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Massachusetts Turf and Lawn Grass Council
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Growth And Development In The Massachusetts Experiment Station

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IN discussing the growth and development in the Experiment Station, I would like to start with a quotation from J. R. Beckenbach of Florida who recently stated that "Modern civilization is . . . unthinkable without a sound and progressive agricultural base. Agriculture is number one and the day that it ceases to be number one in the consideration of the Nation, that day the Nation begins to build future trouble for itself." It seems to me that at the present time there is a very real concern that the Nation as a whole does not attach the importance it should to agriculture. It tends to think more in terms of the problems created by agricultural excellence rather than the benefits to this and other nations.

It is easy, of course, to see why this should happen when we have been faced with the problems created by a surplus production for many years. Even when thousands of farms are abandoned every year and hundreds of thousands of people leave the farm every year, our production still continues at an astounding rate. I don't have to repeat how many more bushels of wheat per acre we are able to grow, how much more productive our livestock are, or how much more efficient our farming operations have become. You are well aware of all this and so are most people in the country. **As a result we continuously hear talk of cutting down on agricultural research and even some talk of stopping it completely.**

I don't know when the balance between our production and our needs will be reached. I do know that when we start cutting back on our research, we will also start losing an agricultural efficiency that has certainly helped us to become the leading Nation on earth. I know also that we are in the midst of a population explosion in this country such that it is predicted by the year 2010 there will be 425 million people in the United States. For these two reasons alone — and I'm sure you could add many others — we must continue our research.

However, this does not mean that we will continue our research in the traditional patterns of the past. The needs have changed and so our programs must change. For example, the work in experiment stations has certainly contributed toward the great numbers of people leaving the farms every year. These people are leaving the farms at the same time that automation is making good jobs more difficult for untrained people to obtain. Surely we have some responsibilities in this social area of agriculture.

The abandonment of great numbers of farms has also created the problem of what should be done with this land as thousands of acres are taken out of production. We certainly have responsibility in this natural resources area.

We are hearing a great deal more about the problems concerned with our water resources. Perhaps these problems properly belong in the natural resource field. Wherever they belong we will be doing more work in this field.

One of the areas of concern in recent years has been the dissipation of funds by all research agencies by attempting to cover too wide an area and in many cases duplicating each other's work. One solution to this problem has been the development of regional research which has enabled several experiment stations to develop coordinated attacks on problems of regional importance. A recent change in the method of financing regional research has made it possible to cut down on the number of projects in which a station participates, and allows more support for the fewer number of projects.

Along with cutting down on the number of regional projects, we are also decreasing the number of non-regional projects which we are conducting. In the past we have had the situation of one man having three or four projects. We are hoping to move in the direction of three or four men working on one project. This is, of course, a team approach to research. We are doing this to a limited extent now but will be doing so more in the future. At the present time we are in the process of getting together a team of scientists to work on the problem of maple decline, a disease or condition which is receiving a good deal of notice. In this team we are starting with a physiologist, a pathologist, an entomologist,

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Secretary-Treasurer: 51 Fenwood Road, Longmeadow 6, Mass.
Coordinator: Prof. Joseph Troll, UMass
Editor: Joseph A. Keohane, UMass

Stockbridge Votes Professor Of The Month

Joseph Troll, Assistant Professor in the Agronomy Department at the University of Massachusetts, was born in Paterson, New Jersey, some forty-three years ago. Room 202 Stockbridge Hall or his home at Comins Road in Hadley are always open to any of his students, past and present. In fact, through his efforts Turf has become one of the major courses here at Stockbridge, attracting students from all over the United States and Canada. One of Professor Troll's projects has been to place his students in respectable positions. A recent survey showed that 90% of the students he placed since 1960 have positions ranging in salary from $5,200 to $7,500 per year. Moreover, Professor Troll does not stop here; he is constantly in touch with those in the field.

Professor Troll entered the United States Navy in 1938 and served until 1941, and reentered the Navy in 1943, serving until 1945. After his discharge from the service, he prepared himself for college by taking courses in New Jersey schools. He entered the University of Rhode Island in 1950, graduating with a B.S. in Agronomy in 1954 and a Master's Degree in Plant Pathology in 1957. While a student at URI, Mr. Troll was a member of Phi Kappa Phi, Phi Sigma, Sigma Zi, Theta Chi, and Alpha Zeta (was Scribe and Chancellor of this honorary agriculture fraternity).

Professor Troll came to the University of Massachusetts in 1957. At that time there were 9 seniors and 15 freshmen in the Stockbridge Turf Management course; currently there are 83 Turf Management Majors. He selects qualified applicants for the eight-week Winter Turf School, and he is the University's Extension representative in matters pertaining to agronomy and turf in the Commonwealth. Also Prof. Troll is Chairman of the Annual University of Massachusetts Turf Conference, which has grown with his help from 100 attendants to an anticipated 700 this year. Our Professor of the Month is also an advisor to the Massachusetts Turf and Lawn Grass Council and an active participant in the Golf Course Superintendents' Association of America. In February, he was a guest speaker at the National G.C.S.A.A. Conference held in Philadelphia, speaking on the value of the two-year school. Incidentally, Prof. Troll invited the entire senior Turf Management class to accompany him to the convention. Prof. Troll is also advisor of the Turf Management Club, and through his effort, on the behalf of the students, has brought many valuable lecturers to the meetings. These guest speakers from positions in the field not only help the students, but bring added recognition to the Turf Management course at Stockbridge. In addition to all of his student activities, curricular and extracurricular, Professor Troll is working for his Ph.D. in Nematology.

Of course, we must not forget Professor Troll's family: his gracious wife, Lonnie; Diane, age 16, a student at Hopkins Academy; and little first grader Judy, age 6. So, while our Professor of the Month Award goes to Professor Troll of the Agronomy Department with our best wishes and congratulations, we must not forget to congratulate all the Troll family for making available to the students of Stockbridge a man who is truly interested in the welfare of the student not only while he is attending school but long after the student graduates.

Once again, congratulations, Professor Troll.

Fred Scheyling '64
Fred Scheying '64

Abrasive Grit Wears Parts Rapidly

Cleaning spark plugs on an abrasive blast-cleaning machine has long been an accepted field practice. Many conscientious repairmen and engine owners blast-clean spark plugs frequently, simply as a matter of routine maintenance. They believe that blast-cleaning spark plugs is a way to salvage the plug, decrease repair costs and improve engine performance. Unfortunately, this is often false.

Our investigation of engines, which wore out prematurely, led us toward the practice of cleaning spark plugs by blasting them with abrasive grit. We blast-cleaned the spark plugs on new engines, and after a few hours of operation, extreme wear had occurred on internal engine parts. The wear had been caused by abrasive grit, which remained within the plug after blast-cleaning. During operation the grit had fallen into the combustion chamber, then worked its way past the piston rings toward the crankcase.

To get an idea of the way in which spark plugs are being blast-cleaned in the field, we had two plugs cleaned at each of five local automotive service stations. We then washed them out in gasoline to remove any abrasive grit which remained after cleaning. All of the spark plugs contained enough grit to cause engine wear. The residue of grit in the 10 plugs ranged between 32 milligrams and 372 milligrams. To give you some idea of the quantities involved, 200 milligrams of grit will fill a circle the size of a nickel.

When a spark plug has been cleaned by the abrasive blast-cleaning, some of the abrasive grit remains tightly packed within the plug after the cleaning operation. Although instructions with spark plug cleaning machines call for solvent cleaning to remove oil deposits before blasting, contacts with local automotive service stations convinced us that few, if any, cleaning machine operators degrease the plugs. Further, simply blowing out the plugs with a forceful blast of cleaner after blast-cleaning is not adequate to remove all the tightly packed grit. In our tests, spark plugs which contained even a small amount of grit caused considerable wear after a few hours of operation. The engines tested had the same internal appearance as many of the engines which have been returned to us with complaints of short engine life — scratched or scored cylinder bores, extreme amounts of smooth wear on crankshaft, crankpins and journals and very high ring wear. The grit which can be

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a virologist, a chemist, and two or three soil scientists. As the work progresses, the composition of the team will undoubtedly alter but I use this as an example of the direction that change is taking.

There are many factors that bring about this kind of a change, but one of the main reasons is that most of the easy problems have been solved. The ones that remain will be much more difficult and will require more research in depth and will not be the kind of problems that one man can normally solve.

One point that I would like to make in this regard is that in solutions to the kind of problems we will be concerned with. **more basic research will be required to give us the knowledge we need. When we work into this type of research program, this will mean that we will have to curtail, to a certain extent, programs we have had in the past of testing commercial products.** We feel that in the long run our teaching, extension, and research programs will all be better for this. These programs do not add to our knowledge, do not attract the graduate students vital to a good research program, and do not attract financial support.

In addition, industry now invests heavily in research on products for the farms and in selling farmers on their products. There is a shift, then, between the roles of public institutions and private industries in developing materials and providing knowledge for agricultural improvement. This is a trend which gives experiment stations new opportunities. They are now free to approach problems of fundamental science, broader knowledge, and social adjustment in agriculture.

However, the fact that we plan more basic research does not mean that we will not be supporting applied research. This is certainly a very vital part of our program and will be supported accordingly. As you know, particularly in non-agricultural areas, there is more status involved in being associated with basic research and a tendency not to think so highly of applied research. I do not share these feelings. **In my opinion, it takes every bit as much intelligence, ability, and ingenuity, as well as the willingness to devote long, hard hours to do applied research as it does basic research.** Excellence of work, whether basic or applied, is what we are concerned with.

Another trend that I should mention is that toward areas of excellence or areas of concentration. All experiment stations throughout the country are devoting considerable thought to the development of areas of excellence. Everyone is agreed that no experiment station can hope to be outstanding in all fields and instead of spreading limited resources to all possible areas, the whole Nation, as well as the individual states will be better served, if each state attempts to become really outstanding in a few special fields. The experiment station directors are thinking in terms of using regional funds to develop specialized facilities at each of the different stations over a period of years. The Congress is also thinking along these lines and has passed a research facilities bill, not yet funded, which will provide support for the same objectives. The purpose of this Act is to assist the State agricultural experiment stations in the construction, acquisition, and remodeling of buildings, laboratories, and other capital facilities which are necessary to more effectively conduct research in agriculture.

I have not attempted to describe exactly what the Experiment Station is doing at the present time. The program is a large one and it would take too much time to discuss. However, we do publish a list of all projects in the Experiment Station each year, which is available to all who want it. In addition, we publish a quarterly abstract of all publications, which is also available. We hope by these two outlets to keep you posted on what is going on in the Experiment Station.

In closing, I would like to say that we feel that a good extension program relies heavily on a good research program, as does a good teaching program, particularly in the graduate school. We believe that we do have a good research program now and plan to have a better one in the years to come.

How To Reconize And Treat Leaf Spot

By
FRANKLIN R. HALL
Field Service Representative
Niagara Chemical Div., FMC Corp.

Appearance of excessive dead areas in leaves may presage the death of a tree. Formation of these dead areas is characteristic of leaf spots which can be caused by insects, toxic gases, bacteria and fungi.

Leaf spots become a serious problem when defoliation results or when infestation is so severe that almost all the leaves are involved and cannot function normally. Defoliation for several successive years *may* bring about the death of hardwoods.

Occurrence of leaf spot is most common in elm, chestnut, oak, red maple, hickory, ash, locust and sycamore. Spread of the leaf spot fungi is by the same route for each of these species. They overwinter in the old fallen leaves, develop and spread to newly developing leaves in the spring. Wet seasons favor increased infestations of leaf spots.

Leaf spots are recognized by the formation of characteristic dead areas in the leaf. Dead areas vary from small to large size, and from round to irregular shapes. Color of the deadened tissue runs from yellowish to all shades of brown and black. The dead areas often fall out, giving rise to "shot holes."

Adequate control is often effected by burning fallen leaves in the autumn, and pruning dead and cankered twigs before spring budding. When infestations become severe and corrective action is necessary, however, there are pesticides available which will do an effective job. These materials and recommendations for their use are:

Material	Amount/ 100 gals.	Remarks
COCS	4 lbs.	Preventive treatments
Ferbam	1-2 lbs.	are suggested where severe in past
Puratized Agricultural Spray	1 pt.	Helpful for leaf spots on walnut, elms, maple

This is the tenth in a series of articles dealing with common pest problems in shade and ornamental trees.

Is It Rye Or Ryegrass?

DON'T LET THE terms rye and ryegrass confuse you. Unfortunately, they apply to two entirely different species.

Both are used for winter grazing in the South. But *rye* is a cultivated cereal *(Secale cereale)* originating from western and southern Asia. Although it is used interchangeably, Northern farmers grow rye primarily for grain and Southern farmers use it primarily for forage. It can be used as a soil building crop.

Some rye varieties are Abruzzi, Balbo, Dakold, Dean, Dominant, Elbon, Emerald, Explorer, Florida Black, Gator, Mammoth White, Tetra Petkus, Prolific, Rosen, Sangaste, Schlanstedt, Thousandfold and Wrens Abruzzi, to mention a few. Some of the older varieties are no longer recommended.

Rye*grass* has its own little den of confusion. Even so, ryegrass research is moving rapidly ahead of current information in terms of better disease resistance, seed production, and seed identification by fluorescent light.

There are two primary cultivated ryegrass species, according to H. A. Schoth and R. M. Weihang.* One is known as Italian ryegrass *(Lolium multiflorum)* and the other as perennial ryegrass *(Lolium perenne)*. They differ and are grown mainly for forage, although some strains serve as soil building crops.

Italian ryegrass originates from Mediterranean regions. In western Oregon, it's called Domestic ryegrass. It's also referred to as Native or Oregon ryegrass. Many people call it annual ryegrass, because it usually grows as annual. But it can be a biennial or even a short-lived perennial!

Variety examples, including some *not yet released,* are Florida Rust Resistant, Gulf and its Uruguayian parent — LaEstanzuela 284, Mississippi State University and Stoneville rust resistant strains, and Tifton 1.

Wimmera and Wimmera 62 ryegrass varieties are probably hybrids between a third species *(Lolium rigidum)* and Italian ryegrass. In addition, Ryegrass 12 and H-1 — both New Zealand varieties not generally available to U. S. farmers — are two artificial hybrids between Italian and perennial ryegrass.‡

True *perennial* ryegrass originates from temperate Asia. It's occasionally marketed as English ryegrass and is usually a short-lived perennial in the South.

Italian ryegrass grows taller than perennial ryegrass. And, perennial isn't recommended for the lower South. Slow establishment, poor winter growth, and poor survival rates make perennial ryegrass inferior in Alabama.

Perennial varieties include Canada's Norlea, USDA Soil Conservation Service's P-312, and the Welsh strains of S-23, S-24, and S-101.

Plants usually aren't confusing, but their names sometimes are.

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* Hughes, H. D., Heath, M. E., and Metcalfe, D. S. *Forages,* Iowa State University Press, 1962, pp. 308-313.

‡ Hanson, A. A., *Grass Varieties in the United States,* USDA Agr. Hdbk. No. 170, 1959, pp. 44-46.

Ted Stamen, who is a graduate student in horticulture at UMass, is doing a follow-up study of graduates of the Stockbridge School of Agriculture in Turf Management, Landscape Operations, and Floriculture.

All graduates in these three fields who have graduated from 1953 through 1963 will receive a questionnaire within the next month. In order for this study to be completed we must receive these questionnaires back, so please return yours to Dean Jeffrey's Office.

This study will be of great value to the Stockbridge School of Agriculture and the various departments. Please help make this a successful study by returning your questionnaire immediately.

Many thanks.

(Continued from Page 2)

introduced into the engine as a result of improperly cleaned spark plugs may well account for cases of "unexpected wear" in which there is no evidence of abuse or neglect on the part of the operator.

Surely, we do not mean to imply that it is impossible to properly clean a spark plug by the abrasive blast-cleaning method. We believe it can be done, but only if adequate precautions are taken to cleanse the plug after blast-cleaning. If a spark plug is degreased, blast-cleaned, then thoroughly washed in gasoline or a similar solvent, it is unlikely that any abrasive grit will remain within the plug. However, because of the incomplete cleaning jobs that we found being performed in the field, we hesitate recommending any procedure which includes abrasive blast-cleaning.

In view of our findings, we most urgently recommend that dirty spark plugs be cleaned only in solvents or by wire brushing or scraping, then regapping. If a dirty plug cannot be cleaned in this manner, it should be discarded and a new plug used.

(Briggs & Stratton Corporation Corporation, will not approve the warranty repair or replacement of an engine which has been damaged by a residue of grit from blast-cleaning spark plugs.)

Lincoln's Gettysburg Address contains 266 words.
The Ten Commandments contain 297 words.
The Declaration of Independence contains 300 words.
The OPS order to reduce the price of cabbage contained 26,911 words.

Notice: The *Turf Bulletin* wishes to announce a new policy. Subscriptions are now being accepted for advertising in the *Turf Bulletin.* All agreements will be on a yearly basis. For further information write to:

Joseph A. Keohane
Editor
Turf Bulletin
Stockbridge Hall, UMass.

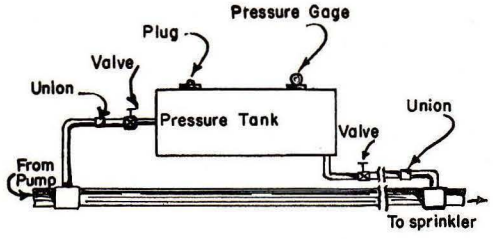
Applying Fertilizers Through Irrigation Systems

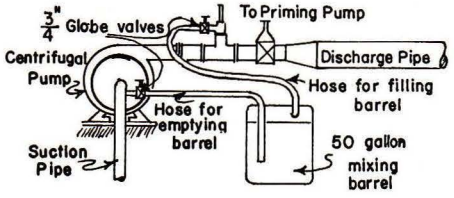
D. HEDLUND
Agricultural Engineering Dept., U. of Mass.

Certain liquid and soluble fertilizers may be applied effectively and economically through sprinkler irrigation systems. Both fertilizing and irrigation can be accomplished in one operation with a great saving in labor and effort. The fertilizer is applied evenly throughout the area provided there is an even distribution of the irrigation water. Several applications of fertilizer can be made during the growing season. The fertilizer is immediately available to the plant because it is in a liquid or solution form.

Fertilizer Injection by Closed Tank Hookup. In the event that town water or deep well systems are used, a fertilizer injecter is necessary, though it may be used with any system. This is a pressure tank connected to the main line anywhere between the pump and the sprinkler laterals. The pressure tank is charged with the amount of fertilizer needed for the area covered by the operating sprinklers on a per acre basis.

Fertilizer Injection by Centrifugal Pump with Barrel. Dissolve the fertilizer in a barrel or drum standing beside your pump. Use a hose connection from the barrel to admit the solution into the suction side of the pump. Use another hose connection from the discharge side of the pump to introduce water into the barrel. Proportions of 1 lb. of fertilizer to a flow of 10 gallons per minute of all types of liquid and soluble fertilizer have been used without harmful results to any part of the system.

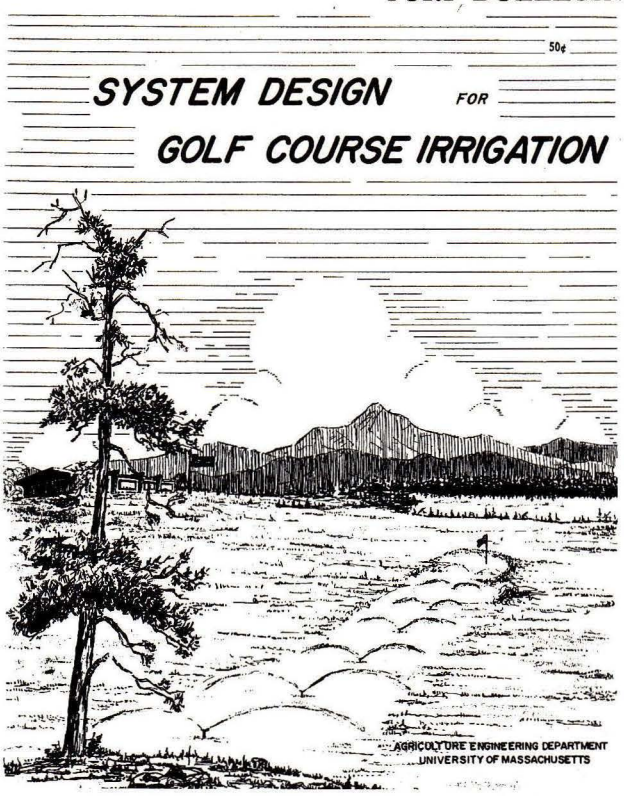




POINTS TO WATCH

Fertilizer Types. Any fertilizer which will dissolve and stay in water solution and is not volatile or extremely corrosive can be used. Fertilizers which can be applied through sprinkler systems are: Ammonium Nitrate, Calcium Nitrate, Nitrogen Solutions, Urea, Liquid Starter Fertilizers, and those complete commercial fertilizers which are in a liquid or soluble form.

Uniform Application. The distribution of the fertilizer will be no better than the water distribution. At least 30 minutes should be taken to inject the fertilizer solution into the sprinkler system. Do not apply when the wind is blowing.



Above booklet available at UMass. Bookstore or by writing to E. Pira, Agricultural Engineering Dept., U. of Mass., for additional information.

Reduce Leaching. The fertilizer may be leached down beyond the root zone if it is applied at the beginning of the application of water. The desirable procedure is to begin application of the fertilizer at the beginning of the last hour of irrigation. Allow about ½ hour for flushing the pump and irrigation system, washing the chemical off the plant, and moving some of the fertilizer into the root zone.

Calculating Application Rates. The computation of the application rate at each setting can be determined from the following table.

ACRES COVERED PER SPRINKLER

Sprinkler Spacing	Lateral Spacings 20′	40′	60′	80′	100′
40	.018	.037	.055	.073	.092
60	.028	.055	.083	.110	.138
80	.037	.073	.110	.147	.184
100	.046	.092	.138	.184	.231

Example:

It is desired to apply 300 lbs. of fertilizer per acre. Irrigation setup:

40′ sprinkler spacing
60′ lateral spacing
10 sprinklers

How many lbs. of fertilizer should be applied at each setting?

Formula: lbs. fertilizer per setting equals **number of sprinklers x acres** covered **per sprinkler x lbs.** fertilizer **per acre.**

From the Table: with 40′ sprinkler spacing and 60′ lateral spacings, **.055 acres** are covered per sprinkler.

$$10 \text{ sprinklers} \times .055 \frac{\text{acres}}{\text{sprinkler}} \times 300 \frac{\text{lbs.}}{\text{acre}} = 165 \text{ lbs.}$$

Sub-Surface Irrigation For Turf Areas

New research activity at the University of Massachusetts has been initiated by the Agricultural Engineering and Agronomy departments to investigate the water distribution patterns and the rate of capillary water movement through the soil profile — basic information related to the usage of sub-surface irrigation for turf growth.

With present methods of irrigation, considerable losses (up to 30%) by evaporation and surface run-off are experienced. Further, in windy weather, sprinkler systems become very inefficient. Sub-surface irrigation virtually e l i m i n a t e s evaporation losses, and wind has no effect on the operation of the system. The increased efficiency of water consumption for irrigation, especially where municipal water supplies are involved, is a valid reason for considering such a system. The addition of chemicals and fertilizers through such a system directly to the root zone are other benefits which might be derived. Irrigation by this method would be particularly useful on golf courses, athletic fields and other recreational areas because the turf areas could remain in play while the system is in operation.

The initial research was conducted in the laboratory involving a series of tests with controlled water pressures and flow rates for the point source sub-surface irrigation of various shapes and sizes of top-soil mounds. Movement of the soil water is traced within the soil profile by a moisture sensing system imbedded in the test mound. From the water movement patterns thus obtained, the design parameters are being determined and the adaptation to sub-surface irrigation is being analyzed.

The most important aspect of this project is the possibility of greater efficiency, convenience and economy in water usage for turf recreational areas.

On Turf And Crabgrass

By Ted Stamen, *UMass.**

As a former Extension Agent in Union County, New Jersey, I have had ample time to become well acquainted with the home owner and his lawn problems. Union County is located in northern New Jersey and is approximately 10 miles wide and 10 miles long with a population exceeding 500,000 people. As a result of this, and the fact that the commercial farmer is almost extinct in this area, we in the Extension Service have a vast suburban clientele to work with.

In 1962, we had two lawn demonstrations in the Union County Park in Elizabeth, New Jersey. These were to show the public how to make a lawn, how to care for a lawn, how to fertilize and how to control weeds. The Rutgers University Weed Specialist was there to answer the vast amount of questions on lawn weeds. It seems that the number one question of the home owner is, "How do I get rid of and keep out crabgrass in my lawn?"

To further substantiate the above facts, pollster Samuel Lubell, as written in the *Saturday Evening Post*, found that most

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Using Calcined Clay As A Soil Conditioner

By Woodrow A. Jaffee*

The very mention of "parks" and "recreational area" brings to mind lovely green lawns, spreading shade trees, and decorative flower beds. The goal of realizing these pretty pictures can be the source of many a headache for the Superintendent. Lawns and paths receive a traffic beating by the public. Existing soils for flower beds, and soils at desirable tree sites, may be compacted and drain poorly. Golf course putting greens, baseball infields, and football fields all get a heavy going-over by the very nature of their function. To sustain good grass, grow good flowers, and maintain good turf under these conditions is a viates compaction and promotes good drainage in these circumstances has been steadily winning condifficult problem. A new soil conditioner that alleverts and supporters and shows great promise of solving many soil and plant problems. This article discusses calcined granular clay soil conditioners — what they do — where they come from — how they can make life a bit easier for the Superintendent.

Calcined granular clays are composed of hard, inorganic, minueral granules roughly 1/8" wide. Physically, their outstanding characteristics are: their ability to absorb water in an amount greater than their own weight and to release the water gradually to the soil medium in which they have been placed; the ability to maintain a loose, friable, porous system in the soil without compacting; their sterility resulting from high temperature firing (calcining) in mill processing; a dependable uniformity with no objectionable foreign matter content; ease of handling; relatively low cost; and applicability to the widely occurring problems of poor drainage and compaction which are so often encountered. Clay deposits suitable for processing as soil conditioners are found mainly in the southern states. Montmorillonite for example, from Mississippi, provides the raw material for two of the best-known calcined clay soil conditioners.

The application of calcined clays to golf putting greens has become an established practice. Compaction and poor drainage can be found in one or more greens in almost any course. The installation of calcined clay into the root-zone area increases pore space., improves drainage so that water gets to thirsty roots faster, and helps rain-wetted greens drain rapidly. The presence of the hard loose granules breaks up tight clay soils and reduces compaction tendencies. The increased pore space presents a porous medium to roots so that roots can spread to reach water and nutrient. Development of deeper root system is almost a predictable result after introducing calcined clay into the green.

The calcined clay is normally applied in one of three ways. The most popular method is to aerify with a Ryan Greensaire, Westpoint, or similar machine using 1/2" spoons. The product is then spread in the amount of 50 lbs. (1 bag) per 200 square feet and raked or dragged into the aerified holes. For a 5,000 square foot green this would require 1,250 lbs. at a cost of $35 to $45 depending on the total quantity purchased. A second method is to incorporate the calcined clay as a 15% to 35% component in the

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"Americans would rather talk about lawns than about almost anything else, except perhaps automobiles. In his interview with home owners, Lubell uncovered what appeared to be a pecking order among lawn keepers. Each person within a given neighborhood knows exactly where his lawn stands in the hierarchy, and each knows immediately which is the best lawn in the block with the least amount of crabgrass.

The collective investment in grass is impressive. **There are 25,000,000 home lawns in this country covering 4,900,000 acres. Americans spend an estimated maximum of $2,892,800,000 a year just on growing and maintaining grass** in such areas as golf courses, airports, parks, highway borders, and home lawns. They plunk down more than $80,000,000 for pest killers as well as additional sums for 4,000,000 power mowers a year and some 1,000,000 tons of lawn fertilizer."

These enormous figures help to cite the fact that the American home owner is on the "Sucker List" of many firms and individuals. I have had ample opportunity to watch highly intelligent people buy, in many cases a lot of worthless products because of a lack of knowledge in this field. One of the major ways the public is being taken over is by crabgrass herbicides, which are ineffective.

I personally feel the land grant colleges have a special duty — to educate the interested home owner in the field of turf, weed control, management, etc. Naturally, there are many people who feel this type of education is the duty of a private agency.

Lawn enemies come in three categories: weeds, insects, and diseases. The Number 1 is crabgrass, for which chemists offer two methods of control. They have developed chemicals which, when spread on your lawn before the crabgrass seed germinates, kill this pest as it sprouts, but doesn't harm established grass. Such pre-emergence crabgrass killers; include chlordane, dacthal, diphenatrile, and zytron. Several arsenates, notably calcium compounds, also crabgrass seedlings and seem to have a long-term killing power, once applied.

"Post-emergence killers are designed to wipe out growing crabgrass while leaving certain desirable grasses unharmed. Two chemicals that are popular are disodium methyl arsonate (DMA) and ammonium methyl arsonate (AMA). More than one application often is necessary and directions must be followed closely to avoid damage to the permanent lawn. Only bluegrass, Bermuda, and zoysia will tolerate DMA and AMA treatment."

Before becoming more specific, I would like to point out the following important facts in crabgrass and weed control in lawns. Weeds only become a major problem in turf when the grass loses its vigor and density and cannot compete with them. Many varieties of weeds thrive under conditions that are unfavorable for the grass. Crabgrass is a serious pest in sections where high summer temperatures check the growth of grass. This favors crabgrass development. In general, most weeds in the home lawn can be prevented by proper management such as, correct watering, fertilizing, mowing, seeding, etc.

As Kingman indicates in *Weed Control As A Science,*

"Weed control alone cannot provide a beautiful lawn. Other recommended practices must follow. For example, ridding a lawn of crabgrass may leave a bare yard, unless plans are made to encourage desirable turf grasses to become established. Generally, you would find desirable turf grasses present in areas where crabgrass predominates. With the elimination of crabgrass and with enough fertilizer, grasses such as Kentucky bluegrass or Bermudagrass soon cover the area."

There are two types of crabgrass, as is cited in *Weeds of the North Central States.* First, there is the large hairy crabgrass (Digitaria sanguinalis). This is an annual which reproduces by seed. It is found in lawns, gardens, and fields, and is the most serious lawn weed in southern United States. It starts growing late, when the ground is quite warm, growing well under dry, hot conditions, and flowers in August and September.

The second type of crabgrass is the smooth crabgrass (Digitaria ischaemum). It is similar to the hairy crabgrass but differs by being not as coarse or tall, lacking hair and appearing more purplish or bluish.

The New Jersey Experiment Station has recommended zytron and calcium arsenate as chemicals for the control of crabgrass. Zytron has proven most successful as a pre-emergence herbicide for use on turf. At 10 to 20 pounds per acre, it gives excellent pre-emergence control of crabgrass. It is my belief that it will also give excellent control on foxtails, barnyard grass, goosegrass, and pigweed.

Calcium arsenate at 1 to 2 pounds per 100 square feet gives excellent pre-emergence control of crabgrass, annual bluegrass, and chickweed. Effects may last as long as one year. Naturally, this depends upon the type of soil, weather conditions, etc. This chemical is applied in granular form. If applied to moist foliage, it may cling and burn the turf grasses. It should be mentioned that arsenates are poisonous materials.

This past summer, I read about an unusual case involving a lawn treated by its owner with one of the arsenicals. His neighbor's dog ate a piece of meat found on the lawn and died. The owner was suing for the loss of his dog and wanted to be reimbursed fo his high veterinarian bill.

Professor Troll has brought out that Dacthal has proven very successful as a pre-emergence herbicide in the spray or granular form. From 8 to 10 pounds per acre will give excellent control of crabgrass, goosegrass, foxtail, smooth chickweed, carpet weed and purslane. This is also confirmed by Klingman.

Simazine has provided excellent pre-emergence control of crabgrass in common Bermudagrass, zoysia, centipede, carpetgrass, and St. Augustine. These grasses are common to the south. Common Bermuda is especially tolerant of simazine. Sandy soils are treated at the rate of 1 pound per acre and heavy soil with high organic matter content at 4 pounds per acre.

Heavy soils have more colloids to absorb than herbidices, and, therefore, it would take a higher rate of application to do the job. Also, uniform application is important.

The New Jersey Experiment Station has worked with 2,4-D for crabgrass control. If I remember correctly, this product has not been extremely successful. Dr. Henry Indyk did the research on this product.

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During the summer of 1950, Defrance and Simmons found that phenyl mercury compounds gave excellent control of crabgras in lawn turf when applied three times at the rate of 2 or 2½ ounces in 5 gallons of water per 1,000 square feet at intervals of 10 days. At these rates, the permanent grasses did not show any discoloration.

A dry formulation of phenyl mercury gave excellent control of hairy crabgrass but smooth crabgrass was not eliminated entirely by rates used in this test. With rates of 12 pounds per 1,000 square feet, no discoloration of the basic turf grases occurred.

These men also experimented with potassium cyanate and found that it provides fair control at the light rates and good control at the heavy rates. However, considerable discoloration of the permanent turf was observed shortly after application but turf injury was not of a permanent nature.

Their early experiments with sodium arsenate indicate that quite severe injury occurs on the permanent turf and does not give satisfactory control.

From these early studies, it appears that satisfactory control of crabgrass can be obtained with certain materials used in this test. This early work confirms the fact that chemical control of crabgrass is more effective when the plants are at the early stages, suc has the 2 and 3 leaf stage, than when the plants are more fully developed.

Joseph Troll, John Zak, and Donald Waddington made a comparison of several pre-emergence chemicals in 1961. Herbicides were applied to turf consisting of Kentucky Bluegrass with small amounts of bent grasses and fine-leafed fescue intermixed.

Dacthal, dry Zytron, Chlordane, Diphenatrile, and Zytron emulsion gave excellent results according to the trials at the University of Massachusetts. Calcium propyl arsonate was rated as poor.

Dacthal and Zytron gave medium injury and the other chemicals used slightly damaged or injured turfs composed of Chewing fescue, Kentucky blue, Merion, Colonial bent, Velvet bent, Creeping bent, Redtop, Tall fescue, and Perennial rye.

Arsenicals or calcium arsenate showed increased control of crabgrass upon doubling the recommended rates of application. At both rates, slight injury occurred on Chewing fescues.

Chlordane, when applied at the rate of 80 pounds of actual active ingredients to the acre, was one of the two pre-emergence chemicals that did not injure any of the grasse tested. Excellent crabgrass control was obtained in all trials. Chlordane also controls grubs, ants, cut-worms, and other lawn pests.

Diphenatrile gave excellent control of crabgrass at the higher rate of application and did not injure any of the grasses tested.

Dacthal and Zytron gave excellent results. Where bent grasses and fescues were present, some injury and discoloration resulted. Bluegrass was not affected. These results agreed with the results of other experiments in the fact that Zytron and Dacthal have proven to be excellent chemicals for pre-emergence chemical control of crabgrass.

DMA and AMA when applied according to labelled directions gave reasonably safe and good cntrol of crabgrass. Best results were obtained when the crabgrass was in the two- or three-leaf stage.

Phenyl Mercuric Acetate (PMA) has shown good control of crabgrass seedlings. It should be used on Merion, Kentucy bluegrass. Both the post-emergence arsenicals and PMA may require repeated applications for best control.

Time Magazine published a very interesting article that brought out the fact that one plant is capable of producing 50,000 seeds. According to this article, crabgrass is a gift bestowed upon us from the old world. How it arrived is still a mystery, but "the suburban affliction defined as 'a grass with creeping or decumbent stems which root freely at the nodes' sneaked in."

It is the most talked about grass in the South and has become the number one nuisance in the North.

"The great, hopeful new weapon against the enemy is the 'pre-emergence' killer, but the big question for the thousands who doused their lawns with the new chemicals is: Will they work? Five companies this year are marketing such products, most of them priced between $9 and $10 for a package covering about 2,500 sq. feet. Scott's Halts, Dow's Crab Grass Killer, Vaughan's Prekill, Pax's Crabgrass and Soil Pest Control, Swift's Rid; others, presumably with names like Unconditional Surrender and "Don't, are on the way." .

Many people are fed up with spending hard-earned money on crabgrass control.

"John Klein, a labor unionist, in Berkeley, California, got involved in a unique lawsuit. He planted his whole lawn with hardy ivy. His status-conscious neighbors decided that this was going too far, and slapped him with a lawsuit for violating a neighborhood compact whose fine print requires that lawns and gardens be kept 'in good and husbandlike manner.' None of this would have happened if he kept up his battle with the number one enemy — crabgrass."

"Crabgrass may be controlled to a large extent by management practices aimed at increasing turf vigor. A number of chemicals also offer promise for controlling crabgrass in established turf, but even with these 100 per cent control may be difficult to attain.

Post-emergence crabgrass killers, such as DMA and AMA can kill crabgrass seedlings with little or no turf discoloration, but repeated applications are required for seasonal control. Under certain conditions (high dosages and high temperature) turf discoloration can be severe. Both of these materials, and all other arsenical compounds are poisonous to man.

Of the pre-emergence herbicides tested, zytron, dacthal, and calcium arsenate have been most promising. Note these results were gotten in 1961. When applied in the fall, and particularly when applied in the early spring, these materials have provided satisfactory control of crabgrass for a full season. However, zytron and dacthal have been injurious to red fescue and bentgrass in some tests, and calcium arsenate sometimes has injured bluegrass and fescues. Uniform and timely applications are essential for best results with these materials."

As previously discussed, crabgrass is controlled by a pre-emergence, a post-emergence, and good management. The chemicals used as pre-emergence and post-emergence herbicides are usually applied as a spray or directly to the turf in the granula form.

"The average home owner uses a modern spreader that throws seed and other materials to the front and sides. Hand cranked models are inexpensive and easy to carry over the shoulder or in the hands. They do well for seeding established lawns and for over-seeding established lawns. Their capacity is small and their accuracy depends on the

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top 3" to 8" when building or rebuilding putting greens. The exact depth of the mix will be decided by local soil, mix prescription, and budget considerations. The percentage used will depend on the sand content of the soil and the amounts of peat and sand prescribed. (See table).

A third method used when aerifying is not performed is to mix the calcined clay as a 50% part of a soil-clay topdressing. Used in this way, the calcined clay again helps to speed up water infiltration, dilutes thatch and speeds thatch decomposition, serves as a leveling material for low spots, reduces surface crustings, and promotes cooling by increasing evaporation on hot days. When used in this way, about 50 lbs. per 500 square feet will be required.

Baseball infields can be treated similarly to putting greens. The incorporation of calcined clay into base line paths will make them softer, less dusty, and increase draining rates. A ½" to ¾" layer of calcined clay should be spread on the paths and rototilled into the top 3".

A number of universities have had good results from installation of calcined clay into their football fields. The goal is to alleviate compaction, increase drainage rates (particularly from rainfall prior to or during games), and to provide a root-zone medium that will help develop the deep root system necessary for good turf. Aerifying and topdressing with 100% calcined clay is recommended as discussed above. If the field is to be rebuilt, then subsoiling or plowing to break up compaction followed by incorporation of the calcined clay into the top 3" to 8" is recommended. The cutting of narrow vertical trenches filled with calcined clay has worked out well and provides quick drainage routes for surface water.

Greenhouse operators in many states have found that the sterility, neutral pH, and quick drainage values of the calcined clay makes it an excellent soil component for propagation benches, seedling flats, and container grown stock. Used solidly in propagation benches it provides good supprt for the young plant and yet permits easy withdrawal of the young plant for transplanting with minimum injury to delicate feeder roots. The quicker drainage of surface moisture reduces or eliminates algae, fungi, and damping off. Used in equal parts with sandy soil, it provides a good mix for seeding flats with more consistent germination and quicker growth. Used in 1 to 3 ratio with sandy soil in containers, it lends itself particularly well to automatic watering systems.

In flower bed applications, a 1" layer of calcined clay should be spread and raked or rototilled into the top 3" to4". Porous root-zone structure is important here to allow plant roots to spread and reach needed nutrients, to allow drainage from the root-zone of excess salt accumulations, and to allow good water and gas exchange with the surface and air. The taller, sturdier plant structure and uniformly good colors and foliage are testimony to these effects.

Application on lawns is similar to that of putting greens, with these additions: In installing new lawns the use of calcined clay in even the top 2" will promote quick establishment and sturdier lawns. After seeding, the spreading of 50 lbs. per 500 square feet will serve as a good mulch to hold seed in place, to shield the seed on hot days, and to hold a surface water reservoir for the seeds. The uniformity and loose free-flowing qualities of calcined clay lends well to large-scale use in mcehanical equipment.

In landscaping with trees and shrubs, the calcined clays can improve survival chances of new plantings and improve the root-zone layers of existing plants. In planting new shrubs or trees, place a 1" layer of calcined clay into bottom of the hole and mix 1 part calcined clay to 2 or 3 parts of soil backfill. For existing plants, spread 1" layer and mix into top 3" to 4" out to end of boughs. For large trees, dig concentric rings of holes (1½" diameter, 12" deep) and fill with calcined clay. The improved drainage and access to the surface can have startling good results on ailing plants.

As a final thought, the calcined clay has several advantages of traditional soil conditioners. Among these are: the ability of the calcined clay to maintain a stable granlar form; little breakdown of granules even after years in the soil; easy, rapid wetting; high absorption rate; and ease of handling. University test programs, field trials, and field use have been almost uniform in their approval. The calcined granular clays are standing the test of time in helping green things to grow better.

Parks & Recreation

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* Sales Manager, Oil-Dri Corporation of America

Pounds of Calcined Clay Required per 100 sq. ft.

Depth of Mix	TERRA-GREEN Part 15%	25%	35%	Conversion Table Pounds	50 lb. Bag	Cubic Feet
2"	850	1400	2000	50	1	1.5
3"	1250	2100	3000	100	2	3
4"	1650	2800	4000	500	10	15
5"	2100	3500	5000	1000	20	30
6"	2500	4200	6000	2000	40	60
8"	3300	5600	8000	5000	1000	150

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speed of the operator's feet and hands. Much practice is required to supply even patterns of fertilizers and pest controls (herbicides) over large areas.

First, many home owners using herbicides for crabgrass control injure their lawns by not following the manufacturer's directions. All herbicides are applied in rates which are calculated per hundred of thousand square feet. Many home owners do not know the size of the area to which they are applying the herbicides. Next, some lawn spreaders do not give a setting for all materials. In this case some individuals apply herbicides by guess work.

If the exact spreader setting is not given, it can be determined by applying a small measured amount of chemical to a measured area of the lawn. You would start with a small spreader opening and increase it until the correct setting is found. This setting should be recorded for future reference.

The home owner or anyone using herbicides should always understand that it is necessary to follow directions at all times.

In conclusion, crabgrass control in lawns depends largely on good lawn maintenance, including proper mowing, watering, insect control, and fertilization. Unless good turf maintenance steps are followed, no chemical treatment will effectively control crabgrass.

Chemicals should be used only to supplement good lawn maintenance — not instead of it!

**(Ted Stamens, Extension Agent from New Jersey, now at University of Massachusetts, on his Master's Program.)*

Effective Precipitation

By F. CLARK, R. SOUTHWICK, *University of Massachusetts*

Precipitation is only one phase of a constant interchange in the location of moisture between the soil and the atmosphere. This interchange is necessary to all forms of life on the earth. Hence, when precipitation occurs, there must be ways for its dispersion and distribution to the various agencies for its disposal. Man has provided none of them. He has only molded, in some cases, more exactly to his own uses what nature has provided.

Effective precipitation is a part of precipitation. This is the part that brings results in the world of nature, the part that plants rely on. The amount of effective precipitation varies greatly as there are many factors which affect the outcome. Temperature, vegetation, infiltration, and the agencies of disposal such as evaporation, transpiration, and runoff all play a part in determining effective precipitation.

Perhaps the most important of these factors is temperature. Temperature is the governing factor in evaporation and transpiration, and in some senses runoff.

Here in the humid East temperature has a strong grip on effective precipitation. It is temperature that freezes the ground in the winter and changes the form of precipitation from rain to snow and ice. With the ground frozen runoff becomes a problem, as this amount of water is lost by the plant to the streams and lakes.

Freezing of the soil surface as well as the upper soil layers reduces the rate of infiltration of winter rains, consequently, a high percentage of the rainfall runs off. Also, where winter conditions persist in cold temperate areas conditions are unfavorable for rapid percolation of water through the profile.

The snow canopy can sometimes contribute water to the soil, however. A heavy snow blanket in a forested area can reduce the freezing of the soil considerably. This snow, along with the forest canopy, has an insulating effect on the forest soil. As snow in the forest thaws much more slowly than in open or cultivated land more water can seep into the soil which will lessen runoff to some extent.

The effect that temperature can have on effective precipitation is not so noticeable in the East as it is in other areas, however.

In the East, or the Atlantic Coast region, rainfall is almost as uniform throughout the frost-free period as the rest of the year.

This uniformity is illustrated in the following table from *Moisture Requirements in Agriculture,* New York, McGraw-Hill Publishing Co.

AREA	FROST-FREE PERIOD						Total	Yearly Average
	April	May	June	July	Aug.	Sept.		
Ft. Myers, Fla.	2.1″	4.5″	8.5″	8.5″	9.0″	6.8″	39.4″	50-60″
Norfolk, Va.	3.1	3.5	5.3	5.0	4.0	3.8	24.7	48
Moorestown, N.J.	3.8	3.6	4.6	4.9	4.0	3.8	24.7	40-45
Albany, N.Y.	2.6	2.7	3.3	3.2	3.2	2.7	17.7	40
Orono, Me.	3.1	3.2	3.2	3.1	3.2	3.7	22.5	40-50

This gives the soil an abundant supply of water through the growing season.

In the irrigated regions of the West two essentials for crops, water and heat, are provided by nature at different times. Generally, most precipitation occurs during the cold non-crop-giving months, the least precipitation coming in the frost-free periods when crops can be grown.

The following table from *Irrigation Principles and Practices,* New York, 1950, illustrates this fact.

AREA	FROST-FREE PERIOD					Total	Yearly Average
	May	June	July	Aug.	Sept.		
Logan, Utah	2.3″	0.8″	0.6″	0.7″	1.5″	5.9″	16.9″
Fallon, Nevada	0.7	0.3	0.2	0.1	0.2	1.5	5.1

Infiltration plays an important part in effective precipitation. In order to be effective the water must get into the soil, and here is where infiltration plays its part.

Infiltration depends on three things mainly: the permeability or the profile, the condition of the soil surface, and the soil surface, and the soil moisture content.

The permeability of the profile can be related to the importance of non-capillary porosity. Here the amount of water that percolates through a soil profile is going to be determined by the permeability of the least pervious horizon. The soil above this least pervious horizon will become saturated with water and then this poorest permeable layer will regulate the infiltration. If this least pervious layer should be at the surface of the profile then the amount and rate of water movement to the rest of the profile will depend on this surface layer.

The condition of the soil surface has a great deal to do with infiltration; a bare soil surface can become crusted over by the action of raindrops which will cut down infiltration quite measurably. However, a cultivated surface can increase infiltration for the first fifteen minutes but then it assumes the same rate as the uncultivated soil. Vegetation can help here, for the greater the vegetation canopy and the more extensive the root system the greater will be the benefits derived from the plant for open structure. Climate influences the soil surface as freezing was discussed previously. Drying also increases infiltration as it opens cracks in the soil which rainfall can enter and increase infiltration.

The soil moisture content at the time of a storm is important to infiltration but it also brings out the amount of runoff that occurs. Runoff is important to effective precipitation, for it is here that a good deal f the rainfall is lost as far as the plants are concerned.

Runoff is usually greater from long lasting storms or from storms that closely follow each other. Here the soil becomes saturated with water and the water must go somewhere, so it becomes runoff. Runoff is very high when the ground is frozen as only a very small percentage of the rainfall reaches the soil.

Evaporation and transpiration from land surfaces vary greatly with climatic conditions.

In regions of high temperatures and high rainfall the evaporation is great — almost to be measured in terms of inches. However the evaporation from a temperate region is almost negligible from the standpoint of drainage and runoff. Even in the hottest days in temperate regions evaporation hardly exceeds .01 of an inch a day.

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Availability Of Phosphorus At Different pH Levels

By
ROY A. BARRETT AND JOHN ZAK
University of Massachusetts

Of the major elements required by plants, phosphorus is one of the most widely investigated. Diversified studies embracing laboratory, greenhouse, and filed experimentation of the phosphorus nutrition of plants in relation to soil problems, have been carried out during recent years.

According to Pierre (Phosphorus deficiency and soil fertility: Soils & Men. Yearbook of Agri., U.S.D.A., 1938), phosphorus has sometimes been called the master key to agriculture. Phosphorus has been accorded this importance due to the fact it is often the most limiting element in crop production in so far as soil fertility is concerned.

The problem of phosphorus in soils is two-fold. First, the amount is usually low, and second, most phosphate compounds are only slightly soluble.

The availability of phosphorus to plants, varies with soil reaction, organic matter content, climatic conditions, texture of soil and the capacity of different crops to absorb this substance. On account of its very unique nature, phosphorus presents a fascinating field of study.

Literature Review

Phosphorus constitutes approximately 0.142 per cent of the earth's crust and ranks twelfth in the list of elements which make up 99.6 per cent of the earth's crust.

In soils the total phosphorus ranges from about 0.01 to 0.18 per cent. Lyon and Buckman (Nature & Properties of Soil. 4th ed., 1943, pp. 22-24), state, that an average content of 0.07 per cent may be assumed for average loams and this represents 1400 lbs. phosphorus per 2,000,00 lbs. of topsoil.

There is a tendency for fine textured soils to possess a higher phosphorus content than coarse or medium textured soils due to the fact that the phosphorous minerals exist chiefly in the fine silt and clay fractions of the soil (Moodie & Smith. Syllabus per Soil Fertility. State College of Washington, Chap. VII.).

Forms of Phosphorus Occurring in Soils

There are three distinct forms of phosphorus occurring in soils (Moody & Smith):

(1) The inorganic compounds in which phosphorus is combined with Ca, Mg, Fe, Al and clay materials.
(2) The organic compounds which exist in plant, animal and microbial residues.
(2) The inorganic and organic phosphorus compounds existing in the cells of living matter.

The amounts and proportions of the different types of compounds, ions and forms of phosphorus existing in the soil are determined largely by the reaction of the soil.

Fixation of Phosphorus

Phosphorus fixation is the term applied to the process whereby soluble phosphorus is removed from solution in soils. This phenomenon has been studied ever since Way discovered its existence in 1850, but even today our knowledge of the process is still incomplete. To realize the intricacy of the problem, one can examine the statement made by Rose (Mellor, J. W. A comprehensive treatise on inorganis and theoretical chemistry Vol. I Col. III. 1823), over a century ago, "No substance offers the chemist greater difficulties than phosphoric acid. The more the behavior is studied, the more the difficulties increase. Every new investigation presents the chemist with anomalies, fresh and puzzling phenoomena make their appearance, whilst the older and already known difficulties are by no means cleared up."

About a century later, Bradfield, Bradfield, Scarseth and Steele. The retention of prosphate by clays. Trans. Third Int. Cong. Soil. Sci. 1:74, 1935) made the following statement in relation to the problem of phosphate fixation: "Natural soils contain so many substances capable of fixing phosphate, that is is hopeless to unravel the mechanism of fixation by the study of such complex systems."

Various studies have been made on the fixation of phosphorus by iron and aluminum to interpret and explain the reactions that take place between the phosphate ions and the soil. In soils where the conditions are extremely acid, iron, aluminum and manganese exist in soluble forms and if soluble phosphates are added, they are readily precipitated by these elements (Lyon & Buckman).

The increase in solubility to be anticipated from the addition of calcium may be modified or nullified by an increased concentration of calcium ion because of the formation of more soluble calcium salts through the reaction of soluble salts with calcium carbonate. This increased concentration of a common ion (Ca) reduces hydrolysis of the calcium phosphates. (Millar, Soil Fertility. 1959).

Investigative results show that minimum solubility occurs between pH 7.0 and 7.5 (Olsen. Soil & fertilizer phosphorus in crop nutrition, Agronomy, IV: 102. Academic Press N. Y. 1953) and maximum phosphorus uptake at pH values of 6 to 7 (Millar, Soil Fertility, 1959. pp. 158).

Absorption of Phosphorus by Plants

Little is known definite of the process by which phosphate ions enter plant roots, although progress has been made toward solving the problem. There is considerabl evidence that plants absorb phosphorus in the mineral form, primarily as the H_2PO_4 ion in contrast with the HPO_4 and PO_4 ions.

Phosphorus intake by plants is slow at first, increases rapidly during the period of growth and then decreases. There is no luxury consumption of phosphorus and plants do not absorb phosphorus from dry soil although they may absorb cations. Excretions from plant root cells can affect absorption of phosphorus in soils. There is considerable but unexplained difference in the ability of plants to absorb phosphorus from different chemical forms and from different soils.

Studies by various investigators of the concentration of phosphate in solution necessary for optimum growth of different plants have led to results varying from 0.2 ppm to 0.7 ppm. A high concentration of NO_3 depresses the absorption of phosphates and the phosphate ion concentration in the soil solution has a great effect on the rate of its absorption.

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On-The-Job Training

JOHN B. TRAYNOR, *Class 1964*

Every Turf major enrolled at the University of Massachusetts, Stockbridge School of Agriculture, is required to complete one full summer of on-the-job training as part of his program. In the classroom, the Turf student is taught principles, theory, and practices which he can apply to his turf profession upon graduation. However, the faculty of Stockbridge have added another facet to these classroom techniques; that is, the practical application of these principles by the student on the golf course itself.

This type of training is an experience which is part of the curricula, and is one of the most important phases of the student's life before he matriculates and seeks a position on his own merit. The time scheduled for this training is from April to September after completion of his freshman year. Of course, many students who are enrolled in the turf course at Stockbridge have had previous working experience prior to enrollment. They must also fulfill the required on-the-job-training. Practically all of the students will assume positions at a golf course, for here the turf major will be ennlightened and guided by men of high caliber and integrity; by those men who have become skilled in the art and techniques of intensive turf culture.

The turf student is asked to submit his choice for the areas in which he would like to work. Once the choice is made, the student must obtain the approval of his advisor, Professor Joseph Troll.

During the training period, the student must perform his duties robustly, ask questions, and maintain a complete daily journal of all events. After work hours there may be a session once a week for the further understanding of how a golf course is managed. This session should be composed of how a budget is prepared, or how one convinces the Greens Committee that a new piece of equipment is needed, etc. The student should also attend local Association meetings, for it is here that he has an opportunity to meet other superintendents of other courses as well as becoming acquainted with new materials and equipment; plus meeting the salesmen from whom he may purchase equipment in the future. If possible, he should attend Greens Commitee meetings with the superintendent. It is important that the superintendent provide living quarters for the student. If it is at all possible, the student should reside on the golf course grounds, so most of his attention will be placed on his work. Some relaxation must be had, for social life is as important to a person as is his work. In most cases the student is an ardent golfer and should be permitted to play golf, possibly with the superintendent if time permits. The superintendent has a very great responsibility to the student, but no less a one than the student may have. For the student is expected to work for his stipend, and be responsible to Stockbridge School for his actions, as this training is considered as part of his curriculum and the student will be graded according to his deeds or mis-deeds

It has become quite evident now, that most all superintendents attend the University of Massachusetts Turf Conference held in early March. At this time, Professor Troll is able to help students and prospective employers get together for possible assignments. Those who are unable to attend the Turf Conference may write to Professor Troll if they wish to select a student trainee for the season. Last year students completed their placement in Chicago, Iowa, Massachusetts, New Jersey, New York, and Vermont.

Of course, we must remember the student is a person, and the Stockbridge School cannot be held liable for his actions. But to date Stockbridge can be proud of its record in maintaining decency and decorum.

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Experimental Procedure

A cropping experiment was set up in which corn was grown in pots under greenhouse conditions. Air-dried silt loam was used.

Three pH levels were attained as follows:

(1) 5.3 No lime treatment
(2) 6.7 3 tons $Ca(OH)_2$ per acre
(3) 7.3 6 tons $Ca(OH)_2$ per acre

Fertilizer 10:10:10 was added at the rate of 1000 pounds per acre in solid form.

Three treatments and a check replicated three times gave a total of twelve pots.

Eight pounds of soil were put in each pot and each pot received the same amount of water throughout the duration of the greenhouse phase of the experiment.

RESULTS and DISCUSSION

53 days after planting, the plants were harvested, oven-dried and ground. The materials were then digested and the phosphorus determination made according to Seherman's system of Determination of Phosphorus.

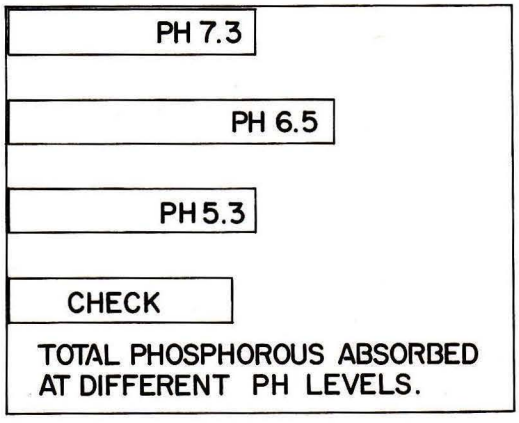
Treatment	Percent phosphorus
7.3	0.22
6.7	0.29
5.3	0.22
Check	0.199

Just following germination, there was no obvious difference in response between the various treatments but gradually the plants at a Ph of 6.7 showed their superiority.

The results seem satisfying since they are somewhat in accord with the findings of other investigators.

According to Millar (Soil Fertility, 1959) maximum uptake of phosphorus occurs between Ph 6 and 7 and minimum solubility occurs between Ph 7 and 7.5.

The result of treatment #2 at a Ph of 5.3 seems justified according to the expected reaction of acid soils as discussed earlier.



Plants Resist Water Flow, Cause Mid-Day Wilting

S. L. RAMLINS, *Soil Physicist*

Connecticut Agricultural Experiment Station, New Haven

Soil water shortages may not be the major cause for mid-day wilting of plant leaves under certain circumstances. Leaves wilt whenever the loss of water from plants into the air exceeds the supply of water from the soil. Thus, anything that limits this supply can cause wilting.

Experiments were designed to locate the bottlenecks in this water supply system, using tobacco. Tests show that resistance to water flow through the conducting or water-transporting tissue of the plant itself is sufficient to cause tension to increase in the leaves to the wilting point.

The problem is much the same as a small boy drinking through a soda straw. If the straw is bent, the resistance to flow increases and the boy has to exert more suction (tension) to maintain the same rate of flow. The analogy breaks down here, however, because plants wilt at high tension whereas small boys do not.

Water tension in plants in inferred from precise relative humidity measurements of plant tissue samples. Although soil water tension was nearly zero (about 1/100 atm.) in this study, a tension greater than 16 atmospheres (atm.) was found in a leaf subjected to drying conditions equal to that of a bright mid-summer day. This 16-atm. difference in water can be explained only by the resistance to water flow through the plant.

Water tension measurements at other positions along this plant indicate that about four-fifths of this resistance occurs within the small veins of the leaf. Only one-fifth of it occurs from the soil to the base of the leaf. Later experiments also have shown that water flow can be limited by the small veins in leaves.

These findings tell us that we cannot always depend on soil water tension to indicate the water status of plants. This is especially true when plants are losing large amounts of water into the air.

This resistance to water flow in plants also helps explain why many crops wilt at mid-day in hot dry weathe. This may occur even though soil water is seemingly adequate.

Wilting at mid-day is especially serious. It closes the leaf pores — through which the raw material (carbon dioxide) for photosynthesis enters — just at the crucial time of intense sunlight. Plant food production normally would be highest at this time. Thus, plants are out of production when they could be at their peak.

Realization that mid-day wilting could be the result of plant factors rather than soil water factors gives us hope that something can be done about it. By proper plant breeding, it might be possible to select far more efficient crops that remain turgid and use this mid-day sunlight to the best advantage.

Danger -- Poison ! ! !

The Relative Toxicity of Agricultural Chemicals

Many persons are concerned with the new insecticides and how poisonous they are to humans and other warm-blooded animals. Those selling and using these materials should be alert and realize the potential dangers involved. Purchasers of insecticides should also be warned of their toxicity and to **follow manufacturer's** directions when they mix and apply these chemicals. Even more amounts of many of the so-called "safe" insecticides and fungicides can cause sickness and even death if they are improperly used. The following table gives the amount of the actual material that will kill 50% of rats to which it is fed on a weight basis; and the amount which, when taken internally, might be considered lethal to a 150-pound man. Those with an asterisk (*) are organic phosphate insecticides.

Material	Acute Oral Toxicity to Rats (LD-50 Mg/Kg Body Weight)	Estimated Lethal Dose for 150-pound Man (in ounces)
Aramite	4,000	9.600
Chlordane	460	1.104
Chlorobenzilate	702	1.685
DDD (Rhothane)	330	0.792
DDT	113	0.271
Dieldrin	100	0.240
*Dithio (Sulpha-Tepp, Thiotep)	8	0.019
Endrin	10	0.024
Kelthane	730	1.752
Lead Arsenate	125	0.300
Lindane	125	0.300
*Malathion	1,000	2.400
Metaldehyde	1,000	2.400
*OMPA (Schradan)	18	0.043
*Parathion	3	0.007
*Phosdrin	7	0.017
Sevin	540	1.296
*Systox	7	0.017
Tedion	14,700	35.280
*TEPP	2	0.005
*Thimet	3	0.007
Toxaphene	90	0.216
Ferbam (Fungicide)	17,000	40,800
Maneb (Fungicide)	7,500	18.000
Nabam (Fungicide)	395	0.948
Zineb (Fungicide)	5,200	12.480

AS YOU CAN SEE FROM THE TABLE, IT TAKES FAR LESS THAN ONE OUNCE OF MOST OF THESE MATERIALS TO KILL A HUMAN, AND SOME ARE SO VIOLENTLY POISONOUS THAT A FATAL DOSE WOULD BE DIFFICULT TO MEASURE BECAUSE IT IS SO SMALL!

The amounts stated in the table would likely be **fatal** when taken internally. But it must be remembered that although it is rather common for these materials to be swallowed, many (such as Parathion and Thimet) are **nearly as dangerous when absorbed through the skin. Beware of breathing in these materials too!**

The effect of the organic phosphates is cumulative in the body. Since all of the phosphate insecticides act in the same manner on the system, they should be avoided if it is suspected that you have

(Continued on Page 16)

Snow Mold

By
JOSEPH TROLL
Department of Agronomy

During the winter there is a fungus disease that can seriously injure the turf areas. This disease is commonly called snow mold. It is caused by the fungus from Fusarium or Typhula species. The former causes a pink colored infection while the latter causes a gray colored injury to the foliage. Snow mold will affect all of the permanent grasses which are found in Massachusetts lawns, including Bluegrasses, Fescues and Bentgrasses.

The infection occurs in the dormant or semi-dormant turfgrass leaves, and the casual fungus is active at temperatures as low as 34°F. and often spreads rapidly under a melting snowbank or under a snow cover on unfrozen ground. The disease can be particularly severe under snow which has been compacted by foot traffic, sled runners, skis and the like. In cases where snow has been compacted by usage, the injury will usually conform to the general shape of the sled, footprint, skis, etc.

As the turf area becomes exposed to the elements, the infected area will generally show up as patchy pinkish or grayish irregular shaped areas. At times, these irregularly shaped areas of fungus growth may only superficially injure the turf, while in other instances the infection may be severe enough to completely kill the affected grasses.

What can be done?

If the grass is regularly infected with snow mold each year, the turf should be protected against such incidence by using one of the following chemicals for control: inorganic mercury, one of which can be purchased under the name of Calo-Clor; phenyl mercury acetate such as PMAS; Tersan O.M., which is a mixture of Thiuram and mercury, or Cadminate or Caddy, a cadmium containing compound. If any of these are used, follow the directions on the container and check to see if any of them are injurious to your grass species. The cure may be worse than the disease. In most instances, however, the use of chemicals is not necessary, as satisfactory control can be obtained by watching the lawn as the snow melts and by prompt vigorous brushing of those areas in which it does appear. Constantly check those compacted play areas for the signs.

Lawns which have been injured by snow mold should receive an extra application of fertilizer in early spring to encourage recovery and the filling in of weak spots. Fertilizers containing all or part of their nitrogen in the natural organic form are particularly effective in this regard.

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Transpiration is also negligible when compared to runoff and drainage. But still, as with evaporation, transpiration is the loss of water, and it has a slight effect on effective precipitation.

Not all water reaching the ground is available for percolation. In certain regions runoff and evaporation cut down the quantity considerably. It is generally accepted that 15-20 percent of the total precipitation percolates to reach ground waters. Many factors such as rain intensity and duration, the soil structure, temperature, and vegetative cover are responsible for the wide variations in effective precipitation.

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been poisoned by any one of them. Note that of the phosphates listed, Malathion is by far the least toxic; all of the others are **extremely poisonous.**

If you are using any the phosphate insecticides, **notify your family physician** to that effect and tell him you want atropine pills to keep in your first-aid kit. Always use a full-face respirator and protective clothing when applying these materials. **Don't forget the rubber gloves.** And **keep insecticides off your skin!!** If you begin to feel light-headedness, tightness of the chest, nausea, or dizziness while using these materials (or immediately after), call for medical aid and meanwhile take the atropine pills as recommended by your doctor.

Be Alert when applying these materials and notify persons purchasing and using them as to the potential danger. These chemicals are very effective for killing certain insect and fungus diseases; but they do not discriminate between these and the human being who handles them carelessly!!!

Poison Centers

The following is a list of Poison Information Centers, which supply information to both physicians and laymen, and Poison Control Centers, which have clinical facilities for treating poison cases and which supply specific information to the medical profession only.

MASSACHUSETTS

BOSTON	
Poison Information Center Children's Medical Center 300 Longwood Avenue	BEacon 2-2120
NEW BEDFORD	
Poison Control Center St. Luke's Hospital 101 Page Street	WYman 6-6711 Ext. 275
FALL RIVER	
Poison Control Center Union Hospital 300 Hanover Street	OSborne 9-6405 or OSborne 4-5789
SPRINGFIELD	
Poison Control Center Mercy Hospital 233 Carew Street	STate 8-7321
Poison Control Center Springfield Hospital 759 Chestnut Street	STate 8-4581
Poison Control Center Wesson Memorial Hospital 140 High Street	STate 5-1241
WORCESTER	
Poison Control Center Worcester City Hospital 71 Jacques Street	SWift 9-7094 or PLeasant 6-1551

NEW YORK

ALBANY	
Poison Control Center Albany Medical Center New Scotland Avenue	HEmlock 8-4541

Issued by the Cooperative Extension Service, Arless A. Spielman, Dean and Director, in furtherance of the Acts of May 8 and June 30, 1914; University of Massachusetts, United States Department of Agriculture and County Extension Services co-operating. 1/64

AMHERST — On Dec. 26, 1913, guests waded through 18 inches of snow to reach Grace Episcopal Church and the wedding of the Lawrence Dickinsons who today observe theirgolden anniversary. Marking the occasion, 83 members of the UMass Turf Management Club, represented by their president, Fred Scheying of Springfield, present a golden floral tribute to the popular professor emeritus and Mrs. Dickinson. A pioneer in the field of agrostology — or fine turf — Prof. Dickinson followed his graduation from Mass Aggie by becoming its superintendent of grounds. Moving on to lawn and golf course management problems, he organized the country's outstanding annual greenskeepers' course and gained recognition as the leading authority in the teaching of golf course maintenance. Though he retired in 1958, he has continued his interest in students, meeting informally with them often and lecturing at least once a semester to those taking the Stockbridge School's turf management major, which he started in 1947. A few days later, Leon St. Pierre and Al Allen made a presentation of an engraved bowl on behalf of the members of the Mass. Turf and Lawn Grass Council for the Dickinsons' fiftieth anniversary.

Mr. Leon St. Pierre
51 Fenwood Road
Longmeadow, Mass.

Dear Mr. St. Pierre:

Yes, I would like to join in the work carried on by the Massachusetts Turf and Lawn Grass Council Inc.

..... Please enroll me as an individual member.
..... Please enroll us an association member.

I would like more information on the Council's

..... Individual membership privileges.
..... Association membership privileges.

Name .....

Street .....

Town ..... State .....

Association .....

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Tall Fescue Control In Lawns

Perhaps your lawn, as many others, has a few clumps or spot of unwanted grasses. They may reduce the *uniformity* and *density* desired. The question is, "How may I *selectively* kill or correct?" First, check and ask until sure of proper *identification*. Second, select the best control measure *available* and *practical* for you.

Identification

Tall fescue is a clumpy, dark-green, coarse-leaved, fast-growing perennial. It is most obvious in early spring and late fall. Also, under drouth conditions it remains greener than bluegrass. It usually starts from some seed included in a mixture (more often sold in cheap, economy brands). Individual plants that survive become obvious as clumps after 2 to 3 years.

To identify, check base of clumps for large, reddish-brown stms. The new leaves are rolled in bud; the old leaves are coarse; and each leaf surface looks like miniature corrugated roofing. It tries to seed in early summer and sometimes in fall by sending up hard-to-mow branched seedheads. Some people may think it is crabgrass, but crabgrass starts from seed each spring and is killed by frost.

It's Not All Bad!

Because of its drought tolerance, rapid and all-season and perennial character, tall fescue is widely used for pasture, erosion control, sod waterways, and pond embankments. In turf it is often used in athletic fields, parking lots, rough roadsides, or other large areas where high mowing is done by rotary mowers.

In about 1953 the price of tall fescue dropped; thus, it was added to many turf mixtures. Since 1960 it is being used only in the cheap, or rough seed mixtures. Even in these, bluegrass should always be included so it can fill in around the fescue clumps. Where wanted, two selections of tall fescue, Alta and Kentucky 31, are available. General seeding recommendations as pound per acre are:

	Tall fescue	*Bluegrass*
Airports and roadside	60 - 80	10 - 20
Heavy wear and athletic fields	80 - 200	10 - 30

Wherever used, tall fescue should be more than 50% of seed mix; otherwise, avoid small percentage and even a few seeds, as other crop, in seed mixtures.

Dig, Kill or Ignore?

Let's see — you decide — look over these choices and choose your preference.

A. Just tolerate or ENJOY it

If the clumps are numerous and funds are limited — maybe it's a back lawn — maybe it's not all bad — it's green! Consider overseeding thin or worn areas again with tall fescue.

B. REMOVE it

1. If just a few clumps — maybe in front lawn, or near the picture window — rake or comb each clump towards its center to determine size and reduce digging. Then, use a shovel, sod cutter, etc., to undercut clump. Go 1 to 2 inches deep to get below the crown where thick stems start.
   a. Shake soil off the loosened clumps when it is partially dry to save soil, reseed and smooth area. Keep moist.
   b. A preferred way is to fill the holes with small pieces of sod; then firm each into place and water. This is best done in early spring, or mid-fall.
2. Consider *removing* all the infested turf, undercut 1 inch deep, discard and resod area with purchased sod. It may cost less than you think. Check with landscape and sod services.

C. WEAKEN it

To just reduce the problem, try vertical thinning, or cutting close, plus heavy fertilization. Also, let competition weaken the tall fescue clumps.

1. *By hand* — by simply chopping into each clump the long leaves, seedheads and old stems may be greatly reduced. Use a knife, a shovel, anyway to get criss-cross slicing. Repeat monthly for one—two years—a manicure!
2. *By machine* — Ask at landscape, rental or major equipment supply sources for motorized vertical mowers. At least a dozen brands are available somewhere in the U. S. The vertical blades or tines on these either cut, pull, or comb out old hatch, long leaves and creeping grasses. Best time of use is mid-fall, but repeated monthly use on tall fescue clumps will reduce vigor and weaken clumps.

D. CHEMICAL KILL?

Not much encouragement here. The large stems with rolled-in-the-crown buds are well protected and difficult to kill. Surface treatments normally only kill the exposed leaves. Do read the labels *twice* before trying anything.

1. *Dalapon* — 4 pounds active/acre may kill the tall fescue clumps treated, but would cause spot yellowing for months and damage adjacent grasses — not recommended. Delay seeding 1 month.
2. *Amino-triazole* — 2 pounds active/acre could kill, but for weeks every white, discolored area would be obvious — not recommended. Delay seeding 2 to 4 weeks.
3. *Paraquat, Diquat, Endothal, Cacodylic acid.* These may kill surface plants — bentgrass, nimblewill, crabgrass, etc. — but don't work well on tall fescue. They would just burn foliage and disfigure the lawn, but need repeat use for best results so their use is discouraged for novices. Overseeding can be done the next week after using most of these.
4. *Sterilants (Volox, Methyl bromide, Vapan, etc.)* when used properly kill everything; may serve in special cases to kill all; then, later reseed onto the best seedbed possible. All these require plastic covering and can damage trees having any roots in area.

As a rule, lawnmowers should realize chemical killing by spots may disfigure and reduce uniformity for such extended times that it is questionable.

E. AVOID NEW INFESTATION

When overseeding, avoid cheap, or economy seed mixtures which may contain some tall fescue as Kentucky 31, or Alta, in them.

Of these five ideas, maybe one can help you to improve, or enjoy your lawn. Continued research is needed on tall fescue control. The difficulty is indicated by the limited suggestions above.

Clumps of bromegrass, timothy, orchardgrass—any bunchgrass—would offer similar control problems.

(Midwest Turf, News and Research, Lafayette, Ind.)

BETTER TURF THROUGH RESEARCH AND EDUCATION

MASSACHUSETTS TURF AND LAWN GRASS COUNCIL
INCORPORATED
51 FENWOOD ROAD, LONGMEADOW 6, MASS.

TROLLING

Why Attend A Turf Conference?

By RAY JENSEN

"Spring has sprung," as someone has said, and with the advent of spring all of us begin to make new plans for you as greens superintendent. However, this season doesn't mean an awakening from dormancy and starting to work as with some occupations, as your job requires constant alertness 12 months of the year. It is necessary, though, that you direct your attention to different areas and make yourself aware of problems inherent to spring and correct them before they arise.

For example, how am I going to gracefully push out that winter grass I tried so hard to establish last fall? How best to cope with traffic problems which come with increased play during this season? How am I going to prevent destructive insect and disease attacks common to warm weather before they occur? What is my fertilizer program for the year going to be and is there room for improvement over last fall? Do I have the best grasses available on my course or am I throwing good money after bad trying to maintain a second or third best? How can I most easily correct this? What am I going to do about those weeds which can wrap up my course overnight if not properly controlled?

The man who professed to have all the right answers to all questions such as these would be vain indeed. There are, however, a number of men who have the best answers to one or more of them. No doubt your experience has taught you the best answer to some question many other men are asking. By gathering together yourself and others with special knowledge at turf conferences, we can often come up with the best information available on the question most commonly asked.

(Southern Turf Newsletter, Vol. III)

Take Time to Think
It is the source of power.

Take time to Play
It is the secret of perpetual youth.

Take Time to Read
It is the fountain of wisdom.

Take Time to Pray
It is the greatest power on earth.

Take Time to Love and be Loved
It is a God-given privilege.

Take Time to Be Friendly
It is the road to happiness.

Take Time to Laugh
It is the music of the soul.

Take Time to Give
It is too short a day to be selfish.

Take Time to Work
It is the price of success.

(Squibb Nurses Notes)