured amendments (e.g. sand, sawdust, peat, perlite, bark, vermiculite, calcined clay, etc.) into the soil to create large pores which drain following irrigation

(despite the perched water table at the container bottom). Unfortunately, insufficient amendment worsens the soil instead of improving it. This means that relatively large amounts of amendment are usually required. A good general recipe for container soils is about 10 volumes amendment mixed with only 3 volumes of soil. Although container smallness and shallowness create problems for growing plants, these problems can be minimized by proper irrigation and fertilization and through the use of soil amendments. Remember, CONTAINER SOILS ARE DIFFERENT and therefore require different care than garden soils.

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WHAT DO YOU THINK ABOUT SAND

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Probably the last thing you expect to hear at a turf conference was someone to stand in front of you and say he does not think anyone in the room grows grass, but that is exactly what I am saying. Let me explain. You can plant grass, water it, fertilize it, mow it, even kill it, but not grow it. I can see no one here small enough to jump into the seed and pump it out of the ground.

I believe the best we can do as professional turf people is try to manipulate and control the environment within which the grass plant is living so as to enable it to more nearly grow to its genetic potential. To do this, it behooves us to know as much as possible about the plant in question, the requirements placed on it by the user, the climatic conditions within which it is located and the rootzone within which it is growing. It is about this rootzone that I am going to speak about for the next few minutes.

Nearly all of the turfgrass under cultivation in the world is on naturally occurring, physically unamended soils. There have been over 7,000 of these natural soil series identified and classified in the United States alone. Most of the natural soils do not have the physical properties necessary to provide a suitable, stable rootzone over time under the use and quality requirements imposed and desired.Therefore, it becomes necessary to amend these natural soils to the point that the finished matrix can allow the desired grass growth.

One of the most widely used soil amenders is sand. Its incorporation into the profile may be to the extent of 100% at which time it becomes the sole mineral agent of the plant's growing medium. The desirable control of the medium's physical properties in this case can be much greater than with the use of finer soil materials.

Whenever we discuss a rootzone condition, it is important that while we are talking in terms of solids, i.e., sand, silt, clay, peat, etc., we should be thinking in terms of the voids or pores created by the random arrangement of these solid particles. It is within these pores that we will find the soil-air, soil-water and plant roots. The pores of our soil may be small enough so as to remain filled with water even after gravitational drainage has ceased. Should this condition re-

main unaltered for extended periods of time, what soil-air is present will become stagnant and the desirable growth of the plant will be reduced. Attempts to correct this condition often include the incorporation of sand into the rootzone in an effort to increase pore size and improve drainage. When doing this, the turfgrass manager needs to keep at least two more things in mind:

1). Incorporation of sand may worsen the condition, and
2). The condition may remain essentially unchanged if the newly created "drainable" pores have nowhere to drain to; that is, if the undisturbed adjacent soil is likewise too tight for rapid water movement and drain lines are either absent or otherwise ineffective.

The above problems are real ones as the technological and market emphasis in many areas of the country during the last decade have been placed on irrigation. So, for most of us, it is easier to irrigate a soil than it is to drain it. But, we must not lose sight of the fact that in a given pore scheme within the soil, the addition of water means the reduction of soil-air.

In looking at an existing turf area where a soil physical problem exists, or where new construction of a turf area is to take place, the first step should be that of defining the problem. If it is possible to correct this problem by the use of sand, the manager can go one step further and learn, to a great degree, how his newly built or amended rootzone profile will act and/or react to different situations. For the same natural forces that create the problem in one instance will insure success in the new profile.

As shown by the success of the PURR-WICK greens over the past few years, quite satisfactory turf can be achieved through the use of an all-sand medium. Research has been done that makes it possible to predict with reasonable accurary the pore scheme and physical properties of any particular sand.

To summarize:

1). One should define the problem,
2). Know the availability of materials at hand,
3). Determine what is economically feasible, and
4). Get <u>about</u> the task of improving the situation.

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UNDERGROUND BARRIERS WITH ROOTZONES

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Natural underground barriers which restrict the rootzone of turfgrasses have been an important part of turfgrass culture for several decades. The most common natural barrier is provided by soil compaction which results from the breakdown of soil structure. Although compaction may occur in the top several inches of soil, the

condition is usually alleviated near the surface by cultivation practices such as spiking and aerification. Below this depth of cultivation the soil remains compacted and then functions as a natural barrier. Usually this kind of barrier is detrimental to turfgrass management because it is too near the surface and restricts root and water penetration. This natural barrier is common to heavily trafficked turf (such as golf tee and putting green areas) grown in medium- and fine-textured soils and has been of great concern to golf course superintendents for many years.

The recent increased use of sand or sandy soils for the growth medium in areas subject to compaction has been a major development in eliminating compaction problems. Since sand has no structure which will break down, it provides ample pore space for water and air movement even under maximum compaction. The disadvantage of using sand is that water moves through it too freely and its capacity to retain water is too small. Attempts to circumvent this problem have resulted in providing a coarse gravel layer or a plastic barrier below the sand to restrict or eliminate downward water loss from the sand. Use of either type of barrier increases the amount of available water held in the sand rootzone.

Research was initiated in 1972 at the University of Arizona to investigate the merits of subirrigation of "Penncross" bentgrass utilizing a plastic barrier 2 ft. below the surface. The research compared subirrigation and nitrogen fertilization from a static water (SWT) 1 ft. below the surface; a water table which was allowed to fluctuate (FWT) between about 4 and 20 inches; and conventional sprinkler irrigation (SI). Washed sand and a 2:1:1 mixture of washed sand, sandy loam soil, and Loamite[1] were compared in conjunction with the irrigation treatments.

Results and Discussion

Growth. Clipping yields tended to decrease from the initial sampling in early July until a minimum was reached in mid-September. This minimum was followed by a slight general increase through October. These general variations in yield appear to be related to variation in daily temperature maximums. The highest temperatures occurred in late July and early August and coincide with the smallest or lowest yield. Yields continued low in July and September as temperatures remained high. As temperatures decreased in October, yields tended to increase. These trends in apparent temperature related yield variations suggest that the periods of greatest heat stress on yield occur in August preceded by about 2 months of daily temperatures above 32°C (90°F).

During the initial stress period in early July, clipping yields remained highest from the turfgrass grown in the sand-soil-Loamite mixture. These plots, however, tended to produce the lowest yields during the period of greatest stress in September. Within these two soil materials, the subirrigation FWT treatment produced significantly more clippings than the surface irrigated plots during both the period of initial heat stress and the period of acute heat stress. Recovery from heat stress was greatest for the surface irrigated plots.

Color. Variations in color appeared to be associated with temperature variations in a manner different from that for growth. Turf color was

[1]A product formerly processed from wood by the Loamite Corp., Santa Rosa, Ca.

not reduced as markedly as yield by high temperatures early in the summer. The amount of color was least in late July and early August, followed by a general increase thereafter. Color differences associated with the two artificial soils were not consistent throughout the study. Surface irrigated plots were consistently greener, however, than subirrigated plots. Of the subirrigated treatments, plots with a FWT tended to recover faster from the early heat stress than did SWT plots. Individual plants on the subirrigated plots exhibited symptoms of N deficiency during the period when overall color was low. Additional fertilizer applied on the subirrigation treatments increased the amount of available N present in the root zone, but did not improve color. Detection of nitrate-nitrogen levels in the soil solution as high as 2.5 ppm in early August suggest that the poorer color of the subirrigated plots was a result of anaerobic conditions which adversely affected N assimilation and/or metabolism. This was further evidenced by the fact that when levels of available N much higher than normally considered adequate were provided by injection of N 5 cm below the surface, a dark green color resulted.

Root Distribution. Total root mass and its distribution with depth in the soil influences the degree to which turfgrasses can tolerate periods of heat related moisture stress. Root distribution for the 6 treatment combinations are presented graphically in Figure 1. The root mass was greater and its extension deeper (growth to 50 cm or 20 in) in the sand material than in the mix. This difference may be explained by the greater % air-filled pore space and lower levels of available N associated with the sand material (Tables 1 and 2).

Greater root masses resulted from subirrigation with the FWT than with an SWT which in turn was greater than with surface irrigation. The large root masses associated with the FWT treatment are likely a result of the excellent moisture and aeration conditions provided by this treatment. Likewise, the decreased aeration and increased wetness of the SWT treatment may account for the reduced mass of roots associated with this treatment compared to that for the FWT. The lower root mass associated with surface irrigation is likely a reflection of the amount and distribution of available moisture under this treatment, as well as the higher concentration of nitrogen in the top 5 cm (2 inches) which encouraged top growth at the expense of root growth. Surface applied water on the sand material quickly moved downward resulting in an even distribution with depth of available water and air-filled pore space, whereas, in the mix, sufficient available water was held in the upper 5 cm to supply the plant's needs. The most favorable aeration in the mix also occurred in the upper 5 cm and would tend to encourage root growth at that depth.

Consumptive Water Use. Consumptive use of water by bentgrass irrigated from a stable water table for a one year period totaled 59 inches for the sand and 53.5 inches for the sand-soil-loamite mix. These values are considerably less than the amount of water normally used for sprinkler irrigation and indicate that subirrigation may provide a means for substantial water savings. On a daily basis, use ranged from about 0.2 inch in August to 0.05 inch in January.

Additional Observations. Damage to the turfgrass from insects or disease was not apparent nor was there evidence of any nutrient deficiencies or disorders (aside from that already discussed in relation to N) on any of the plants. Moisture stress, manifested as temporary wilting, was most apparent on the surface irrigated plots especially

those in which the turfgrass was grown in sand. Soluble salts did not accumulate to a degree harmful to the turfgrass.

Summary

Bentgrass turf which was subirrigated with a fluctuating water table was less subject to summer heat stress than surface irrigated turf. A major problem experienced with the subirrigated turf was that of providing an environment conducive to proper nitrogen assimilation and metabolism. This problem seemed to be most severe when irrigation was from a stable water table. Since it did not occur until after several weeks of high temperatures, it may be unique to hot desert climates. The problem was avoided the following summer by surface fertilization of N. Dessication occurred more frequently in the surface irrigated turf than in that which was subirrigated.

Subirrigation appears to have some potential for maintaining bentgrass greens in regions characterized by several weeks of high temperature.

Table 1. Vertical distribution of NH_4^+- plus NO_3^--N in two artificial soils irrigated by three different methods.

	Surface irrigation and N application		Stable table		Subirrigation & nitrogen app. Fluc.	
Depth	Sand	Mix 2-1-1	Sand	Mix	Sand	Mix
cm	ppmN					
0-5	5.3	13.9	4.4	6.3	4.1	5.9
5-10	4.0	8.7	4.7	6.8	4.2	5.5
10-20	3.7	8.0	3.9	8.0	5.0	6.6
20-30	3.5	7.5	5.0	7.0	4.5	6.0
30-40	3.7	3.8	6.8	7.1	8.5	10.3
40-50	3.0	2.2	15.0	12.7	13.3	15.5

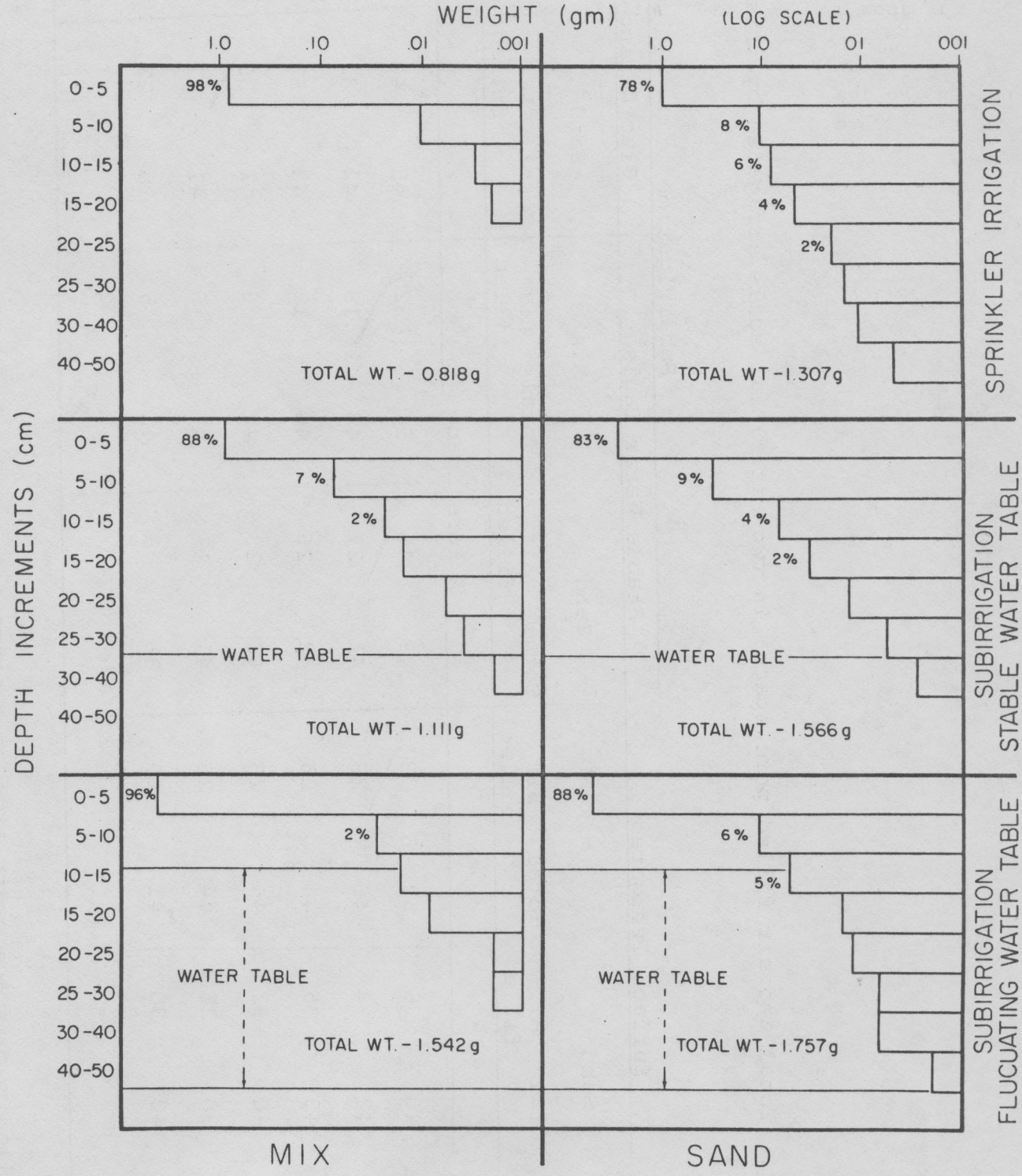
Table 2. Total and air filled pore space* in two artificial soils irrigated by three different

Depth (cm)	Surface Irrigated				Subirrigation							
					Stable Water Table				Fluctuating Water Table			
	Sand		Mix		Sand		Mix		Sand		Mix	
	Total	Air filled	Total	Air filled	Total	Air filled	Total	Air filled	Total	Air filled	Total	Air filled
	% Pore Space											
0-5	46	36	52	33	49	40	51	32	48	40	54	44
5-10	42	34	46	28	41	27	43	18	42	32	44	30
10-15	43	35	44	25	42	26	46	18	43	32	47	30
15-20	40	32	44	23	43	23	42	9	42	30	44	23
20-25	38	28	44	24	41	17	41	6	41	27	44	19
25-30	40	30	41	20	38	8	41	5	38	22	42	14

*Air filled pore space calculated as a percentage of total pore space.

Range total pore space sand 49-38, average 42

Figure 1. Effect of soil material and irrigation treatment on the root distribution of bentgrass following hot summer weather.



LOOSENING SOILS UNDER TURF

John Roberts, Graduate Student Turf, Purdue

Cultivation has been an important part of agriculture for many centuries. The problem arises when soil particles near the surface become so compacted that essential air and moisture penetration to the rootzone is restricted.

Turfgrass areas of all kinds are being subjected to an increasing amount of traffic each year. However, only rather recently have studies been conducted on this condition.

Beginning in August, 1974 plots were set out on a silty clay loam with a bluegrass sod and on a fine sand on a bentgrass putting green. Work was conducted under two soil moisture levels field capacity and near saturation. Greensairing the first week of each month allowed sampling to occur within three weeks following cultivation. The (3/8" diameter) tines penetration depth was 7.6 cm (3 in.). The cores were shredded and replaced in all plots following cultivation. Cultivation occurred through November and was then terminated.

One of the considerations regarding cultivation is its influence on weed invasion. In October a total weed count on the bluegrass plots was taken and summarized in Table 1. Dandelions were the dominant weed. The bentgrass plots showed no increase in *Poa annua*.

Table 1. Influence of cultivation on weed invasion under bluegrass sod.

Machine	Freq. month	Total No. weeds
Greensaire	1	10
	4	26
	Check	12

We were interested not only in the upper 1 - 3 inches where compaction is supposedly being relieved by aerifying, but also just below the lime penetration depth. Table 2 shows bulk density values taken in November on the silty clay loam plots at the 3 - 5 in. depths. The fine sands showed no increased compaction compared to the check at the 3 - 5" depth.

Table 2. Bulk density values at the 3 - 5" depth following four months of cultivation on a silty clay loam soil.

Freq.	Soil moisture	
Month	Moist	Wet
1	1.33	1.36
2	1.34	1.39
Check	1.31	

When soil particles become compacted to the point where air and water penetration become limiting, problems can arise. It's desirable to have a proper pore size distribution that would prevent this condition - restricted air-water movement. 90 days following the November cultivation samples were taken to observe the influence of time and resettling rates on large pores in the upper 1 - 3 inches (7.6-12.6 cm).

Table 3. Large pore distribution in the upper 1-3", 90 days following 4 months of cultivation.

Freq. month	Soil moisture	Texture silty clay loam	Fine sand
		%	%
1	Moist	12	34
2	Moist	10	33
1	Wet	10	-
2	Wet	9	-
Check		15	33

When water infiltration rates were recorded in September, cultivated plots on the silty clay loam showed decreased infiltration rates compared to the checks. The reverse was true on the fine sand putting green.

Interested in the amount of soil removed by the Greensairing tines, a thin plastic sheet was placed on the soil surface and held firmly in place while the Greensaire made one pass across. The cores entrapped on the plastic were then transferred to bags and the dry weights were determined. A 3/8" diameter tine set at a 3" penetration depth was used.

Table 4. The dry weight of plugs removed.

Area				
1 sq.ft.	1000 $ft.^2$	M^2	Location and	Texture
gms.	lbs.	gms.		
123	270	131	Exp. PURR-WICK	Fine sand
131	290	140	PAT Football	Sand top mix

It should be mentioned that both soils being cultivated would probably not be considered "problem" soils. Plots under compacted soil will begin this spring. While some of the data presented indicate rather negative results due to aerifying, the entire scope of the compaction problem has not been considered.

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TURFGRASS CULTURE FOR LAWN BOWLS IN AUSTRALIA

K. S. McWhirter, Dept. of Agricultural Botany
The University of Sydney, Australia

In Australia, turfgrass areas varying in standard and degree of preparation are used for horse racing, cricket, rugby football, soccer, lawn tennis, croquet, golf and lawn bowls. Lawn bowling and golf are the sports which make the keenest demands on turfgrass managers to produce grassed surfaces closely approaching the player's ideal. For lawn bowls, this ideal is a closely mown, uniform turf with a compacted surface that is fast and level. Lawn bowling is a popular participation sport in Australia, largely due to the ability of curators to regularly prepare surfaces which make the game pleasurable to a majority of players.

The problems and practices involved in producing a lawn bowling surface of a high standard are not unique, but they do represent a blend of the practices employed in the more familiar forms of turfgrass culture. It is my aim here to describe some Australian practices to the specific requirements of the game of lawn bowls.

Lawn Bowls

The object of lawn bowls is to propel a biased bowl on a curved trajectory over a distance of at least 66 ft. with the speed and direction required for the bowl to come to rest as near as possible to a marker ball, the jack. A player scores the number of bowls he places nearer the jack than the closest of his opponent's bowls. Each delivery of 4 bowls from one position constitutes an end, and the cumulative score over a pre-determined number of ends (15, 21, or 31) determines the winner of a game.

The main feature of lawn bowls is that it is non-strenuous, inexpensive, outdoor sport that combines the elements required to cultivate player interest, namely a degree of skill, competition, and rapidly changing fortunes. The game is most popular as a leisure sport among persons in the 35-70 age group. It is a game which provides opportunity for social contact, and it is a game in which men and women, young and old, can compete on truly equal terms. In Australia it is a large participation sport, with over 250,000 regular players belonging to about 1200 bowling clubs.

Lawn bowls is played outdoors on a rink measuring 120 ft. in length and 15 ft. in width. A standard bowling green is 120 ft. square, and this accommodates 8 rinks. At full capacity, one green can occupy a total of 64 players at one time. Most clubs have three greens.

Lawn bowling is a game of touch and continuous correction. For these reasons, the playing surface needs to be level and uniform. Players are fastidious in their requirements and uncompromising in their evaluation of a playing surface. Ideally, the surface should be flat with variations no greater than 1/8" to 1/16", and fast. A fast surface minimizes the effort required and emphasizes skill and judgment. A fast surface is produced by a combination of rolling to compact the surface, by frequent light topdressing to keep the soil right up into the surface, and by moisture control. There is no recipe for

producing a fast surface, and much depends on the greenskeeper's knowledge of the response of the grass species and the particular green to treatments.

Bowling Green Construction

The key to good turfgrass culture for lawn bowls is proper green construction. Many problems of maintenance and poor playing characteristics have been traced to improper construction, attributed usually to lack of funds. Construction of a full, new green by a contractor costs about $ 16,000 (U.S.) There is no authority to supervise the construction, but the Australian Turfgrass Research Institute recommends that contractors attempt to comply with the UGSA Greens Section specifications. The main requirements are for adequate drainage and retention of pore space under surface compaction. However, deviations from the USGA specifications are common. In general, a new green profile will consist of a tile-drained subgrade, overlaid by 9 - 12 in. of coarse sand and topped by 6 - 9 inches of a sandy loam topsoil. There is no mixing of soils, but natural soil and sand conforming to requirements are selected specifically for bowling green construction.

Grass Species and Establishment

The commonly used grass species are New Zealand bent (Agrostis tenuis), Penncross (Agrostis stolonifera), Green Couch (=Bermudagrass, Cynodon dactylon), and Queensland Blue Couch (Digitaria didactyla). Bentgrasses are used exclusively in southern Australia (Victoria) and inland NewSouth Wales. Along coastal N.S.W., the milder winters and long summer growing seasons permit the use of either Bermuda or bent. This permits a 3-green club to take advantage of the complementary seasonal growth by having patterns of - 1 Bermuda (summer) and 2 bent (for spring and autumn). In northern N.S.W. and Queensland, Blue Couch is preferred in frost-free areas.

Minor species used are Cynodon transvalensis and Cyanochloris macivori. The latter is a natural hybrid of a Cynodon sp. and a Chloris sp. The Australian Turfgrass Research Institute has recently distributed a locally selected clone of couch grass, names Greenless Park. This is a semi-dwarf, prostrate growing form, with medium-fine stems and leaves, and it produces a closely knit, uniform surface. Due to quarantine restrictions the vegetatively propagated Bermuda grasses cannot be imported into Australia. Some have been introduced despite the restrictions, but they are not well-suited to Australian conditions.

Establishment of bentgrasses is usually by seed, whereas the couch grasses are planted vegetatively with stem pieces from shredded turf. A grid of steel reinforcing mesh is used to press stem pieces into the surface soil and to ensure the vegetative planting is absolutely level. Sod is not used.

Maintenance of a Lawn Bowling Green

The bowls greenkeeper contends with two problems in the maintenance of a playing green. These are the problems of (1) promoting active grass growth and preservation of a level surface by a program of light topdressing, fertilizing, watering, and pest disease and weed control, and (2) organizing a maintenance schedule which makes the green available for daily use and yet coincides peak condition with major

club events. In many clubs, bowls are played 6 days a week, with Monday the only day available for uninterrupted maintenance. Rotational use of the three greens in a club provides some flexibility, but, nevertheless, bowling greens are heavily trafficked. The resulting wear and compaction produce major maintenance problems, which are overcome by coring, topdressing and a major renovation at least annually.

Pests, Diseases, and Weeds

Disease and insect problems of lawn bowling greens in Australia are very similar to those encountered on turf areas in U.S.A., and the same range of chemicals are available for combating them. Some local problems of major concern are:

1. Damage due to nematode infestation. The nematode involved is Heterodera major, and this infestation was encountered frequently in the Newcastle area of N.S.W.
2. Fairy rings caused by Sclerotima rolfsii.
3. Damage by bent greens by the Argentine stem weevil Hyperodes bonariensis
4. Dry patch.

This latter term refers to the progressive development of localized patches of water repellant sand (hydrophobic sands). This problem is under active investigation by the Australian Turfgrass Research Institute. The problem appears to be the most common on bent greens, but the cause and permanent cure are not yet known. The effects of dry patch are alleviated by use of detergents.

While much of the turfgrass experience accumulated in U.S.A. can be translated to the Australian situation, the existence of these local problems emphasizes the need for a local research organization concerned with turfgrass problems. This research need is being partially fulfilled by the Australian Turfgrass Research Institute, located in Sydney and supported by the N.S.W. bowls and golf associations. I wish to acknowledge the loan of photographic slides by Mr. P. McMaugh, the Australian Turfgrass Research Institute, 68 Victoria Avenue, Concord West, N.S.W., Sydney, Australia.

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ROOTZONE SYSTEMS FOR NATURAL TURF

W. H. Daniel, Melvin Robey, and Ray Freeborg
Purdue University

Everyone agrees that a good natural turf is the ideal playing surface, but that mud and maintenance create all sorts of problems.

Now, if there were only some way of eliminating mud-causing conditions of scientifically controlling the surface...of maintaining the precise turf condition, moisture content and temperature you desire...

There is a way, as will be indicated in the following evaluation of the four natural turf choices:

Option 1, Prescription Athletic Turf.

PAT is a natural turf on a flat (uncrowned) surface over three water-control systems. Patent applied for in June, 1972 by Purdue Research Foundation. Licensee issued by PRF to PAT, Inc.*

First, whenever it rains during a game, the suction pumps (below the surface), which are attached to the terminals of drain tubes, are turned on and they pull the moisture through the compacted sand, topmix and turf.

Second, the flat subgrade is covered by a strong continuous plastic film which forms a waterproof barrier that conserves the maximun rainfall. Only the excess water is wasted through a pre-set outflow control.

Third, automatic subirrigation is achieved by back-watering through the drain tubes. Moisture sensors in the rootzone sand signal the need for rewatering whenever necessary.

So water control is achieved in three ways: suction, conservation, and subirrigation, in addition to the flat (level) field.

Where needed because of climate or usage, the soil can be heated by electric resistance cables placed 12 to 24 inches apart.

Also, vented covers (clear plastic shseting with holes 4-6 inches) can give a "sweater" or "greenhouse" effect to reduce frost damage and increase grass growth.

PAT is not an additive; it is a replacement. It improves the playability of the field and extends its usage by countering the very wet, very dry, very cold, and very hot extremes of climate.

The first PAT field was installed at Goshen (Ind.) High School in 1972. It was limited to the middle 36,000 sq.ft. of the field,with one pump and 16" rootzone above the plastic film barrier. The construction took two months, with the sod being laid two months prior to the first home game.

The field had 26 uses that first year, including football and band practice for the High School-Junior High School, and normal use by a community high school. The next year the field had 45 uses, and the turf was still adequate.

Normal management included light overseeding before games and light rolling after games. Even with five inches of rain in the 48 hours up to game time, the field was ready for use.

The first full-sized field, 62,000 sq.ft. with 2 pumps, was installed at Grand Valley State College, Allendale, Mich. It was inaugurated in late season (1972) during an all-day rain - but the field stayed firm and ready for use while the outside areas turned to mud.

Four PAT installations were made in 1974:

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* Prescription Athletic Turf, Inc., P. O. Box 5187, Lansing, MI 48905 holds national license, and all inquiries should be directed to them.

1. Ross-Ade Stadium, Purdue University, under the direction of Melvin Robey, Superintendent of Athletic Facilities, and co-inventor of the patent. Excavation began on March 25 and sodding was finished on June 5. Its first use was after a two and a half inch rain. The suction drew off the water so that the field was perfect - while the nearby practice areas were muddy.

2. Reitz High School, Evansville, Ind. Bermuda was used on 53,000 sq.ft., with the PAT System extending only 4 ft. into each end zone. Sand was washed from the Ohio River.

Mississippi State University. Tifway bermuda was sprig planted with the equipment of the Mississippi Grass Nurseries.

4. Milwaukee Campus, University of Wisconsin. A large intramural field was finished in August, using Warren's A-20 sod above a prepared topmix of peat, sand, calcined clay and vermiculite.

Meeting Player Needs: The PAT System makes big cleats obsolete. Short cleats are adequate and more of them can be used. This makes the shoes safer and more dependable. And since the turf is torn up less, more games can be played on it.

What about skin burns? Remember, flesh is about 70% water, grass is about 80% water, and moist soil is about 20% water. That water lubricates when sliding and provides safety (despite grass stains).

Artificial turf, when the air is dry, may be only one to two percent water. So, when the 70% skin slides on it, it cannot readily lubricate; thus the skin-burn relationship. That's one reason why artificial turf is often moistened before use.

Suction Allows Leeway at Surface: Since the player requires firmness underneath him, the one to three inch surface (including turf) must have adequate support for the cleats and the action. This positive drain of suction pumps makes for level as well as firm playing surfaces.

In baseball the basepaths can be installed with a concentrated suction under them. This will enable you to confine your rain-coverings (even in professional stadiums) to just the small circles of the pitcher's mound and home plate, where dense clay is necessary for firm footing.

Estimated ready-for-use PAT costs range from $2 to $3 per sq.ft., depending on location, delivered sand costs, overhead, etc.

Option 2, The Sand Bed Method.

This uses almost pure sand from dunes, river beds, or pits - attempting to avoid the mud caused by silt and clay. It thus provides water penetration.

Research by Bjorne Langvad of Sweden during the 1960's, D. Ralston and W. H. Daniel in 1968-71, and W. B. Davis and others of California during the early 70's, shows that good turf, when maintained, provides good wear.

System of Building a Sand Bed Field:

1. Shape subgrade (soil) 4" to 8" below final grade - use 1% slope.
2. Then make 3" wide trenches 10-30" apart and 4-12" deep into subgrade.
3. Place narrow slitted drains ("Turfflow or equal).
4. Install automatic irrigation throughout - use some of same trenches.
5. Then spread blanket of sand 4-6" and fill all drain trenches at same time.
6. Spread 1-2" loose peat, or local bark, sawdust, manures, etc.
7. Spread ample fertilizer containing a slow-release nitrogen.
8. Mix peat into upper sand to hold more nutrients and moisture at surface.
9. Compact and plant, don't sod.

The idea is to assure fast water penetration even with compaction. Excess rain water can then more easily move into the soil and subdrains, and the crown can be less (6-12"). The irrigation should be automatic, for sands tend to be drouthy.

Many soccer fields in Scandanavian countries have been built along these lines.

The Hy-Play system in Oregon observes this pattern, with all soil (even from sod) avoided. In California the fine sands (less than .5 mm) are preferred for such use. The cost depends on sand prices and hauling distances. An estimate of automatic irrigation alone may be $6-10,000.

Option 3, Adding Sand to Soil.

Improvement of many older athletic fields has been attempted by mixing sand and peat 1-6 inches into the surface, as on golf greens. This can be significant only when the sand content predominates (usually above 80%). Uniform mixing, ample sand content, and annual loosening will make for better playability.

When it rains during use, however, mud is still a problem. When extremely sandy, such mixtures may loosen, provide less traction, and, as the turf wears out, create an uneven surface.

The cost of such additions must be considered and that the improvements can be reduced or destroyed by the heavy soil in the new sod, by the surface crusting, or by surface tillage trenching.

Option 4, The Old Type - Natural Soil.

At one time, a good topsoil, handled as farmland, was the practical thing. Simplicity was the rationale and economical construction was the usual objective. So, schools chose a natural local soil, a mixture of clay, silt and sands. After the track, stands and other features were completed, the field was crowned, tilled, fertilized, and seeded. Such fields may look good in the pre-season when the turf is normal. But with rain, then what?

Vertical Trenching Equals Faster Drainage: Narrow vertical trenching can help most natural-soil areas. This is now a big thing in low-cost improvements, as the removal of excess surface water is the

first requirement.

The old farm-type tile drainage backfilled with soil is totally obsolete. Just forget the conventional tile and avoid those old architectural specifications. Standard drainage is too slow and it's useless for the speedy removal of water.

Using the bare soil with the soil with the sod already present, or after shaping the new area to grade, you should:

1. Make vertical trenches 15' apart (more or less) and not over 3" wide. (Note: Consider making long parallel runs). Each trench can be level or slightly sloped.

2. Place the drain tubes with narrow slits (Turfflow or equivalent.)

3. Backfill to overflow with washed sand. The sand must extend to the final surface so that the surface water can enter readily.

4. Remove or spread the soil from the trench.

5. Do not disrupt or cover the sand during planting, or the fast-drainage advantage will be lost.

Vertical trenches have vastly improved wet areas in fairways and playgrounds wherever water accumulates. Just trench through any low areas, insert drain tubing, then backfill to overflow with sand. Continue to add more trenches until the drainage is ample for the area.

The Compaction Problem: Where soil predominates, the play on it will cause compaction, as the finer particles of clay and silt are crushed together. Dryness will incut excess hardness, causing injuries. In desperation, many groundskeepers will attempt repeated aerifying or cultivating by machine. Natural soil will pack and harden.

The Mud Problem: During a rainfall, the closely packed clay and silt has so few openings that it restricts both air-escaping and water penetration. The water remains on the surface and lubricates the mass, turning it into mud. You not only wind up with a muddy game, but you can ruin the field for the rest of the season. Then you'll have to go through another siege of urgent reworking, reseeding, and repair to get the field into shape again.

The Usage Problem: Natural soil, when muddy, is difficult to use for P. E. activity. The mud on the uniforms and the tracking into buildings are added burdens. That's why many fields are "saved" for prime events rather than used to the maximum.

The cost of a natural soil is uncertain. But by the time the hauling, filling, grading, draining, fertilizing, seeding and irrigation are completed, it will come to about $1 per sq.ft. (Architects and contractors can provide more accurate local costs). You can use this as a base in comparing it with other systems of construction.

Summary: A football player must run, turn, stop, twist, push, slip, fall, slide, roll, and get up afterwards. In fact, about half the players end up on the ground during an average play. That's 11 players for 150 plays, which comes to about 1,650 falls per game. It's hence essential for the surface to not only be firm for running, but to give for falling.

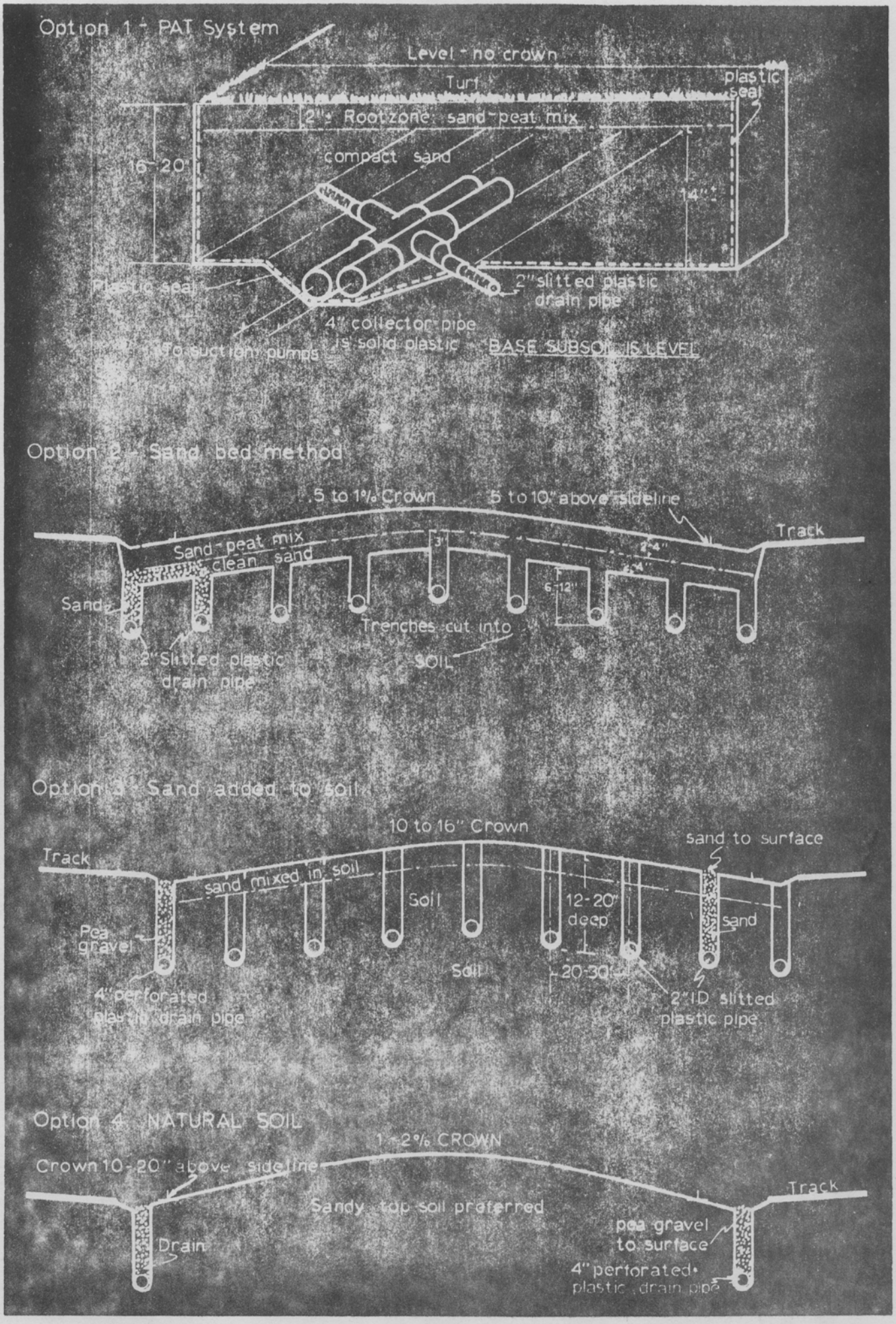
Equally important is the proper traction for muscle response. The turf should provide enough support to assure the foot of moving less than a half-inch downward and a half-inch sideways in any normal action.

Trainers are keenly concerned about ankle and knee injuries. More cleats with wide spacings and shorter lengths make sense. The old idea of mud cleats having fewer and longer cleats close to the center of the shoe must be discarded.

Player safety is all-important, and a good turf surface is a prime safety factor.

Readers interested in a leaflet on athletic field maintenance can secure copies of AY-16 from Dr. W. H. Daniel, Department of Agronomy, Purdue University, West Lafayette, Ind. 47907.

Dr. W. H. Daniel is a Professor in Agronomy, Dr. R. P. Freeborg is an Assistant Professor, and Melvin Robey is Superintendent of Athletic Facilities at Purdue University. Daniel and Robey are co-inventors of the PAT System.


Option 1 - PAT System
Level - no crown
Turf
plastic seal
2" Rootzone sand-peat mix
compact sand
16-20"
14"
2" slitted plastic drain pipe
4" collector pipe is solid plastic
To suction pumps
BASE SUBSOIL IS LEVEL
Option 2 - Sand bed method
.5 to 1% Crown
5 to 10" above sideline
Track
Sand-peat mix
clean sand
3"
2-4"
6-12"
Sand
Trenches cut into
SOIL
2" Slitted plastic drain pipe
Option 3 - Sand added to soil
10 to 16" Crown
sand to surface
Track
sand mixed in soil
Soil
12-20" deep
sand
Pea gravel
Soil
20-30"
4" perforated plastic drain pipe
2" ID slitted plastic pipe
Option 4 - NATURAL SOIL
1-2% CROWN
Crown 10-20" above sideline
Track
Sandy top soil preferred
Drain
pea gravel to surface
4" perforated plastic drain pipe

PURDUE INCREASES STUDENT LOADS

A. R. Hilst, Associate Dean and
Director of Resident Indstruction
Purdue University

The enrollment in the School of Agriculture has been increasing steadily during the past decade. The increases during these last five years have been particularly large and, of course, have caused several of our departments both space and staff problems. Take a look at the statistics:

	1969-70	1971	1972	1973	1974
Increase in new students over the previous year	23%	11%	22%	11%	16%

Another way to show the magnitude of the increase in enrollment and one which perhaps more dramatically points up our problem, is to examine the increase in both the total number of students in agriculture and the increase in total student contact hours taught by the instructors in agriculture.

	Total Number of Students in the School of Agriculture	No. of Student Contact Hours
1970	2,062	41,741
1974	3,186	59,165
Increase	55%	42%

Unfortunately, the large enrollment increases have taken place during a period when the university as a whole has not had budget increases to appreciably increase its funding for the School of Agriculture. In fact, as far as funding is concerned, the administration has had difficulty in maintaining status quo. Inflation has more than devoured the additional funds allotted to the university for instructional purposes. As a net result, we now have less actual purchasing power for salaries, extra labor, supplies and expenses, etc., than previous years.

What does this all mean? Well, simply this - we have had to cut corners on instruction. HOW - in certain courses, due to lack of staff, laboratories have been dropped and the courses taught strictly on a lecture basis; in other instances, "expensive" but critical features of a course have had to be discontinued; such as, individual student study work or even student field trips; and still in other instances, it has been necessary to curtail or drop completely certain areas of work.

The School of Agriculture is a complex composed of three divisions - one, instructional arm, resident instruction; a second, the Experiment Station, or the research arm; and the third, the Cooperative Extension, or the extension arm. As I had indicated, our enrollment increases have swelled the ranks of our classes and caused us to add so many additional sections that a real shortage of teaching help has developed. In order to attempt to meet this need, it became necessary in the last biennium to transfer approximately 10 professors (full-time equivalents) from the research arm and/or the extension arm to teaching. Of course, these transfers have not been without conse-

quence. As you might imagine, many critical research problems will go unsolved and certain extension areas will go unmanned. We must take care of our teaching responsibilities at all costs. We must insist that, as well as being one of the largest agricultural schools in the nation, we must remain one of the very best agricultural schools in the nation. This cannot be done without the help of all.

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A STUDENT COMMENTS

Scott Street, Senior in Turf Management
Purdue

When asked to speak about my experience as a student, I had no idea how difficult making a relevant statement would be. I have spent many hours talking with my fellow students, the faculty, and my family about the purpose and direction of my university career. My main concerns were the curriculum, the faculty, and the university's responsibility to give students access and use of its facilities.

I have also been puzzled by the order of priorities in the areas of teaching, research, and extension education. I came to realize that the system is a victim of its budget, not unlike other institutions or businesses. Academic advisors are also teachers and researchers. Their advice to students concerning the use of elective courses is limited to reports from students who have completed the course, or to recommendations of a catalog description. Ask any student his opinion of a course and he will tell you any number of things from:.."The course was an easy three hours of 'A'," to "The professor delighted in telling the students to devote 92% of his time how to receive a passing grade." There always seems to be a difference of opinion concerning the value of any course.

Turf students are required to have a basic education in the sciences with a major emphasis in Agronomy. Horticulture, Botany and Agricultural Engineering are also taken with varying degrees of enthusiasm.

The major complaint of most turf students seems to be the lack of giving technical experience in the area of management. At the yearly debate during turf seminar, students bring up points that their well-rounded curriculum has somehow left out those important day-to-day tools that are the immediate indicators of success or failure. How and when do you prune a tree? How do you grind a bedknife? These are examples of the kinds of questions commonly asked by turf students. I was lucky to have worked where I could get such experience. I scalped my share of aprons with greens mowers, skinned a few trees, and applied chemicals in the wrong place.

A turf student makes mistakes and this is where we rely on professional turf people for summer jobs, not only for financial reasons, but for a valuable learning experience. Have you employed students during the summer or as assistants? Do you communicate with them? Do you answer their questions the best you can?

I recently read an article in an area superintendent's association publication which was rather disturbing. The author of the article suggested that their association stop supporting university scholarships because their financial help prepared students to compete in their job market and would mean the loss of their jobs. I wonder if this superintendent would be able to provide a valuable work experience for a student or an assistant. Your presence at this conference and your attendance at the short course, Chemicals for Turfgrass Use, although compact, give you much of the same information in turf that we receive as students. Our studies include the same publications and trade journals to which you subscribe.

There is no need to feel insecure about answering a student's questions. A student employee or assistant can prove to be an asset to his employer and co-workers. Communication is a two-way street and questions from a new point of view may be enlightening for everyone. It is important to be sure the questions are understood and that a breakdown in communication does not occur.

The university is limited in what it can provide technically because of funds, facilities, and time. Its major role is to provide the scientific basis for acquiring solutions to problems and a general understanding of the complex world in which we live. With your help as professionals in turf and instruction provided by the technical schools of equipment and product manufacturers, the future of our profession will be bright.

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OUR STORY

Virgil G. Miller, AIA, Architect
Evansville Public School's Indiana

Evansville, which has a population of 137,537 people, is located in the southernmost part of Indiana on the Ohio River.

The Evansville-Vanderburgh School Corporation is composed of 32 elementary schools and 5 public high schools. There are presently 3 football playing fields in Evansville which are used for regularly scheduled varsity games. These 3 fields must serve a total of 8 football teams, 5 public high schools, 2 parochial high schools, and the University of Evansville, so we have a minimum of 40 regular season games to be played on 3 athletic fields every year, not including reserve games, junior high and grade school.

Before the installation of the PAT System, all 3 fields had a 16" crown with standard yard drains, or catchbasins located along the sidelines. Our watering system consisted of rain trains. Each spring we plowed up each field, added some additional dirt and fertilizer, and reseeded the entire field. Usually by the time the first game was to be played during the first week in September, the field looked green and in fairly good condition. However, the grass was still young and a deep root system had not yet been established. As a result after 2 or 3 weeks of heavily scheduled games and one rain, the field's

always looked in poor condition. If we were unlucky enough to have a hard rain shortly before or during the time a game would be played, the field would suffer considerably and in some cases would not recover the rest of the season. This condition was aggravated because of the number of games played on the field and the inadequate length of time building custodians put in on maintenance of the fields.

In the spring of 1970, Dr. Daniel had a Parks Conference in Evansville. Our athletic director, James Graham, attended this conference and saw a model of the PAT system which was on display. It looked like a system that would provide a much safer and resilient playing surface, and also a system that would greatly reduce the amount of maintenance required for the field. This is primarily because of the ease in draining off excess water, and also the ability to water thru the PAT system. Unfortunately funds were not available to proceed with the installation of such a system at that time.

In 1972, due to a declining enrollment and redistributing plans, the school corporation undertook the task of removing some of its old school buildings and selling the excess property. It was decided by the Board of School Trustees that they would use the funds from the sale of the excess school property to renovate Reitz Stadium, which was 50 years old and had fallen into a state of disrepair. The first phase of the project was to remove the existing dilapidated bleachers, renovate the concrete structure, provide new fiberglass seats, and increase the fencing.

We also began to think about the work that would be required to get the playing field in good condition, so in November, 1972, we contacted Dr. Daniel, who met with the superintendent, assistants, the director of athletics and myself. He showed us slides of the PAT system and answered questions.

On May 9, 1973, we showed the 7 members of the Board of School Trustees slides and answered questions concerning the scope of the proposed project. At that meeting one of the board members, Mr. Bob Ossenburg, was appointed by the president of the Board to visit the site of the new PAT system which had been installed at Goshen, Indiana. Mr. Ossenburg was favorably impressed with the system and reported his findings to the Board.

During this time a company was formed called Prescription Athletic Turf, Inc., and Bob Linton and Mr. Frank Stallings of PAT, Inc., became the national licensee for the PAT system. On November 21, 1973, Bob Linton, the general manager of PAT, met with two board members, and administrators in order to explain the services PAT would provide to the school corporation and give us some idea of the approximate costs of the system.

On March 6, 1974, we sold the site of the old Central High School; this gave us the necessary funds to proceed with the project. Bob Linton started drawings and specifications; we worked closely together in preparing the specifications so competitive bids could be received from a number of contractors and all state requirements would be fulfilled.

On May 8, 1974, I presented the bids to the Board of School Trustees; we received 3 bids with the total cost of the project being

$74,577. Doug Wearren of Wearren Nurseries was the low bidder and work was started the following week. Work progressed smoothly until it came time to install the plastic liner. We lost 2 weeks due to excessive wetness - it seemed to rain every day. After weather conditions moderated and the plastic liner and piping had been installed, we began backfilling with washed sand. A small bulldozer was used to push the sand from the side of the field toward the center, always keeping a heavy layer of sand between the plastic and the tractor.

By the first of July, 1974, the contractor was spreading 6 tons of calcined clay, 1700 lbs. of Vermiculite, 680 lbs. of 18-5-9 fertilizer, and 68 cu.yds. of peatmoss over the sand surface. The finish grading was completed by the end of the week.

On July 13, 1974, the field was sprigged with a Westwood Bermuda, which was brought from a golf course in St. Louis. A commercial mechanical sprigger was used and the sprigging was completed in less than one day. A system of overhead sprinklers were set up on the field in order to keep it moist on the surface at all times. We kept the temporary sprinkler system for over 6 weeks. By the last of August the roots were some 5" deep and we were able to keep them moist by watering thru the PAT system.

Our first game was scheduled to be played on September 6, 1974. However, we decided to postpone the opening of the field until September 26, 1974, which required rescheduling 3 games to other fields, but we felt the additional 3 weeks would do much toward insuring a closely knit turf and further extend the root system. On September 26, 1974, the first game was held on the PAT system. The field was in excellent condition and very little damage was sustained to the turf.

During the 1974 season we played 5 high school varsity games, 3 reserve games, 1 post-season bowl game by the University of Evansville on November 30, 1974.

On July 25, August 9, August 19, September 3 and September 28, 1974, we fertilized the PAT surface (53,000 sq.ft.) with 500 lbs. of 18-10-10 fertilizer each time.

Although we took bids on the soil warming system, we elected not to install the soil warming system at this time, but instead, to use the vented clear plastic field cover (with 1/2" diameter holes perforated on 4" centers).

We had a heavy frost occur on the field during the 2nd week of October, before the field cover arrived on the site. The frost browned the field considerably and stunted the growth of the grass. About 5 days later the cover arrived and we immediately installed it on the field. I was quite surprised to find that after a week the grass had once again turned green and we were able to sustain the green grass until the 30th of November. During the winter we have left the field cover off, and the Bermudagrass was dormant and brown.

This year we intend to play 18 varsity games on the PAT system. 4 of these will be by the University of Evansville. Since this year is the first year we will play a full schedule of games on the field, we will still be learning what we can and cannot do with the system.

We are well pleased with the performance of the PAT system, and

if you talk to a coach or a player in Evansville, Indiana they will tell you the PAT system is the best thing that has happened to football in a long time.

Editor's note: When seen on 7 April '75 new Bermuda sprigs were just emerging and the survival of late fall warm-up was adequate, but less than uncovered endzones.

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PAT INFORMATION

Editor's Note: This current information is included in lieu of talks at Conference.

As of 11 April '75, the patent claims were allowed. Thus, the serial No. 263,434 of 16 June '72 as first introduced, was thrice amended, and filed as of 23 Jan. '75, and approved as serial No. 435,691 in Group 351 under the title, Planted Surface Conditioning System.

The patent is in the names of W. H. Daniel and M. L. Robey as made through the Purdue Research Foundation, which by ruling handles patentable ideas generated by Purdue staff.

PRF has an agreement with a national licensee, a newly formed company, Prescription Athletic Turf, Inc. of 705 E. Oakland Avenue, Lansing, Michigan, 48905, 517/485-3128. This company has exclusive rights and responsibility to install PAT fields. Inquiries should be forwarded to PAT, Inc.

The patent describes the specifics which produce a uniform suction at the surface and the control of wetness.

It also describes the exact system of sensor, resistors, switches and valves which gives automatic subirrigation based on soil moisture. It also describes the automatic suction tension measurement and its effective use in produced repeatable levels of moist turf for best playing conditions.

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THE PAT SYSTEM

Mel Robey, Supervisor of Athletic Facilities
Purdue University

Editor's Note: Following a film showing some construction on the PAT System at Purdue University, these comments were made by Mel Robey.

Athletic fields didn't have many answers until 1960-67 when the fields became important and demands were increased. The vertical trenching with sand backfill improved surface drainage.

Around 1966 Monsanto put in the first artificial turf in Massachusetts. Then in 1967 the Astrodome was constructed to Astroturf, after one season of trying to grow turf.

Astroturf fields:

2 in '68 - Indiana State and Seattle, Wash.
4 in '69
8 in '70
35 in '71 - injuries and concerns became more evident
25 in '72
25 in '73
25 in '74

We're told that 25fields per year is Astroturf's expected target!

Tartan has, since 1970, only 25 fields in, and has stopped bidding.

Polyturf began in 1971 and has only 8 - 10 fields in, and has stopped.

A total of 160 fields are reported.

Fortunately at Purdue the Athletic Directors have been willing to improve the Stadium turf and have kept natural turf. Costs are about $2,500 per year just to maintain the Purdue Stadium turf itself.

In the period 1967-72 artificial turf was a panacea in claims, in claims, but since then many questions and changes in the claims made for artificial turf. The intense multi-use potential of use is an obvious pdnt of value.

The PAT System is the most innovative to come about in that it provides so much for the players. In the fall of'74 PAT at Purdue was at least 100 times better than our field before. We could handle the water and be ready for use at all times.

The field holds 100,000 gals. of water when full, a tank to hold excess water if rain would not be worth building for just holding surplus rainwater.

The soil brought with the sod willtend to compact and seal. Greensairing and topdressing with fine sand can reduce this.

Visiting players and coaches have not had any adverse comments,but many favorable comments. Jardine of Wisconsin, "Anybody not having artificial turf already should consider the PAT System." The coaches quickly noticed the flat field and liked it.

Fields built include these:

1972 - Foreman Field, Goshen High School, Goshen, Ind.
Grand Valley State College, Grand Valley,Mich.
1974 - Ross Ade Stadium, Purdue University, W. Lafayette,Ind.
Scott Field,Mississippi State University, Stateville,Miss.
Reitz Bowl, Reitz High School, Evansville, Ind.
Engelmann Field, Univ.of Wisconsin, Milwaukee, Wis.

1975 - Mile High Stadium, Denver, Col. Sodded
R. F. Kennedy Stadium, Washington, D.C. Sodded.
Saginaw Valley College, Michigan - to be constructed.
Sexton High School, Lansing, Mich. - to be constructed.

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SHALL WE START A BUSINESS?

J. E. (Jim) Carter, EZ Lawn Service
Richmond, Ind.

The idea of starting a new business during a recessionary period such as we are now experiencing may not be wise according to come economists and other business experts. However, I think it well to mention that the custom Lawn Service business is a very specialized type of business, that so far, has not been seriously affected by the downturn in the economy.

The customers generally served by this type business are the middle income and upper income groups and for the most part, these are individuals whose jobs have not been affected too seriously by the economy. We have concentrated our advertising efforts in the better residential areas of the towns we are serving and, really, we have discovered that they are still almost eager for our services. Many of the residents know of our service and like the idea of having local people involved. To many of these residents a beautiful green lawn has become a status symbol and there seems to exist a spirit of competition among them in their efforts to have a more beautiful lawn than their neighbors. Many have tried the do-it-yourself approach by purchasing materials and equipment at the local garden center and applying the materials themselves, but it seems that quite often their results are not that good, or it takes too much of their recreational time. Therefore, they are glad to pay for the service and have it done.

In my experience it seems there are about 8 steps that a person must go through to start a business and have a good reason to think it will be successful. These steps generally will apply to an individual, or a group of people.

1. Idea. You must have a sound and logical idea as to what kind of business you want to get into. This may take time and research. Sometimes a person might recognize a need for a particular type of business in a community, or a general area,or the idea may come through an invention or some technological change.

I recognized the need for a good local lawn service in our area. The only service we have had in Richmond is based in Troy, Ohio - some 40 miles east. It seemed to me that a good local lawn service could do the job better and at less expense, and we also would be more available for counselling services and we do know most of our customers. The one thing we knew was that it had to be good, and we must give excellent service.

2. Develop a Plan. I began to draw up a plan for action, or you

might call it - implementing the plan. Exact equipment - the best-suited and labor-saving must be sought out and matched to the results desired.

3. Obtain Capital. I estimated the capital that would be needed. I felt that we must have enough capital to purchase needed equipment and supplies and have enough capital left to run us through one year. Don't be under capitalized.

4. Seek Out Good People. These people should have some capital and with the willingness to take the calculated risk of a new business venture. In our case we got 5 people involved originally, and then as we continued our research we discovered 2 other men who were already in the farm liquid fertilizer business. These men were willing to put up their share of capital and furnish the mixing tanks and storage space for materials and supplies. After checking them out we gladly made them a part of our corporation, and then have become an integral part of our business. They can guarantee us our supply of nitrogen and other fertilizers. During this period of shortage it is comforting to know that we will have adequate supplies to serve our customers.

We have tried to get the type of individuals involved who can not only contribute capital, but can also contribute some talent or special knowledge to the corporation. Example: George Goble and Jim Frazer are our fertilizer experts, Fred Powers and Chuck Wellings manage their own businesses and have good sales and marketing techniques. The Jenkins has advertising and finance talents, and finally young Jim Carter has a degree in business administration and 18 months experience in a large metropolitan bank. As a bank vice president, I am just along for the ride - to make sure that we don't have financial losses and to be there when we distribute the profits.

5. Attorney. The next step we took was to seek out a good, hungry attorney. These may be difficult to find since most attorneys do quite well. Or, you may find an attorney who may have some special knowledge about the type business you are starting. Sometimes the attorney may want to become part of the corporation if he likes your ideas.

6. Procedures. Next, together with the attorney, we went through the necessary legal steps to get the corporation into being. We had our E - Z LAWN name which we wanted to protect, so we had it registered with the Secretary of State. The attorney drew up the articles of incorporation and the By-Laws. At that time we elected to operate under Sub-Chapter S of the Internal Revenue Act, so he also drew up those papers. We felt it advisable to draw up a buy and sell agreement to set guidelines for the disposition of any outstanding stock. The attorney did this, and also drew up corporate resolutions which govern who may sign for our corporation.

7. C.P.A. The next step was to employ a good C.P.A. Most of us have had experience with the local C.P.A. firms and selected one which we thought would offer us prompt and thorough service, and since he is a local he has influenced some of his friends to subscribe to our service.

8. Put Plan to Work. Finally, further develop and refine the plan and put it to work. We decided that it would be necessary to have great expertise in a business which we really knew very little about. Our contacts directed us to Purdue University and Dr. Ray Freeborg. He agreed to become our Consultant and has become an invaluable part of

our service. He has advised us about our purchases of equipment and the types and amounts of fertilizers, herbicides, etc., to use. He has even helped us in the development of our advertising campaign. We feel that we are very fortunate to have him on our team.

Young Jim Carter is the manager of our firm, and I must say we are very pleased with his efforts. He now has an opportunity to put into practice some of the business and management techniques he learned in college. I also believe it is good to have a Manager who is part owner. He should be more motivated towards making a profit.

At present, before the first treatment, we have approximately 250 lawns to service, plus 2 football fields. We are also contacting industrial and business firms, and have already signed up several of these.

I hope to have stimulated your thinking about starting a new business as some thoughts and experiences have been shared.

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OUR SUCCESS WITH LAWN CARE - BIG CITY

Elton J. Mellum, Tempo 21
Elk Grove Village, Ill.

Tempo 21, Inc., is a Turf Management Corporation providing a professional fertilization and weed control program for home lawns in the Chicago area. When we were asked to speak on our success in the Big City, we were immediately reminded of some of the glowing reports we had all heard at turf conferences about how one could make vast fortunes in the custom lawn service business. Of course, these reports were an attempt by individuals to relate the pride and enthusiasm they felt, and they were always given by people like ourselves who, with the help of God, had "made it." So, we decided to dwell on a less exciting, but more practical side of this business. We hoped to prepare people for the realities of the lawn care business as we have experienced it. This report is based on that hypothesis.

1. The Struggle for the City
   A. Overcoming the Negative Images.

The concept of lawn care in the large city is the gypsy image of some landscapers who employ migrant and marginal people to work on lawns. These people are generally unskilled technically, and communication with them is next to impossible. This may appear to be a very biased image, but we have found, nevertheless, that it exists. Combined with this are the yearly newspaper articles on "lawn service" scandels, where people contract to have work done and pay part or all of the fee in advance only to have the people they contract with skip town.

To overcome this image takes both money (for image creating equipment and avertising) and time. It also takes excellent technology from day one as people are not prepared to trust your "word"- only results will establish trust and credibility.

B. Being Heard in the Noise

The mailman is the bearer of tidings each day from the grocery, shoe store, laundry, vacuum cleaner salesman, shopping center, hardware store, discount store and, maybe, from you. With all the competing demands for the homeowner's attention, even to get your information read it must be a work of professional excellence. And even so, only one out of every 50 brochures will be opened, and only one out of every hundred will be read. The market in the big city is vast and so are the sums of cash needed to tap it.

C. You Are Not Alone in the City

Competition is another factor in the city. Large established companies like ourselves and some others are going to benefit more from your advertising than you are because the nature of the business requires educating people to the idea of the service. Once they buy the idea, the tendency is to go with the better known company. But, even in the face of this you can make it if you persist.

II. Success Based on Technical Expertise and Experimentation

A. The Textbook Lawn.

In the city you will almost never deal with a "textbook" lawn - therefore, innovation will be more necessary than "degree" technology. Topsoil is not a common rule, but rather an exception on home lawns, creating greater variants than on golf courses or in agriculture.

B. From Technician to Detective

Once you work on someone's lawn you are naturally blamed for anything that happens from then on . But, technical knowledge will not always sustain you in determining liability; more often you will need to function as a detective to find the cause of the problem. A car floormat thrown on the lawn on a sunny day causes burn spots, spilled gasoline, a late frost, a natural gas leak, regularly spaced bare patches, possibly indicating an impromptu baseball diamond, and a thousand other non-agronomy related problems illustrate why it is necessary to be a lawn detective as well as a technician.

C. I Wish I May - I Wish I Might

The ideal way to go is with the ideal product. A company in Columbus, Ohio tried that and went broke. And, the biggest company there benefitted from their loss. You can see that in order to make it you will need to be a little lucky and very careful. "I wish I may, I with I might, I wish upon a star tonight" is fun but only for those who have first established a program they can live with for their area.

D. Experimentation is Necessary.

Heat, humidity, wind, rain, clay, shade and the season of the year are all factors, of course. You need to determine the combinations and be prepared for, as you know, fertilizers don't lie and many people know every blade of grass in their lawn!

III. Overcoming Spiraling Cost

We all know costs are spiraling. Volume is about the only way to overcome this problem because you cannot pass all the cost increase on to the customer.

Since we started in 1972 the cost of a truck is up 44%, tanks are up 27%, fertilizer up 72% for spring, 211% increase for urea and 110% for 2,4-D. And, if this is not enough, the cost of fuel is up 63%, and fertilizer spreaders 50%.

Companies that started before this drastic increase happened had a whole different ballgame. This doesn't mean it can't be done. It can, but not on a shoestring.

IV. THE HOMECOMING

At TEMPO 21 we've somehow escaped the grim reaper of inflation and the wolf of obscurity. I won't say we've got it made. (No farmboy would ever be foolish enough to say that when he has nature to contend with). But, at least we can now go home at night and get reacquainted with our families and friends and relax a little.

In this business its homecoming that you live for and a chance to have time with your family for they are a part of it all too.

We sincerely hope that for you with dreams of large fortunes in the lawn service business this presentation will wake you to reality. Fortunes are not guaranteed by ideas, but achieved only by long and hard labor, sacrifice and being fortunate enough to be associated with the right combination of people. Our success with lawn care was achieved by overcoming the obstacles and paying the price. The same formula will do it for you - with luck.

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PUMPS, NOZZLES AND SOLUTIONS

B. C. Brandenburg, Delavan Manufacturing Co.,
West Des Moines, Iowa.

Commonly used types of pumps in turf spray applications include piston, roller, gear, centrifugal and turbine. Power sources may be tractor PTO, hydraulic motor-driven or gas engine driven.

Piston pumps have 1 to 4 pistons with capacities up to 25 gpm. Operating speeds are usually in the range from 600 to 800 rpm. Most piston pumps operate on the positive - displacement principle. Output is almost directly proportional to speed and is affected only slightly by pressure.

Roller pumps used by the turf industry have capacities up to 50 gpm with typical pressures of 50 to 300 psi. Operating speeds are usually not over 600 rpm for attachment to a standard tractor PTO shaft with 540 rpm speed. However, some roller pumps are designed to operate at speeds up to 1,200 rpm.

Rollers in roller pumps are made of rubber or nylon. Housings are made of cast iron or a more abraision and corrosion resistant Ni-Resist, an iron-nickel-chromium alloy.

Gear pumps have capacities up to 50 gpm with pressure ranges of less than 300 psi. Operating speeds are usually 400 to 800 rpm. Wettable powder chemicals can cause rapid wear in gear pumps.

Centrifugal pumps with capacities up to 180 gpm are available for the turf industry. All centrifugals must be operated at high speeds,

usually in excess of 3,600 rpm. Because of their high rpm requirement, hydraulic motors are often a source of power, although set-up drives are used to power the pump from a tractor 1,000 rpm PTO. Gas engines may also be used.

Centrifugal pumps do not have the capability to produce pressures in excess of 100 psi. They are an excellent pump for handling all types of spray solutions, including wettable powders and suspension fertilizers.

Turbine pumps operate at a lower speed, 1,000 rpm, than do centrifugal pumps. This lower speed gives longer life. Their capacity is less than 100 gpm and they are not designed to attain pressures in excess of 60 psi. The turbine can produce high volumes at low operating speeds and is an excellent durable pump for low pressure spraying jobs.

Each of the types of pumps discussed has its own distinguishing features. Selection of a particular pump will depend on several factors such as cost, power requirement, operating speeds, pressure limitations, capacity and type of material being sprayed. There is no one best type of pump that will meet optimum conditions for all of these factors. When selecting a pump be sure to have capacity to attain spraying volume desired and also to give adequate bypass for agitation.

One of the most important, and probably the most neglected, component part of a sprayer is the nozzle system. When one considers that the nozzle serves the functions of metering the liquid, atomizing or breaking up the liquid into droplets, dispersing these droplets in specified patterns, and providing hydraulic momentum or impact, the selection of a proper nozzle becomes very important.

Types of spray patterns produced by various kinds of nozzles include: hollow cone, flat spray, even spray, flooding and straight stream.

Flat spray nozzles are designed to produce a narrow eliptical spray pattern. Uniform distribution across the full width of the spray boom is attained by overlapping the tapered edges of the individual nozzle's spray pattern.

Even spray nozzles produce a spray pattern similar to the flat spray nozzle, except it is not tapered at the outer edges. This nozzle is designed for banding applications and should not be used for broadcast spraying.

Flooding nozzles also produce a flat spray pattern. Their design achieves a wide spray angle up to 160°. Angle can be maintained at lower pressures than with other types of nozzles.

Straight stream pattern nozzles produce a straight jet of fluid. They are used for handgun spraying and for sub-surface application of liquid fertilizers and soil fumigants.

All of the above mentioned nozzles will produce droplets of approximately the same size at equal pressures and flow rates. They will also produce about the same percentage of fine droplets under 50 to 100 microns, or droplets of a size that are susceptible to drift.

Ecological and environmental pressures have resulted in the development of spray nozzles that will produce larger droplets and a lesser percentage of fine droplets than will conventional nozzles. Substantial drift reduction is achieved with this hardware.

Several nozzle manufacturers offer foam hardware that substantially reduces drift by creating larger droplets. This type of nozzle requires the addition of a foam adjuvant to the spray solution. Foam droplets are created in the nozzle by air being drawn into the nozzle and mixing with the spray solution containing the foam adjuvant. The adjuvant has other properties including wetting of foliar surfaces, spreading the droplet, adhering the spray to the target area and aid to penetration of systemic compounds. Chemical application with foam hardware leaves a visible deposit that can last for several minutes. This can be an aid in preventing skips or overlaps in handgun spraying.

Delavan Manufacturing Company has developed another type of drift reduction nozzle that does not require the use of additives to produce larger spray droplets. This patented nozzle the Raindrop™ produces only 1/20th the amount of fine droplets under 100 microns as will conventional type nozzles. Mass Median Diameter (MMD) droplet size produced by the Raindrop nozzle is approximately double that of conventional nozzles at equal pressure and flow rate.

Turf spraying results in the usage of many different kinds of spray solutions. Several different chemicals and micro-nutrients may be mixed in the tank for simultaneous application. Liquid fertilizers may also be a part of the spray solution. These materials combine to give the spray solution properties different than water.

It should be remembered that nozzle flow rates are based on water. The addition of other materials to water can make the specific gravity, surface tension and viscosity of the spray solution unlike that of water and result in flow rates somewhat diferent than would be obtained if just water were sprayed. As example, a spray solution weighing 12 lbs. per gal. has a specific gravity of 1.44 and will reduce flow rate through a nozzle by about 17% compared to water. A spray solution weighing 7 lbs. per gal. (.84 specific gravity) will flow through a nozzle approximately 10% faster than will water.

Specific gravity, surface tension and viscosity also have effect on the size of droplet formed by a nozzle. Rules of thumb are as you reduce surface tension, droplet size is reduced, and as specific gravity or viscosity increases, so does the size of the spray droplet. Other rules of thumb are that as pressure is increased through a nozzle droplet size becomes smaller, and that as pressure remains constant and nozzle size is increased, droplet size becomes larger.

Manufacturers supplying the spray equipment used by the turf industry offer a wide variety of complete sprayers, pumps, nozzles and sprayer accessories. This equipment comes in many sizes and capacities to meet diverse requirements of the industry. When you select a piece of equipment keep in mind what your specific needs are.

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THE EXPANDING CHALLENGE OF PRODUCTS

Charles Schmidt, Indiana Seed Co.
Noblesville, Ind.

With greater emphasis on the different facets of the turf industry, a new era of significant importance to seed companies is the expanding challenge of product lines to meet more specific problems. Today the turf problems of the homeowner, golf course, park department, athletic field, housing development, highway landscaper, etc., are now an integral part of a seed company's overall program. To meet this challenge we feel our customers are looking for professional guidance to help solve their problems and a place to purchase the products they want.

In turfgrass culture, the development of new grass cultivars,a broadening base of fertilizers, broader spectrum of chemicals, new mulches and other related programs has made it necessary for change in our company's turf sales program. To implement such a program requires some depth of contemporary turf knowledge. We must participate in turf related activities and belong to professional organizations. We must collect and disseminate technical data and convert it into practical knowledge and offer products to meet the challenge.

To illustrate our product expansion program, we are concentrating our sales in the following areas:

Seed: We stock and offer 12 bluegrasses, 6 ryegrasses, 6 fine fescues and 6 bentgrass varieties to meet different conditions at all economic levels.

Fertilizer: A specialty fertilizer for the homeowner and a professional fertilizer for the professional turf man.

Mulches: Two products available for use with hydroseeders -- Silva-fiber and Terra Tack.

Equipment: Fertilizer spreaders, seeders, and hydroseeders to meet the demand of specific jobs.

We hope we can provide the counsel and cooperation to our customers as we expand our products. This will require skills, experience, and technical training. We will constantly strive to be of assistance to you and your problems and handle products to meet the new challenges of the turf industry.

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FERTILIZATION - IT'S A MATTER OF BALANCE

D. B. Pfleiderer, The Bishop Co.
Lebanon, Pa.

The key to a successful turf fertilization program is balance. A grass plant is a complete manufacturing unit which uses energy from the sun, carbon dioxide from the air, water and nutrients from the

from the soil, to produce beauty in the form of green grass, oxygen, and dollars as the results of increased property values. Since the soil does not normally supply enough or the proper amounts of essential nutrients, the fertilizer program must supply the needed balance.

Two diagnostic tools to help determine the nutrient levels needed in a turf area are soil and plant analysis. Both are essential since soil testing measures nutrients available in the soil, while plant analysis measures what is actually taken into the plant. A balanced fertilization program - which usually accounts for less than 5% of the golf course budget-can affect at least 50% of the outcome of a turfgrass management program. Proof of this can be seen when one observes a low or non-fertilized turf and see weed problems, bare grass areas, lack of blade strength to hold ball on top of turf, lack of color, more disease and/or lack of recovery, less drought and heat tolerance, etc.

In this midwest area research indicates that normally a balanced feeding program takes into account nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron and possibly manganese. Of these, Nitrogen is King! If this nutrient is neglected the response to everything else is only intermediate. Even in turf seedings, and contrary to many beliefs, nitrogen is equally or more important than phosphorus. Research indicates a 2-1-x fertilizer ratio for starting seedings.

Our industry bases everything on the 1 lb. of nitrogen per 1,000 sq.ft. standard and this is excellent. However, keep in mind the type and source of nitrogen. There is a difference between readily available nitrogen, intermediately available and slowly available forms. Your best hedge against turf with a lack of color response, excess mowing, grass burn, or excessive labor costs is a chemical combination of nitrogen that contains all three release types.

There is a strong research available indicating that potassium must be in balance with the nitrogen. Since potassium is the cheapest of the macro-nutrients the old adage of "if a little bit is good, a lot more is even better" can definitely be wrong. An example would be where excessive potassium (twice as much potassium as nitrogen) reduced the resistance of bluegrass to drouth and heat during the summer months. Other nutrients to check when turf lacks color are sulfur and iron. Also proper fertilization can reduce the incidence of a certain disease and weed infestations. In fact, regardless of the causal organism involved, proper fertilization is important for enhancing turfgrass recovery.

By "putting it all together" - the results of soil testing, plant analysis, field tests and experience, the ideal ratio based on 1 lb. of nitrogen would be: 1.00 nitrogen, .25 P_2O_5, .50 K_2O, .2 sulfur, .04 iron. In terms of a commercial fertilizer ratio, an 18-8-9 with 2% sulfur and 1% iron would be ideal.

Do your turfgrass a favor - get on a feeding program, monitor results and save fertilizer materials and money by supplying a proper balance of nutrients to all turfgrass areas.

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UREAFORMS - NITROFORM

George Osburn, Hercules, Inc.,
Wilmington, Del.

The condensation products of urea and formaldehyde manufactured under conditions which will provide agronomic activity are called ureaforms. Ureaforms in commerce today contain 38% nitrogen, of which a minimum of 70% is water insoluble nitrogen, and have an activity index of 40, minimum. Thus, the number of units of water insoluble nitrogen is a minimum of 26.6 of the 38 units of nitrogen, and the activity index is the function of cold water insoluble versus hot water insoluble. The remaining units of nitrogen in the total of 38 are, by definition, called water soluble even though the solubility in water is only 1 gram in 250 milliliters of water.

We can see from this that commercial ureaforms are made up of 3 distinct polymer groups or molecular sizes, known as CWS (water soluble), HWIN (hot water insoluble) and WIN (water insoluble). In chemical terms, the polymers range from monomethylene ureas up to and including polymers containing 6 moles of urea per molecule. The lower molecular weights are more water soluble polymers that release the nitrogen through microbial action more rapidly. The more complex molecules are harder for micro-organisms to digest and are, therefore, slow-releasing of the nitrogen.

The first commercially available solid ureaforms became articles of commerce about 1956-1957 and came about through the research work of Dr. K. G. Clark of the USDA at Beltsville. The basic specifications developed by Dr. Clark are still in use, and the major refinements have come in the processing techniques worked out to increase the WIN fraction to at least a one-third portion of the total nitrogen.

Two manufacturers make products which meet the defined specifications for ureaforms. These products are sold in large quantities with turfgrass fertilization the largest market and major outlet. The golf course market is a very key part of the total marketing as golf course superintendents and those in turfgrass research were the first to understand and appreciate the merits of ureaforms as efficient nitrogen fertilizer sources. Dr. Daniel, our host, is one of the earlier workers with ureaforms, and his work was primarily focused on the golf course turf.Greens fertilization was of primary interest. Later work has been expanded to cover the entire area where even turfgrass is grown and maintained. Today the major market for ureaforms, in terms of tons of products sold, is in home lawn maintenance, followed by professionally tended turfgrass. Highway hydroseeding programs and erosion control maintenance programs are also important.

The professional manager of turf, wherever he is, is the one to whom ureaforms offer the greatest potential, and whose understanding of how they work is far more critical than in the homeowner field. As with many new products, many misconceptions and false panaceas abounded. Today the managers of turf areas and homeowners are far more sophisticated than some 20 years ago, and a greater understanding exists of the make-up of many of our maintenance products. We do believe, however, that ureaforms are the products which put across the now widely accepted understanding of slow-release nitrogen. In other words, ureaform was the pioneer in slow-release nitrogen and has made for

faster acceptance of later introduced slow-release nitrogen products. Among these are nitrification inhibitors, coated material fertilizers and polymers of higher aldehydes used in place of the formaldehyde as part of the molecule.

Most quality fertilizers on the market derive their water insoluble nitrogen contact from ureaforms. Most of the products which are characterized as quality fertilizers contain at least 50% of their nitrogen from ureaforms. This means that they contain a minimum of 35% water insoluble nitrogen. This type of formulation practically insures freedom from fertilizer injury and predictable performance when used as directed.

We believe that ureaforms are here to stay in that they utilize, in almost equal proportions, urea and formaldehyde. These are the two most efficient and least expensive nitrogen and aldehyde compounds available. Technology will, in time, allow variations in the proportions of water soluble to water insoluble nitrogen for more specific end uses. The manufacturing process is basically a condensation procedure, and once the know-how was reduced to practice, the plants operate very efficiently. The proof of the understanding and efficiency of ureaforms is evidenced in the fact that the basic information developed by workers in the turf field, such as Dr. Daniel and others, has been translated into other markets. There is demand for ureaforms in perennial crops such as rubber, bananas, tea, coffee, horticultural crops, such as hot-house grown cucumber and flowers, outdoor growing of horticultural crops in containers, and even short growing cycle vegetables, such as tomatoes. All these will profit from the use of ureaforms as a source of nitrogen. Ureaform fertilization of these crops is a reality today and we foresee ureaform as a very basic nitrogen source world-wide in future years.

I mentioned earlier that there were many false panaceas about ureaform, the most common of which was for fertilization once a year. Ureaform would solve all fertilization worries. The product, however, was strong enough to overcome this kiss of death, and like all other nitrogen sources, ureaforms have to be used with understanding, and in the way they were intended to be used when they were made. The important things to know about ureaforms in turfgrass mangement are:

1. They are efficient. More than 90% of the nitrogen in ureaforms is eventually released for plant assimilation and can be accounted for.
2. The cost per unit of ureaform nitrogen is the critical cost, not the cost ton.
3. The unit cost of water insoluble nitrogen is still more critical and must be compared with other sources of organic nitrogen on an equal availability basis.
4. With currently available ureaforms one can expect that essentially all of the nitrogen in ureaforms will have become available to growing grass in three seasons, in the northern climates of the U.S. In more tropical areas all of the nitrogen will be released and made available in about 2 years or less. Stress conditions accelerate this release date, somewhat, but for most practical conditions these are adequate guidelines. The nitrogen in ureaforms is made available to growing plants by digestion of the molecules by microorganisms, which are for the most part plants themselves.

5. A rule of thumb in describing ureaform release rates is that the water insoluble nitrogen will be released at a rather constant rate of about 6% per month so long as the soil temperatures are higher than 50°F and not more than 90°F. Since most of the micro-organisms are plants, it naturally follows that when conditions are right for turfgrass growth, they will be right for micro-organism activity, and nitrogen will be made available to the root system of the grass.
6. When climatic conditions are not right for turfgrass growth, they are equally unsatisfactory for biological activity in the soil, and no nitrogen is converted from ureaforms to ammonia to nitrate for plant absorption.
7. Ureaforms do not leach. The nitrogen, therefore, remains in the soil, awaiting the proper time for turf to begin to grow again.

A basic understanding of these few points can equip the turfgrass manager to think out his nitrogen management programs, to grow acceptable turf with the most efficient source of organic nitrogen,and in the minimum quantities needed in these days of critical supply and economic challenge.

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SCOTT'S PROGRAM AND PRODUCTS GIVE SUCCESS

Dick Gray, O. M Scott's
Marysville, O.

Success is more than just a level of performance - it's also a method of performance. It doesn't "just happen". Nobody "just happens" to be successful. Success must be planned, then pursued. It is a culmination of the right steps, the right tools, at the right time.

There are different pathways to and of success, different levels, and, along the way, different tools. The pathway I've chosen is granular, and the tools -- programs, products and services.

We all plan to some degree vacations, work, construction, Anything lasting or worthwhile is planned. The Conference is a prime example. The booklet we all received was detailed, showing speakers, rooms, times - an orderly arrangement of events.

We at Proturf make plans also. They look like this and we call them programs. This, or one similar regardless of the author, can be a very important and useful tool. First, it's a schedule of operation to insure maintenance continuity. It shows the application, the rate, approximate timing for all your areas. It's a system for tracking progress, anticipating needs, and maintaining <u>your</u> level of perfection. It's also an inventory. You know the rate per application, rate per area, rate per year. More than that, you know unit cost, application cost, area cost, and firm total cost. So, it's also a budget or cost analysis.

The benefits of programming are three-fold:

1. Your turf benefits. With consistent management, preventive maintenance and no diets, you eliminate the valleys in turf quality.

2. With consistent playing turf, fewer worker-golfer conflicts, and fewer interruptions in play, the golfer benefits.

3. By eliminating people problems and reducing turf problems, you benefit.

If programs are the keystones to sound management, then the supporting blocks must be products. One is useless without the other.

Select those products that are best for you, those that are most practical, those that have the most value. Don't confuse value with cost. Cost is the worth to the seller; value is the worth to you. To find value, ask these 3 questions about a product:

1. Is this the best product for my turf? Why?
2. Is this the best product for this job? Why?
3. Is this the best product for me? Why?

A product has value if it's efficient. The greater the efficiency, the greater the value. If a product reduces maintenance costs, if it eliminates extra operations, if it combines operations, then it becomes efficient. Efficiency saves time, efficiency saves labor, and time multiplied by labor equals value. With 65% of your budget in labor that can be several dollars. Maximize efficiency; minimize operations.

Naturally I speak of granular combination products. For example, on greens we can reduce application time by 75% and operations by 50% with one product - fertilizer plus DSB fungicide. And, on fairways, we can stop and control leafspot for up to 4 months with a single application of F.F.II. Compare that to conventional spray applications. Again, the key is efficiency.

Finally, the third tool is <u>service</u>. There is more to a product than the contents of the bag. Is the company turf-oriented? Is it service-oriented? Will they take soil tests, disease and weed I.D.'s, nematode counts? Do they have turf research facilities available to you? How about seminars, educational manuals, magazines? It's important that you align yourself with a turf company. After all, you have invested your job by using the products, and more importantly, you've invested your name and reputation.

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IBDU AND PRODUCTS

Cliff Helwig, Swift & Co., Agricultural Chemicals
Chicago, Ill.

If we are going to retain the luxury of fertilizing golf courses, then we are going to have to use fertilizers that are different from those used in farm crops. You, the golf course superintend-

ent, are going to have to adapt to slow controlled release N-P-K formulations. This change can take place now since new advance technology to develop sophisticated products is not required. Such fertilizers are on the market today like Par Ex formulas. In addition, slow release nitrogen has been in use for over 20 years. It is this latter area, nitrogen, that I want to highlight. In particular I will discuss with you IBDU, a different concept in controlled release nitrogens.

IBDU is 31%, while urea formaldehyde, the 20 year old slow release standard bearer, is 38% nitrogen. Aside from IBDU having 7% less nitrogen, there are several other key differences between these two materials.

1. Water Soluble Nitrogen
   a. IBDU - 3.1 units, or 10%
   b. Urea Formaldehyde - 10.5 units or 28%

2. Water Insoluble Nitrogen
   a. IBDU - 27.9 units, or 90%
   b. Urea Formaldehyde - 27.5 units or 72%

3. Available Water Insoluble Nitrogen
   a. IBDU - 27.9 units or 90%
   b. Urea Formaldehyde - 18.0 units or 47%

4. Unavailable Water Insoluble Nitrogen
   a. IBDU - None
   b. Urea Formaldehyde - 9.5 units or 25%

5. Total Nitrogen Actually Available
   a. IBDU - 31 units or 100%
   b. Urea Formaldehyde - 28.5 units or 75%

6. Total Water Insoluble Nitrogen Actually Available
   a. IBDU - 27.9 units or 90%
   b. Urea Formaldehyde - 18.0 units or 47%

These comparisons are very important, from both economic and agronomic standpoints. Simply stated, IBDU is 100% available to the turf, whereas only 75% of urea formaldehyde becomes available to the turf in a single growing cycle. Also, there is nearly twice as much available WIN in IBDU as there is in urea formaldehyde which makes these two materials very distinct.

Aside from IBDU and urea formaldehyde being chemically different, they are also unlike in how they mineralize. IBDU becomes available to the turf by hydrolysis, whereas urea formaldehyde is completely dependent on warm soil temperatures and bacterial activity for its nitrification. Since IBDU does not depend upon either soil temperature or bacterial activity to mineralize to soluble form, it is a more predictable source of slow release nitrogen. This distinction means that with IBDU you can maintain good color turf during cool, dark months of the year.

IBDU is available in one particle size of "coarse" (ranges .7 to 2.3 mm). The larger particle size will continue supplying nitrogen to your turf for longer periods.

In summary, there are 5 primary factors that affect release rate of IBDU and urea formaldehyde:

1. Granular size
2. Soil moisture
3. Soil temperature
4. Bacterial activity
5. Air temperature

For its slow release benefits, urea formaldehyde depends on 4 of these 5 factors, 3 of which you have no control over, soil temperature, bacterial activity and air temperature. IBDU slow release pattern is not controlled by these 3 factors. Rather IBDU is dependent on just 2 of these 5, granule size and soil moisture. So, IBDU is pretty close to self control.

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IBDU IN SPRAYERS

Cliff Helwig

In the fall of 1973, I started my first test using IBDU, a slow release nitrogen, along with liquid nitrogen. Up till then we could not advise any liquid application to use IBDU as it is too water insoluble. We also knew that because of the granule size we would be unable to use any type of piston pump. So, one of the applicators had a 1200 gal. tank equipped with a centrifugal roller type pump without screens, so the problem of the particle size jamming up anything was eliminated. The next problem we had was the nozzle size which needed a hole size greater than 2.0 mesh size, and with a fan spray nozzle.

I asked these applicators why they wanted to use a slow release fertilizer like IBDU and they both said, "To give their customers a longer lasting green lawn at a slightly higher cost." Also, they could eliminate any possible burn factor from the liquid as they were shooting for less call-backs from the customer.

A question I would ask all lawn service people - "Does a slow release nitrogen like IBDU belong in your program?" Why IBDU? Because of the way it releases by hydrolysis, and the bigger the particle size the longer it will last. If the homeowner supplies enough water to his lawn the greener it will get with IBDU. Since the particle size is coarse IBDU, this will give the homeowner a longer lasting green turf.

Most of the applicators are putting down ½ lb. of liquid nitrogen and ½ lb. of slow release IBDU per each application. They apply this 4 times a year along with the rest of their chemicals. This programmed use of slow release IBDU, along with the liquid, has been very successful in the Detroit area. If you want to try it or have any questions, please contact any of our Par Ex distributors, or Swift Chemical, St. Louis.

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ORGANIFORM - A NEW CONCEPT

A. H. Bowers, Hawkeye Chemical Co.,
Clinton, Iowa

Before I talk about Organiform 24-0-0 let me set the stage with a brief description of Hawkeye Chemical Company since it is a new name to many of you in the field of turfgrass management.

Hawkeye Chemical is a leading Midwest producer of nitrogen products for agriculture and industry. Located at Clinton, Iowa, we are a wholly-owned subsidiary of Skelly Oil Company, and since 1963 have been producing hundreds of thousands of tons annually of ammonia, prilled ammonium nitrate, urea-ammonium nitrate fertilizer solutions and other nitrogen compounds. We are currently the only supplier of a liquid urea-formaldehyde concentrate which several leading turf and garden fertilizer manufacturers use in deriving water-insoluble nitrogen in their formulations.

While we do not actually manufacture Organiform 24-0-0, as sales agent we introduced it in Illinois, Iowa and the Kansas City areas in 1974, and this year are represented by distributors of golf course supplies in these areas.

Now, what is Organiform? The Organiform process is a patented procedure whereby odoriferous natural organic material, such as leather tankage or sewage sludge, is recycled and upgraded into a high analysis, granular, slow release nitrogen fertilizer without offensive odor, by chemically linking methylene ureas to the protein molecules in the natural organic base. The material we are offering is 24% N, of which 8% is water soluble organic nitrogen and 16% water-insoluble nitrogen. Since it contains no soluble salts the product is non-burning; since it is a combination of natural and synthetic organic compounds, it is bulky enough to enable easy spreading, but is not so bulky that it takes a lot of material handling or storage space per pound of nitrogen contained.

Although Organiform has been used successfully since 1967 in the northeastern states, both as an ingredient in mixed grades and for direct application for turf, until last year it was unknown in the Midwest. Therefore, in order to evaluate its performance under our conditions a project was set up here at Purdue to determine its nitrogen release characteristics in greenhouse and field studies. Paul Granger, under Dr. Daniel's direction, has completed the first year's study. This has included nitrogen retrieval in greenhouse pots, as well as application at various rates of N to bentgrass and bluegrass with response measured by clipping weights.

Figure I shows the comparative rates of nitrofication of some nitrogen materials. In a study by Organics, Inc., soil containing the various nitrogen sources was incubated under constant temperature and moisture, with the NO_3^- nitrogen release measured by chemical analysis at regular intervals over a 21-week period. This bacterial release exhibited a very even, consistent rate in the case of Organiform and, as expected, by a 38-0-0 ureaform.

Figure II illustrates release rate of nitrogen from Organiform as determined by weights of clippings removed from bluegrass plots

where Organiform was applied at 4 lbs. of N per 1,000 sq.ft. at Purdue on July 3. At the end of September a good steady release was still being maintained, but declining growth due to the approaching end of the growing season is evident in October. In 1975, application will be made much earlier in order to provide a longer, more typical period of evaluation.

Organiform 24-0-0 is a slow release material, although its water-soluble N content furnishes visible greenup within a few days of application. Based on the successful results of many golf courses in 1974, we recommend that it be applied at not less than 2 lbs. of N per 1,000 sq.ft.

In summary, Organiform 24-0-0 will have these appeals to the professional turf manager: safety, good spreading characteristics, consistent nitrogen release, and non-corrosiveness.

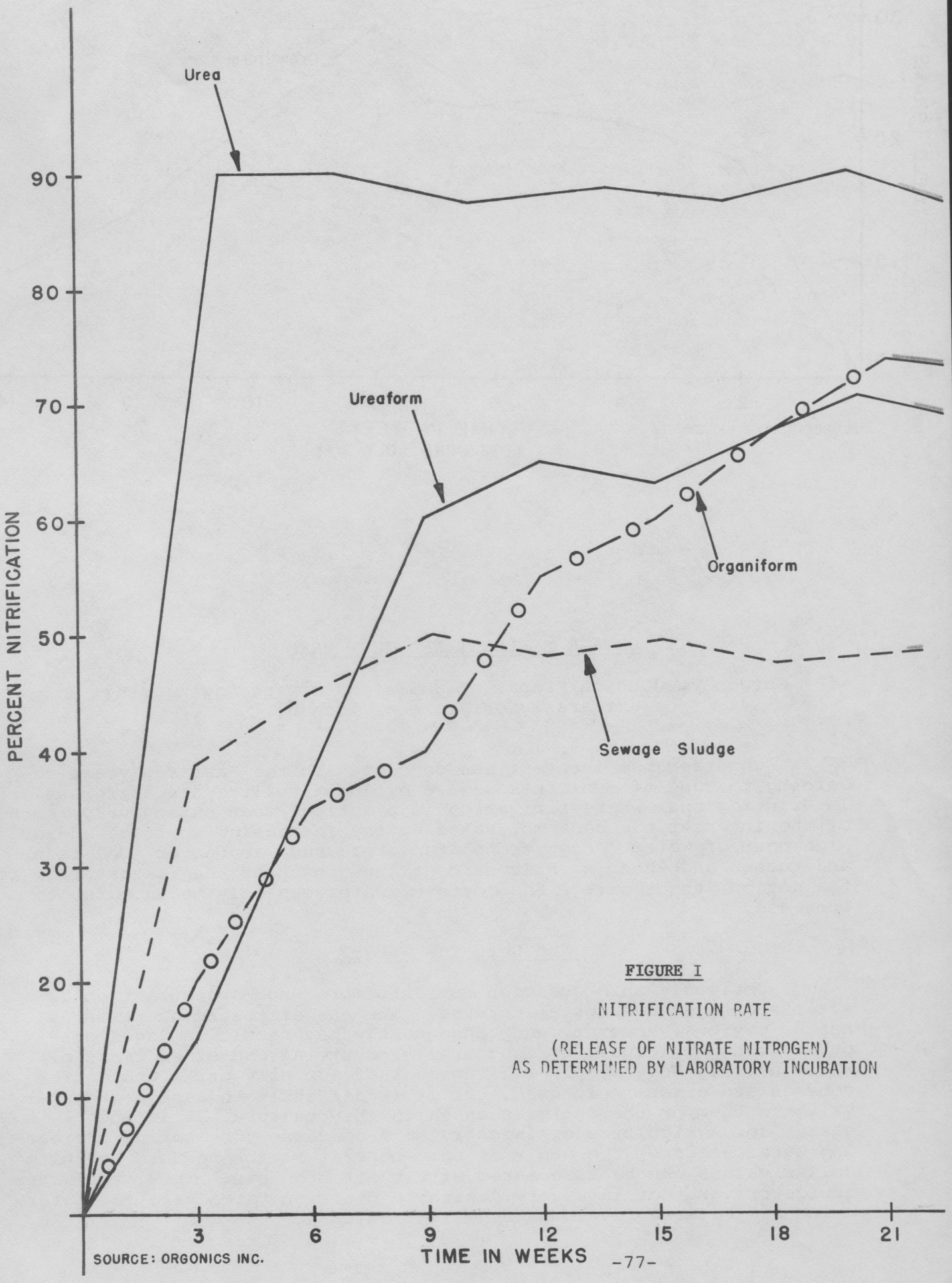
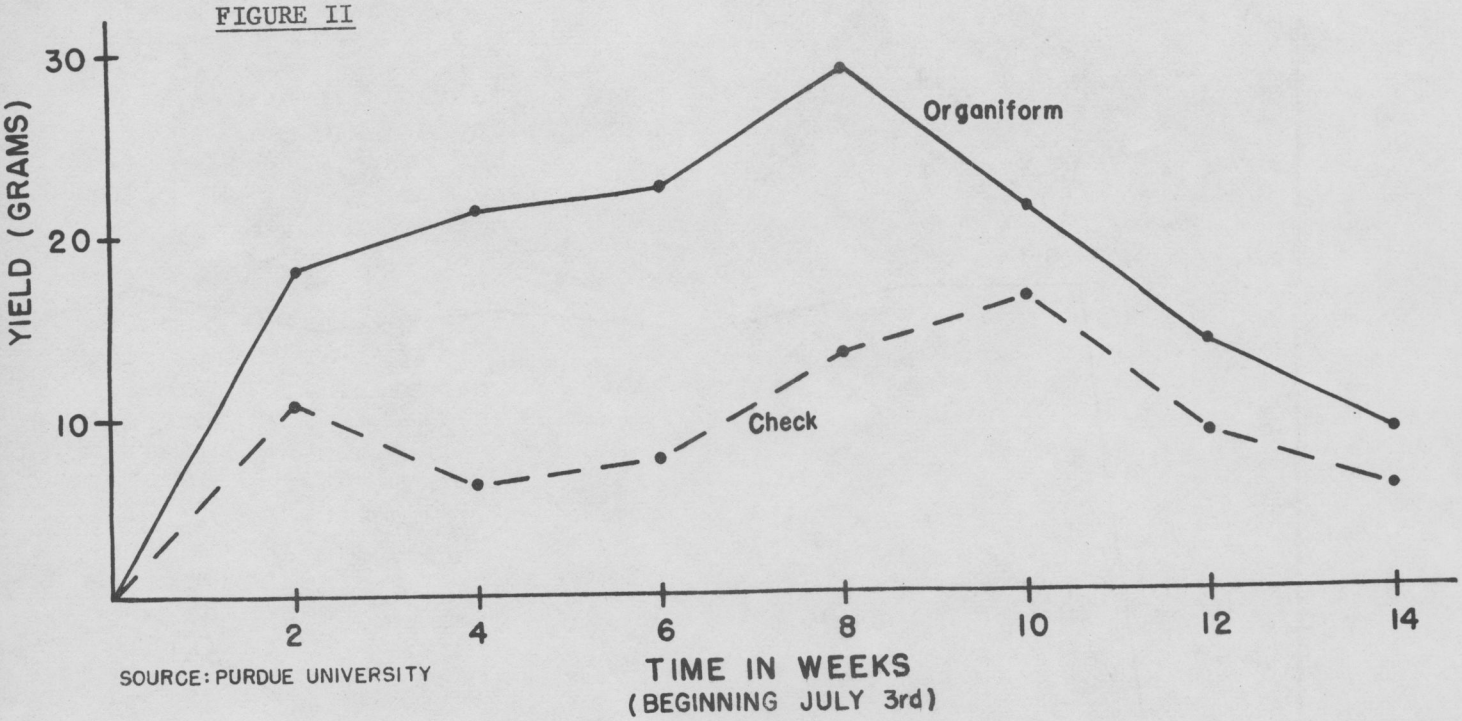


FIGURE I

NITRIFICATION RATE

(RELEASE OF NITRATE NITROGEN)
AS DETERMINED BY LABORATORY INCUBATION

FIGURE II



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SEWAGE EFFLUENT AND TURF USES

Gordon V. Johnson, Dept. of Soils, Water and Engineering
University of Arizona, Tucson

Considerable interest has developed in the last few years regarding the use of municipal sewage effluent to irrigate turfgrass. In arid regions, where irrigation is practiced most extensively, much of the interest has been motivated by the increasing shortage and/or high cost of water. As metropolitan areas such as Denver, Colorado, and Tucson and Phoenix, Arizona continue growth at the fastest rate in the nation, the shortage and costs of water can only be expected to increase.

Who Gets The Water?

Obviously this question receives more and more attention as water shortages and costs increase. The answer to the question is not so obvious, however, and consequently may result in legal disputes among municipal, agricultural, industrial and other kinds of water users. Most people will agree that our city parks and golf courses are extensively used, yet it is difficult to assess a dollar value to them or the turfgrasses which they culture. It is much easier for agriculture or industry to show cause for meeting increasing water needs on the basis of cost-benefit ratios because definite dollar values can be associated with their products. Thus, turfgrass irrigators are not in a very desirable position to compete for water which can be used for industry or agriculture.

Sewage Effluent Excess

The inability of turfgrass irrigators to justifiably compete with other users for good potable water can in many instances be circumvented by realizing that 1) secondarily treated municipal sewage effluent is usually considered an excess commodity, and 2) the irrigation quality of treated effluent is normally only slightly lower than that of the domestic water supply.

Evidence of the first point is easily verified by simple observation of what is currently done with treated effluent. In a majority of instances treated effluent is dumped into the nearest stream or large body of water. Obviously in these instances there is no current competition for the effluent and it is available for whatever safe uses can be demonstrated. Competition for use of effluent may develop in the future, however, as awareness of its value for irrigation increases. The turfgrass irrigator will be in a better position to compete for treated effluent than for good potable water. Treated effluent is not suitable for domestic household use, nor will there be much demand for it by most industries. There may be demand by agriculture, however, especially in critically water depleted areas.

Determining the ultimate user of the effluent will be influenced greatly by local policies, politics, and relative importance of turfgrass and agriculture. Some advantages to irrigating turfgrass with effluent are:

1. Utilization of nutrient constituents (primarily N and P) on an annual per unit area basis is high relative to groundwater contamination by these elements

2. Use continuity is not interrupted by cultivation, seeding and harvesting operations common to agriculture, and

3. The use is in close proximity to the source thereby minimizing transmission expenses.

Practicing the concept of sewage effluent irrigation of turfgrass may not be economically feasible for large cities which have a nearly static population because of the expense involved in building new pipelines from existing treatment plants to large turfgrass areas. Small cities and cities which are growing rapidly can more easily adapt the concept by planning parks, golf courses, cemeteries, etc. close to existing or future sewage treatment facilities. This latter category of cities also includes those which currently experience the water shortage problems eluded to above.

The quality of treated sewage effluent should in most instances, not be a deterrent to its use for turfgrass irrigation. This statement is especially true when the principal source of effluent is from domestic household use. The quality of effluent will vary widely from one location to another, depending on the type and efficiey of treatment, as well as the quality of original water. The concentration of dissolved salts will typically be about 300 ppm greater in treated effluent than the original water source, and may require more careful management for irrigation use. In addition to the total dissolved salt concentration, the ionic concentration of specific elements such as Na, Ca, Mg, N, P, K, B, Cd, Ni, Cu, and Zn must also be considered because of their effects on soil properties and plant growth.

Quality will be a major factor limiting the extent to which effluent may be used for irrigation. Other factors influencing use will be type of soil and climate.

Effluent Quality

An indication of the variance and the average quality of effluent is provided by a recent survey of effluent quality from 59 Michigan treatment facilities. A summary of that report is given in Table 1.

Table 1. Effluent Quality Variance in Michigan.

Parameter*	Total N	PO_4-P	Ca	Mg	Na	K	SAR	EC
	ppm							
High	285	8.1	187	38	265	66	7.4	3.5
Low	10.7	0.03	29	7	12	4	0.4	0.25
Average	35	2.3	66	19	97	11	2.8	1.0

*SAR - sodium adsorption ratio, EC = electrical conductivity mmhos/cm.

The average values reported in Table 1 represent an acceptable quality water for irrigation. The average EC value of 1.0 indicates a medium salt content, but suitable for turf grown in soils of moderately good drainage when irrigated to provide periodic leaching. The sodium hazard, indicated by SAR, is low and should not present a problem. The nitrogen (N), phosphorus (P), and potassium (K) concenare acceptable for actively growing turf. The N concentration would be sufficient, but the P and K insufficient to provide the requirements for these nutrients by most turfgrasses. Based on current fertilizer prices, the N in an acre-foot of this "average" effluent is worth in excess of $20. Concentrations of the heavy metals copper (Cu), cadmium (Cd), zinc (Zn), lead (Pb) and mercury (Hg) were often below detection limits and considered non-hazardous under normal conditions.

The boron (B) concentration is not a problem in humid regions. Boron is relatively mobile in soils and accumulations in soils can usually be removed by leaching. Boron concentrations of 1 ppm or greater in effluent should be considered potentially hazardous to turfgrass. When effluent high in B is used, the soil and effluent should be tested periodically to determine the need for leaching or substituting better quality water.

The Soil-Turf Tertiary Treatment System

A most practical way of viewing the problems associated with effluent irrigation is to view the soil and turfgrass as a tertiary effluent treatment system. In this regard, the main concerns will be related to the capacity and efficiency of the system. Capacity and efficiency are interrelated; whenever the capacity is exceeded efficiency will decrease and both will be variable functions of effluent

volume and quality in a manner similar to that for primary and secondary treatment plants. Just as primary and secondary systems have designed capacities, the soil-turf system has an inherent capacity. Overloading has not been uncommon to cities experiencing unexpected growth. It is not unlikely for the same deteriorating situation to occur with the soil-turf tertiary system, and for it to be caused by the same factors. However, since the soil-turf system is a "living" system, its deteriorated efficiency is much more difficult to revitalize and must be carefully guarded against.

Capacity of the Soil-Turf System

The Soil. Soils vary widely in the physical and chemical properties important to effluent irrigation of turfgrasses. The property of greatest concern is soil texture because it strongly influences the cation exchange capacity (CEC), salinity, alkalinity, infiltration rate, percolation rate, and water-holding capacity of the soil. Coarse textured soils, such as a sandy loam, are most desirable, although heavier textured soils, such as loam or silt loam, are acceptable under closer management. The CEC of sandy loam soils ranges between 3 to 10 milliequivalents/100 grams and will normally be sufficient to absorb the average cation components in a one-inch effluent irrigation. The most limiting characteristic of sandy soils is their moisture holding capacity. Since sandy loam soils will retain only 1 to 1.5 inches of available water in the surface foot of soil, irrigations must be more frequent than for finer textured soils. Although loam, silt loam and clay soils have greater capacity to retain available water and absorb chemical constituents in effluent, they are also more likely to become alkaline, saline, or compacted because of restricted internal drainage.

All soils, but especially fine-textured soils, should be tested periodically to determine if salt or sodium (Na) are accumulating. These tests are performed routinely for a minimal charge by most university and commercial soil testing laboratories. Exchangeable Na percentages above 15 often impair infiltration and indicate the need for applying gypsum, improving drainage, and leaching. Electrical conductivity of extracts from a saturated soil paste exceeding 4 mmhos/cm is harmful to salt sensitive plants and indicates a need for leaching.

The heavy metal elements, Cu, As, Cd, Ni, and Hg are of environmental concern when their concentrations exceed toxic levels in the biological food chain. Although turfgrasses normally are remote to the food chain, awareness of the activity of the elements is important when effluent is used for irrigation. Fortunately, these elements are usually found at very low concentrations in effluents, especially when the source is from domestic household use. Furthermore, in arid region soils where the potential for irrigation is greatest, the basic soil pH (greater than 7) causes them to become inactive as a result of their precipitation as oxides or hydroxides. In humid region soils, which tend to be acidic (less than 7), the same type of inactivation can be accomplished by periodic liming to raise the soil pH.

The soil will generally not be a factor limiting effluent irrigation provided sound soil management required for conventional irrigation is practiced.

The Turf. Most types of soil will have sufficient capacity to remove the major portion of impurities in one normal irrigation with effluent. Actively growing turfgrass will absorb from the soil the

major nutrient elements (N, P and K) removed from the effluent. Thus, the capacity of the soil to remove these elements is maintained by actively growing turfgrass. Of these elements, N is required in greatest amount by turfgrass, and it also is usually the most concentrated in effluents. The extent to which this removal occurs for N is indicated by the results of a 32-week study conducted at the University of Arizona reported in Table 2. These results clearly show that the soil-turfgrass system is very effective in removing N from effluent (average effluent N concentration was 20 ppm), and that most of the N removed ends up in the turfgrass clippings. Obviously some of the N removed remains in the roots and unclipped portion of the turf, and some is biologically incorporated in the soil organic matter. Irrigation at the high rate added an average of about 1 lb. of N/1,000 $ft.^2$/month, which is the commonly recommended rate for actively growing turf. Although the average removal efficiency was greater than 90% for all systems, the decrease in removal efficiency associated with high irrigation rates and coarse textured soils is evident.

Table 2. Mean Values for Removal Efficiency and Nitrogen Utilization for Soil-Turfgrass Systems

Soil Type*	Irrigation** Level	Removal Efficiency	Utilization of N by Grass
		%	%
SL	L	94.4	115.5
SL	M	94.6	83.0
SL	H	94.0	86.7
SiL	L	96.9	82.4
SiL	M	95.6	70.5
SiL	H	91.5	68.8

*SL = sandy loam; SiL = silty loam
**L, M, H = approximately 4, 7 and 11 inches applied per month

Quality, with respect to N, of the effluent from the soil-turfgrass tertiary treatment system is illustrated in Figure 1. Organic N was high in the solutions passing below the root system for all treatment combinations. This observation was believed to be associated with the suction removal of solutions for analysis. When regular irrigation water supplemented with N and P was used instead of sewage affluent, similar concentrations of organic N were found in the testing effluent. The concentration of nitrate nitrogen never exceeded 1 ppm and is far below the minimum for acceptable drinking water.

When clippings are not removed, the N in them is subject to incorporation into the soil organic matter, or after organic decomposition, reuse by the turf, or loss by leaching or volitalization. These same natural processes determine the fate of commonly added fertilizer N.

The importance of actively growing turf to maintaining a high removal efficiency is illustrated in Figure 2 for the SL soil. Initial removal efficiency was high in late September when common Bermudagrass was actively growing. The Bermudagrass was scalped and over-

seeded to ryegrass in October. During this ryegrass establishment period removal efficiency was decreased because the turfgrass growth was much below optimum. Removal efficiency increased to nearly 100% when the ryegrass became well established in December. The decline in January was a result of infestation by a low temperature pythium disease. Recovery from the disease and reestablishment of active turfgrass again resulted in high removal efficiency in March and April.

Irrigation rates had little or no influence on turfgrass growth or activity, and consequently removal efficiency was not significantly affected by irrigation rates. Obviously, continued successful effluent irrigation of turf will be possible only so long as actively growing turf is maintained. Barren areas and areas of very poor turf in arid climates are most often associated with poor distribution of water and N. Using effluent for irrigation should alleviate many of these problems since a major part of the N requirement will be met by the effluent applied; thus, distribution of N and water will be similar. Adequate irrigation should also be more feasible in these arid regions because of the lower cost of effluent compared to potable water.

Irrigation Rates and Frequency

Effluent irrigation rates and frequencies will vary depending on the local soils, climate, and effluent quality. As a first approach, the minimum rate and frequency must be at least as great as used for good quality irrigation water. The total application should not exceed the soil water holding capacity, and should be frequent enough to meet the water requirements of the turf. The experienced local irrigator should already be familiar with these requirements.

When N concentration of the effluent is high, or if the supply of effluent is not limiting, it is possible to provide the entire N requirement of the turf by effluent irrigation. The annual volume of effluent required to supply turf with 1 lb. of N/1,000 ft.^{2}/month has been calculated for Tucson, Arizona and is included here to illustrate how the irrigation volume must be adjusted in relation to effluent N concentration.

When these volumes of effluent are received or applied at a constant rate throughout the year, then they must be viewed in relation to turf consumptive water use. For Tucson, Arizona the turf consumptive water and N use would be met by applying 56 inches per year of an effluent containing about 35 ppm N (dashed line). In order for this to be accomplished however, excess effluent received during the period from November through March would have to be stored for use during the period from April through October. If the effluent contained 30 ppm, 6.5 inches applied per month would provide sufficient N and an excess of water. The merit of this excessive application would have to be considered with regard for relative costs of effluent and supplemental N, as well as the need and suitability of the soil for leaching.

Commercial Experiences

Current and past use of treated effluents for turfgrass irrigation have been generally limited to the more arid areas. Several locations have irrigated with effluent for 5 to 10 years without experiencing any unique problems.

Summary

Treated municipal sewage effluent can be and is being used successfully to irrigate turfgrass. When the effluent and its intended use meet the requirements of local, state and federal agencies such as Public Health Departments and Water Quality Control Boards, then the remaining limitations on the use of effluent will be similar to those considered for conventional irrigation.

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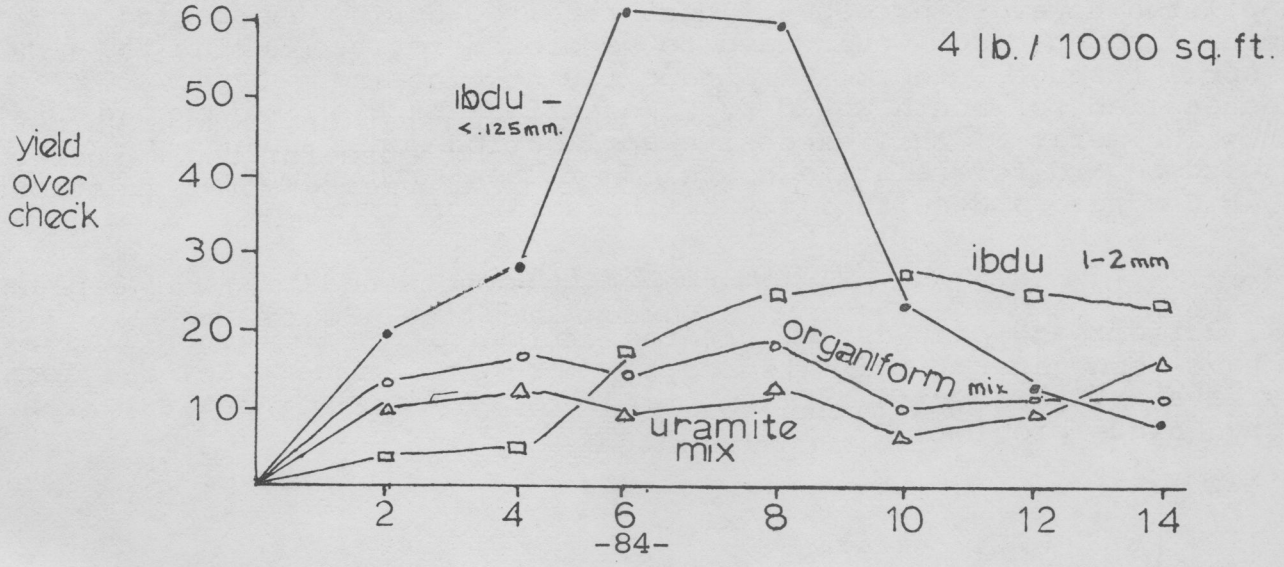
NITROGEN SOURCES

Paul Granger, Graduate Student
in Turf, Purdue

The slow release products for sources of nitrogen are becoming more and more used by the golf course superintendent. These products offer many advantages: one application may last for approximately 4 months of feeding, it stores in the soil so it can be absorbed by the roots and used by the plants when needed, there is no chance of burning with these products even when rates of 32 lbs. of actual nitrogen is incorporated in the soil, less care is needed in placement, and finally there is no feast or famine as with the inorganic fertilizers.

In the past year and a half, we at Purdue have worked with 3 of these slow release products. IBDU, which is 31% nitrogen of which 27.9% is in the insoluble form; Organiform, which is leather tankage protein with ureaformaldehyde added, 24% nitrogen with 16% in the insoluble form; and Uramite which is 38% nitrogen with 27% in the water insoluble form. It is the first action of release wherein the products differ. IBDU undergoes hydrolysis as it breaks down to urea, to ammonia and finally to nitrate. Uramite and Organiform are dependent upon microbial breakdown in the conversion to urea.

Results from some of the experiments conducted at Purdue will be presented here. In field studies, we tested 35 combinations of particle sizes, rates and products. Data from one rate is presented here:



Smaller particle sizes were found to release nitrogen faster than the larger size particles. Uramite and Organiform responded closely at this rate in yields, but color for Organiform was lower than that of all other products.

In greenhouse and field studies to determine how much of the fertilizer was used up after certain time periods after 30 days results correlated very closely with approximately 25% of the Uramite, 10% of the IBDU, and 60% of the Organiform being used. After 60 days 40% of the Uramite, 30% of the IBDU, and 60% of the Organiform being used.

In laboratory incubations these products were tested for nitrification rates and pH differences. It was found that after 15 days Uramite, IBDU, and Organiform had nitrified 10.43%, 9.15% and 8.28% of the nitrogen applied. After 30 days, Uramite, IBDU, and Organiform had nitrified 12.8%, 11.3%, and 10.6% of the nitrogen applied. In studying pH changes after 15 days, Uramite, IBDU, and Organiform had changed .55, .55, and .6 pH units. After 30 days these products had lost .9, .95, and .7 pH units, respectively while the check had remained constant at a pH of 7.6 throughout the study.

Further experiments are being conducted to determine recommendations for best uses of these products for the midwest.

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IMPROVING OUR GOLF COURSE

Clyde Lyons, Grounds Supt., Valley Brook C. Club,
McMurray, Pa.

My greatest single challenge when I started at Valley Brook Country Club was how to communicate with over 500 members and the necessary committees to accomplish the projects needed to improve the course.

Course Development and the Greens' Committee

I believe that a golf course superintendent's job consists of 4 main parts -

1. Public Relations
   a. Letters to the membership on lawns & gardens
   b. Workshops at the clubhouse for the member
   c. Being available to the members for questions
2. Salesman
   a. Selling of improvements and long range plans to the Greens Committee, Board and also membership.
3. Turfgrass Manager
4. Crew management

Making of reports explaining work accomplished and work to be done. This makes possible for the members of the Greens Committee to answer other members and the Board's questions. Slides are shown at Green's Committee and Board meetings to show work being done.

Course Improvements

1. A little bit about our course:
   a. Size of membership - over 500
   b. Amount of play - 250 rounds of golf per day - 40,000/year
   c. Fairways are bentgrass, which are maintained with 3 lbs. nitrogen (Greens 5 lbs. on Penncross). Potash and phosphorus are applied when needed.

2. Records include:
   a. Labor and materials used for course improvements. This way you have a good record so it can be converted to capital improvements and be written off on taxes over a number of years.

3. First impression a lasting one:
   a. Entrance to golf course is very important - signs - roadways and landscaping.

4. Course improvements:
   a. Improvements should be made so maintenance is minimum problem.
   b. Small improvements make large impressions.
      1. Flower beds
      2. The use of stumps as flower pots
   c. Replacing eyesores with beauty:
      1. Triangles where cart paths meet and it is impossible to maintain grass, install a flower bed. This also helps direct traffic.

   d. Drainage:
      1. Make tile lines at least 37 inches deep; for maximum efficiency we put in 10,000 ft. of drainage. Shallow drainage tends to make wet areas. We found many such places on our course. We also found tile lines without outlets.

   e. Irrigation:
      1. Proper installation of irrigation heads. Place gravel around sprinkler to facilitate drainage.
      2. Pulling of plastic pipe underground where additional irrigation is needed so fairways are not disturbed.

   f. Sand traps:
      1. We have 100 sand traps that must be rebuilt because they were designed in such a manner that the surface water washes the sand out. This costs many man hours to replace sand after a rain.
      2. Proper construction of sand traps.
      3. Use of sand traps to speed play by placing them so they prevent balls from going into stream banks or ravines.

g. Advantages of a sod nursery:
   1. To patch bare spots
   2. To speed up new projects

h. Thatching and overseeding to improve fairways.
i. Advantage of a test green
   1. To test equipment and to instruct new employees in mowing procedures.

FACTS: TO CUT A ONE ACRE PLOT 200' x 217'

Size Mower inches	Net cut inches	Swaths	Miles/acre	At 3 MHP hours
18	14	171	6.9	2.3
21	17	141	5.7	1.9
24	20	120	4.9	1.6
26	22	109	4.4	1.5
30	26	92.3	3.7	1.2
36	32	75	3.0	1.0
48	44	55	2.2	.7
60	56	43	1.7	.6
70	66	36	1.5	.5
80	75	30	1.2	.4

Comparisons of Mowers

Reel Mower
- -less horsepower requirement per foot of cut
- -produce the best quality of cut
- -maximum safety
- -long use life with minimum repairs
- -diameter of the reel and number of blades must be matched to site and type of turf
- -cut with a scissors type action
- -1 to 1½ HP per foot of cut
- -will handle turfgrass to 6"

High Cycle Rotary Mower
- -two to three 3000 R.P.M. spindles
- -acceptable quality of cut
- -high belt wear
- -available undermount or three point hitch
- -will handle turfgrasses to 6" maximum
- -low horsepower requirement - 2 HP per foot of cut

Flail Mowers
- -horizontal shaft type impact mower
- -coarse or thin blades available
- -must operate at 540 R.P.M., maximum safety
- -3½ to 4 HP per foot of cut
- -acceptable quality of cut
- -will handle turfgrasses to 12"

Rotary Cutter

-single spindle 1300 R.P.M.
-cut for control rather than æsthetics
-will handle hardwood to 1½"
-5 HP per foot of cut
-must run at 540 PTO speed

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ROLE OF EQUIPMENT IN TODAY'S ECONOMY

J. R. Watson, Vice Pres., Toro Co.,
Bloomington, Minn.

Most of the words in this title have obvious meanings. But, defining what today's economy has become is seemingly too difficult even for our government leaders in Washington and elsewhere. But, regardless of how one attempts to define, illustrate, or dissect the current economy, there's one thing for certain, the conclusion will be confusing and by most definitions, depressing and too long in coming.

The high inflation rate, coupled with a deepening recession, and a nagging energy crisis, have affected, and will continue to affect each of us for quite some time. The situation has not only caused changes and adjustments in our personal lives, but has also provoked adjustments in our professional vocations. You can be certain that despite the current unfavorable economic picture, turfgrass managers will be expected to improve upon previous year's maintenance levels in turfgrass areas -- and to do so with budget dollars which in most cases will be inadequte for the task.

I should like to concentrate on one aspect of your maintenance program, your equipment, and hopefully provide some ideas and guidelines which may enable you to continue to provide top quality turf for the users of your turfgrass facilities. There are a number of things the turfgrass manager can do to conserve fuel and cope with inflation. Selecting the most efficient piece of equipment for each specific job function in your maintenance program is one.

Manufacturers of turf care equipment recognize that the energy crisis, coupled with the economic picture, dictates fiscal responbibility and that this will have considerable consequences on the equipment purchases of turfgrass managers. Consequently, manufacturers are now offering equipment which can give you lowered total maintenance costs, while actually improving the quality of that maintenance.

There are alternatives to outright purchasing of new equipment, and if a manager prefers leasing equipment he may realize several advantages, including greater flexibility. Jim Fischer of Toro outlines several advantages to leasing in a recent article in Weeds, Trees and Turf, including the fact that:

1. Leasing conserves your working capital.
2. Leasing offers the opportunity to obtain equipment without excessive cash outlays. With payments spread over a long period

of time, the equipment is actually paying for itself as it functions. When rentals are treated as fully tax-deductible expense, cash outgo decreases and usable capital is increased.

3. Leasing preserves existing credit. Your established credit lines are not affected and remain readily available. Leasing provides an additional, non-conflicting source of credit, thereby increasing your borrowing base.

4. Leasing overcomes budget limitations -- a factor you can easily identify with. The minimum cash outlay involved with leasing, plus modest payments, allows you to fit the lease into the tightest of budgets. Even when your spending schedule is severely limited, leasing allows you to obtain the equipment you need when you need it.

5. Leasing can minimize the effect of inflation. The bulk of your payments are made with tomorrow's dollar which, if inflationary pressures continue, will be cheaper than today's.

6. In addition to offering an advantage of a tax deductible expense, leasing is not based on a tax program but rather on a capital conservation program; that is, the freeing of capital so that it can be used effectively to develop profits.

7. And finally, leasing offers greater flexibility. With leasing you have a wide variety of plans and programs geared to fit specific financing needs -- long term or short term, straight line or accelerated, renewable or replaceable. So you can see that leasing can play a valuable role in your coping with inflation.

But, whether or not you elect to lease your requipment or purchase it, the important thing to keep in mind is that your equipment must be in proper operating condition.

The proper maintenance of the vital parts of any machine is important not only in an effort to conserve fuel, but also in extending the functional life span of the machine. Herb Colwill of our engineering department recently wrote about turf equipment efficiency, and I believe several points Herb made are relevant here.

1. Operate engines at 75 to 80% of rated maximum load. Develop a scale to show fuel consumption at different levels of load-rated horsepower.
2. Use fuel with the recommended octane number.
3. Do not use substitute fuels.

4. Landscape new facilities and modify existing landscapes to accommodate equipment with greater capacity.
5. Avoid idling, keep motor tuned up.
6. Train operators to obtain maximum efficiency.

7. Where possible eliminate mowing of steep slopes.
8. Keep accurate operating and service records.
9. Employ a full time mechanic or arrange for routine checks of all equipment and operational procedures by a qualified mechanic.

10. When moving from one area to another, or transporting within one area, use paths and roadways when possible. This practice will save on fuel and avoids wear on your turf.
11. Plan purchases on basis of need and avoid impulse buying.
12. Use equipment compatible with the job function.

One should not overlook irrigation systems when reviewing the role of equipment in today's economy. You may have seen several of these suggestions in a recent edition of the Golf Superintendent. The suggestions include:

1. Using minimal amounts of water whenever possible
2. Checking the nozzles on sprinklers frequently to avoid oversprinkling
3. Irrigating turf areas during evening hours to minimize evaporation
4. Inspecting valves, pump impeller, bolts and motors frequently
5. And if necessary, remodeling the system; this will save money in the long run

Obtaining an analysis of the soil may not only save expenditures for fertilizer, but will provide you with a better foundation on which to base your fertilization program. You may reduce your mowing frequency and still maintain good growth and color in your turf.

So far I have been talking about practices you may adopt concerning your equipment, primarily when it is being used. But, it should be mentioned that there are also other areas that are involved in the role of equipment in today's economy.

Today the major concern of any turfgrass manager must be how to efficiently and effectively maintain well-groomed courses suitable for player demands in a time when costs are high and energy supplies are low. Since mowing is one of the major time consuming operations, success in mowing involves design of equipment and facilities.

The energy crisis, coupled with the current economic situation demands that each turfgrass manager must be productive and must demonstrate his superior managerial skills in his job function. Only by so doing will he be able to design or plan for success in mowing.

The turfgrass manager must know what funds will be available to him, the current and contemplated labor force, what the pay scales are at the time, and what they are likely to be in the near future. He must be aware if there are any prospects that his facility may be expanded or redesigned. And finally, he must be cognizant of what new equipment is on the market, what it will do -- and even more importantly what it won't do, what it's life span is, and a host of other considerations. Among them, planning for adequate equipment.

It seems to me that planning for adequate equipment -- budgeting for new equipment -- requires the development and execution of programs built around equipment presently available, not for equipment expected to become available at some future date. Planning for adequate equipment is indirectly the responsibility of the governing board of an organization but, in actuality, it is the direct responsi-

bility of the superintendent acting within the confines of an operational program.

Participation of the superintendent or turf manager in local, regional and national educational conferences is invaluable from the standpoint of keeping abreast of new developments in turfgrass operations and on the availability of new equipment.

When planning for new equipment, the turfgrass manager should carefully examine the capacity, the maneuverability, the sturdiness and durability of equipment -- and in the case of certain mowing units their trimability. These design features along with a study of the maintenance records to determine annual service and repair cost on each piece of similar equipment presently owned and operated, will provide a basis for projecting life expectancy. The reliable manufacturer and his authorized representative will be of great assistance in this respect. In addition, some organizations (for example, mine) have developed a simple form for recording, by machine and operator, such items as: hours operated, gas and oil consumption, down hours, service required, replacement parts and labor costs.

At the end of the cutting season your records will show the number of hours the equipment has been operated, plus the cost of maintenance. This information is invaluable for determing the proper type of unit to use in a given area, the most economical brand of equipment, the good as well as the undesirable equipment operators, and methods for improving maintenance.

It must be recognized that adequate equipment for one turf facility may be inadequate for another and excessive for a third. Therefore, equipment must be selected on the basis of the individual requirements for the particular facility. Thus, both the design of the equipment and the design or layout of the gounds are involved.

A common reason for shortened life span and high maintenance costs is the use of a machine for the wrong job. When choosing equipment:

1. Consider the terrain to be cut. Is it wooded, rough cutting, hilly or the more formal areas? If rough, or otherwise, decide if a reel or rotary type machine is to be purchased, based on course conditions.

2. Consider the size of the course or courses, and buy the largest machine that is practical. The job gets done faster -- with less man hours -- with larger capacity equipment. If the machine is to be used for trimming purposes and demands on the mower are not too heavy, a small, low horsepower, light-duty machine may be used, but higher maintenance costs on this type of equipment are inevitable.

3. Look for simplicity of design. A complicated machine has many moving parts and may have a high maintenance cost. Also, it may be difficult to adjust and a trained expert may have to be used for repair.

4. Check for construction and durability. The machine should be substantially built, well-braced, with good bearings. The sideframes, handles or drawbars should be heavy enough to do the job. The bed bars, reels, blades should be rigidly constructed.

Variations in terrain on which the machine is used, the type of lubrication it receives, the correctness of repair, the treatment by the operator, storage, accuracy of records,all have an influence on cost per machine per year and useful life span. However, to get the lowest possible machinery operating costs under your conditions, buy quality equipment, buy the right machine for the right job, operate and maintain it properly, and keep adequate records.

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DESIGN FOR SUCCESS IN MOWING

J. R. Watson

The major concern of any golf superintendent today must be how to efficiently and effectively maintain well-groomed courses suitable for player demands in a time when costs are high and energy supplies are low. Since mowing is one of the major time consuming operations, success in mowing involves design of equipment and facilities.

The energy crisis, coupled with the current economic situation demands that each turfgrass manager must be productive and must demonstrate his superior managerial skills in his job function. Only by so doing will he be able to design or plan for success in mowing.

The turfgrass manager must know what funds will be available to him, the current and contemplated labor force, what the pay scales are at the time, and what they are likely to be in the near future. He must be aware if there are any prospects that his facility may be expanded or redesigned. And finally, he must be cognizant of what new equipment is on the market, what it will do -- and even more importantly, what it won't do, what it's life span is, and a host of other considerations; among them planning for adequate equipment.

It seems to me that planning for adequate equipment -- budgeting for new equipment -- requires the development and execution of programs built around equipment presently available, not for equipment expected to become available at some future date.

Planning for adequate equipment is indirectly the responsibility of the governing board of an organization but, in actuality, it is the direct responsibility of the superintendent acting within the confines of an operational program. Records are almost a necessity to properly determine the most economical time to trade in old equipment. They are also the best tool for selling a board of directors on your new equipment needs.

The landscape design plays a sometimes forgotten role in successful mowing. Many of our turf facilities, especially private golf clubs, were designed and constructed during an era when labor costs were negligible and mechanization of little importance, thereby creating many time-consuming operations requiring the use of low capacity, and often costly equipment. Landscaping may not have been planned, but grew haphazardly over the years with little thought to the maintenance demands being created (often in accordance with the whims and fancies of one individual).

Shrubs and trees requiring specialized care in the way of spraying, trimming and pruning, and often located in such a manner as to interfere with large capacity mowing equipment -- thus, requiring additional time-consuming operations to maintain surrounding turfgrass -- do not contribute to efficiency. The superintendent has a responsibility to point out these deficiencies and to develop a long-range program of redesign in keeping with modern trends. This would include landscaping to eliminate problem trees and shrubs, substitution of more hardy species requiring minimum maintenance, and located to accommodate equipment with greater capacity.

The construction of greens and tees employing the latest materials and techniques developed through research, will unquestionably lead to improved design, and will contribute to efficiency and thereby to success in mowing. Such a program may require several years of completion, but with competent direction, supervision and adequate equipment, may be accomplished through careful budgeting for new and replacement equipment.

Other considerations, when evaluating design for proper selection of new equipment to improve efficiency, would include:

1. Consultation with the manufacturer or his representative regarding the type of equipment needed. Information on new equipment and improved features, as well as the suitability of their equipment for the job at hand, is readily available from the reliable manufacturer.

2. The availability of parts and service facilities. This is of prime importance when selecting equipment. If repair parts are not available when needed and a machine is inoperable for extended periods, it is of questionable value and certainly will contribute little to efficient operation.

3. Develop or estimate a reasonable or probable life and, based on current replacement costs, allow for the proper amount of depreciation per year. Then, request or provide a yearly sinking fund for the orderly replacement of the equipment when it becomes economically feasible, or when new and improved equipment becomes available.

4. Prepare supporting statements for capital budgets. List each price of equipment separately and state concisely why it is needed, and the benefits to be derived from its use.

5. When possible, invite those responsible for approving your selection of equipment to join you at local turf equipment field days or national shows.

Capital budgeting has significant long-range implications and may have a major impact on the economic well-being of some turfgrass facilities. If a large commitment would jeopardize the financial structure of the organization, then a leasing program should be considered. Most major manufacturers offer practical leasing arrangements or programs to qualified organizations.

Summary

Design for success in mowing becomes more a function of selecting adequate and efficient, presently available equipment. The selec-

must
tion/be based on a careful analysis of the design and layout of the private golf course. In many cases, the golf course superintendent may find a redesign or updating of the course layout will produce a higher degree of success in mowing. Such changes should be made only within the framework of a long range plan designed by a golf course architect and, obviously, approved by the membership.

Manufacturers keep abreast of equipment needs. Their equipment must be designed to accommodate their customers needs, otherwise they are not competitive and do not survive.

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A SUCCESSFUL FAIRWAY PROGRAM, 1967 ON

Carl G. Hopphan, Supt., Aurora C. C.,
Aurora, Ill.

My very first and probably most important point of issue this afternoon is to clear up the wording of the title of my topic. What I really mean is that the word ON should be added a dozen times to the end of the title to even faintly describe reality. A dictionary defines the word program as "a plan to follow" - to this I would like to add the word "forever." A successful program is a plan to follow forever, I say this in light of the fact that in 1967 I started a program on my fairways to eliminate Poa annua. Within three short years I felt that a great deal of success had been achieved, and my fairway problems were rapidly drawing to a beautiful end. Before I get too far ahead of myself, let me briefly run through the actual program.

A general meeting of the entire membership was called to acquaint them with the proposed program. I very honestly explained the complete program, giving costs, time elements, and most important of all I painted an extremely black picture of how our fairways would look before success was achieved.

Along with the 1.5 lbs. of tri-calcium arsenate, from the fall of 1966, 4 lbs. more was sprayed on our fairways, and watered in, the latter part of April, 1967. The first two weeks of April saw our new seeder laying approximately 8 seeds per lineal inch into a slit made by the Aero-blade. A blend of Merion, Newport and Delta bluegrasses was used. The depth of cut was made to put the seed just below the thatch, thus lying in direct contact with the soil. Our next step was to run over the entire fairway with a topdressing mat pulled behind a turf truckster. By doing this we somewhat topdressed the loose soil back into the slits, giving the seed some cover. The drag matting at the same time also fluffed up the loose thatch and rolled it into clumps. These clumps were then swept up with a power sweeper, leaving the fairway in an acceptable playing condition. Our final step was to water the entire fairway to settle and provide moisture for the new seed.

A second and third seeding was applied the month of May, crossing from different directions only in the areas where the dead Poa annua was really thick.

I then followed up in the month of June with 2 more pounds of

tri-calcium arsenate. The remainder of that summer I restricted my watering program, putting only enough moisture on to keep the new seed growing actively. I found this aided the tri-calcium arsenate in prevention of Poa annua survival.

Two more pounds of tri-calcium arsenate were applied to all fairways shortly after Labor Day, thus creating a total of 9.5 lbs. of actual T.C.A. per 1,000 sq.ft.

Another cross-seeding was put down in early fall, once again only in the thin areas.

My feeding program throughout this first calendar year consisted of 5.5 lbs. of actual nitrogen per 1,000 sq.ft., no phosphorus, and 4 lbs. of potash per thousand.

The following spring, 1968, found little, if any, Poa annua germinating. I did notice that the new seeding was filling in the bare spots. I was far more amazed at how the old established bluegrass plants were filling in now that they had no competition from the Poa annua. Our time and efforts were now devoted to hand-scratching smaller dead spots and following up with hand-seeding and topdressing. A number of the approaches to our greens, where the Poa annua had been quite dense, were patch sodded. Due to concentrated traffic and daily mower turning, seed development was too slow.

The 1968 program consisted of 3 lbs. of nitrogen, no phosphorus, 4 lbs. of potash, and 2 lbs. of tri-calcium arsenate per 1,000 sq.ft.

In 1969, I started out the season with about twelve areas on different fairways where, due to puddled water standing for extended periods of time, the turf was completely killed. These pocket areas were cut out with a sodcutter, filled level with dirt, and slit trench drains filled with pea gravel were run out into the rough. These areas were then seeded.

In 1969, 3.6 lbs. of nitrogen, 1.8 lbs. phosphorus, 6.3 lbs. of potash, and 2 lbs. of tri-calcium arsenate, was applied to all fairways.

Living with pure bluegrass is great. Now - 1970-75 - my main concern is to keep them this way. During the following seasons I made the decision to switch from Chip-cal to Dacthal. I felt that it would be somewhat safer, and also by this time Chip-Cal was almost impossible to buy. A complete spring and early fall program has kept any Poa annua from returning. I am using 14 lbs. spring, and 20 lbs./acre Dacthal W-75 about Sept. 1.

It wasn't very long at all before another problem showed up - this being small patches of bentgrass. Due to the one inch height of cut, these patches of bent were heavily matted and became a problem for my golfers. September 11, 1973, I went after this bent before it became too much of a problem. Chip-co Turf Kleen at 5 quarts per acre was spot sprayed on the few areas where the bent was appearing. At this 1 lb. of 2,4-D acid rate the bent turned off quickly and remained knocked out. Later that fall and into early winter I noticed that the bent was not returning in any way at all, so I planned to plug these spots the following spring. Spring arrived and a sudden trap changing project was thrown into my lap, leaving the bentgrass spots secondary.

By the first of May established bluegrass plants had filled in so thoroughly I just left them alone. Once again, without the competition of the more aggressive bent, the bluegrass had no problems.

More than ever before I now regard mowing procedures, watering and my fungicide program as all being of equal importance if there is to be success.

Mowing bluegrass fairways 7 days a week keeps the blade trim at all times, providing a far better lie for the golf ball. The plant itself is not as greatly shocked as it would be if mowed less frequently. Mowing patterns such as alternating directions of cut, crossing, and even striping help to keep the blade upright.

Watering should be held to a minimum - that bluegrass plant does not have to be standing in a swamp to be at its best. Soil structure will greatly determine moisture needs. Fairways at the Aurora Country Club never get more than 5 to 6 waterings per growing season.

A sound fungicide program is a must. Spring leafspot can badly damage bluegrasses, thinning them out, and very often this damage reaches into the crown of the plant, and a thin, weak turf cover will prevail throughout the entire season. This past season my 31.3 acres of fairways were sprayed with Acti-Dione RZ and TGF no less than 8 times. I feel that prevention still comes cheaper than cure.

With the development within the past few years of a great number of fine new bluegrass varieties, the day will soon be here when bluegrass fairways will stand out as some of the finest in the entire world.

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POA ANNUA CONTROL AIDED BY SOIL ANALYSIS FOR ARSENIC

R. P. Freeborg and W. H. Daniel
Purdue University

Summary

The objective of this study was to develop a soil test procedure for available arsenic to supplement the use of Poa annua L., annual bluegrass, as a bioassay plant in determining toxic levels of arsenic required for its control. This soil test procedure is similar to that routinely used in the extraction of available phosphorus. Arsenic and phosphorus are extracted with Bray P-1 (0.03N NH_4F; 0.025N HCl) from 1.5 grams of soil. Soils are also analyzed for % sand and silt. An estimate is made on site of existing annual bluegrass population. These data are then used in the determination of arsenic concentrations required to obtain a desired % control.

Among professional turf managers annual bluegrass, Poa annua L., continues to be a major problem. Its tolerance to heat, drought, and low temperature is poor. Where these conditions exist, it is not

likely to survive and is considered a weed grass. Where survival is dependable, however, it is maintained as a permanent turf. Thus it can be both friend and foe, and can make the most perfect turf imaginable or become a dismal failure.

Where local conditions permit and encourage good performance and survival of annual bluegrass, turf managers want to keep it. They can well afford to do so when it is a useful and dependable grass. For example, Oakland Hills Country Club at Detroit, Michigan, has excellent annual bluegrass on its old 18 hole course. The soil is sandy and well drained. An abundant earthworm population keeps thatch accumulation to a minimum. Thus with good organic matter content, good drainage, and adequate irrigation annual bluegrass serves them well.

In sharp contrast, the Country Club of Indianapolis has slopes that are silt loam and hard to wet. For years there has been annual bluegrass infestation in the fall, survival in the winter, and thinning often to the extent of complete loss in the summer. In the mid-1950 arsenic was applied to stop yearly invasion. Since then treated fairways have become predominantly perennial bluegrass. The accumulation in the upper rootzone of available arsenic ions has given long term selective annual bluegrass control with adequate survival of perennial grasses.

As early as 1929, arsenic has been observed to control annual bluegrass. The Pennsylvania State University Field Day report, 1940, showed partial control with sodium arsenite on bentgrass putting greens. Since 1951, Daniel has observed control, first with lead arsenate and then calcium arsenate.

Lead arsenate with its very low solubility persisted for long periods but required higher rates to obtain control. Although calcium arsenate was more variable in response than lead arsenate, the former was less expensive, less was required for control, and it did not contaminate the environment with lead. Therefore, calcium arsenate has become the most widely used in 1965-75.

Granular arsenic formulations came into predominant use. These are usually on vermiculite. They flow freely and can be used in either gravity flow or broadcast spreaders. There are other preemergent controls available. None, however, can offer the gradual elimination of annual bluegrass achieved when arsenic is used. Also, arsenic permits germination of seeded perennial grasses while inhibiting germination and growth of annual bluegrass, especially when arsenic levels are below 19.5 g active ingredient (ai)/m^2 (4 lbs. ai/1,000 sq.ft.).

Current recommendations require split applications to obtain gradual control. Applications which should begin in late summer before fall germination of annual bluegrass may be as follows:

> With 48% tri-calcium arsenate (Chip-Cal) as a source of arsenic apply from 5 to 15 g ai/m^2 (1 to 3 lbs. ai/1,000 sq.ft.) After rain or irrigation apply another 5 to 15 g ai/m^2. If a major part of the turf is perennial bluegrass or a desirable grass, make a third application at the above rate about 2 weeks later.
>
> When annual bluegrass is the predominant species two applications before fall germination should be adequate. The follow-

ing spring, after frost is out of the ground, apply another 5 to 15 g ai/m^2. Apply well ahead of the germination date for smooth crabgrass, Digitaria ischaemum (Schreib.) and crabgrass, Digitaria sanguinalis (L.) Scop. This should also eliminate chickweed, Stellaria media,Cyrill., prevent crabgrass, and weaken existing annual bluegrass.

In the late summer of the following year apply another 5 to 15 g ai/m^2 to assure continued toxicity. Final target rates are from 40 to 70 g ai/m^2 (8 to 15 lbs. ai/1,000 sq.ft.). Throughout the program overseed repeatedly at light rates with selected perennial grasses as needed.

Existing annual bluegrass plants serve to indicate toxicity levels. If plants are chlorotic and stunted, toxicity is adequate. If toxic levels have not been obtained, continue treatments in spring and late summer until toxicity is observed. Then reduce applications to 3 to 5 g ai/m^2 (1/2 to 1 lb. ai/1,000 sq.ft.) for yearly maintenance.

Until recently the only practical method available to determine the level of arsenic toxicity was to watch for the existing annual bluegrass to become chlorotic and stunted, usually in spring and fall. Now the use of annual bluegrass as a bioassay plant can be supplemented with information derived from a soil test for available arsenic which was developed at Purdue University. The data from this soil test can be used to determine existing levels of arsenic, as well as what levels are required to control annual bluegrass.

The procedures involved are in part similar to those used routinely in the analysis for available phosphorus. Available arsenic is extracted with Bray P-1 extractant (0.03N NH_4F; 0.025N HCl). Atomic absorption spectrophotometry is used to measure arsenic.

Determination of arsenic concentrations required for control are based on data obtained from soils where arsenic had been used previously to control annual bluegrass. Samples were collected from 26 golf courses in the midwest. These were taken from the 0 - 5 cm depth, where most applied arsenic is retained. Soil was air-dried, crushed and passed through a 20 mesh screen. Then a 1.5 gram sample was weighed and analyzed for µg of arsenic and phosphorus, and % free iron oxides. The % sand, silt, and clay, % organic matter, and pH was also determined. Statistical analysis showed that µg of arsenic and % silt and sand were most important in the determination of annual bluegrass control. Phosphorus was also included in the final analysis to predict toxic levels of arsenic because of its reported interactions with arsenic.

These data were used to generate a table that would permit prediction of arsenic concentrations required to obtain a desired percentage of control. The table of predictions for µg of arsenic/1.5 grams of soil required to obtain an estimated percent annual bluegrass control was set up as follows:

Arsenic micrograms	Poa annua control	Phosphorus micrograms	silt %	sand %

Thus a soil is analyzed for ug of arsenic and phosphorus, % silt and sand, and an estimate is made of the existing annual bluegrass population. These data are then compared with those in the table to predict arsenic concentrations required to obtain desired control. This information will then indicate whether additional arsenic is needed, whether existing concentrations are adequate, or whether they are approaching levels that could be toxic to desired turfgrasses.

There are now two criteria to aid in determination of concentrations of available arsenic in the soil and level of toxicity; the field bioassay with annual bluegrass as an indicator, and a soil test to measure available arsenic. However, no one can prescribe exactly how much arsenate is needed for establishment of toxic levels on any individual turf area. Conditions such as temperature or soil moisture affect the susceptibility of annual bluegrass to arsenic and can always vary.

It is often a long two year program for turf managers before adequate control can be obtained. Bare, thin areas, development of desirable turf to replace thinning annual grass, the management program all are influenced by the arsenic levels. The process is often a difficult one, requiring patience and perseverance. The importance of developing additional aids is obvious. Information now available through soil tests for arsenic is but another step to be followed by further investigation and research.

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PRINCIPLES OF SUCCESSFUL INSECT CONTROL FOR GOLF COURSE TURF

Dr. Harry D. Niemczyk, Professor of Entomology,
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Wooster, Ohio

Today's successes with insect control have happened and will continue to happen when the principles of insect control are properly applied. With broad spectrcum insecticides such as chlordane, heptachlor, aldrin and dieldrin, successful control of grubs meant spread it and forget it for 4 - 5 years. Though we may not have known it at the time, control was being achieved because the method had sound principles built into it.

Suppose we could no longer use these long-lasting insecticides and 'the scatter gun approach?' Suppose we were forced to use short residual insecticides and 'the rifle approach?' The facts are that these are no longer suppositions. (We already know that the production of aldrin and dieldrin has been stopped, and the Environmental Protection Agency has issued an intent to cancel all registrations of pesticide products containing chlordane and heptachlor, except those that apply to the control of structural pests. This notification was published in the November 26, 1974 issue of The Federal Register. If the uses of chlordane and heptachlor are cancelled, and it is my opinion that they will be, successful insect control will mean that the turf manager will have to know more about what he is doing and why he is doing it. This is where the understanding and application of the prin-

ciples of insect control come into play.

The Target Principle

The insecticides and other materials used to control insect pests on a golf course will change from time to time, as new research findings appear, and future laws governing the labeling and use of pesticides will permit. However, the principles underlying how control is achieved will remain essentially unchanged. This underlying principle I call "The Target Principle." Generally it means that each and every time a pesticide is applied for control of a pest, the application should be made with a specific target in mind. Specifically, it means that treatment should be based on a knowledge of which pest is present, how many, what stage is present, and exactly where in the turf the pest is located.

Target Principle Applied to Grub Control in Fairways or Roughs

Controlling soil inhabiting insect pests such as grubs is a good example of where application of the Target Principle is the key to achieving control. The answers to what species of grub is there, how many, what stage, and where, can be obtained by only one means - careful and close examination of the situation!! If the superintendent chooses not to do this, then he will need to see to it someone else does it. This is best accomplished by obtaining the service of a professional entomologist.

Survey to Identify Problem

First, each turf area should be surveyed to get a clear picture of the problem. This can be done anytime the grubs are near the surface, but to get the most benefit from any insecticide treatment which may be necessary, surveying should be done from early August to mid-September.

The survey is conducted by digging 10 to 15 small holes 7" x 7" to a depth of about 3 inches, at various locations throughout the length of the fairway. A square-end-garden-spade works fairly well for this purpose because the end is about 7" across. The number of grubs found in each survey hole should be recorded. From time to time the rastrel pattern (Figure 1) of a few grubs should be examined with a hand lens to identify the pest.

Some grubs are very small during August, therefore, one must look carefully. If identification is uncertain, put 10 - 20 in alcohol and send them to the Extension Entomologist, Department of Entomology, at your State University.

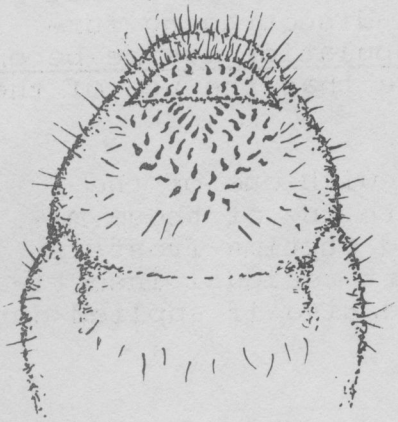
The next step is to convert the recorded number of grubs per hole to grubs per square foot. If the survey hole is 7" x 7"this is done by multiplying by 2.9.

To Treat or not to Treat, and Where?

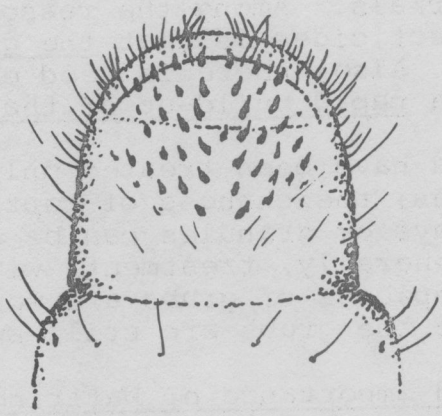
Treatment should seriously be considered in areas with:

8 or more Japanese beetle grubs per square foot
5 or more annual white grubs per square foot
3 or more May or June beetle grubs per square foot

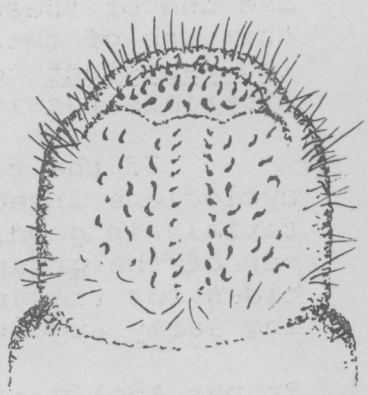
TYPICAL RASTREL PATTERN OF COMMON PESTS



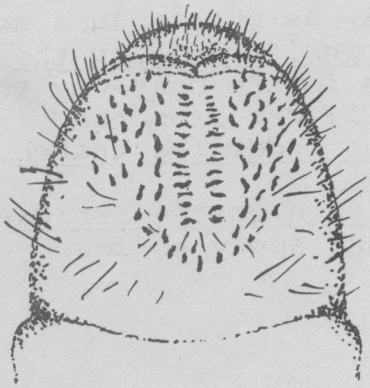
Japanese Beetle



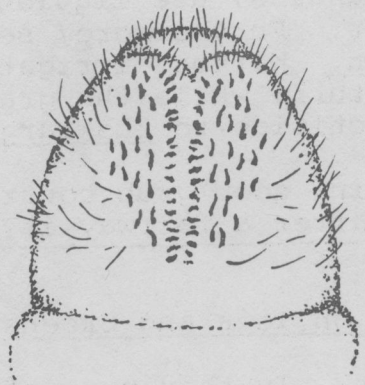
N. Masked Chafer



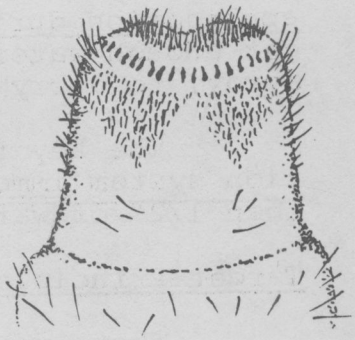
Oriental Beetle



May Beetle



European Chafer



Asiatic Garden Beetle

Figure 1.

Location of the infestation on the golf course, moisture stress on the turf, etc., are among the factors to be considered.

The species of grub causing the problem is an important consideration. Two and three year cycle grubs, such as some May beetles, are the most destructive of the grub species because they are large, feed longer and simply eat more than the smaller species. Among the one year cycle grubs, the masked chafers are larger than the Japanese beetle and do more damage.

Examination of the data from each fairway and rough will show which should be treated. The course maintenance budget will, in some measure, determine what can be done. If the intention is to apply a long-residual insecticide and the aim is protection from damage for a few years, perhaps treating the whole fairway is best. However, if a short residual insecticide is to be applied, time and money is wasted if uninfested areas are treated. This is where the time and effort spent surveying can save money.

Which Insecticide to Use?

If the fairways were treated 2 or more times in the last 10 years with the cyclodiene insecticides, this means either dieldrin, aldrin, heptachlor or chlordane, or the pre-emergence Bandane®, do not use one of these materials. Among the reasons for discouraging further use of these insecticides is that the grub population may be becoming resistant to them. Also, there is good evidence that the use of these materials results in a rapid build-up of thatch.

If the fairways have been treated only once with one of the cyclodiene insecticides, the chances of control with one of these materials is good. Sprays or granules can be applied anytime frost is out of the ground. Generally, treatments with short residual insecticides for the annual species of grubs are most effective if applied during early August while the grubs are still small.

Proper Application and Importance of Watering-in

Water is the key to penetrating, whether liquid or granular formulations are applied. If there is no irrigation in the fairways, consideration should be given to applying a granular formulation when the weather forecast indicates rain within the next day or two. If not equipped for applying granules, use liquids and apply as much volume as your sprayer will deliver. Furthermore, seriously consider making the application during a rain. Without irrigation, this is the only way to get enough water on the turf, while the grass is still wet from the spray, to carry the insecticide to the target; a grub under the thatch.

The key to obtaining good grub control is to turn on the irrigation system immediately after a fairway is treated and apply no less than 1/2" of water.

Target Principle Applied on Tees and Greens

What is the target? In this part of the country the black cutworm is the primary problem, with sod webworm second. Occasional infestations of armyworm may occur in tees and greens.

Diagnosing the presence of webworms, cutworms and other insect larvae is really not very difficult. The indicator most commonly used

is blackbirds or robins on the greens searching and probing for the larvae. The clearest evidence of cutworm is a small hole in the turf, with a circle of turf around it that has been chewed off well below the cutting level of the greens mower. Another is feeding injury around an aerification hole.

Another way of determining if you have sod webworm or cutworm is by using a material called Diagnostic Aid®. This material is a pyrethrins formula available from the TUCO Company. The cap covering the bottle is filled with the liquid, mixed with 1 gal. of water and the solution applied over one square yard of turf. This irritates the cutworms and webworms and brings them to the surface in a very few minutes.

Principle of Control

If the target is cutworm, keep in mind that the larvae lives in a burrow or aerification hole during the day and surfaces at night to feed on the grass around the burrow. They also wander across the turf and make new burrows. Sod webworms, on the other hand, cut off the grass blades at night, often dragging them into their silk-lined tunnel. The principle of controlling these two insects involves application of an insecticide which kills the larvae when they crawl across, or eat the grass.

Most granular formulations must be watered after application in order to distribute the insecticide over the turf. Most liquid treatments should not be watered in and applications made in the late afternoon or evening when golf traffic is down or stopped. The insecticide should be left on the turf for at least the first night following application to allow time for the larvae to feed on and crawl across the turf. This 24-48 hr. period is when the major reduction in insects occurs. Whenever possible, the greens should be mowed before treatment so the insecticide will remain on the grass blades as long as possible.

Thus, the principle of sod webworm and cutworm control on tees and greens is to let the pest come to the insecticide rather than take the insecticide to the pest.

Which Insecticide to use?

Which insecticide is best? There are at least 4 or 5 or more insecticides registered for control of cutworms and sod webworms. Although chlordane is registered for control of these insects, it is least effective. Information from Tennessee, Ohio and other areas, indicates that the incidence of sod webworm actually increases when chlordane is used. Though not thoroughly substantiated, there is some evidence to indicate this may be due to long term removal of the natural parasites and predators of the sod webworm.

On some courses as many as 3 cutworm damaged spots per square yard seemed to cause no particular concern among golfers. Generally, these are low budget courses. At other courses, no feeding scars are tolerated on the putting surfaces.

Generally, in the northern states, two applications - the first one in June and the second in August - keeps damage from these insects to a minimum. In the southern states, where sod webworm is more common and cutworm is also very common, applications are often made every 3 weeks starting in April. Some courses are known to apply an insecticide every 1 or 2 weeks to insure against damage. The necessity

of treatment that frequently is, at least, questionable.

In conclusion, let me again advise that application of The Target Principle to any insect control program can save time, money and turf. Knowing exactly what, why and where before you start just makes good common sense!

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WOMEN WE HAVE KNOWN

Dudley Smith, Silver Lake Golf Club
Orland Park, Ill.

One year ago, as a bachelor and President of the Midwest Regional Turf Foundation, Dr. Daniel would not permit me to present this exposé. Values have changed, presidents of all kinds are victims of scandal, and true confessions are the order of the day. I am married now, and with women pushing their noses and busts into our profession, it's time to discuss our affairs with them.

I thought I had a unique situation at Silver Lake when a woman answered my want ad for seasonal outdoor help. Why not try her, I thought! In three years time, my one lady laborer became five, and I had my own harem. Salesmen started calling at noon when the women were on their lunch break. Customer service and deliveries to Silver Lake was never better. The same salesmen kept tabs on which superintendent had just hired a college girl.

In surveying fellow superintendents, I found the men who hired one female employee, generally increased the number to two or three. Most of the ladies did the same chores, regardless of their club affiliation. There are few jobs on the golf course that women cannot handle. Each of the superintendents thought his girls were "super." I have selected one (who had unusual talent) from each club - a series of herstories, if you will.

"Jesse" - Prestwick C.C., - Dick Trevarthan

Jesse was the original female worker on the southside of Chicago. Jesse, a farm wife, has retired and moved with her arthritic husband to Arizona. This mature lady mowed roughs with 5-gang blitzer units 8 hours a day from April until frost. She wore slacks and tennis shoes to work, carried her lunch pail, and ate with the older men on the crew. Jesse was dependable and a perfectionist at her work. Since she was an older woman, the offensive language she overheard the men use did not raise a problem.

An interesting note: her son received his Ph.D. in plant pathology from the University of Illinois and is now teaching at an eastern university.

"Gloria" - Fox Lake C.C. - Ray Schei

Gloria, a 19-year old high school graduate, was looking for outdoor work when she was hired. She is now one of 5 female crew members

at Fox Lake. The girls work 40 hours a week, including the weekend. If they work Saturday one week, then they alternate and work Sunday the next week.

Gloria is a year round employee. In the summer she has sprayed the greens, done sodding jobs, and . . . shoveled sand up in the bunkers. During the winter she washes the equipment with a hot water pressure cleaner, and has been grinding the bedknives. This past week Gloria attended the Toro Service Clinic held at Itasca C.C.

Last summer while wearing a halter top and short shorts to work in, she was "propositioned" by a foursome of golfers and has since changed her dress habits. Speaking of dress, during the winter Gloria dresses up one day a week complete with lipstick, and does secretarial work,payroll, etc. in the office.

"Debbie" - Glen Oak C.C. - Fred Opperman

Debbie is a college student majoring in landscape architecture. She and another girl maintain all the flower beds at Glen Oak, weeding, edging and pruning. Debbie wears short to work, eats her noon meal at the clubhouse, and does not use the washroom at the barn, but has access to facilities provided for the girl caddies.

With her horticulture background she has identified and labeled every tree and bush on the golf course. The superintendent has a map with a complete inventory of his plant material. Debbie may not return this summer, but what an excellent source of talent - horticulture students looking for summer work!

"Mary Beth" - Marriott Inn Resort - Joseph Grenko

Mary Beth is a college student with a farm background. The superintendent was attracted to her when she worked as a waitress in the clubhouse. In 1974, Mary Beth operated a 9-gang fairway unit. Joe Grenko's appraisal - "the best damn tractor driver I've ever seen. No skidding, and no banged up trees. She was a natural."

For the 1975 season Grenko has hired 5 girls ... so far. They will start Monday, March 17, and work year 'round. Starting pay will be $3.00 per and rise to $3.50 by autumn. Joe expects half his crew to be women.

The women will be supplied with Marriott uniforms which they must wear. A 7-day work week prevails, and Grenko expects his women to do all the mowing, plus be available for night work making artificial snow, and snow removal jobs in the winter. Grenko is convinced women labor is the direction to look, and prays his 1975 crew will provide more girls like Mary Beth.

"Margaret" - St. Charles C.C. - Art Benson, Sr.

Margaret is 20 years old and a full-time employee at St. Charles. Her summer duties include mowing greens and grooming sandtraps. She does work weekends - Saturday one week, Sunday the next week. Mr. Benson feels that the $2.25 and $2.50 per hour offered by Sears and Marshall Field Co. is disgraceful - his girls start for $3.00.

Margaret was reprimanded by some of the women club members for dressing too scantily .... There was no objection from the men.

In the winter Margaret cleans and washes parts in the maintenance barn and does housecleaning in the clubhouse. Keeping the women on full-time shampooing rugs, polishing furniture, dusting, etc., provides an experienced crew when spring arrives. Mr. Benson feels women are not adept at snow removal tasks.

"Connie" - Edgewood Valley C.C. - Harold Frederickson

There used to be a mother and daughter waitress team in the Edgewood Valley clubhouse. Harold noticed that Connie needed some sunlight and fresh air and soon had her under his wing. Connie operated the Sand Pro machine, assisted on the spray rig, and fertilized all the trees with the little fertilizer spikes.

Connie was calorie conscious and usually worked straight through the lunch period and went home early. She also took advantage of the club pool on Mondays, with the other clubhouse employees. Many of the clubhouse women were envious of this beautiful girl working with the men out on the grounds.

Harold tried Connie on a brand new triplex greenmower, and within an hour she had it in the lake. When he arrived at the scene Connie was in tears. "How could I get angry?" he said.

Connie is majoring in modern dance at Arizona State University, and is currently working on the grounds at the Champions Golf Club in Houston, Texas.

Frederickson says, "I'm very happy with my girls. In fact, this winter we spent $5,000 installing a ladies washroom and lounge in our maintenance shop."

"Claudette" - Silver Lake Golf Club - Dudley Smith.

Claudette is a housewife and mother desiring to supplement the family income, but the idea of outside work "turned her on." She is also an ecology nut. Claudette collects mushrooms, berries, and asparagus while out mowing. She has a pet crow at home, and talks to the squirrels and ducks on the golf course.

Claudette can handle any of our mowing jobs and usually does the fungicide applications. She "begs off" when aquatic weed killers are applied (they harm the fish), or when arsenicals are used for Poa annua control (you are killing the birds).

This past season the girls did all the aerifying, verticutting and clean-up chores on all the greens and tees. Claudette and the other girls steam-cleaned the dirty equipment when we disassembled it this winter, and they did an excellent job painting the flagpoles, ball washers, and tee benches. Women are naturally neater and they don't spill paint.

The women employees at Silver Lake have only worked spring and fall. They report in the morning after their children are on the school bus, and leave at 3:30 P.M. to resume their motherly duties. The women do not work on weekends, or on school holidays. Since I have adequate schoolboy help during the summer months, the women fill the labor shortage that exists in early spring and again in the autumn. Working only six hours a day fits nicely into their home

schedule as well. The women eat their sandwiches at the barn with the male employees, but usually they are watching their diets and settle for an apple or a can of beer. They use the same washroom as we use, but lock themselves in for privacy - they also keep the john much cleaner than we did.

In conclusion. . .

1. What does O.S.H.A. have to say about women?
   Practically nothing. If women fit our needs, then hire them.
   a. Make sure your girls are 18 years or older
   b. The minimum wage is $1.90, but my survey showed golf courses were paying between $2.40 and $3.00.
   c. Women may work 6 days a week, 8 hours each day.
   d. Safety shoes with steel toes and hardhats are <u>not</u> required, but strongly suggested.
   e. Regarding washrooms, 1 toilet must be provided for each 15 employees. Make sure the door can be locked from the inside, and cover the window with a curtain. Suggest females use the halfway house, rather than the barn facilities.

2. Women want equal pay for equal work, and they desire a variety of jobs - not the same machine every day. I might add some long-time male employees resent the women getting all the "gravy" jobs.

3. I have found some jobs impractical for the ladies. They are not strong enough to change hole cups, or unload truckloads of fertilizer.

4. Try to keep your women isolated with individual assignments, this will reduce the time spent at the coffee pot, and curtail the gossiping.

5. You will notice that with women employees you have a cleaner golf course. First, they will stop and pick up a paper cup rather than mow it into confetti. Secondly, the four letter words will disappear from the barn walls, and verbal profanity will be a thing of the past.

Are you tired of discussing the weather with your assistant? Are you tired of smelling the grease and gasoline on your mechanic's overalls? How about checking the water temperature at the pool with Connie? Get a few wild ideas in your head, and then go home, thinking this golf course work isn't so bad after all.

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<u>SEED AND SOD IN CANADA</u>

Dr. W. E. Sieveking, Director of Crop Research
Maple Leaf Mills Limited, Georgetoen, Ont., Canada

In many ways, Canada may be compared to the U.S. by the figure "10%". Canada has about 10% as many people, and about 10% of the Canadian population is French speaking. The Gross National Product of

Canada is about 10% that of the U.S., and Canada has about 10% as many golf courses as the U.S., i.e., about 1250 in total of which about 550 are in Ontario. Also, Americans in general have about 10% as much knowledge about Canada as Canadians have about the United States.

Admittedly, Canada's climate is severe by comparison to the U.S. In spite of its tremendous land area, the agricultural economy of Canada's three prairie provinces can be roughly equated to that of North and South Dakota, Nebraska and Kansas, while that of Ontario and Quebec combined is comparable to that of the state of Ohio. These two factors of a lesser population and a more severe climate affect all phases of turfgrass production, utilization and research.

Golf courses in Canada are increasing in number. While most of the older golf courses are within 100 miles of the U.S. border, reflecting Canada's population distribution, many of the newer golf courses are being built in the ski resort areas in an effort to attract off-season customers. I understand that a number of these courses are being constructed by hockey players.

Construction of golf courses ranges from good to bad, depending on the financing. Occasionally attempts are made to save money on tees and greens. Canada has a few very good golf course superintendents, but many are poorly trained and poorly qualified. On the average, the Canadian superintendents would rank lower than their U.S. counterparts, although a few superintendents such as Sid Puddicombe at Edmonton, are making a significant contribution in upgrading the general level of competence.

Turfgrasses used on golf courses include Toronto C-1 and Penncross bents on greens, Seaside bent, annual bluegrass, fescue and common Kentucky bluegrass on fairways, and Merion and Fylking Kentucky bluegrass on tees. The newer close-mowing Kentucky bluegrass varieties, such as Fylking and Nugget, have been receiving increased interest and usage on greens aprons, tees and fairways. In general, the new golf courses are seeded, and repairs are made with sod, mostly Merion Kentucky bluegrass sod. Very little bentgrass sod is being used.

Associations of interest relative to golf include:

Royal Canadian Golf Association, 696 Yonge St., Toronto, Ont.	416-925-4397
Ontario Golf Association, 74 Victoria, Toronto, Ontario.	416-366-3834
Ontario Golf Supts. Association, 45 Riverbank Dr., Toronto	416-233-2269
Canadian Golf Supts. Association, 2159-A Weston, Toronto	416-244-0960

Sod growers are somewhat better qualified and better informed and do a good job of producing quality sod. However, their principal items consist of pure Merion sod, a 50-50 mixture of Merion and common Kentucky bluegrasses, and various Kentucky bluegrass-fescue mixtures. They have shown only limited interest in the newer improved varieties of Kentucky bluegrass. This has not been due to a lack of information on their part so much as a lack of interest on the part of their customers. The sod growers have been relying on the private companies to sell their (the sodgrower's) customers, and I believe this is as it should be. The private companies, though, are still developing sound sales programs. Some proprietaries are being produced by sod growers, principally

Fylking and Nugget, but the quantities are not large.

There is an organization called the Nursery Sod Growers Association of Ontario, Carlisle, Ontario - 416-689-8845 - which has functioned very well, but there is no national organization at this time. In 1974 it included a membership of 34 members from Ontario, 5 grower members from outside Ontario, and 16 associate members, primarily seed and chemical companies. The membership had about 19,000 acres in sod production in 1974, ranging in size from 50-2000 acres, and representing better than 75% of the total sod production in Ontario. One larger grower sold 5,000,000 yards in 1974.

The Sod Growers Association has tended to shun governmental influence and have themselves established a set of sod standards for quality, inspection, and do their own policing and servicing. A grower's field is inspected and classified by other member growers of the association. The members all have an interest in producing and promoting quality sod, and they are not easy on one another.

The packaged lawn seed business is similarly tied to Merion, Park and common Kentucky bluegrasses with ryegrass and fescues added in major amounts. All types and prices of mixtures are available with a few premium mixtures of improved varieties at higher prices. The shelf prices are generally lower and the margins smaller than a similar product in the U.S., and the Ontario market is about equal to that of the Detroit and Buffalo metropolitan areas combined.

Seed production in western Canada offers great potential. The two principal areas are in Manitoba and northern Alberta, but these are concentrated primarily in the fescue and timothy grass seed crops. I know of other areas in western Canada that I feel are better suited to grass seed production within the limitations of variety adaptation. Certain varieties produce well and other produce nothing. For example, I have obtained plot yields as high as 1,000 lbs. of orchardgrass seed and 800 lbs. of Kentucky bluegrass seed of selected varieties without imposing any significant seed production technology. Yet, most of these kinds of seed are imported into Canada, predominantly from the U.S.

Why aren't these seeds being produced in Canada? The answers are easy to find. First, Canada has not developed nor promoted a technology. Certainly, a technology exists in the U.S. such as in Oregon and Washington, but this technology cannot be directly transferred. For example, open field burning has been a part of the Oregon techology for many years. In the Peace River country snow soon follows and occasionally precedes harvest. How do you burn a grass seed field covered with a foot of snow?

Another factor has been the selection of varieties. Many of the varieties tried in the past have not been adapted for seed production in Canada and have not produced satisfactorily. New varieties should be tried in plots or small scale seed fields first. Such testing facilities are available at Beaverlodge, Alberta through Agriculture Canada at the University of Manitoba at Winnipeg, and through some private companies. The one major requirement is snow mold tolerance.

Because of poor experiences and this lack of technology there is a declining interest in the production of proprietaries in northern Alberta and the relatively reliable success with wheat and barley in more promising areas make it difficult to interest new growers in the production of Kentucky bluegrass. I sincerely believe the development

of seed production of such species as Ky. bluegrass is possible if one starts with the right grower and a variety of potential based on local tests.

In preparing for this speech I asked a number of my colleagues two questions - What can Canada offer the U.S., and what does Canada need from the U.S.? Aside from its seed production, Canada has little to offer. Canada does export some sod to the U.S. and some sod growers produce on both sides of the border, but this is insignificant in the total turfgrass picture.

On the other hand, Canada needs technology. A couple of my colleagues estimated that Canada is 20 years behind the U.S. in technology. Canada has less than 10% of the U.S. research effort in turfgrass science. I do not know of anyone in Canada devoted full time to turfgrass research, and there is no one hired for extension work. The technology is available from the U.S., and we rely heavily on programs at Purdue, Penn State, Rutgers, Michigan State, Rhode Island, and elsewhere, but we need more work in Canada to modify this technology.

Like everyone else we are always interested in new and improved varieties, and Fylking and Cheri Ky. bluegrass came to North America from Sweden through Canada. Yet, Canada today does not have a major breeding program on turfgrasses. Our most serious problems are snow mold, of which 5 different kinds are known, annual bluegrass, dollarspot and seed production, and I think we're making progress.

Canada is a popular place to visit in the summer for fishing. Should you come north for your vacation this summer I hope you will take the opportunity to visit some of Canada's universities, private companies and sod growers, and that you bring along your golf clubs to try some of the new courses in the north. I believe you will find them challenging.

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CLASSIFICATION OF TURFGRASS SOD FOR ONTARIO

From: Nursery Sod Growers Association of Ontario, 3284 Keele St., Suite 10, Downsview, Ontario, Canada. 416-633-1591

Turfgrass Nursery Sods: All sod that has been especially sown and cultivated as a turfgrass crop.

No. 1

A. Kentucky bluegrass sod: Sod grown solely from seed of cultivars of Kentucky bluegrass. The sod should contain not less than 50% Kentucky bluegrass cultivars licensed for sale in Canada by the Canada Department of Agriculture. Other grasses and clovers should not be apparent in the turf and no more than 2 broadleaf weeds, or 10 other weeds per 50 sq. yards shall be present. Sod should be of sufficient density that no surface soil will be visible when mowed to a height of 1-1/2 inches.

B.	Kentucky bluegrass-fescue sod:	Sod grown solely from a seed mixture of cultivars of Kentucky bluegrass and Chewings fescue, or Creeping red fescue. At time of sale, the turf should not contain less than 30% fescue and not less than 40% bluegrass.
C.	Named cultivars, i.e., Fylking, Nugget, Baron, etc.	Sod grown from certified seed of a licensed Kentucky bluegrass cultivar. At time of sale other grasses and clovers should not be apparent in the turf.
D.	Bentgrass sod	Sod grown from seed or stolons of bentgrass cultivars generally used on putting and bowling greens.
	No. 2	
E.	Nursery sod:	Nursery sod that does not meet the above specifications.
F.	Field or pasture sod:	All sod that has not been sown and cultivated as a sod crop.

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MAJOR GRASS SEED GROWING IN THE NORTHWEST

Jay Hager, Loft-Kellogg Co.
Milwaukee, Wisc.

In the Washington-Idaho, Spokane River Valley and Palouse country and Oregon's Willamette Valley, we are concerned with the effects of poor burning on seed production.

In Oregon's Willamette Valley, bentgrass, Kentucky bluegrass, ryegrass and fine fescue production predominate. With the introduction of new herbicides this area has changed from ryegrass, bentgrass seed production to producing some good quality Kentucky bluegrass.

OK, let's take a look at the Rutger's University turfgrass planting. Reed Funk, the Director at Rutgers, has had a tremendous amount of success and has developed many of the Kentucky bluegrasses on the market today. We will take a dollars and cents look at what the new varieties can do for the professional turf manager.

There is also a look at Loft's Research program to see the varieties available to Dr. Fred Ledeboer and an explanation of some of the things he is looking for in his breeding stock.

The University of Idaho at Moscow, because of the seed production in the state, lets their trial plots go to seed. This gives us a good chance to see the characteristics of the various turf varieties at maturity and to discard varieties that don't produce enough seed. Also we can eliminate grasses that are not true to the variety's apomectic asexual production.

Some of Loft's test plots in the Willamette Valley help to determine the yield potential and cultural problems of new turfgrass

varieties.

From the production trials, the next step is to grow foundation seed which is used to start the production fields. The true test of a new turfgrass variety is what happens in the farmer's field... marketing and actual yield versus production costs to determine a good merchandisable variety.

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METROPOLITAN GOLF AND SUCCESS

Carol McCue, Exec. Dir., Chicago District Golf Association
Room 905, 211 East Chicago Ave., Chicago, Ill.

My brief talk does fit into the complex of "Success with Turf" because those of us in golf associations believe we contribute too. I don't know how many others in golf fit our category, but I know those of us who are administrators of golf associations are only aiding and assisting what the producers do and the maintenance people keep for our gorgeous playgrounds.

Many have said the greatest literature in sport comes from golf, and the greatest intellectual game is golf. None of this could happen without the research and painstaking care the turf scientists have provided.

Those of us in golf administration like to think of ourselves as part of the dynamics of golf - the dynamics being the motion and energy that keeps the game growing. And like any movement, we all need each other. Beautiful and testing courses, and athletic fields developed by scientists need people like us to figure out the games, the rules, the handicaps and the tournaments.

Briefly, a sports association carrying its load is a listening post, a clearing house and a sounding board. What's new? What's old that's still working? What do we do next year and in five years? I don't think anyone in sports should plan beyond 5 years any more.

A sports association is usually governed by a board of directors and maintains a staff equal to the challenge of its charter. A budget must be developed, income determined, bills paid, like any other business -- tournament schedules confirmed, entries mailed, pairings made, media contacts maintained, computer programs, publications, seminars sponsored, and other services indigenous to sports promotion - in our case we also provide and administer hospital and major medical insurance for employees of golf clubs without an administration fee to the club or employee.

Our board feels a philanthropic responsibility, and in 1944 formed the Chicago District Golf Charities, a corporation separate from the Association, with a separate board of directors. This is a vehicle to enable golfers to contribute to charity as a group of midwest golfers. The Charities has given more than half a million dollars to worthy organizations. In the beginning the money was used mostly to

build golf courses at veterans administration hospitals,,and several members of the Midwest Association of G.C.S.A. contributed to the design and construction of courses, among them Allan Wyman at Danville, and Gerald Dearie, Sr. at Downey. In addition to golf facilities at VA hospitals, 30 organizations now participate in an annual disbursement of about $45,000. The Chicago District Golf Charities also sponsors golf charters all over the world as a fringe benefit to members. We've been to Spain, Greece, Scotland, England, France, Puerto Rico and Bermuda.

Sports associations can also act as a storehouse of traditions, records, names and addresses and countless bits of information frequently requested by the public.

I hope I've given you a glimpse of "Metropolitan Golf and Success" and I hope you agree we fit into "Success with Turf." Our philosophy at the Chicago District Golf Association is not to close our minds to anything new, and each year to try to bring new ideas and methods in our operation. I'd like to come back in 10 years and report we're still at it.

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A DAY IN THE LIFE OF A GOLF COURSE SUPERINTENDENT

Harry Murray, Century Toro Distributor
Cincinnati, O.

During the golfing season the superintendent's day usually will start anywhere from 5 to 7 AM. A phone call from the local police, or night waterman that something has gone wrong on the golf course, or at the clubhouse, may start the day even earlier.

The superintendent is responsible for a large dollar investment -- golf course itself and the equipment that is utilized. Many times he is called on to be an electrician, carpenter, road builder, purchasing agent, tree surgeon, landscaper, salesman, welder, mechanic, truck driver, bulldozer operator, backhoe operator, plumber, psychologist, sociologist, employer and employee. The superintendent's knowledge must be vast, but we can't forget the main objective is growing grass. If only he was given the time to do this job without all the varied interruptions, his job would be a little easier.

Superintendents must attend the club's board meetings and be able to sell his program to the members. He sometimes must accept the changes they request even though they do not fit his program or budget. Another responsibility is to attend local superintendents' meetings. Maybe he will host a meeting at his club. In many cases, he will attend a state meeting and/or a national meeting to keep up with the latest information on new procedures, equipment and methods.

I recall visiting Dick Craig one day at the Jack Nicklaus Golf Course, Mason, Ohio. The electric power company was running a power line through the middle of his golf course. Of course, the heavy equipment operators were trying not to tear up the turf and also stay out of the way of golfers, and to me it seemed like an impossible task.

At Holly Hills G.C., Waynesville, Ohio, the fourth of July flood had swollen a creek into a river and washed parts of 3 fairways away. It took a week of hard work to replace the soil and replace sod on the fairway before the holes could be open for play.

Harmond G.C. at Lebanon, Ohio, lost a large amount of trees in the April tornado. Dick James worked night a day for a month cutting down, cleaning up and replacing trees.

This past summer a train wreck on a rail system that borders Walnut Grove C.C. kept Dennis Bond up all night. A tank car caught fire and the only way to get to the wreck was across the country club. Water would not put out the fire so a foam-filled truck from Wright Patterson Air Force Base was called to this emergency. The fire was finally contained. During the night it rained when it was time to move the trucks out, the ground was too wet to drive on and the golf course was severely damaged. The club received $7,000 for damages. Then Superintendent Bond had an extra responsibility of overseeing the repairs.

As we knew, every day can be something new for the superintendent, and the challenges must be met and each problem, big or small, handled to the satisfaction of all concerned. I know sometimes it must seem like an impossible task to you. However, if you stop at the end of each day, each week, each month and at the end of the year to reflect on all that you have accomplished, I know you will receive the fulfillment of a job well done. Try it - it works!

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SUCCESS MEANS IDEAS AND ACTION

Carl Schwartzkopf, Mid-Continent Agronomist
USGA - Green Section, Crystal Lake, Ill.

The following presentation is a collection of ideasthat superintendents have put into action, which have contributed to the success of maintaining turfgrass at their clubs.

1. The eroded creek banks was stopped at Forest Hills C.C. in St. Louis with Gabion wire baskets.

2. Colored signs to facilitate the communications between the superintendent and golf shop to indicate the condition of the course:
   Red - course closed
   Yellow - course open - no carts
   Green - course open with carts

3. Pete Hitch, superintendent at Meadowbrook C.C. near St. Louis found that an old golf cart after an overhaul and slight modification to the club carrying area, is very helpful in transporting personnel around the course.

4 & 5 With the disposal of clippings becoming a problem to Vern Hanson while superintendent of the Minneapolis G.C., he constructed this spreader. When the mower operator has finished cutting a green,

he empties the clippings into the spreader. As he drives from one green to another he actuates the spreader, thereby disseminating the clippings.

6. To prevent golf balls from rolling off the bank and into the water, this net was constructed of wire mesh at the Sea Island Golf Club in Sea Island, Ga.

7. With heavy rains and a soft soil condition, Milt Bauman, superintendent at the Seattle G.C. has equipped his tractors, sprayers, etc., with over-sized high flotation tires.

8. To minimize the hand-mowing and clipping around trees, many superintendents have been using chemical control in these areas.

9. To help remind golfers and caddies to repair ball marks, this superintendent stenciled a little reminder on the flag pole.

10. When the yellow lines appear on the cart path, it indicates that the path must be used. At other times it is travel anywhere.

11. To minimize the vandalism to tee benches, the Janesville, Wisconsin Park and Recreation District devised this concrete bench.

12. The increased cost of railroad ties discouraged Jim Manka, the superintendent at the Old Warson C.C. in St. Louis from using them to replace a retaining wall after a flood. Jim was able to obtain utility poles, have them cut in half and substituted them for the railroad ties.

13. In an attempt to minimize the damage by flooding and erosion of the banks, Jim Manka constructed a water shoot.

14. To help keep the carts off the tee, Bill Byers, the superintendent at Des Moines G. & C.C. used railroad ties very effectively as a curb.

15. This particular superintendent used a pot of flowers for the ladies tee markers. This little idea made him successful in gaining the support of the women that he needed for implementing other programs.

16. The sand traps at Callaway Gardens are lined with asphalt to keep bermudagrass and other weeds from growing through the bottom.

17. In anticipating the conversion to the metric system, Dick Toupal, the superintendent at North Oaks G.C. in Minnesota, and his general manager, Harry Olson, have included meters along with yards on the tee placards.

18. This construction supervisor borrows one of his employee's bikes for transportation around the course.

19. Jim Manka changed a straight arrow cart path to this beautiful winding path that is also considerably safer - a true idea that was a success only after a lot of action on behalf of Jim and his crew.

20. If you do have an idea, remember that before it can be a success it is necessary to implement action. No rule for success will work if you won't. And finally a question - if you have enough time to do it right the second time, why not do it right the first time?

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WHERE SUCCESS LIVES

Andy Bertoni, W. A. Cleary Company
Northville, Mich.

Well, here we are winding up this great conference, trying to tie the knot to a beautiful package. It has been successful, all the speakers who spoke about success were successful. By this time, you feel like the guy who stood on the corner, watched a load of sod going by, and said, "That's what I call a success, when you can send out your yard to be trimmed!"

It has been a great get-together, for all of you are well on the way to success because you saw fit to attend this conference.

To set the example for our search for success, let us look no further than our Executive Director, Dr. Bill Daniel. He was honored in New Orleans when he was chosen to receive the GCSA's Distinguished Service Award, the greatest tribute our Association can bestow upon an individual. For this, he is a grand success! Yes and No! He reached the pinnacle of our profession, but knowing our Bill, he will work harder proving he deserved it, and use it as a rung on the ladder to future successes. So, let's all follow this likeable Pied Piper.

What is your idea of success? And, where does success live? It lives in the hearts and minds of those who labor gloriously to produce a beautifully conditioned and playable course for people to enjoy. It pertains to those who supervise and have an abundant budget; to those who work hard and have an adequate budget; to those who slave and sweat and have an inadequate budget. All are equally successful if they mentally and physically put their everything in their chosen profession and vocation.

No one is successfully happy who has already reached success and is disenchanted and complacent. This is the best argument for setting goals that are unattainable -- so that the striving becomes an end in itself.

Don't be fooled by the fact that your course is beautiful, and think that you are successful. You are successful only if you can cope with the fact that tomorrow the course will look awful. No matter how hard you work and have the course looking great, remember it is only temporary. Actually, if you want to put success in another way, that Super is successful if he can keep his course in top condition most of the time! A wise Super once said that when your course looks perfect -- look out! That is the time to start renovating.

Sad will be the day when you become content with the job you are doing, the life you are living, thoughts you are thinking, and deeds you are doing. Give so as to get the approval of your other self, and success will be yours. But, pray that success will not come any faster than you can handle it. Like the fellow said, "I'd rather be lucky than good," and the answer to that is, "You've got to be good to be lucky!" Elbert Hubbard stated, "Some men succeed by what they know, some by what they do, and a few by what they are."

I will list off some success factors and see in what category you belong:

There is more to greenskeeping than cutting grass.

Have you helped young people to earn money for their education by employing and helping them? Oh, what a great feeling it is when someone who has succeeded in his life's ambition returns and thanks you for helping and directing him.

Helped some despondent family man who failed all his life only to help him find himself and become a successful golf course worker?

Helped someone to appreciate nature and her wonderments?

Helped lawn lovers with your talents by discussions, demonstrations and talks?

Appreciate the fact that our profession allows us great family rapport, know and work beside your son and your daughter?

Gained the respect due you for your professional demeanor in your community?

Do you ever consider your golf course as an open cathedral whereby God can look down on your handiwork? Do you ask Him if He is pleased with what He sees? If He and you agree, no one else matters.

Do you only look for the good things on your course rather than looking for the things that are not good, so that you can repair them to make it a better place for the golfer to enjoy?

Do you treat your crew as you would like to be treated by the golfer?

Do you realize that kindness is the language the deaf can hear and the blind can see?

Do you treat those who call on you courteously, remembering that they are trying to help you?

These questions could go on ad infinitum. I would suggest you make your own checklist and review it periodically.

Now, let's list a few definitions of success:

Success is never giving up.
Success is helping a fellow Super be successful.
Success is continually trying to improve.
Success is learning how to enjoy life.
Success is not blaming others for your faults and failures.
Success is possessing enthusiasm, that one necessary ingredient in life.
Success is avoiding the greatest mistake you can make, which is the fear that you will make a mistake.
Success is measured by your ability to organize, systemize, and supervise.
Success is caused by mental attitude rather than by mental capacity.
Success is half won where one gains the habit of work.
Success is being useful.
Success is to labor faithfully towards a goal.
Success is to think and will success.
Success is not to love power and money - and so on.

There is nothing impossible to the man who can will. Will is the key to success. What you will is the success you become. One who hopes to be super-successful must know more about some one thing - not only know, but know how to do it better.

You have been chosen to work with nature. You must succeed by honoring nature by making it better through research, make it more beautiful, and make it more pleasant for others to enjoy. In no other profession does God and man work more closely to create beauty for the enjoyment and pleasure of mankind. (Sometimes you wonder if golfers belong to mankind!)

When Charles Kingsley was asked to name the secret of his success, he replied, "I had a Friend." And Browning said, "A minute's success pays for the failure of years." And I like Mark Twain's "Let us endeavor to so live that when we die even the undertaker will be sorry." Remember that those who try something and fail are infinitely better than those who do nothing and succeed.

To realize the greatness of our vocation, just ponder and mull over the fact that we sell the greatest product in the world PLEASURE. We create good conditions for people to enjoy. We help doctors, businessmen, etc., to recharge their batteries so that they may renew their tasks in a refreshing and wholesome manner. We help youngsters to find their way, to partake of the good things in life. And, look at the joy and fun we afford the oldsters and no-so-olds! Keep this thought in mind and you are well on your way to success.

So in concluding, let me recall to you the story of the gardener in England who had the cathedral grounds and flowers in beautiful condition. One day the Bishop, a pompous fellow who surveyed the area said, "I see that God and you have done a good job on the grounds and flowers." "Yes," replied the old gardener, "But you should have seen it when God had it all by Himself!

This poem by Robert Louis Stevenson seems to tell it all:

The Meaning of Success

That man is a success
who has lived well, laughed often and loved much;
who has gained the respect of intelligent men
and the love of children;
Who has filled his niche and accomplished his task;
Who leaves the world better than he found it
whether by
a perfect poem
or a rescued soul;
who never lacked appreciation of earth's beauty
or failed to express it;
who looked for the best in others
and gave the best he had.

Now go out and have a successful season!

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