G. J. NOER

SUMMARY OF PROCEEDINGS

ANNUAL CONFERENCE OF THE

MID-ATLANTIC ASSOCIATION OF GOLF COURSE SUPERINTENDENTS

Under the Auspices
of the
Extension Service - University of Maryland

Holiday Inn-Downtown
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January 6 and 7, 1969

INDEX

ANNUAL CONFERENCE OF THE
MID-ATLANTIC ASSOCIATION OF GOLF COURSE SUPERINTENDENTS
HOLIDAY INN-DOWNTOWN, BALTIMORE, MARYLAND
JANUARY 6 AND 7, 1969

Summary

With approximately 200 in attendance the annual conference of the Mid-Atlantic Association of Golf Course Superintendents was called to order by Dr. George S. Langford, State Entomologist, University of Maryland. He observed the Mid-Atlantic Association had for more than 40 years been pioneering for the betterment of turf. He said that according to historical notes prepared by Dr. Ernest N. Cory, the Mid-Atlantic was conceived when Reg Giddings, Dick Scott, Bob Scott and Oscar Pitts got together at Columbia Country Club and worked out tentative plans for an association. The first meeting was at the New Howard Hotel in Baltimore. Following the call to order, President George Cleaver introduced Dr. Frank L. Bentz, Jr., Vice President for Agricultural Affairs, University of Maryland who brought greetings from the University of Maryland.

Special events during the conference were a luncheon and a banquet. At the luncheon Dr. Gordon M. Cairns, Dean of Agriculture at the University of Maryland outlined the educational programs at the University of Maryland available to young people interested in turf work. The principal speaker at the banquet was Tom Mascaro. He entertained with slides and humorous commentary depicting "happenings" on golf courses. At the awards ceremony, Angelo Cammarota, Green Superintendent at Bonnie View Country Club, Baltimore, was named "Superintendent of the Year" and was presented with a plaque. Angelo was selected for "the way he maintains his own golf course and his relations with the club's professional staff, green chairman and his fellow superintendents." In making the presentation, George Thompson, Superintendent of the Columbia, Maryland Country Club, saluted Angelo on behalf of the Mid-Atlantic Association for his devotion to the advancement of the green superintendent's profession. A $300.00 scholarship award was presented to William Thomas Ramsberg, 3rd on behalf of the Golf Course Superintendent's Association of America. The presentation was made by Bob Shields, Superintendent of Woodmont Country Club, Rockville.

Newly elected officers were also installed at the banquet. Robert C. Milligan Superintendent of the Gunpowder Country Club, Laurel, succeeded outgoing president, George Cleaver of Chestnut Ridge Country Club, Baltimore. Russell Kerns, Woodholme Country Club, Baltimore was installed as vice president and Edward Dembnicki of Indian Spring Country Club, Silver Spring, was named Secretary-Treasurer. Directors for 1969 are: Lee Dieter, Washington Golf and Country Club; Bert Yingling, Beaver Creek Country Club, Hagerstown; J. Paul Barefoot, Soldiers' Home, Washington; George Thompson, Columbia (Md.) Country Club; Robert C. Miller, Suburban Country Club, Baltimore; Dennis McCammon, Springfield (Va.) Country Club and Past President George Cleaver.

Under a topic entitled "The Need for Basics", Bob Shields, Superintendent of Woodmont Country Club, Rockville, led a provocative discussion. With slides and commentary he reviewed a number of serious problems he had encountered during the summer. It was a consensus that those in attendance gained much from the experiences that Bob shared with them. Mr. M. H. Day,, Supervisor of Seed Inspection, Maryland State Board of Agriculture, talked about some of the things to look for on the seed tag. He cautioned buyers to check all labels so they would know what they were paying for.

The Conference was closed following an excellent resume of the educational papers by Angelo Cammarota.

GREETINGS FROM THE UNIVERSITY OF MARYLAND
DR. FRANK L. BENTZ, JR.

On behalf of the administration of the University of Maryland and, in particular, the Agriculture Administration, I bring greetings and a warm welcome to this Annual Conference. We in Agriculture are pleased to have the opportunity to work with you in problems related to the production and management of turf and ornamental plants and to assist your part, if I may call it that, of the Agricultural Industry of the State in any way that we can.

It may seem strange to think of golf courses and agriculture in the same breath. What do you picture in your mind when the word "agriculture" is mentioned? I judge the thoughts of most of you will be of a herd of cows, or a field of corn, or an apple orchard, or perhaps a field of tobacco. And I would also bet that many of you may think of agriculture as of little importance in Maryland. I'd like to take just a few minutes to try to change that image.

Yes, Agriculture is farming. Farming on 20,000 farms involving about half the land area of the State; providing jobs for nearly 40,000 workers on farms; with cash farm sales of over $300,000,000 annually.

Yes, Agriculture is farming but it is a far more complicated kind of farming-big business requiring far more in the way of managerial skill - cow herds of 100-250 cows, grain farms handling 1000-2000 acres of corn and soybeans, broiler growers handling 5000,000 birds annually with modern efficient mechanized broiler houses; integrated broiler operations providing chicks, feed, fuel, medications, processing and selling the finished birds - owning feed mills with millions of bushel capacity. To run these operations we need farm managers, herdsmen, crop production specialists, fieldmen for fertilizers and feeds, plant supervisors, technicians to name a few.

But when you think of Agriculture do you also think of the industries directly associated with agriculture? What about the farm chemicals industry - fertilizers and pesticides in particular? The farm equipment industry, the food processing industry, the nursery industry, the turfgrass industry, golf courses, plant and animal disease and pest control, home horticulture including sales of seed, fertilizer, chemicals, plants? All of these are Agriculture. These industries provide jobs for 137,000 workers and together with farm sales contribute about $1,500,000,000 annually to the economy of Maryland - about 15% of the gross income of our State.

The nursery and green house industry in Maryland includes over 270 establishments and sold products valued at over $12,000,000 in 1966. Approximately 100 farmers or firms are producing about 50,000 acres of turf. As you well know, there are 150 golf courses in the State. There are over 5000 establishments in Maryland selling seed and often other farm equipment and supplies ranging from the corner grocery to hardware stores, supermarkets and highly specialized seed stores.

My message is that Agriculture is important in Maryland - one of our State's largest industries - and it will continue to be important for years to come. It is important that the people of our State understand the contributions of Agriculture and support the needs of the agribusiness industry. Our job in Agriculture at the University is to serve that industry by providing research and education programs related to agriculture, home economics, 4-H & youth, and community resource development. We also have the task of providing the trained people needed by the industry. In this respect I want to point out that we need more good students in Agriculture. The opportunities for employment are tremendous and we are not able to meet the requests for agricultural graduates. We are making serious efforts to interest more students in agriculture and hope in a few years to make some significant progress.

The scholarship assistance provided by your Association is most helpful in interesting students in the turfgrass area. It is this kind of assistance that we need as well as your own personal efforts to let students know of the opportunities available to them.

May I express my thanks for the opportunity to meet with you this morning and say that we look forward to a most successful day tomorrow.

THE PRESIDENT'S MESSAGE

GEORGE CLEAVER
SUPERINTENDENT, CRESTMONT RIDGE COUNTRY CLUB

Dr. Langford, Dr. Bentz and fellow superintendents: It is a pleasure to extend greetings to you on behalf of the Board of Directors and members of the Mid-Atlantic Association of Golf Course Superintendents. I wish to thank our Program Committee and especially Bob Milligan, the chairman. I also want to recognize the cooperation of the University of Maryland through its staff of turf experts, Dr. Beal and Mr. Hawes, and particularly recognize the untiring help that Dr. Langford has given us in putting this conference together for many years. But there is more to a conference than finding speakers and printing a program. The important part of a conference is you - the people who attend.

Turf conferences such as this one, the first of the year, are just one of a series of local meetings throughout the year and serve the purpose of bringing together the various groups for sharing or discussing mutual problems, and this develops a more relaxed freedom of expression between men in the practical field and those in scientific research. I feel this sharing of technical and practical knowledge is the keystone to the continued progress of our profession. Speaking of meetings, Jones was asked why he didn't join in the discussion. He replied, "I learn more by listening. Anything I would say, I already know."

Gentlemen, this is January 1969. As people react to this fact they will fall into two groups. One group will say, "This is a new year!" The other group will remind us that "another year is before us" or "another year has gone." It sounds like they are expressing the same thing. But I don't think they are. To one group the New Year brings another chapter of adventure and experience, new challenges that lie ahead and new accomplishments. Like a well trained hunting dog ready to go. To the other group, "another year has gone and in its place there is another year to face." Ahead looms unsurmountable drudgery, increasing problems, the same dull repetition. We see and hear new experiences and adventures everytime we attend a conference. We don't have time to experiment with everything ourselves so we should attend these conferences to keep up with the times. People today are astronaut-minded. When Johnny is told that his grandparents are taking a trip around the world, he asks, "How many times?"

There is a saying - "Have tomorrow's mind instead of yesterday's." "You can't do today's job with yesterday's tools and be in business tomorrow;"which means we must all strive to keep abreast of times with modern methods of operation and modern equipment and materials which enable us to increase our efficiency wherever possible. I remember Frank Dunlap saying, "To accomplish something, you must start and then there are only two ways a golf course can go - forward or backward!"

Use the Positive Approach. You have heard people say, "Don't worry about it. You can't get out of this world alive." "Think like a man of action and act like a man of thought". "The shadow is always behind the man who walks toward the light." These can be nothing less than positive approaches to the job that we have at hand.

I don't feel that there is a way of definitely comparing the standards of golf courses today with those of several years ago. As I said in one of the Newsletters, basically the golf course looks the same in the fall as it did in the spring. It's hard to explain this to the green committee. But I do think the standards of golf courses have improved a great deal through the superintendent's efforts and the turf conferences. Mr. Evans, past president of Delaware Golf Association said that the Delaware Turfgrass Association has accomplished more in two years than it has in sixteen, which is an indication of the success of the superintendent's work.

We have been speaking about scientific research; what this herbicide will do or what that fungicide will control. With all of this research, we cannot overlook the simplest thing in our search to get an answer to our problems. As an example, I talked with a superintendent having trouble with a green. He thought perhaps it might be air circulation and wondered how long it had been since he trimmed the trees and shrubbery. Upon checking his records, he found it was eleven years ago. This explained why he was having the same trouble that he had before. Eleven years passes like eleven days when a fellow is busy on the golf course. Good reason for keeping records.

Basic research is essential. We will hear more about "Back to Basics" later. One thing I would like to say here is that the soil is basic and fundamental in the successful growth of plants. The golf course itself is basic to the Country Club. Not long ago I heard about a club manager telling the superintendent to do something to the greens so the steaks will taste better. No golf course superintendent can afford to remain static in his professional development. Progress must be his incentive or ultimately he will fall by the wayside.

Now, gentlemen, have a good time and enjoy yourselves.

DEW IS NOT DEW

by

TOM MASCARO
WEST POINT PRODUCTS CORPORATION

Dew on turfgrass areas is not dew. Most of the commonly called "dew" is in reality exudated water or guttated fluid exuded from the open stomata of the grass blades or from the clipped ends. Very little research has been done on the origin, composition or effects of exudated water, yet there is much evidence that it has a profound effect upon turfgrasses. Many theories have been presented but few have been documented by resource research. It is my hope that this discussion will stimulate research people and others to delve into this fascinating and important subject, and that the turf man who studies the following presentation will better understand some of its mysteries and how to cope with its effects through cultural practices.

The effects of exudated water apparently first received recognition when the United States Golf Association over twenty years ago conducted a survey among member clubs relating to the incidence of disease on putting greens. One conclusion that was drawn from the survey was that the golf courses that practiced early morning watering had less disease than those that did not. No one understood why but this practice worked and through the years has been adopted by many superintendents. The practice of early morning watering must, in some way, be related to exudated water but its function is not too well understood.

Although we have made great progress in the science of turfgrass culture, a great deal of mystery still surrounds some of the problems we encounter.

These words indicate a mysterious set of circumstances of which no one is quite certain.

I suspect that many times we blame disease for loss of turf for lack of a better answer. We have special names for these problems; like, "melting out," "wilt," "spring dead spot," and even "summer dead."

Turfgrasses seem to die out overnight. Diseases strike and become uncontrollable. It seems to me that there must be an answer to why we lose control and turf is severely injured or lost.

Great progress has been made in the development of fungicides. They are of tremendous help to carry us through critical periods. Yet they fail us under certain conditions. Note these three words: Under Certain Conditions.

Another great mystery to me is why more basic research is not being done on why these problems occur in the first place.

Aspirin is great, but it seems to me that it is mighty important to know why we have a headache. Therefore, in this discussion, I will discuss more the why rather than the cure.

During my many years in this great turfgrass industry I have seen and photographed many problems. I have been particularly fascinated with the mysteries of the effects of turfgrass loss.

I have been deeply disturbed when men who were good turfgrass managers lost their jobs because they failed to keep their grass alive under certain conditions. Feeling that there must be an answer, I listened to many theories and studied the research literature for any clues that could be pieced together.

The evidence I have accumulated seems to indicate that there are many factors that can be related to this problem. One of these factors, however, apparently has a pronounced affect as to why turf diseases occur and is the least understood. This factor is exudated water.

Exudated water is surrounded by mystery. It is not even called by the same name by different people. Some call it exudated water. It is referred to as exudate water. Others will call it guttated water, water of guttation, or guttation fluid. Still others say it is water of condensation. Children call it "fairy rain" but most of us call it "dew."

Many people have talked about dew, much has been written about it, not much is known about it, and what is known many times is full of misconception.

I would like to quote from the following article that was published nationally a few years ago:

"What Causes The Dew To Fall?"

"Have you ever wondered why there is dew some nights and not others, why nights but not days, why on some parts of the lawn but never on others, or what dew is?

Poets have called dew "nature's water jewels." Children see it as "fairy rain." The meterologist says, "the air got too cold to hold all the moisture---the excess fell to earth."

Three requisites are essential for dew to form---moist air, a cold surface, and a clear sky. If clouds gather, dew ceases to fall. If tree foliage overhangs the lawn, effect is like a cloud and dew does not collect.

But when the day has been brightly sunny and the night turns real cool, conditions are right for a copious fall of Dew. Next morning you will discover that the very smallest grass blade has not been neglected. It will be dew-laden and an object of beauty.

Frequently a leaf will have a single large dewdrop, clear as a diamond, deposited at the very tip of the blade. Sometimes two or even three large drops will be held suspended, while upon the extreme sharp edge of one or both sides of the blade there will be a collection of small, bead-like drops in orderly, precise fashion. When the large dewdrop perched upon the tip of the grass blade starts to fall, it descends rather slowly at first, following the extreme edge of the blade as it slides down and joins up with the other dewdrops it encounters strung along the edge of the leaf. Eventually the combined drop becomes heavy and falls to the soil.

Dew can provide a valuable addition of moisture for your lawn."

Much of this article is misleading, yet it says what most people think about dew.

The so-called "dew" we see on turfgrasses is largely exudated water. It doesn't fall, it rises. Most of it is water exuded or "pumped" out of the plant.

Light and temperature affect this process. During the night with lower temperatures and lower evaporation rates the exuded water accumulates. Apparently through the process of osmosis root pressures build up to force water out of the hydathodes. During daylight hours with higher temperatures and more rapid evaporation the reverse takes place. A few investigations have shown that the plant system is under tension and water can be taken in by the leaf. If the evaporation rate is low during the day, however, exuded water will remain and sometimes continue to form.

Perhaps the reason so called "dew" does not form under trees is that the soil is drier and water is not present to be exudated. We know that there is a definite relationship to the amount of exudate and the available soil water.

Close observation will show that the orderly, precise arrangement of the dr droplets is due to the location of the hydathodes and that the single large droplet at the tip of the blade is much larger than normal if the blade has been cut. These are facts and have been documented by a few research scientists.

Here is what these men had to say about turfgrass disease and exudated water...

J. K. Wilson
1923

"Exudate contains both organic and inorganic materials." The organic materials suggest exudate water may have a similar composition to that of the plant sap. Hydrogen ion concentration is almost the same as the sap. As plants become older the exudate becomes more acid.

A substance (sugar enzymes peroxidase, reductase, or a combination of them) suggests that nitrates which are taken up by the plant are in part reduced to nitrites as they pass up through the plant tissues, and that this reduction may continue for some time after the water has been exuded.

The organic material that is present in exudate water seems to be easily utilized by bacteria.

Turfgrasses exudate water at different rates depending on the species. This is easily seen on turfgrass areas of mixed grasses. The exudated water is much heavier on some than on others.

The bentgrasses, bermudagrasses, and poa annua are prolific pumpers; bluegrasses are medium pumpers, and the fescues and zoysiagrasses are the driest or pump the least.

G. M. HOFFER
1949

Hoffer's Theory:

When turf is well fertilized with a quickly available nitrogen, the guttated water contains a high concentration of nitrates. The nitrate salts cause a chemical burn on the grass leaf. The destroyed cells are then decomposed by bacteria to available organic matter.

The Fungal spores germinate and sustained by the organic matter. If a great

deal of thatch exists, some of the guttated water is absorbed and held. When optimum temperature and moisture exists, fungus growth starts in the thatch and quickly spreads to the grass blades at the surface.

If the soil is compacted, this will restrict the infiltration of guttation fluid and a dangerous concentration of nitrates are held at the soil surface. This concentration of nitrate salts will cause a chemical burn of the plant stems and pave the way for fungus growth.

If a turfgrass area is well fertilized with a quickly available nitrogen and the exudated water is collected and poured in one spot, a severe chemical burn will result.

Engel
1955

"Very acid soil conditions favor most of the turf diseases."

"Tender succulent grass, which has received an excess of water and nitrogen, is susceptible to most diseases."

"While high humidity contributes to the softness of grass, it also may aid growth of the fungi."

"Air movement has a great influence on humidity as well as tempreature at the turf level."

Large Brownpatch	77 - 86°F
Pythium	93°
Copperspot	81 - 86°
Dollarspot	68 - 86°
Pink Patch	65 - 73°

Early morning watering rather than evening has been found to keep turf more free of disease.

Lime to maintain pH above 6.0.

R. M. ENDO

1967

Guttated water is the fluid exuded from the fixed, open stomata located at the tips of the grass blades. When drops of guttation fluid are placed on the leaves of seaside bentgrass and threads of dollar spot fungus are added to the droplets, the threads grew sparingly to well and caused a variable amount of infection. When water was used, the fungal threads grew very sparingly and failed to cause any infection.

When bentgrass seedlings were sprayed with spores of Helminthosporium sorokinanum suspended in guttated water, the plants developed very severe symptoms on 99% of them in 2-4 days. Nearly all the seedlings were dead after 6 days.

Plants inoculated with spore - tap water suspensions developed water soaking, yellowing and necrosis on 10% of the plants in 6-7 days---all plants survived after 14 days.

Guttation water increased infection and disease. It induced acceleration and increase in spore germination.

One can readily see, from the research work done by these scientists, that exudated water and disease occurrence are inter-related.

Many golf course superintendents have contributed much to the practical aspects of this problem. Although most were not trained scientists, they did possess a green thumb and an intuitive sense that enabled them to do the right thing at the right time. To mention a few, Carl Bretzlaff, Golf Course Superintendent, who was at Meridian Hills Country Club in Indianapolis, would use a drying apparatus on his greens when disease weather was upon him. The rig consisted of several layers of burlap fastened to an axle mounted on wheels and hand pushed over the "dew" laden greens. He always kept his greens dry and along with the use of fungicides never had any trouble.

Joe Valentine, Golf Course Superintendent of the famous Merion Golf Club in Ardmore, Pennsylvania, relied on the use of hydrated lime "to change the pH and dry the greens" is the way he put it. He would use 5 to 10 lbs. of hydrated lime per 1,000 sq. ft. at three to four week intervals during "brown patch and dollar spot weather."

Jimmy Comito, Golf Course Superintendent at Huntingdon Valley, Pennsylvania, relied on severe dragging of the greens during periods of heavy "dew" and disease weather. "Dragging the greens breaks up all that mold," he would say, "as soon as the mold starts up again, drag it some more - keep the greens dry too."

Marshall Farnham, Golf Course Superintendent, Philadelphia Country Club, firmly believed in early morning watering during the many years that I knew him. I cannot recall his experiencing any difficulty holding grass on his greens. Trained in plant breeding and having graduated from Cornell University, he was well versed in the science of turfgrass culture. I always felt that he related exudated water with the incidence of disease and although neither of us had a pat answer, we agreed that dilution of exudated water with early morning watering was a good practice.

Oscar Bowman, Golf Course Superintendent at Worham Country Club, St. Louis, Missouri, when he was superintendent at Algonquin would say, "top dressing does more to prevent and control disease than anything else." A firm believer in top dressing, he has always relied on this important cultural practice and its value is reflected in his superb greens.

Other golf course superintendents, too numerous to mention, had, I have found, a number of things in common with these men. First, they all had a "green thumb," that is the natural ability to get plants to grow. Second, they all practiced good cultural methods, making sure that everything was in balance, and third, especially during critical disease periods, they used methods that more or less kept the turf dry. Without knowing about exudated water, they sensed that there was a definite relationship between heavy "dew" and disease.

Another factor which should be brought out in this discussion of exudated water is the strong possibility that turfgrasses are also injured and perhaps killed by accumulated salts carried in the exudated water.

Marloth in Egypt in 1887 found salts on the leaves of tamarix as the result of exudated water residue. Lepeschkin in 1906 found glucose and basic oxalic acid. Klein in 1913 found that on some plants nitrate salts were deposited on the leaves as residue from exudated water.

Marloth reported the following after collecting the salts from the leaves and stems. The dry salts consisted of:

51.9% $CaCo_5$ - Calcium Carbonate

12 % $MgSO_4H_2O$ - Magnesium Sulphate

4.7% $MgCl_2$ - Magnesium Chloride

3.2% $MgHPO_4$

5.5% NaCl - Sodium Chloride

17.2% $NaNO_3$

3.8% Na_2CO_3

We know that plant injury will occur when a high concentration of salts is present in the soil solution. Seeds are also affected. It has also been shown that injury will result by all soluble salts whether they contain plant nutrients or not. If we look at some of the fertilizing materials used on turfgrasses, we find that many have a high salt index:

MATERIAL	SALT INDEX
Nitrate of Soda	100.0
Calcium Nitrate	72.8
Ammonium Sulphate	53.7
Nitrate of Soda Potash	51.2
Ammonium Nitrate	49.3
Muriate of Potash	39.9
Urea	26.7

MATERIAL	SALT INDEX
Potassium Nitrate	20.1
Sulphate of Potash	14.1
Ammonia, Anhydrous	9.4
Diammonium Phosphate	7.5
Super phosphate, 20%	6.4

The salt index of a fertilizer indicates its relative tendency to cause seedling injury or crop burn.

Marloth's work seems to support the theory that exudated water containing a high concentration of various salts can cause injury in one of three ways or in combination. One, as the exudate forms and the water evaporates, the salts accumulate on the leaf. When these salts reach optimum concentration, they cause a leaf burn. Secondly, if the exudate falls and is absorbed by the thatch and held there, plant stems can be injured or burned when the salt concentration reaches a toxic level. Thirdly, if the exudate is washed into the soil root zone and high concentration of salts is formed in the soil solution, then root burn and injury can occur.

Summing up all of this foregoing information, we can form a theory which should be carefully investigated.

THEORY

Turfgrasses can be injured or killed from the effects of exudated water under certain conditions.

Exudated water is the result of the natural biological function of grass plants. It is the result of normal transpiration and is a continuous function of normal healthy plants. If normal exudation is stopped or retarded in any way, the grass plants may suffer.

Exudate water is formed on the leaf at the open stomata along the sides of the blade and at the tip. If the grass blade is cut and open cells are exposed, exudation will be profuse in this injured area.

Exudated water evaporates as it forms during periods of low humidity. It accumulates during periods of high humidity. Humidity levels are always much higher in the micro zone where grass grows. (The micro zone can be considered to exist from ground level to the level of the grass mowing height.) Exudated water has the same pH as the plant sap and soil water. It contains all of the nutrients available to the plant. If tests of exudated water are made for the determination of N P K and other elements, the results will show only the nutrients the plant is picking up. Low or excess nutrients will be present in the exudated water.

When exudated water evaporates, the solid portion contains salts and other substances.

If the exudated droplets remain undisturbed and evaporate while on the leaf, the remaining salt, etc., will accumulate.

If the pure exudated water droplets contain a high concentration of nitrates and fall to rest on the flat surfaces of lower leaves, burning of the live tissue may result. If the pure exudated water droplets fall into a thatch layer, under certain conditions the exudate will be absorbed by the thatch. Research has shown that thatch can and does absorb and contain toxic substances that cause severe injury to turf.

Exudated water when diluted with irrigation water becomes harmless provided the diluted exudate is washed into the soil water. If the soil beneath the turf is open and porous, this process is facilitated. If the soil is hard and compacted, the salts from the exudated water will be held at the soil surface. When the concentration of salts reaches toxic levels, burning of the stems may occur.

If the soil surface is compacted and relatively impermeable to water, the exudated water that falls may with irrigation be carried along the soil surface and concentrate in pockets and small depressions causing injury of an uneven nature. This same process may occur in thatch. Concentrated salts from exudated water may be washed out of the thatch into low lying areas or pockets causing damage there.

Exudated water contains the proper nutrients to support bacterial activity.

Turfgrass diseases thrive on the nutritive content of exudated water. Dr. Endo has shown that the mycelium of the fungi penetrates the droplet for nourishment. Mycelial growth is greatly accelerated when exudated water is available.

Accumulated exudated water held in the thatch and the soil surface is a perfect nutritive medium to support fungal growth.

Exudated water, according to Dr. Endo, will increase infection and disease. It will also accelerate an increase in spore germination.

Exudated water is produced at different rates and this seems to be determined by a number of factors.

1. Grasses of different species apparently because of their biological structure have the ability to exudate water, each at a given rate.

Among the popular turfgrasses, their exudating rate can be shown as follows:

Bentgrasses - high

Bermudagrasses - high

Poa Annua - medium high

Bluegrasses - medium

Fescuegrasses - low

Zoysiagrasses - low

The rates at which these grasses exudate water can be directly related to the incidence of disease.

The bentgrasses and the bermudagrasses are highly susceptible to many diseases. The bluegrasses are moderately susceptible. The fescuegrasses and zoysiagrasses are the least susceptible and, of course, are the driest of the grasses.

Soil water, which is available to the grass plant, also is a determining factor as to the amount of exudated water.

Temperature and rate of growth, depth of root system, and frequency of cut, all play an important part relative to the amount of exudated water.

Wetting agents that apparently stop the formation of "dew" in reality only reduce the surface tension of the droplets. They cannot adhere to the grass blade and run off as they form. This may have some beneficial effect although accumulation of salts could still occur in thatch and at the soil surface.

Some of the foregoing statements are fact, some theory. Needless to say, there is enough evidence on the relationship of exudated water and turfgrass problems that this whole subject should be thoroughly and scientifically investigated. Unitl we can get the answers to some of these aspects of exudated water, we must continue to grow turf as best we can. Following is a suggested approach by H. B. Musser.

H. B. MUSSER

TURF MANAGEMENT

Conditions favoring fungus diseases:

1. Moisture
2. Temperature
3. Soil acidity
4. Soil fertility
5. Matted turf

Cultural practices:

1. Provision for adequate surface and subsurface water drainage.
2. Good air circulation over greens.
3. Correction of surface compaction with suitable aerating tools.
4. Modification of heavy soils by a program of aerating and top dressing to build a porous layer.
5. Adjustment of soil reaction to pH 6.0 or higher.
6. Use of the more slowly available nitrogenous fertilizers in quantities that will produce normal growth without overstimulating.

7. Provision for a constant supply of available phosphate, potash, and trace elements.

8. Adjustment of watering practices to provide as long intervals between applications as practicable. Continuously saturated turf must be avoided.

9. Elimination of matter or spongy turf.

WHAT to do during periods of stress:

1. Practice early morning watering. (This dilutes the exudated water and dries green before mowing.)

2. Use sufficient water to wash exudate into the soil. (Possibility of salt accumulation is minimized.)

3. Use high pressure and direct stream directly into turf. (The fungi mycelium can be mechanically destroyed at least temporarily by the force of the water.)

4. If a disease attack seems uncontrollable, drag mat the green in two or three directions, then mow. (This will mechanically destroy the mycelium of the fungi at or near the surface of the turf.)

5. If severe thatch is present and fungicide will not control the spread of the disease, try light vertical mowing. (Verti-cutting will mechanically destroy the fungi mycelium.)

6. Top dress lightly. (Top dressing does something to turf for which no substitute can be found. It will mildly stimulate the turf, dry it somewhat to help retard fungal growth.)

7. Lime
(If disease is rampant, dust with 5-10 lbs. of hydrated lime per 1000 sq. ft. at 3-4 week intervals. Although this amount of hydrated lime is small, care should be exercised when applying it. Grass must be dry or a burn will result. Apply after exudated water has evaporated. The hydrated lime should not be watered in, but left to remain on the turf until the next watering.)

In closing, I hope that I have stirred your imagination. There is too much evidence to ignore the possible effects of exudated water on turfgrass problems. On the other hand, we lack documented evidence about the cause and effects of so called "dew."

Research is not the exclusive domain of the scientist, it is also a part of the practical man's job to be inquisitive, to study, and to experiment with cultural practices, to help supply some of the answers.

Even if we cannot prevent some of these problems from occurring, it would be comforting to know why the grass died.

TRENDS IN GOLF TODAY

by

HARRY C. ECKHOFF
NATIONAL GOLF FOUNDATION

The phenomenal increase in public golf facility development in recent years is positive indication that golf is the nation's fastest growing competitive outdoor sport. Golf is a game now enjoyed by over 10 million players from all economic levels of American life.

Sixty-five per cent of all the new golf courses opened for play in 1968 fall in the public category. In 1967 it was 61%. In the "public" category I have combined semi-private courses (privately owned but open to the public on a daily fee basis) and municipal operations which are usually open to anyone.

At the close of 1968, 53% of the nations's golf courses were public operations. Just 10 years ago public courses comprised only 42% of the country's total golfing facilities.

The three principal types of golf courses in the United States are private, semi-private and municipal. In order that we may analyze trends more easily, I shall cite a brief definition of each.

Private Golf Club. A limited use facility, usually nonprofit, designed for the specific needs and desires of a restricted membership. The membership may own a proprietary interest (equity type club) or the ownership may be vested in private enterprise that leases, rents or in some manner makes the facility available to the members.

Semi-Private Golf Course. One open to the public in varying degrees as prescribed by management. Its primary purpose is to operate as a successful business venture. Accordingly the operating policy is geared to return the greatest net profit to the owners. There are some semi-private courses that have member privileges but still encourage fee-paying public patrons. The so called pay-as-you-play country clubs fall in this category.

Municipal Golf Course. A course constructed and operated by a tax supported agency such as a state, county, township, city, town or park district. Its chief goal is to provide golfing facilities to the greatest number of its citizens at the most reasonable cost to the taxpayers.

PUBLIC GOLF GROWTH PHENOMENAL

For many years the majority of the nation's golf courses were private country clubs. It was only during the past decade that this picture changed. A study of NGF facility statistics for 1958 and 1968 reveals the following:

Semi -Private courses experienced a meteoric rise of 115% during the 10 year period ending January 1, 1969. Municipal operations increased 45% and private clubs 42% during the same decade.

The overall growth for all types was 67% - going from 5,745 courses in 1958 to 9,615 in 1968. Active golfers now total about 10 million; were about 4 million a decade ago.

A recent NGF study as to where golfers play gives the following picture:

45% use municipal courses; 39% semi-private and 16% private. Since only 53% of the nation's courses are public (municipal and semi-private combined) and 84% of the golfers allegedly play these courses, it can be assumed there still is a shortage in this category, especially in municipal facilities.

Municipal golf courses in heavily populated areas continue to report almost capacity play during their golfing seasons. Many semi-private courses likewise report substantial increases in rounds of golf play each year. In many instances public courses have become so crowded on weekends that local radio stations broadcast the waiting times for tee off as a public service for courses in their respective listening areas.

Golf playing equipment sales are going upward annually. Manufacturers reported total sales of $161,787,906 (manufacturers selling prices) for 1967 (1968 figures not available until April, 1969). This represents a 35% increase over sales reported five years ago. In fact golf sales during the past five years enjoyed the greatest gain of all types of athletic goods sales (average increase for all categories was only 28%.) Last year golf equipment sales equipment sales accounted for 49% of the total athletic goods volume - far ahead of baseball and inflated goods categories.

NGF's New Speedy Program

In an effort to help the nation's public golf course operators speed up snail paced play reported on many courses, NGF initiated a nationwide Speedy Play program in 1968. This program included a series of posters and information sheets mailed during May, June and July to all golf courses at no cost. A total of 280,000 promotional pieces were included in the mailings.

The posters depict various violations of etiquette which induce slow play. A precocious little rabbit named Speedy was created to symbolize NGF's attack on slow play. Speedy is pictured as correcting these breaches of etiquette, for example - leaving carts or cars in front of greens and looking too long for a lost ball- The information sheets include a workable method for starting players on both the first and tenth tees and other management tools for expediting play.

Acceptance of the Speedy program throughout the country has been most gratifying. NGF has received over 2,000 replies on a follow-up questionnaire sent to each facility. While this first effort has only cracked the surface in the fight to eradicate slow play, NGF's planned program for 1969 will attempt to expand this successful initial step.

From a practical business point of view, Speedy can mean substantial increased income from greenfees. Let's assume that each golf course in the United States increased its play by 50 rounds on every Saturday and Sunday of its playing season. For 10, 000 course this means an additional million rounds of golf played each weekend and, at $2.00 per round, this brings in an additional $2 million per week to the golf course operators of the country.

The Speedy program is but one of NGF's efforts to assist golf course operators with operational and administrative procedures. It has become quite evident that many courses seeking such help do not know where to go. NGF (the national clearing house for golf information) is emphasizing its research to accumulate more factual data from operating facilities and in turn will disseminate such information to all courses that request assistance.

Trends in Operational Policies

Many public golf courses are implementing policies and programs designed to increase golf play, especially for weekdays. I shall cite various ideas that are proving popular and successful.

Public golf courses located in heavily industrialized communities have found that assisting various industries in organizing golf leagues and making their golf facilities available for league play on certain days has increased play and income materially. One municipal course in the greater Albany, New York area reported that 40 industrial golf leagues were using its 18 hole facility in 1968.

Some courses are catering to special company and organizational events such as golf outings and picnics and are making their golfing facilities available either on a daily rental basis or individual green fee charge. A semi-private golf course operator in the greater Pittsburgh, Pennsylvania area states his course served 97 days of such golf outings last year.

Likewise numerous private golf associations use public golf courses for their golfing activities. One New York county reported that 17 private golf associations were using its five 18 hole municipal facilities as their home courses.

Semi-private courses frequently have a low cost annual membership arrangement which requires members to pay a green fee each time they play. A Mid-Atlantic course operator has the following scale of annual membership fees: single person $50.00; husband and wife $75.00; each additional family member $15.00. Holders of such memberships may play 18 holes on weekdays for $3.00; weekends and holidays $4.00. They may bring guests who may play 18 holes by paying $1.00 more than the quoted fee for card holding members. This type of operation is often referred to as a pay-as-you-play country club and is proving to be quite successful.

Use of powered golf cars has become an accepted practice at all types of golf courses in the United States. A well managed, well maintained fleet of golf cars can be one of the golf course's best sources of income. The golf car industry reports an increase in manufacturers' shipments of 8% for last year. It is estimated there were 147,000 golf cars in use in 1968.

The actual design of a golf course will determine to some extent the number of golfers it can accommodate in a day. Developers and designers of public courses should consider the attractiveness of a facility serving 250 or more players daily. The layout should be challenging and interesting but not too difficult. Concern for the safety of players and for the movement of traffic on the course is also a part of the golf course architect's job. Course developers should assure themselves that they have a competent and experienced golf course architect prepare their plans and specifications.

Courses For Specific Uses

Annother trend to help speed up play is to provide different types of facilities which may appeal to golfers of varying playing capabilities. The pattern that is emerging is for 27 or 36 holes of golf - 18 regulation length and 9 or 18 regular par-3 or executive type (some par 4 holes). Such variety of facilities will be challenging and interesting to golfers at all levels of capability. It

reduces the probability of slow play on the more difficult layouts as individuals will tend to play the course best suited to them.

The recent trend to build and operate golf courses for kids only is another movement to ease the pressure on crowded golf courses. In the long run it should boost speedy play too since the kids will be playing faster golf when they hit the adult courses. Nine such facilities are known to be in operation in the United States today. Six are a part of private club facilities; the other three are municipal.

Bangor, Maine operates - in addition to its 18 hole regulation length layout- a 4 hole, 335-yard course for youngsters ages 6 through 12. Play is free. However, in order to be eligible to use it, youngsters must take at least one golf lesson (also free). Lessons are given every Saturday morning. Juniors up to age 16 may also attend these classes. A special city employee supervises play on the kids' course. Bangor municipal golf course officials report an average play from 25 to 30 a day by youngsters during the golfing season.

Lincoln's (Nebraska) Junior Golf Course is for golfers 15 years of age and under. Here the rules read "Adult golfers may play only during hours when school is in session or after 9:00 p.m."

Over 100 youngsters age 17 and under regularly play the Hazeltine National Junior Golf Course at Chaska (near Minneapolis), Minn. This is a 9 hole par-3 layout approximately 820 yards long and built adjacent to the regular 18 hole course.

Actually the movement to build facilities for juniors is just one demonstration of a general trend in recent years to construct courses for a number of specific uses.

One very familiar use is the course designed as a recreational focal point for a cluster of subdivision homes. Some recent high rise apartment and condominium projects also include golf facilities for use of the occupants. About 28% of all the new courses opened in the nation in 1968 were part of real estate ventures.

Many schools, colleges, industries, fraternal organizations, military and Veterans Administration installations throughout the country own and operate golf courses. There are also courses for use of male golfers only.

One course developer in northern New Jersey currently has an 18 hole facility under construction which is to be usedsolely for golf instruction and golf outings. Present plans call for five 2-week golf schools serving 150 students each. Facilities include motel type accommodations sufficient to house the student body and faculty. No memberships or daily fee play are contemplated for this operation. When not being used for the golf academy, the entire facility will be available on a daily rental basis to industries and other groups wishing to hold golf outings.

Golf courses are springing up these days in many small rural areas of the nation where until a few years ago country clubs of their own existed only in the wishful thinking of a few residents. Chief assist here has come from long term (up to 40 years) low interest rate loans available to nonprofit associations in rural communities of 5,500 or less population for recreational purposes through the Farmers Home Administration, U.S. Department of Agriculture. Since the program's inception in 1963, FHA has approved 800 such loans through fiscal 1968 for a total

of $88 million. About 600 of these projects included golf courses. Loans often cover 80% of the costs of such ventures.

Golf Growth Will Continue

There is every indication that golf course development will continue to grow in the years ahead. 312 new regulation length facilities opened for play in 1968. Another 374 were in some stage of construction at the beginning of this year. In addition, NGF files indicate 915 new regulation prospects and 162 new par-3 prospects for the year.

Leading states in new golf courses opened for play in 1968 were: California (33); North Carolina (23); Pennsylvania (19); Michigan, Florida, New York (16); Illinois, Texas (12); New Jersey, Ohio, Wisconsin (11).

The development of adequate golf playing facilities is of great concern to NGF. Supplementing the work of the headquarters staff are full time trained regional representatives located in strategic areas of the nation who are available to golf course planning groups at no cost.

Good golf courses are expensive to build. While the cost may vary from $200,000 to $2 million, an 18 hole regulation length facility - completed and ready for play - is seldom accomplished for under $500,000. Golf courses are also expensive to maintain. Annual maintenance budgets for 18 holes run anywhere from $50,000 to $100,00 or more.

There is no indication that there will be any significant decline in interest rates, prices of land or construction costs. If market research results for a specific golf project are favorable, the time to build is NOW.

RECENT DEVELOPMENTS IN TURF

by
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Three things which happened on many golf courses in 1968 that nobody needs to be reminded of are:

1. Dessication--in February. There was a lot of moisture in the soil but it was too deep and/or frozen. With a lack of snow cover, high winds dried out the top 1 to 2 inches of soil. Most of the remaining water was frozen and could not be used by plants. As a result a lot of damage occurred to turfgrasses and other plants throughout this area. Early January 1969 looks very much like a repeat of these conditions.

2. Pythium disease--on bentgrass greens. In late July pythium started causing severe damage on some greens in this area. In August several greens were almost wiped out. All of this occurred despite regular spray programs using Dexon and/or Zineb to prevent or cure it. According to Dr. George Bean, the leading turf Pathologist in this area, the fungus apparently was growing so fast under ideal growing conditions during this period that these fungicides could not control it. Description and control measures for this disease, along with that for Fusarium blight which took its toll of Kentucky bluegrasses, can be found elsewhere in these proceedings.

3. Annual bluegrass--made an unusually spectacular exit in July and August. Several courses, and in other turf areas not on golf courses, were left with almost no live turf cover despite regular watering programs. Under conditions like we had last summer--heat, drought, high humidity, etc.,--about the only way to keep this from happening is to have no annual bluegrass around.

There were also many other problems of the preventable type last year. For example: improper use of herbicides such as arsenic, 2, 4-D and dicamba, and improper use of fertilizers such as applying too much or at the wrong time of year. Heavy use, high day and nighttime temperatures and high humidity also took their tolls.

We are delighted to see several golf course superintendents starting to use specifications when buying turfgrass seed. According to our latest information there is little or no difference in the price per pound of the seed but there can be a tremendous difference in the quality of the seed you buy for the same price.

Printed specifications can be used to help assure you that you get what you want and ask for. Several superintendents got quite a jolt last year when they had some of their seed tested. Sometimes it was after the seed was delivered to them and in a few cases after most of it was already planted. The important thing is to use detailed specifications when purchasing seed and follow up to see that the seed you received meet these specifications.

Certified sod is beginning to be used in the state. Superintendents should take advantage of this guarantee of genetic purity and overall high quality when purchasing sod to use on golf courses.

Insects--chinch bugs and beetle grubs--were quite active in Maryland last year. Grubs at one time were considered serious problems but during the past few years they have caused little trouble. Chinch bugs have never been considered a serious problem in Maryland but during the summer of 1968 they caused severe damage in some areas.

Grubs can be controlled easily with insecticides such as chlordane and dieldrin. Chinchbugs can be controlled with insecticides such as diazinon, dieldrin and sevin. Be sure to identify these problems before using treatments to control them. Several problems cause similar symptoms but for treatments to be effective, you must first find the exact cause.

We at the University are working on several research and extension projects which are of interest to superintendents and others in the turf field. Results and information from these projects will be presented in great detail at various field days, conferences and meetings at later dates.

EDUCATIONAL PROGRAMS FOR THE GOLF COURSE SUPERINTENDENT AT THE UNIVERSITY OF MARYLAND

Dr. Gordon Cairns
Dean of Agriculture
University of Maryland

It is of mutual benefit to share new information and discuss field problems in conferences presented cooperatively by organizations and the University of Maryland. The Annual Conference of the Mid-Atlantic Association of Golf Course Superintendents has had a wonderful history. Meetings and conferences of this type provide an opportunity for educational up-dating annually.

The areas or departments in the College of Agriculture at the University of Maryland of greatest interest to the golf course superintendent are found in the Agronomy, Agricultural Engineering, Botany, Entomology, and Horticulture Departments. Many staff members have cooperated with you on problems of mutual concern.

For a number of years, efforts were made to establish a turf program at the University. Eventually the requests bore fruit with the establishment of a faculty position in this area of work. Your co-operation is and has been appreciated. Dr. Deal has demonstrated effective leadership in that position. Much has been accomplished in a relatively short time.

In the four year program leading to the B.S. degree, a person prepares for opportunities closely associated with your needs in the plant sciences. The General Crops and Turf Management curriculum has been of special interest to several young men. At the present time eight undergraduates are interested in turf management. The graduate program has two men enrolled at the present time. It is anticipated that two more graduate students will be studying in this field at the University in the near future. The course, Turf Management, Agronomy 109 is given in alternate years. In the fall of 1965 there were 22 students enrolled and in 1967, 33 students. In addition, an evening course was offered in the spring of 1968 with an enrollment of 38. The course is scheduled to be given again in the spring semester of 1969.

Of great interest to many people has been the Institute of Applied Agriculture, a two year terminal program, initiated at the Universtiy in the fall of 1965 to prepare students for specific opportunities in four areas of work. Of major interest to you is the Turfgrass and Golf Course Management Program. There are some 20 Institute students interested in this field. Those who have completed the program are in responsible positions. We hope that you will encourage more prospective students to enroll in the years ahead. Appreciation is expressed for the scholarship which your Association will award to a student in the two year program beginning in 1969.

The contribution made by research to the development of this field within the state must be stressed. Likewise extension programs and those carried out under the State Board of Agriculture contribute effectively to the implementation of new knowledge that is available through the campus education and research programs.

The College of Agriculture shares a mutual desire to prepare students trained in this field and to develop and disseminate new knowledge. We look forward to the continued fine working relationships with your organization.

NEW TURFGRASS VARIETIES

by
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A number of exciting new varieties of Kentucky bluegrass, fine fescue, perennial ryegrass, and bentgrass are at various stages of development at turfgrass research centers throughout the country. A few of these are beginning to be sold commercially. Many should be of considerable interest to superintendents improving golf course turf. As any professional turf grower knows, each variety has its own special merits, requirements, and areas of greatest usefulness. Thorough testing is required in each region to detect varieties of greatest value.

KENTUCKY BLUEGRASS VARIETIES

Kentucky bluegrass is hardy, attractive, and widely adapted. New varieties currently becoming available such as Fylking, A-10, A-20, A-34, and Kenblue will make this species even more useful. They will soon be followed by other elite varieties currently being increased in Western seed fields, including Pennstar and Sodco, as well as some outstanding selections in experimental plantings.

Fylking Kentucky bluegrass produces an attractive, dense, moderately low-growing turf of a rather fine texture. It maintains this leafy appearance during seed head setting time in May and June when most other bluegrasses become quite stemmy. An attractive, rich, dark green color is developed in early spring which is maintained into late fall and under moderately adverse growing conditions such as low fertility and incipient drought. Fylking has good resistance to both stripe smut and Helminthosporium leaf spot and melting-out. This combination gives it a tremendous advantage over most of the other bluegrasses in current use. Fylking is rather tolerant of close mowing. However, cutting the grass at a height of 1 1/2 inches will aid vigor and help prevent weed invasion. Fylking has performed well in mixtures with other bluegrass varieties as well as with the improved varieties of fine fescue and perennial ryegrass.

Warren's A-10 Kentucky bluegrass (Plant Patent #2615) is a narrow leafed, dark green selection of medium density. Its most outstanding attribute has been its excellent summer performance in St. Louis, Missouri and Dixon Springs, Ill. It has moderate resistance to leaf spot and powdery mildew, good resistance to stem rust and stripe smut. This grass is too highly sexual for reproduction by seed and must be propagated vegetatively.

Warren's A-20 Kentucky bluegrass has better overall disease resistance than any of the named selections available today. It has good to excellent resistance to leaf spot, stripe smut, mildew and stem rust plus above average resistance to Fusarium roseum. Turf produced by A-20 is attractive, dense, dark green upright and of medium leaf width. It will tolerate rather close mowing, Unfortunately, this variety will not reproduce true by seed and must be propagated vegetativley like Zoysia.

Warren's A-34 Kentucky bluegrass is a vigorous variety with significantly better shade tolerance than any other bluegrass currently available. When maintained at a 2-inch mowing height, it will tolerate shade up to 65 percent of the daylight hours during the tree leafing period. A-34 is available only as sod at the present time. Seed production is being increased.

Kenblue Kentucky bluegrass is a blend of seed harvested from natural stands in the famous bluegrass region of Kentucky. It is typical of the better lots of Common Kentucky bluegrass available in past years. Present purchasers of Common Kentucky bluegrass are very likely to obtain seed of Newport of some other single strain variety of bluegrass selected for high seed yield. Purchase of seed of

certified Kenblue will assure the consumer that he is getting a bluegrass of known origin and of considerable genetic diversity. However, it must be realized that Kenblue is not an improved variety. It is highly susceptible to Helminthosporium leaf spot and melting-out, and will not tolerate close mowing. Its best use will be in mixtures with the better turf-type bluegrasses such as Merion and Fylking, or for seeding areas receiving moderatley low amounts of nitrogen fertilizer and cut high.

Improved Ryegrass Varieties

Perennial ryegrass is a cool-season grass best adapted in regions having mild winters and cool, moist summers. Poor summer performance can be expected in warmer regions such as Washington, D.C. and Baltimore, Maryland. Therefore, it is highly unlikely that straight seedings of any ryegrass variety will give satisfaction for permanent turf in this area. The greatest value of the improved ryegrasses will be for temporary, cool season turf, overseeding, and in mixtures. The new turf-type ryegrasses such as NK 100, Pelo, and Manhattan are such an improvement over common perennial ryegrass that many people fail to recognize them as ryegrass. They are finer-textured, much more attractive, more persistant, lower-growing, leafier, and have better turf-forming properties. They are easy to establish and will grow on a wide range of soil types. The new ryegrasses are easier to mow than common perennial ryegrass but can be difficult at times. Frequent cutting and a sharp mower helps maintain top quality. The new ryegrasses have usually done well on the sandy coastal plain soils on Long Island and look promising for overseeding in the South. Further research and experience is needed to assess their specific usefulness in other areas.

Most of the basic germplasm of NK 100 perennial ryegrass originated from plants surviving for many years in old pastures in the British Isles. It is similar to varieties used extensivley for sports turf in England. Such plants were crossed with Oregon perennial ryegrass and selected for persistance, leafy growth habit, turf quality, and an attractive, bright, medium dark green color.

Pelo perennial ryegrass was bred in Holland. This variety has an attractive, bright, moderately light green color. It is leafy and has shown rather good resistance to Fusarium snow mold.

Manhattan perennial ryegrass was released by Rutgers University. Many of the parental plants of Manhattan were selected from old turf areas in Central Park on Manhattan Island in New York City. Manhattan has a very attractive, rich, medium dark green color. It produces a finer textured turf of greater density and a slower rate of vertical growth than other available ryegrass varieties.

Norlea perennial ryegrass is a rather short-lived variety developed in Canada. It is useful as a nurse or companion grass if quality seed not contaminated with annual ryegrass can be obtained.

Fine Fescue Varieties

The fine fescues are tolerant of acid soil, low fertility, and shade. They will not tolerate wet soils or excessive amounts of nitrogen fertilizer in hot weather. They perform best in cool climates. Summer performance is not as good as that obtained from a good bluegrass variety unless the fescues are gown in cool, partly shaded locations or in regions having cool summers.

Highlight chewings fescue, developed in Holland, has an excellent record of performance at the Sports Turf Research Institute at Bingley, England. High-light

produces an attractive, dense, fine-textured turf. It has a pleasing, bright green color during the cool weather of spring and fall.

Ruby creeping red fescue, another Dutch variety, is fine-textured and has a light, attractive, bright green color. The slightly more open growth of Ruby appears to enhance its performance in mixtures with Kentucky bluegrass. Tests by Dr. Glen Wood of the University of Vermont indicate that Ruby has good shade tolerance.

Seed production has also been initiated on two other elite varieties of red fescue. They are Jamestown, developed at the University of Rhode Island, and Wintergreen from Michigan State University.

New Bentgrasses

Pennpar creeping bentgrass was recently released by Pennsylvania State University. It had demonstrated the best overall disease resistance of any variety of creeping bentgrass and showed promise for use on golf course putting greens. This variety must be propagated vegetatively.

Holfior colonial bentgrass is a Dutch variety which has been tested in the United States since 1956, showing good performance in many areas. Holfior has a medium dark green color, a rather upright growth habit, medium texture, good density, and rather good disease resistance. This grass should be of value for use on fairways, tees, and on the aprons and collars of greens either alone or in mixtures with other grasses.

Exeter colonial bentgrass was developed at the University of Rhode Island. It has a very attractive bright green color and a good record of performance in a number of tests throughout the northern part of the United States. Exeter shows promise for use on fairways and similar turf areas.

Kingstown velvet bentgrass can produce a beautiful, very fine-textured turf on golf greens and for sun and shade mixtures on damp soils in its area of adaptation. This elegant grass was developed by turf specialists at the University of Rhode Island. It does best in cool, moist climates where the fertilizer program is light to moderate and where mowed at 1/4 to 3/4 inch.

PRUNING ESTABLISHED TREES AND SHRUBS

by
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Department of Horticulture

Pruning is an art as well as a science. However, in order to fully understand the principles of pruning, it is important to know the growth habits of each variety of plants. Too often all plants are made to look alike as a result of indiscriminate use of hedge shears. But by observing the natural growth habits of plants each tree or shrub can be made to appear natural in the landscape.

To properly prune, it is important to have good sharp pruning shears, loppers and saws. Tree wound dressing is necessary only for covering wounds that are 1 inch in diameter or greater, and for covering all open wounds on rose bushes to prevent borers from entering the rose canes and to prevent dessication.

Pruning rose bushes should begin in the fall as soon as the leaves have fallen. The canes should be cut to within three feet from the ground in order to prevent damage to the graft union and roots which may result from the wind

swaying the tops. Final pruning of the canes should not be completed until the following spring just before the buds begin growth. At this time, remove all thin pencil-type growth and canes infested with borers and cankers. Allow only three to four large canes to remain on the plant and remove all excess canes as close to the graft union as possible. The selected three to four canes should be cut back to within 12 to 20 inches of the ground line, and the cut ends treated with tree wound dressing.

Spring flowering shrubs such as forsythia, weigelia, spiraea, etc. are pruned as soon as they have finished flowering. At this time, prune out all old stems covered with rough flaky bark. These stems should be removed near the ground without leaving stubs. This is most easily done with a sharp pair of loppers. After all of the old stems have been cut, remove all of the thin weak stems with a pair of hand pruning shears. Plants that have not been pruned properly or neglected are best pruned by simply cutting the entire plant down to the ground and allowing new stems to develop from the crown.

When pruning narrowleaf and broadleaf evergreens, first remove only the large branches down near the center of the plant. These branches should be removed just above a horizontal branch. Again, avoid leaving stubs because they will not heal properly and will cause excessive sprouting on some plants. After removing the large branches with loppers or saws, use hand pruners to remove the smaller outside branches.

When pruning trees simply remove all suckers or bottom shoots first. Inspect the tree and remove any dead or dying branches, branches that tend to rub together and branches that detract from the natural looking appearance of the tree. To remove large branches, always make the first cut approximately one to two inches on the underside of the branch. This first cut is to prevent the bark from tearing down the stem of the tree. The second cut should be made one to two inches beyond the first cut starting on the upper side of the branches. After the branch has been removed, the third cut should be made flush with the tree and the cut surface painted.

When repairing bark wounds, remove all the loose and damaged bark and sap wood using a clean sharp knife. The upper and lower ends of the wound should be pointed in order to promote healing and free drainage of water. Next, cover the wound with several applications of tree wound dressing.

With a little practice, anyone can develop the art of pruning. Learning to prune ornamental trees and shrubs properly can save you time and money, and give you a more natural looking landscape.

NEW TURF CHEMICALS - LABORATORY TO GOLF COURSE

by
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Each year Du Pont research men will screen many thousands of different chemical compounds which are looked upon as potential candidates for new agri-chemical product development, and we would assume that many other agricultural chemical companies are doing similar screening. The odds on any one of these compounds finally making the grade as an agricultural chemical are naturally fairly staggering. It is doubtful that even the most ardent enthusiast of a gaming table in Las Vegas would have much confidence in getting involved in an

operation like this. The odds against success seem just too great! The fact is, of course, that sound knowledge and judgment applied at the right places by the right people---and in the right way---can help to reduce the odds substantially, but such knowledge and judgment never really eliminate questions and unkown elements that can and do turn promising product candidates into mere laboratory curiosities.

To reach the grower as a commerial product, "Product X" must survive a series of increasing complex investigations. Judgments and decisions will be made along the way not by just one man, but by a team of individuals trained in many and varied disciplines---both in and out of the Du Pont Company. And many years elapse before we or anyone can be sure that "Product X" will indeed live up to its promise and justify the time and money that will have been put into its development.

The first critical screen for "Compound X"---assuming this looks like a prospective selective crop herbicide or fungicide---would occur in a plant research greenhouse. Here our technical people would be interested in determining whether the compound controlled weeds or disease at a reasonable rate of application and also what effect the compound might have on major crops. Tests of this kind can be carried on with a minimum expenditure of time and effort. By testing thousands of candidates, we have learned to focus our attention on the most promising ones. We study these carefully and then select the promising few for initial field trials on one or more of our field research stations.

This field screen represents the second major hurdle for prospective chemicals. To carry out tests on this scale, we need a few pounds of product and we need a full growing season. We are interested in knowing how the compound works on 30 to 40 different crops in addition to controlling disease or weeds in the field instead of in a greenhouse pot.

We are not really hoping for a universal chemical, we are merely trying to develop basic knowledge about the compound to determine where it may be useful and where it shows no promise at all. The principal question is whether any of the greenhouse successes merit continued effort and attention and, if so, at what level.

"Product X," of course, is still in the hands of our agrichemical research people, but it is also being looked at in a preliminary way by the product development group. They will act as liaison between the grower and the laboratory; their judgment will be particularly important in assessing practical worth under variable use conditions involving soil types, climate, disease organisms,weed species, and crop tolerance.

Now, as "Compound X" comes through the initial field screen on our research farms, we will again have to synthesize a bit more of it. We may modify the compound a bit, based on first year knowledge, but we are naturally very anxious now to get field tests in different parts of the country and indeed throughout the world.

Environmental factors are suddenly important and field evaluation passes into the hands of our own product development representatives. They work, on occasion, with trained investigators and experienced growers who assist in planning the tests and evaluating the results. But our development staff---a highly skilled group of agronomists, entomologists, plant physiologists, plant pathologists, and biochemists---is in charge. Their reports and recommendations may prove to be the most critical in all the tests we have run to date or those that still lie ahead.

We have already run initial tests on toxicity to determine that the product can be handled safely by the people who will be involved in using it. We have other toxicity tests ahead of us to determine biological data for product labeling. The first of these tests involves a 90-day rat feeding program or "skirmish" test to give us general information on chronic toxicity. This is followed by a full two-year chronic feeding test for both rats and dogs, a three generation rat reproduction study, a study to determine toxicity to fish and wildlife, and a feeding study with lactating cows to determine what happens in meat and milk, all necessary to provide data for the labeling. But negative or uncertain findings on any of these toxicity tests may throw "Product X" back into the laboratory for modification or may even eliminate the product from any consideration at all.

The preceeding explanation of how new chemicals are born and how they find their proper niche in the commercial field is interesting, but in the turf field many, no doubt, are asking how does this affect me personally and what are you doing to solve our problems.

To answer these questions we can tell you that all of our new agrichemicals are being tested in the turf field. Many of them will do a good job of solving some problems, but because of cost of manufacturing, competitive products, potential use, safety to humans or plant life, they do not all fit in the turf field.

However, as new chemicals are released from the laboratory to our development group for field evaluation those that fit in the turf field are initially offered to two or three qualified investigators at experiment stations. We are interested in outside information on the suitability of possible new products, including data on rates of application, effectiveness of treatment and possible limitations for general use. In addition, some of the commercial products that have shown activity to control turf problems are also included in our continuing turf trials. In our trials, naturally the first prerequisite is effectiveness and the next, but very essential, is a margin of safety for the plant. The ideal product would provide control at minimum rates, but would not cause injury at any rate. Unfortunately, this type of product is most unusual, and we are constantly telling our distributors and consumers to be sure to read and heed the package label as it is put there for their protection.

Many of our trials never get beyond the small plot experiment. Several years ago, for example, we were testing an organic mercury for weed control and for about a month or more it looked promising. Unfortunately the next time we looked at our plots, we had complete control of all vegetation. Everything was dead! Another time, to my embarrassment, I tried a thiram product as a seed protectant. We had been selling another formulation of thiram to control smut in onions, but had problems with dust. With my experimental product, we had no dust and everything appeared normal until time for seed germination when we observed one difference. The seeds treated with the experimental product never emerged through the soil. Needless to say, neither product was ever sold for this use. However, with experiences such as these we do learn that we must check and re-check results before products can be considered for commercial use.

Fortunately all our experimental work is not negative. On another occasion we received from our experimental station a mercury-thiram combination product that has all the advantages of the individual products and none of the disadvantages or injury that may be caused by mercuries alone. When this combination product was first tried, there was a chemical breakdown; but with formulation changes,

this was corrected. We were able to supply a stable product with long shelf life that would be equal or superior in performance to the two ingredients used as a tank mix. In another case our research people came up with a pre-emergence crabgrass control that could be used at seeding and yet would not affect the germination of bluegrass, bentgrass or fescue.

At the present time we are working with a systemic fungicide. Several experiment stations have reported a longer residual disease control for certain diseases with this fungicide than any others they have tested. Also, it is reported that the product will control stripe smut in bluegrass and nothing else has had any effect on this disease to date. But more must be learned about timing and rates of application.

Another product that has recently come out of the Du Pont experiment station is "Demosan" chloroneb fungicide. This is another non-mercurial fungicide that has been most effective as a control of seedling blights on cotton seed. In some tests, the use of the product has made the difference between a stand of cotton or a failure. This past year we tested the product on turf and in a test in Rhode Island , it was outstanding as a control of snow mold. However, these data must be duplicated by other investigators and confirmed by the consumer. "Demosan" is still at least a year, and possibly two, away from being a commercial product for turf---if future tests confirm the work done in Rhode Island.

As new products are introduced and registered for turf, we still must be careful to supervise sale and use of the products to be certain they are sold and used properly. Too often, many look at new products to be the answer to all problems. New chemicals, fungicides, insecticides, herbicides and nematocides will be produced and when used properly will do a particular job. They are not intended to replace the man in management, but to provide a tool to aid the golf course superintendent to do a better job.

To use turf products most effectively, they should be applied as recommended on the label, and be used as a part of a good management program. The more we study diseases, the more we become aware of the interrelationships between environmental factors and cultural practices. Good cultural practices alone will not prevent disease, but when combined with regular applications of a good preventive fungicide, they will keep disease under control.

Pythium and Fusarium Blight

by
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DISEASE: Pythium

SYMPTOMS: Weather is an important factor in the occurrence of Pythium. An abundance of moisture either from rain or high humidity plus temperatures in excess of 90° F are necessary for disease development. Pythium blight first appears as dark, water soaked irregular areas of turf ranging from 2 to 4 inches in diameter. As the leaves are killed, the color of the areas fade to light brown. The infected areas rapidly increase in size and numbers and with optimum environmental conditions, turf can be completely destroyed within 24 hours. Since the fungus is spread by water, the infected areas often occur in elongated streaks corresponding to the direction of surface water movement.

CONTROL: The two fungicides found most effective against Pythium are Dexon and Zineb. The recommended dosages are 2-4 oz. of Zineb and 3 oz. of Dexon per 1,000 sq. ft. applied as a protective spray before symptoms occur. Severe outbreaks of Pythium occurred in the mid-Atlantic states this summer even though fungicides were used as recommended. Usually hot and humid conditions over an extensive period of time probably reduced the efficiency of Dexon and Zineb in controlling Pythium.

In addition to chemical control, Pythium severity can be greatly reduced by providing good surface and sub-surface drainage, avoiding over-watering and maintaining proper pH and fertilizer levels.

DISEASE: Fusarium

SYMTOMS: Fusarium and Pythium are both high temperature turf diseases. Fusarium symptoms first appear duringearly June as daytime temperatures approach 90° F. The fungus remains active throughout July and August and occasionally during September if the weather has been warm and dry. Fusarioum first appears as circular areas of light brown infected turf. These infected areas increase in size in number and occasionally a small amount of healthy sod will occur in the center resulting in a "frog eye" effect. Disease severity varies directly with light intensity; the most severely infected areas receive direct sunlight. Normally a lawn will recover from Fusarium blight with the approach of fall, however, symptoms will occur again the following summer.

CONTROL: The two fungicides that have been reported effective against Fusarium are Dithane M-45 (FORE) and Tersan OM. Results from the mid-Atlantic states using these chemicals have been erratic indicating the need for more studies on control of this important disease.

Since disease severity is closely correlated with temperature and moisture, it may be possible to control Fusarium by altering the cultural conditions under which the grass is grown. Preliminary studies indicate that grass which is allowed to show drought symptoms before water is applied is more susceptible to Fusarium. Periodically "syringing" turf to lower temperatures may prevent Fusarium blight development.

Tractor Safety and Maintenance

by
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Tractor safety involves most of us, whether we drive tractors or not. The loss of life, the loss of time, the suffering, the inconvenience, and finally, the property damage caused by tractor accidents. In Maryland, during 1968, we have a record of 28 tractor accidents, 16 of these were fatal. The largest single cause of tractor accidents was tipping (lack of stability.) Thirteen tractors were involved in tipping accidents; nine tipped over sideways, four tipped over backwards, 9 were fatal. Next to tipping, falls account for the second largest category of tractor accidents. This means extra riders on a tractor with a seat built for just one person, the operator. Ten falls, six fatal. Four P.T.O. accidents; these were unshielded P.T.O.'s, a loose floppy coat, or the sleeve of a coat caught and subsequent injury. One fatality with P.T.O.'s, combining soy beans during November. Fire accounted for one injury. Collison between a tractor, and an automobile also one injury. Twenty-eight tractor accidents, more than we've had in this state since 1961, when we had a record of 35 tractor

accidents. How about our young people under 20 years? Eight were involved in tractor accidents out of the 28 this year. This is somewhat normal: '67, nine; '66, five; '65, nine.

"Why do tractors upset?" Three forces that dominate stability are involved and three or more safety rules.

Forces dominating stability: center of gravity, the point of balance of any object toward the center of the earth. The center of gravity is centered approximately at the front end of the swinging drawbar where it normally fastens to the underpart of the tractor just ahead of the rear axle. If the center of gravity can bepinpointed, then it means that the wheels form a base where they contact the ground and the front wheels or the pivot on the front axle makes a triangle with the center of gravity in the center of this three-pointed triangle.

The second force dominating stability is force of power, the force transmitted to the rear wheels by the engine. Regardless of the size of the tractor, from the small tractor that pulls a mower to the hundred horsepower tractor, any time the rear wheels become stuck in mud, in a ditch, in snow or anything where it becomes an easier matter for the engine to pick up the front end of the tractor than to rotate the wheels, this thing will happen. The American Society of Agricultural Engineers and others have spent a great deal of time testing tractors for stability and have specified along with the manufacturers, a maximum drawbar height assuming level ground. This drawbar height is normally 15 inches high off the ground. With hydraulics on modern tractors and the ability to move the drawbar up or down, this often times becomes a factor in the operator attempting to get the maximum traction and pull by raising the drawbar slightly. The fact of the matter is, that the height of the drawbar is critical and gives the maximum torque and pull at a point just short of raising the front wheels off the ground. So the center of gravity and force of power are two factors we tell our youth that work closely together. So long as we keep the center of gravity within the triangle, force of power should move us along and do all the work. However, if the tractor gets into such a position that the center of gravity falls outside of the triangle, the tractor will tip over sideways or backwards.

The third force dominating stability is centrifugal force, the force exerted on a body as it revolves about a point. Centrifugal force can be considered to be at the center of gravity. For figuring centrifugal force: the weight of the tractor times the speed squared, divided by the radius of the turn. Young people have difficulty understanding why we say, slow down before turning. This is the reason - centrifugal force. A 5000 pound tractor traveling at 5 mph, making a turn with a 20 ft. radius would look like this if set down in a formula: 5000 (weight) times 5^2 or 25 over 20 feet (radius of turn). If we multiply and divide this one out, we'll find out that it comes out to be 6,250 pounds of centrifugal force, and working with youth, somebody usually hops up and says, let's double the speed. In other words, the formula now reads, 5000 times 10 mph, when squared gives us 100 over 20. If we work this out, we find out that it comes out to be 25,000 pounds of centrifugal force. So when we double the speed in making a turn the centrifugal force not only doubles but increases by the fourth power. Now let's go back to the normal speed of 5 mph and shorten up the turn from the 20 ft. radius to a 10 foot radius, 5000 times 5^2, which is 25 over a ten foot radius and we multiply and divide this out, it should come to be 12,500 pounds of centrifugal force, which is twice the force of the original problem when we were making the 20 foot radius turn. So when we cut the radius in half, we increase the centrifugal force by two times. Thus you can see the necessity of slowing down before making a turn.

Tractor Maintenance

The tractor in tip-top mechanical condition properly maintained is a safer tractor in our books. Read the manual that comes with the tractor, save this manual and go back and refer to it from time to time. Re-read it; save all manuals that come with equipment whether they be mimeographed sheets or sizeable booklets. The operator's manual is peculiar in that it is a book specifically written for the tool or implement. So first in a series of maintenance, we would say, read and follow the operator's manual. Establish a routine---daily, weekly, monthly, seasonally. The better care you take of the tractor and internal combustion engine, like your automobile, or your scooter, the better it will work, the more satisfaction and trouble-free service it will give you. A few rules must be observed if you expect to reap dependability and satisfaction with an internal combustion engine.

I expect an engine to start when I turn the switch or punch the starter button or pull the rope. I hope you do the same thing. This is not asking too much. This is the expected performance of these engines if they're working right. My students oftimes have troubles, the engines won't start. I say the first thing is to check if there is gas in the tank. As silly as this may seem, this is one of the first places to look. Do we have fuel? Is the fuel getting from the tank to the carburetor where it belongs? Equal to this, is the engine getting air? Our textbooks have told us for years that for every one part of fuel by weight, the amount of air required to burn that fuel is 15 pounds. We learned a long while ago on our 4-H Tractor Program that boys were not accustomed to weighing air and visualizing it in pounds so we converted it to volume. For every 5 gallons of gasoline burned in an internal combustion engine, the air contained in a silo that holds 90 tons is required to burn that 5 gallons of fuel, so that the air cleaner on your engine, big or little, regardless of what size uses a tremendous amount of air. Keep the air cleaner clean. In big tractors, working on farms, etc., the recommended procedure in our 4-H Tractor Program is to service the air cleaner daily. Keep the fuel clean. Fill the tank at the end of the day to cut down on condensation.

Changing oil. As an internal combustion engine operates, with fuel and air, some of the fuel, carbon, other by-products, small amounts of acid get down into the crankcase and ultimately contaminate the oil. Owners' manuals normally recommend change of oil at some prescribed period of time. During our Annual Turf Day down at the Coliseum in College Park the last two falls, I talked with a number of home owners and asked them about changing oil in their mowers. Most of them tell me, we don't change oil at all. We just add oil. Well, this is not changing oil and doesn't get rid of the contaminants and the foul material that is contained in the oil. Our recommendation, then as now, was to change once a month. I know some commerical operators that do this very thing. In talking to one of them, I said, "You mean you change oil twelve times a year?" "Yes," he said, "that's right. First of each month we change oil whether it needs it or not." I wouldn't be at all surprised that this operator has less repair bills than the other man who never changes oil and just adds oil occasionally and then winds up with burned out bearings and a lot of other repair bills. So, change oil. Use good oil. If you're running diesels, for heaven's sake, use Series 3 oil. In a two cycle engine use a non-detergent oil, "an outboard motor oil."

The next area of emphasis in maintenance is the electrical system, and herein lies the crux of most of the problems why the engine doesn't start and why it doesn't run, etc. If the tractor has a battery, the plates must be kept covered with a liquid material at all times. Distilled water is still best, but any kind of water is so much better than no water but why waste a little bit of

time saying anything about the quality of water that is put in the battery but please keep the plates covered. In visiting 100 farms with tractors in use, 90 plus-I find plates showing when I take the cap off and look in the battery. Do a better job than this. From the battery to the distributor, the breaker points, the condensor, the coils - if we run tractors the year round, Spring and Fall, they should have a tuneup. The tuneup would normally include a new set of points with a new condensor. Wires that carry this high voltage from the coils and the distributor to the plugs. Like light bulbs, these things do have a life expectancy. There was a time that I wasn't so sure of this, but the longer I work with internal combustion engines the surer I am that the difference between the spark plug and the light bulb is that it goes and leaves you in the dark; the spark plug quits and leaves you out someplace where you don't want to be. Many manufacturers of small engines do not want you to clean the plugs and put them back in the engine. If you read your books carefully, you will find that the warranty is null and void when you do this. What then, do you do? Throw the plugs away and put in a new set. Again, I have a farm operator who tells me this story - that once a year, in the Fall, he buys all new plugs for his rolling stock, cars, pickups, tractors, trucks, snow-machines and everything else he owns. He says that before he use to continually have two or three or more things in the morning that wouldn't start. They would tow them and push them and do all kinds of things. Since placing new spark plugs in a few years ago, he tells me he very seldom has trouble that a certain vehicle won't start. So we keep the electrical system in good shape.

The cooling system. If it's an air-cooled engine, keep the fins and the air passageways free of leaves and grass and mouse nests and this sort of thing. If it's a liquid -cooled engine, in the winter-time, depending on the type of thermostat, put a coolant in that will stay in and when springtime comes, take it out, flush the cooling system and put good clean water in. Here's a place probably where distilled water would really pay off if used with a rust-inhibitor to keep the minerals and other deposits out of the cooling system. Between fall and winter , flush the engine of the cooling system again before adding the antifreeze for winter operations.

Engines that are not used during the wintertime should be winterized. That is, stored for winter by running engine till it's warm, draining the oil, putting in fresh oil, the kind we'll use the next time we run the engine. Drain the fuel tank, the fuel line, and the carburetor of all the liquid that's in the fuel tank and dispose of it. Take a couple of tablespoons of light engine oil and squirt it into the spark plug hole and carefully turn the engine over a couple of times by hand to distribute the oil around the valves and the cylinder. Respace the spark plug or better still, put in a new one and if it's on rubber tires, block it up so that the tires will not be down and if it has a storage battery, take the storage battery out and charge it and put it down in a room or a place where it will not freeze. Drain the coolant, if it's a liquid-cooled engine and mark it so that the first person attempting to start it the following spring will put coolant in the radiator and fuel in the gas tank and the first or second crank or pull on the cord should send the engine on its way. It's late now to winterize engines but if they've been setting since last summer until now, maybe if you winterize them now, they might start next spring. Otherwise, they might not start. Good luck with your tractors in 1969.

Pesticide Chemicals Program

by
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David Shriver delivered a slide presentation depicting some of the problem areas which confront turf management specialists when pesticides are used.

Statistics were presented which showed how accidents occur, to whom, when, and which pesticides were most often involved.

Specific recommendations were made in order to decrease the pesticide accident rate.

Living With POA ANNUA

by
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When I accepted the position of golf course superintendent at Washington Golf and Country Club in the spring of 1961 I found the following conditions:

the greens were extremely small, built for the day when 200 golfers a week was heavy play. Now I would be expected to maintain 3,000 to 4,500 square foot greens in an era when 2,000 players a week can be expected during the season. The soil in the greens were tight and compact, perculation was slow and pore space at a minimum. The soil analysis showed high phosphorus (500 lb. per acre range) and low potassium (40-72 lb. per acre range). The pH was low, in the 5.5 to 6.1 area.

What could you expect to be growing on these greens other than poa. It was the only grass that could survive under these conditions. Forty percent to 90% of the turf cover on the greens was poa annua.

I felt that, ideally, the answer would be to start from scratch and rebuild all the greens. Certain factors made it impossible for me to start on this program at the time, including: poor member acceptance of newly constructed greens and financial considerations, among others.

I embarked on the following program and have found it very successful.

Fertilization: I put 5 lb. nitrogen and 1 lb. of potash on, split in two applications in the spring. The nitrogen source---ureaform; potash---recrystalized muriate. I also put 1 oz. of celated iron on at this time---April 1st and May 1st. During the summer I spoon fed the greens by putting 1/10 lb. N. and 1/10 lb. K. on with my spray application. My fall fertilization consists of two applications of a low phosphorus fertilizer (10-3-7, 12-4-8) in quantities enough to apply 1 to 1 1/2 lb. N. at each application. This program has balanced out the fertility and pH factor of the greens, maintained the poa and seems to have favored what bent I have in my greens.

Top dressing and aerifying: A spring and fall application of 1/4 yard (per thousand) of topdressing consisting of 70% coarse sand combined with a fairly heavy aerification and followed by five or six aerifications during the spring and fall has greatly improved the top 2 1/2 to 3 inches of the green surface. Compaction is

reduced, perculation has improved greatly and pore spaces allow air to enter the root system.

Fungicides: Thiram has been the main stay of my fungicide program. Spring and fall, over the years, has seen me go from cadminates to dyrene and now to daconil. These chemicals have shown progressively better control of dollar spot for me--- 1/2 oz.-1 oz. P.M.A. according to season is added to the main chemical program. Zineb, over the last three years, has seemed to have given me a preventative control of pythium on one problem green.

Watering: The greens are watered as needed in spring and fall. The watering pace accelerates as we get into the hot weather to a maximum of every other night. We make it standard procedure to syringe the greens any afternoon that the temperature is over the low 80's.

Mowing and verticutting: We mow our greens daily through the whole growing season, in the spring and fall at 1/4 inch and in the summer at 5/16 inch. We have found that very light verticle mowing does a lot to reduce the number of seed heads on the green, and improves the appearance and putting quality of the greens.

Weed Control: The only weed that is any real problem is silver crab and we remove this by hand. We don't feel that we can take a chance on thinning our poa with the present chemicals available. Soft (hairy) crabgrass is no problem as the 1/2 oz. of phenol mercury takes care of that.

Our program has paid off during the past eight years with a minimum of green problems. We built a new putting green that helped reduce the reluctance of the membership to building new greens. This past fall we built three new regular greens and hope to continue this rebuilding program. We plan to use chemicals to keep the poa and silver crab under control in these greens. We have lived with poa and have been successful but we by no means advocate it. You are living on a powder keg when you are living with poa annua. If your percentage is too high for your bent to regain control, by all means rebuild. But if you have to live with it perhaps my experience will be of some help.

Control of POA ANNUA With Betasan or Pre-San

by
Dennis McCammon
Springfield Golf and Country Club
Springfield, Virginia

Kids these days are not much different than they've ever been---they grow up, run away from home, and get married. The only trouble is that now it isn't always in that order.

There are several things in this old world that have to be done in order so that the results of the job will be correct. A striking example is as follows. You and I have just recently paid for an all expense round trip ticket to the moon and back for three astronauts. I have heard several people express their dismay and concern at the large amount of money being spent on this project, saying there is nothing to be gained.

But I imagine many Spaniards said the same thing when Queen Isabella gave Columbus his three ships some 500 years ago.

We aren't here to discuss history, either past or present, but we are here to discuss Poa annua control. How the heck is he 'gonna tie astronauts in with grass you ask? Well, just watch.

We talked a minute ago about the order in which things should be done. Almost everyone has some kind of a routine by which they live and work, whether it is a superintendent or an astronaut. And in comparing them to us, let's take a quick look at some similiarties. Materials are important to both of us. They must be fresh, up to date, and have a full set of directions with them that must be followed to the letter. Personnel is also important. They must be trained in their job, whether they are going around the moon or spraying a green.

Equipment is important. It must be adequate to do the job and simple enough that it can be operated by the people who have been trained for the job. Timing is a big factor also. A simple mis-calculation and the spaceship misses the moon or we have crabgrass in the fairways.

Weather is another thing that must be considered. A moonshot will be scrubbed if weather conditions are not just as optimum as they should be and the superintendent will not put on his material if he is not assured of a nice shower right after application.

And the most important factor of course is cost. This factor will probably always be the sore spot in selling any kind of program to a group of people who are paying the bill, but if proper justification can be shown for it, the problem becomes a little easier to sell.

When we started our Poa program in 1966, I must admit I felt a little like an explorer setting out and charting an unknown course. But I found my reward with Poa---control.

We put just a small test plot out initially and after we saw the results, began on the front nine. The reason we chose the front was because the population of Poa was somewhat worse than on the back due to the fact that the front is about two years older than the back.

After only one year of testing, the results were so outstanding that we decided to treat the back with the same material. Not only did we get good Poa control, but as an extra benefit we got nearly 100% crabgrass and goosegrass control.

Two applications per year of bensulide material are necessary for good Poa control on bent greens. Fall application is the most important since probably more Poa germinates then, although some Poa germinates throughout most of the growing season depending on seasonal variations in temperature and rainfall.

We are finding that complete eradication of Poa from an infested area may take yearly applications over several years. To complete this eradication program, the approaches to the greens should also be treated.

Ideally fairways should be treated, but unfortunately cost on this material is not low enough yet to warrant its use on large areas.

Safety of bensulide is questionable. University studies show some root shortening, top discoloration, and general weakening of the desirable turf after application. But it has been my observation that there is only a slight yellowing of the good grass after growing season application. However, if the turf is under stress at the time of application, some injury may occur. Of course this may happen with many other chemicals besides a bensulide material.

In areas heavily populated with Poa, thinning is noticed in the Poa clumps. This is due to the flush of new Poa not coming in due to inhibited germination. But it is amazing to see just how fast the desirable grasses will fill in these bare spots.

Any aerifying or top dressing operations should be done prior to application because these jobs tend to pull seeds up which will be controlled by the spray. Bensulide remains active in the soil for a long period of time. Because of this, the period of control is longer than with many other pre-emergence materials. Re-seeding must be delayed from 4-6 months depending on soil type, pH, and irrigation, the latterbeing the most important.

Application methods depend on the formulation used. Liquid and granular are both available and both work well, however the liquid is generally preferred. We spray our greens with a truckster and have been since 1966. The method reduces our labor, time, and particularly on material due to very little being lost by wind drift.

This method of greens spraying has been well accepted by our members and to my knowledge, no one has ever said anything against it.

We can spray 4 greens per 100 gallons of water, including 15 feet of approach or 1 pass around the green. The average length of time it takes to spray a green is from 5-8 minutes.

So far, I have not observed any ill effects to the turf, at least not anything severe. As I stated, there is slight yellowing, but it is only temporary and the grass grows out of it. For anyone who has deep roots, I would advise watching the roots to see whether any shortening does appear.

Controlling POA ANNUA with Arsenates

by
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Purdue University
Lafayette, Indiana

Arsenic toxicity can selectively remove Poa Annua in turf, thus Poa annua---free turf---is a reality already proven in research and on entire golf courses. Recently a speaker used kodachrome pictures from over 30 golf courses to illustrate observed progress in this. By 1969 over 300 courses currently have some control program underway.

A four step program is basic:

1. Add no more soluble phosphorus. Why juggle two items? Why build reserves higher?

2. Start accumulating toxic arsenic. Repeat lighter application, get uniform distribution. Allow time for new grasses to grow and fill in.

3. Start improving stand of desired turf---by Aero-blade seeder, or any way to get seed into the soil, repeatedly overseed as space is available and weather permits.

4. Short days, cloudy days, wet soil and time favor selective Poa annua weakening

to be evident in these periods. Chickweed, Poa annua, crabgrass and goosegrass are less tolerant to arsenic than bentgrass or bluegrass. Arsenic interferes with the transfer of carbohydrates within the susceptible species.

A WEED

Several states have declared Poa annua a weed in seed. For example, in 1968 Florida required that the number of Poa annua seed per pound of grass seed be listed on the label. Further, seed is prohibited from sale if above 5,000 seed/lb. And, it is hoped this limit can be reduced after one year of review.

Basically there are five points relevant to the control of Poa annua. These are:

TECHNOLOGY - principles
TOOLS to accomplish the work
TECHNIQUES of man and equipment use
TIMING for plant and user benefit
TIME for biological processes

Let's describe Poa annua. It is Poa (of the meadow in Greek). This includes hundreds of species scattered almost world-wide of which Poa pratensis compressa and annua are some representatives. The early botanist seeing Poa annua germinate and produce seed in the same season, which was in contrast to perennial types called it annua, i.e., it seeds in some six to eight weeks after germination under some conditions. Now it is just like tomatoes, coleus, etc. - it will vegetatively increase until some adversity kills the plant parts. You have seen summer desiccation, severe disease smothering under ice as such damaging failure points. Also you have seen a beautiful sheen of new Poa annua come up.

I recall seeing such on August 5 at Cleveland Country Club one year. So, a normal Poa annua plant under watered fairway conditions in Cleveland would be fall germination, winter survival, spring lushness, summertime weakening, some disease, some wilting, and when things get really tough complete loss either in the winter under ice or in the summer, but then new germination occurs. We can break this cycle, we can reduce the competitiveness of Poa annua - the technology is available. Examples of success have been observed, reports of progress have been disseminated.

Club members have seen the bar revised, the kitchen modernized, the locker room changed, the grill increased. They expect these things to be major renovation of high cost with a considerable period when tradesmen may create complete unuse - the bar is closed - the grill is out. Why should it be different when we start to change the grass on the golf course? They expect continued, perfect playability out there! It takes time to revise the grill, to tear out the old, to put in the new, to refinish the walls, and it takes time out there on the golf course.

Again, someone in the club made a decision following a policy that led to improvement, and someone must make that type of decision for the club if they are going to have Poa annua removal, and it is a major decision. It requires financing public relations promotion within the membership, within the community, for we have all heard statements like - "Say, what's happened to --Country Club? Their fairways are all BURNED UP!" and the word gets around when really it is to be expected.

Some of the bottlenecks in observing Poa annua control start out rather insignificant. First, things look pretty good; now the club is well-groomed, the course is always ready for play, the superintendent is on the ball, and the turf survived last year, so why change it?

Second, the other country club tried it and they sure had some bare areas. That is not for us. In other words, one decision, one observation and the program is taboo. Our members won't stand that.

Third, the Greens Chairman catches too much "hell" already. He is fair game for every golfer to lambast as if it is club policy to beat down the official. Again, public relations are important, but somebody needs to make decisions for the club during their term of office for the benefit of the club; yet I recognize your problem and appreciate the need for meetings such as this.

Fourth, there is the problem of superintendent and crew, and equipment setup to do the job efficiently well and effectively. I have seen many errors in applications, which were unnecessary mistakes. It does take quality personnel and adapted equipment, but these are not new to good golf courses and good turf growers.

Technology

Selective repression of existing Poa annua, selective prevention of new establishment is the key. It is a small job to control Poa annua! The BIG job is to grow desired grass! We know that arsenic accumulated in the root-zone can over ride phosphorus uptake and selectively stunt existing Poa annua as well as seedlings. We also know that Betasan, Balan, Bandane, among others, can prevent seedlings of Poa annua becoming established. Each chemical has its good and bad points - that is technology. Each chemical will do certain things and permit the turf manager to do certain things. For example, Balan will prevent both Poa annua and new bent or bluegrass from seed; so will Betasan and Bandane.

Nevertheless, the turf manager should select a chemical which will be used in a repeated program that provides him with continued control. Again, technology is understanding the inter-relationships of repression of weeds, forcing of growth of desired grasses, and the principles he must follow to benefit from the selective program. For example, forcing growth with fertilizer, protecting existing grasses with fungicides, overseeding when thinness is evident - all of these are just technology.

Tools

Tools include the equipment and the manpower. The new Rogers Aero-blade seeder combination was recommended to five or six golf courses considering Poa annua renovation just because it does a uniform job of placing wanted seed in the preferred position for germination and survival.

There are combinations of tools that may be available for spreading the materials, for applying the seed and reducing the thatch, for applying the water. Upgrading to automatic irrigation, purchasing of needed equipment are just preliminary steps providing tools for improvement.

Techniques

Techniques vary widely depending on tools, depending on terrain. Basically the techniques are related to habits. I have seen golf courses start at the edge of the fairways, overlap in the middle with arsenicals just like they were mowing. They crowded together between the sand trap, spread apart in the wide spots, and then two years later you can see where the man did or did not go twice. I have seen where sprayers slowed down and killed everything, where equipment going down-hill went fast and up-hill slow so that extreme differences in results were achieved. Even calibration, simple as it is, can be overlooked.

Since this is repeat accumulations, records are important for if we miss out on how much has been applied, then uncertainty prevails on what should be applied, then question arises as to results achieved. For example, we strongly recommend that no soluble phosphorus be used when arsenic is being accumulated as Poa annua is being reduced. With this in mind it takes understanding of technology, it takes different techniques of purchasing, and if one does change his program so he uses some soluble phosphorus, then uses arsenic, who knows where he is? In contrast, if only arsenic is used, then one seeing results can interpret the end results and know where he is.

Timing

Timing is always important whether it be fighting the bull in the arena, or working to get the most from nature's normal responses. When shall the program start? Early fall is preferred. When shall it achieve toxicity? One year later. When shall I put on seed? When there are openings. When shall I put on arsenic? When stress of climate is medium. How soon may I repeat overseeding? Every two weeks. How often may I apply arsenic? After next rain or irrigation. How much shall I apply. All of these are related, thus it is very wise to have samples, models. It is wise to take trips and see other areas previously treated. And, as mentioned earlier, it is strongly suggested that timing be concentrated into one fairway, three fairways or nine fairways. Don't start on eighteen fairways. Set some timing fast and some timing slow. Treating one-half of fairways is simplest and safest for initial program for the "best" half can be used. All clubs that I know of starting a program have later enlarged the control program. (At Brae Burn, Art Anderson used lead arsenate in 1938, '40, '44, '47, '51, '55, '59 and '64 to maintain his program.)

Time

You understand a bluegrass seed. It will germinate in six to eighteen days, puts up one leaf, starts a crown, puts up a second and third leaf. As it starts its fourth leaf it also starts a tiller at the crown, then a second tiller, now it has some 8-9 leaves, and it is at least two months old---still a seedling. Then it puts out underground rhizomes, a horizontal stem which, as it emerges, causes spread characteristic of bluegrass. Now it is a teenager. A bluegrass planted August 1 with irrigation could have rhizomes in November, but a seedling dropped carelessly in October may be useless and dried by desiccation in the winter so there is nothing next spring. Meanwhile, Poa annua, which grows more normally and vigorously, completely overmasks it.

For example, at Meridian Hills Country Club in Indianapolis overseedings made in two successive falls produced a very sparse bluegrass cover of less than 5%. When arsenics kept out the Poa annua and crabgrass, the less than 5% advanced to over 95% in one season.

The purpose of overseeding is to initiate sparse starting plants which, by spread, can fill in. Bentgrass grows similarly making stolons. Bentgrass plants two to three months old are still very small. Actually where arsenics are being used at least 90% of the turf increase is from spread of existing plants. For high budget courses plugging of thin areas is a real possibility in critical spots.

Toxicity with arsenic can be summarized by these steps -

1. Stop applying soluble phosphorus.

2. Improve poor drainage areas with vertical trenching.

3. Gradually build arsenic toxicity by repeat divided applications.

4. Repeatedly introduce the desired by overseeding and plugging.

5. Re-sod the worst first. For example, fronts of tees and aprons.

6. Cloudy days, short days, wet soils and time, favor selective Poa annua weakening.

In summary, when your club determines the policy and budget for your program, the turf manager carries out the policy. Poa annua control should require two years, but the results will be worth the effort. So, I am through with Poa annua - the failure grass. It is not up to modern standards. 2,4-D took care of broadleaves, Silved took out clover, Dicamba has removed knotweed. Now it is Poa annua's turn at bat.