GTI HILITES

Coring Enhances Benomyl Treatment for Dollar Spot

Dollar spot is a serious disease problem of bentgrass, the grass species most often grown on bowling greens. In addition thatch is a recurring problem on bowling greens. It is controlled in part by coring. Professors Tom Hsaing and Jack Eggens and graduate student Leon X. Liu of the Univ. of Guelph have combined the treatments for the two problems to enhanced the effectiveness of a fungicide used for the control of dollar spot on bentgrass.

Benomyl is a commonly used systemic fungicide on turf as a soil drench for the control of the disease, dollar spot. The soil drench is usually achieved by apply a large volume of water to distribute the fungicide into the soil. Where infiltration is low and where a significant depth of thatch occurs the benomyl movement into the soil may be restricted. This is particularly true where thatch occurs because thatch may absorb large amounts of the fungicide.

Hollow tine coring is an accepted procedure for increasing the infiltration rate and decreasing the thatch accumulation, while at the same time stimulating root and shoot growth. The surface area of turf exposed to the chemical may be more than doubled when the surface area of side walls of the core hole are taken into consideration.

The GTI researchers applied benomyl at 3 kg/ha in 1250 litres of water/ha, 1, 7 and 14 days after hollow tine coring. Twenty mm of irrigation was applied immediately after the benomyl treatments.

Turfgrass clippings, the upper 10 mm of thatch (thatch depth ranged from 14 to 21 mm) and the upper 10 mm of soil were removed at 0-10, 11-20 and 21-30 mm from the core holes for benomyl analysis.

The insure a uniform dollar spot disease occurrence the plots were inoculated with a mixture of five strains of the dollar spot fungus at weekly intervals commencing the day after benomyl application. Visual evaluation of the disease was made 1, 7, 14, 21 and 28 days after the fungicide application.

Four replicates of the treatments were applied in each of 1992 and 1993. The average of the two years of data are reported herein.

Among all coring treatments, those cored 14 days before benomyl treatment gave the highest concentration of benomyl in the grass clippings one day after the fungicide application (Table 1). The increase was primarily associated with the turf immediately adjacent to the core hole. Core cultivation one day prior to benomyl treatment provided the longest lasting uptake of the fungicide, reaching a maximum 14 days after application (data not shown).

The level of benomyl in the thatch was significantly higher than in the grass clippings(Table 1). Benomyl concentration decreased as the distance from the coring hole increased and with the time which had elapsed from the time of coring.

The soil from treatments which had been cored one day prior to benomyl application had significantly higher concentrations of the fungicide than coring seven or 14 days for all distances from the coring hole. Thus the core holes were the avenue for major water movement into the soil during the irrigation of the plots after benomyl application.

Benomyl application significantly reduced the occurrence of dollar spot on the bentgrass (Table 2). The longer the delay in fungicide application after coring the lower the degree of control of the disease; to the extent that allowing 14 days to elapse gave no better control than benomyl without coring.

This interesting experiment clearly demonstrates that the timing of one management practice with respect to a pesticide practice can result in an enhancement of efficacy of the pesticide. Another management practice whose timing can also influence dollar spot control is light nitrogen applications.

A worthy project for the researchers to consider is the degree by which the rate of benomyl application can be reduced when the application is coordinated with coring and nitrogen applications. It would be interesting to determine if the same concept applies to other systemic pesticides.

Table 1: The influence of coring at three times prior to fungicide application on the concentration of benomyl in the bentgrass leaf, thatch and soil at three distances from the core hole.

Benomyl concentration @ 3 distances (mm) from core hole

Coring prior to application (days)	Leaf 0-10	Leaf 11-20	Leaf 21-30	Thatch 0-10	Thatch 11-20	Thatch 21-30	Soil 0-10	Soil 1 1-20	Soil 21-30
				(benomyl conc. ppm)					
1	0.6	N.D.	N.D.	38.6	26.6	6.8	6.3	3.7	3.7
7	0.8	0.5	0.5	31.2	25.2	22.0	3.2	1.4	1.6
14	1.2	0.8	0.7	26.3	22.8	19.8	1.0	N.D.	N.D.

Table 2: The influence of coring at three times prior to application of benomyl on the control of dollar spot in bentgrass.

Coring prior to application (days)	Days after benomyl application 1	7	14	21	28
	(No. of dollar spot patches/two m[2])				
1	0	0	0	0	0
7	0	0	0	8	18
14	0	0	2	19	43
Benomyl less coring	0	0	7	21	48
Check	0	3	19	51	103

UNDERSTANDING TURF MANAGEMENT

THE FESCUES

the 18th in a series by
R.W. Sheard, P.Ag.

Tall fescues will tolerate the soil conditions and maintenance of a poor sports field, but a good sports field will not tolerate tall fescue.

A renewed interest in the fescues has occurred in recent years as a cool season turf species with the advent of the turf-type cultivars of tall fescue. The interest has been sparked by the ability of some members of the fescue family to continue to provide an acceptable appearance when under stress such as drought or heat.

The Fescue Family

The fescues originated in Europe, but today are common throughout the world.

While there are approximately 100 fescue species, only six are considered of any value for turf. The six are divided into two groups on the basis of leaf texture or width: the course fescues and the fine fescues.

The course fescues are tall fescue (*Festuca arundinaceae* Schreb.) and meadow fescue (*Festuca elatior* L.). The fine fescues are creeping red fescue (*Festuca rubra* L.), chewings fescue (*Festuca rubra* L. subsp. *commutata*), sheeps fescue (*Festuca ovina* L. subsp. *ovina*) and hard fescue (*Festuca ovina* L. subsp. *duriuscula*).

As the name suggests the coarse fescues are characterized by a relatively broad, wear resistant leaf and deep rooting. As a result they are relatively stress tolerant, especially to drought and heat. Stands of pure tall fescue, however, tend to become clumpy, particularly in thin stands, because it is a bunch grass which expands by tiller formation at the edge of a wide crown. Meadow fescue is a relatively short lived bunch grass which has some tolerance to poor drainage, but is seldom considered for sports field mixtures.

Under heavy wear, mixed stands of tall fescue with spreading rhizomatous species such as Kentucky bluegrass, tend to isolate the bunch grass into unsightly clumps. A pure tall fescue stand, overseeded with bluegrass for renovation purposes, will quickly become an unsightly rough turf.

While originally developed as a pasture species for the transition zone between cool season and warm season grasses, recent cultivar selection has generated turf-type cultivars of tall fescue which have a finer leaf that is visually more acceptable. The studies have also considered the insect resistance of tall fescue due to endophytic alkaloid production.

The fine fescues are generally represented by creeping red fescue, however, there are subtly differences between the various subspecies. Creeping red fescue has short, slender rhizomes and is thus capable of colonizing bare areas. In contrast chewings fescue does not have rhizomes. Sheeps fescue, also a bunch type grass, has the ability to survive under extreme drought conditions of sandy to gravelly soils. Hard fescue, likewise a bunch grass, is the coarsest of the fine fescues.

Fescue Advantages

The major advantage of the turf-type tall fescue cultivars is their tolerance to stress, whether it be from drought, heat, fertility or wear. During periods of heat and drought stress the leaves retain their colour and rigidity better than most other turf grasses. The coarse nature of the leaf imparts a relatively high degree of wear tolerance into tall fescue. It has therefore been suggested for sports fields where minimum maintenance is to be used.

The second advantage of turf-type tall fescues is the recent interest in endophyte alkaloid production which imparts a degree of insect resistance to the tall fescue (see Sports Turf Manager, Vol 8, Issue 2, 1995).

Due to the darker green colour of the leaf, tall fescue appears to tolerate low fertility and an acid pH better than other turf species. Nevertheless its growth performance is best with a soil pH of 5.5 to 6.5 and medium to high fertility. An advantage for non-sports field use, such as drainage channels, is its tolerance to wet conditions and ability to survive periods of submersion.

Tall fescue emerges rapidly which makes it a desirable species for overseeding areas where the turf has been lost due to excessive wear.

Meadow fescue has many of the same advantages of tall fescue, but in addition it has a brighter green leaf, a finer textured leaf and greater shade tolerance. It is seldom used in sports field mixtures in North America, but is more compatible than tall fescue in mixes with Kentucky bluegrass.

The main advantage of the fine fescues is the fine textured leaf. The principal species used for turf is creeping red fescue, so named from the extravaginal type of root development and the occurrence of thin, short rhizomes. It also has a fibrous and extremely dense root system.

Creeping red fescue has the greatest shade tolerance of the cool season turf species. Shoot density under shaded conditions, however, is less than in full sun. Nevertheless under full sun conditions a mixture of bluegrass and red fescue will be dominated by the bluegrass. It has good drought tolerance but does not tolerate poorly drained soils.

The primary advantage of Chewings fescue is its tolerance to acidic soils. Its other attributes are similar to red fescue.

The principal advantage of sheeps fescue is the high degree of drought tolerance. It is also a particularly long-lived perennial. Hard fescue also has similar properties but may exhibit greater poor drainage tolerance.

Fescue Disadvantages

With the exception of creeping red fescue the main disadvantage of the fescues is their bunch type growth habit. Unless a very dense stand is maintained the advantage associated with the wear quality of fescues is lost on sports fields. Furthermore when the stand becomes thin and is overseeded with bluegrass or ryegrass the overall appearance of the field deteriorates due to the surviving course clumps of tall fescue.

To maintain a desirable turf of tall fescue an intense overseeding program is required. Seed germination is sufficiency rapid to allow the overseeding programme to be successful even during periods of field use.

Tall fescue does not have the cold tolerance of the bluegrasses. This adds to the thinning of the stand and the tendency to form a clumpy, undesirable turf within a few years of seeding.

Due to the very fine nature of the leaf and the tendency to lay over or lodge, the fine fescues are difficult to mow unless maintained at a relatively low mowing height of 4.0 cm.

Cultural Practices

Good performance of fescues is obtained with medium levels of nitrogen. In fact the red fescues may decline in quality with high levels of nitrogen. Phosphorus and potassium requirements are similar to other turf species.

With the exception of the red fescues cutting at less than 5.0 cm will encourage the clumpy growth habit of the fescues.

While tolerant to adverse soil conditions best performance is obtained where good soil conditions of porosity, drainage, neutral pH and fertility are maintained.

Seed mixtures of tall fescue and perennial ryegrass should be (by weight) 50% ryegrass : 50% fescue. With bluegrass the mixture should be 20% bluegrass : 80% fescue.

NEW MEMBERS

Brian Campbell, St. George's School, Vancouver
Jack Funk, Univ. of Toronto
John Wilson, York University
Hendrick Verkammen, York University

Sharpening Rotary Mower Blades

John Lindenfelser, John Deere Ltd
& Devon McGee, Encore Manufacturing

Rotary mowers cut grass as the blade's cutting tip, moving at a high velocity, impacts the grass blades. For the quality cut, the cutting edges of the mower blade must be sharp.

Commercial cutters should install new or resharpened blades at least once a day. This is required for a professional quality cut.

A blade's cutting edge varies in length but is usually several inches long. The first inch does most of the cutting. Assume you are moving with a walk-behind mower with a blade at 3250 rpm. At this speed, the blade rotates at 54.17 revolutions per second. Also assume that the mower is going forward at 2 mph or 3 feet per second. With two cutting edges on the blade, the 54 rps equates to 108 cutting swaths per second. At 3 fps, each swath removed a 5/16th - inch strip of grass; therefore the interior portion of the cutting edge contributes little to the cutting process. Since the first inch does most of the cutting, it is important to get a good edge on this area.

With some of the popular mulching blades, the extended cutting edge recuts the clipping during suspension. It is also felt that the increased ground speed of riding mowers makes it beneficial to increase the length of the cutting edge.

Once the mower blade has been removed for sharpening:

- Check the blade to assure that it is not bent and that it has the correct attitude in relation to the mower housing and the ground surface. (To check this, place the blade on a perfectly flat surface). The blade should be straight, with the cutting tips lower than the heel (centre portion) of the blade.
- Sharpen the blade by grinding the top surface only, maintaining the original cutting edge angle. Make sure all nicks are removed and that the cutting tips are smooth and sharp.
- Make sure the blade is balanced. Use a commercial balancer or place the blade on a pin clamped in a vase. If one end of the blade swings downward, material must be ground gradually from the heavy end until the suspended blade will remain in a fixed position.
- Properly reposition the blade on the mower. Tighten the retaining nut securely.

[Reproduced from *Landscape Management*, May, 1995, pp 38.]

EDITORIAL

Who Pay$?

Traditionally agricultural research and extension has largely been funded by the Federal and Provincial governments. Turf research and extension has always been a beneficiary of that funding.

The policy was the result of a desire on the part of the Federal and Provincial authorities to promote a vibrant food producing capacity. In part the policy resulted from the initial development of the country. In part the policy developed from food shortages in Canada and in England during the two wars. In part the policy developed from the social aspect of maintaining low cost food. To a large degree, and with global markets, none of these reasons apply today.

Furthermore, none of these reasons justify turf being a part of the policy. Nevertheless turf contributes to the general well being of the nation, through recreational activities, aesthetics of the environment, even pollution abatement. Strong arguments can be made for sport which involves turf as a means of crime prevention by providing an alternative activity to burn off excess energy.

While industry has contributed significant funds for projects of current interest to industry in product development, the infrastructure - the expensive part of the system - has largely been established through tax payers money. A notable exception is funding of the Frost Building at the Guelph Turfgrass Institute.

In the past few years, however, budget restraints have drastically curtailed the funding available for turf research and extension. To continue the research and extension programs in turf alternative funding must be found; funding for projects which are not the focus of a particular turf supply company, but which are necessary for the turf industry as a whole.

One avenue which should be explored to generate the necessary funding is "user pay". Should a charge not be levied for all extension calls which truly reflects the cost of that service - a cost equivalent to what a private consultant would bill? Should a research project at the GTI not be charged the full cost of maintaining the facility - a percentage of the station capital cost, the operational cost etc.? Should new services be generated by GTI to service the needs of the industry on a cost recovery basis?

Developing Turfgrass Cultivation Programs

Dr. Robert N. Carrow
University of Georgia

Adverse soil physical conditions are a frequent cause of limited turfgrass growth. Soil compaction, just one cause of poor soil physical properties, is often considered the most important cultural problem on recreational sites.

Alleviation of soil compaction and other physical problems requires several approaches: cultivation, soil modification, drainage, traffic control and careful irrigation. With continual traffic on golf courses, cultivation is the most common means of dealing with adverse soil physical problems.

Although cultivation *techniques* have been widely used on golf courses, superintendents have found it difficult to develop sound cultivation *programs.* Fertilization programs, for example, are formulated from a wide base of knowledge about turfgrass fertility needs, soil test results, understanding of fertilizer carriers and so forth. From this scientifically based pool of knowledge, a good fertilizer program - setting forth rates, timing of applications and other specific guidelines - is established. In contrast, cultivation programs have been developed more by trial and error.

In this article, the keys to formulating a sound cultivation program will be discussed. Key steps to developing a good program include the following:

- Identifying the problem(s).
- Selecting the best method(s).
- Determining the desired frequency and timing.
- Applying cultivation at correct soil moisture.
- Evaluating your results.

Identification of the Problem

Unless the specific, primary (basic) soil physical problem or problems on a site can be identified, several things can occur. First, the best cultivation procedure(s) cannot be chosen, and second, the best overall approach to solving it cannot be determined. Perhaps soil modification or drainage would be a better long-term approach. If cultivation is involved, frequency of cultivation is difficult to determine. Included in identifying the problem is its location within the soil profile, such as a surface compacted layer, a fine textured soil several feet deep or clay lens at 12 inches.

Soil physical problems and their location within a soil horizon are not always easy to identify. *Symptoms* that evolve from the presence of a primary problem are what the grower normally observes, such as a water-logged soil, standing water, poor aeration, black layer, poor rooting, a hard soil, a droughty area, low infiltration/percolation and, in some instances, excessive infiltration/percolation. Unfortunately, various symptoms can be caused by several primary problems.

Some suggestions in identification of soil physical problems are:

- Use probe or shovel to carefully observe the different layers or horizons in the soil to a depth of 1 1/5 to 2 feet. Do not ignore even small layers if they differ distinctly in texture from surrounding layers.
- If you think that a layer interferes with water movement, take a cup-cutter-size core with the layer in the middle portion. Add water to the top (in a small depression) and see if it will move across the layer.
- When the soil has been thoroughly wetted, such as after a prolonged rain, slowly insert a long, pointed steel probe (pencil-size diameter) in the soil and note whether any areas of high resistance are present. Carefully observe the layers to see whether roots penetrate them or water perches above them.
- Observe the root growth patterns for any indications of limited rooting deeper in the profile. Conditions that hinder rooting throughout the whole profile and not just a zone in the profile are a surface-compacted layer (either thin or several inches in depth) and an excessively fine-textured soil throughout the profile.
- If you suspect a high water table vs. a drainage barrier that perches a water table, core a hole several feet into the soil and follow the depth of the free water table over a 3-4 day period. A high water table normally will remain relatively static, and if it is a perched water table, the deep core should drain it and cause a rapid lowering of the water.
- Use common sense to determine whether poor contouring is simply channeling water into an area in quantities higher than soil infiltration can remove it, thereby causing an excessively wet area.
- If a sodic problem is anticipated, have a soil test conducted.
- Check with individuals with expertise in soil physical problems such as the state extension specialist. USGA agronomist or soil conservation personnel.
- Proper identification of the primary soil physical problems is not easy. This is one of the main reasons why good cultivation "programs" have not evolved nearly as rapidly as other routine programs used on golf courses. However, considering the potential for expending much labor and money without results when the wrong approach is chosen, good motivation exists for a more logical approach.

Select the Best Method or Methods

As stated, cultivation is just one choice for alleviating soil physical problems. The pros and cons must be weighed for cultivation, soil modification, drainage and other less important measures such as traffic and irrigation control. Often a combination of approaches is necessary.

Because the focus of this article is cultivation, we will assume that cultivation is the best option in this instance. The next step is to select the best cultivation method or methods to deal with the physical problems on your site. Important questions to answer are:

- How much *surface disruption* will occur? For close-cut turf, this is of particular concern. Also, the degree of disruption is important in determining the time of year an operation can be done, the degree of interference with turf use and how frequently it can be used. Moderate to severe disruption of the sod generally means timing the operation only in a period of rapid regrowth for the species and conducting the procedure as infrequently as possible.
- What is the *longevity* of expected results and what is the *magnitude* of improvement desired? If a procedure results in a reasonably long period of alleviating a problem, then a higher degree of injury may be tolerated. Also,

soil physical problems are often corrected by removing excessive water or by altering the pore-size distribution and density of the soil. The later aspects cannot be achieved without soil movement, thus, greater potential for injury in many cases.

If the superintendent desires a major degree of soil cultivation, then closer tine/blade spacings and deeper penetration or both will be necessary.

- *How deep is my problem* located in the soil? Different cultivation procedures may vary from 1/4 inch penetration to 16 inches. Unless cultivation blades or tines penetrate the problem zone, little benefit is expected.
- Is soil *loosening desired* or is penetration without loosening acceptable? Certain cultivation operations have a high degree of loosening while others do not. Loosening alters the pore-size distribution and density of fine-textured soils to produce macropores for root, water and gas movement. These macropores would be in addition to any pore space created directly by the tine or blade and would be between areas of penetration.
- Do you desire to *topdress* with sand after cultivation to modify the soil over time or to keep channels open? Topdressing can be applied after any cultivation procedure that does not bring soil to the surface. However, operations that leave larger or deeper holes require considerable sand to fill the holes, and working the sand into holes is not easy. Disregarding the difficulties of sand application, sand that fills cultivation cavities (whether small or large) will help prolong the beneficial life of the cultivating operation. It is very desirable to have a cavity open to the soil surface to facilitate maximum water infiltration and gas exchange. A cavity created deeper in the soil that becomes closed to the surface does serve as a root channel but is much less effective for water and gas exchange than one open to the surface or filled with sand to the surface.
- Do I want soil to be *brought to the surface*? A grower may wish to bring soil to the surface to remove it from the site as part of a program to partially modify the soil with sand addition. A frequent concern with Verti-drain operations on golf greens is whether to use hollow tines and bring up a core, remove it and topdress with sand or to use solid tines and topdress.

  In this case, the "ideal" from the soil physics standpoint would be to use hollow tines to reduce side and bottom compaction around the tine. However, the "practical" belief of this author is that the relatively wide tine spacings and loosening tine action minimize these potential problems. This would not be true for hollow vs. solid coring tines where spacings are at 2 inches and tine operation is vertical without appreciation loosening of the soil.

  Sometimes growers want soil to be brought to the surface for the additional benefit of topdressing. This is a factor to consider especially on fairways.
- *Will localized compacted* zones occur somewhere in the soil as a result of using procedure? The occurrence of a compacted zone immediately beneath 3-inch coring tines - both hollow and solid - have been observed in the field and demonstrated in research situations. Primary factors that influence the development of such layers are: closer tine spacings will result in more rapid formation, soil texture with soils high in clay and silt are more prone to formation of such zones, and more frequent cultivation, especially on a moist soil, favor compacted zone development.

  Any implement that is pushed into the soil will cause some compaction - the important issue is whether more compaction is alleviated that formed. For example, core aeration at 2-inch spacings with 3-inch tines is useful in correcting a compacted surface zone. At the same time, it may contribute to development of a compacted zone at 3-4 inches in the profile over a period of time. Periodic cultivation with a procedure that penetrates deeper will correct the deep zone. Once every two or three years would be sufficient on most sites to destroy any deep zone of compaction created by core aeration.
- *Other practical considerations* in developing a cultivation program include: weight of the equipment on golf greens, cost of purchase of equipment or leasing, availability of equipment for leasing and speed of operation.
- Assuming a clear understanding of the problem(s) present on a site, a cultivation program is formulated to correct the situation. This generally means that several different procedures often must be used and that when several methods are used, the timing and frequency of each procedure will differ.

  For example, core aerification may be conducted spring and fall on a golf green, pin spiking or small solid tine coring in the summer on a biweekly basis, and Verti-drain or drill aerification once every two or three years. Each procedure is selected to deal with a specific problem, and the superintendent must weigh the pros and cons of different options and select the best methods for his site.

Determine the Desired Frequency and Timing of Cultivation

A proposed program should be developed on paper for each site. Frequency of an operation depends on the severity of a problem and persistence of a problem such as surface soil compaction from normal vehicle and foot traffic. In the case of topsoil that has very high clay content, deep cultivation several times per year would be beneficial for one to two years, followed by a less frequent program of deep cultivation. The same soil, however, would be prone to continual surface compaction and may require core aeration two to three time per year every year.

Timing of cultivation is controlled mainly by the degree of injury that occurs and whether play is disrupted. Operations that cause moderate to severe turf injury should, ideally, be timed when the turf has an opportunity to rapidly heal. For cool-season species, this would be early to late spring and early to mid autumn. For warm-season grasses, summer is best.

When a cultivation operation is performed that causes initial deterioration in turfgrass quality, golf course superintendents have traditionally applied supplemental nitrogen fertilization before or immediately after the procedure to stimulate recovery. Additional irrigation is also used. Research by B.J. Johnson and R.N. Carrow on Tifway bermudagrass demonstrated a long-term decline in turf quality after core aeration, even under a good lawn-care program, when supplemental nitrogen and irrigation were not used.

Other factors that influence timing are:

- Condition of the turf at the time of cultivation.
- Whether any unusual environmental or pest stresses are present.
- The potential for weed seed exposure, especially *Poa annua.*
- Whether the pre-emergence herbicide barrier to control annual grasses may be disrupted. Researchers at Michigan State and Georgia have demonstrated that this is not a concern in most situ-

ations.

- The availability of labor.
- Whether soil moisture is suitable.

Apply Cultivation at Correct Soil Moisture

Different cultivation methods are most effective at a particular soil moisture level at the time of application. If soil moisture is outside this range, effectiveness declines.

Methods that have loosening action on the soil are more effective if the soil is somewhat drier than field capacity. Field capacity would be the soil moisture at one day after a good irrigation or rainfall event on a fine textured soil. "Somewhat drier" would be two to four days after irrigation or rainfall.

If the soil becomes too dry, the implement will not be able to penetrate and will lose its effectiveness. In contrast, on excessively moist soils, little loosening action occurs.

For operations that penetrate the soil, but with minimal loosening action, a soil moisture near field capacity would be best. Any cultivation should be avoided at soil moisture above (wetter than) field capacity to avoid destruction of the soil structure.

Evaluate your Results

The benefit of cultivation are often difficult to evaluate. You should be able to observe improved filtration/percolation, better rooting, increased shoot growth or loosening of the soil; this, the grower should see fewer of the symptoms that represent clues to the presence of soil physical problems. Using the same procedures to identify the primary problems on a site is beneficial in identifying results. Careful observation of the soil profile is particularly beneficial. Sometimes an untreated area can be left for comparison.

While evaluation of cultivation results is difficult, it is well worth the effort to adjust your program over time. Certainly this is one area where the experience of superintendent and observation over time are essential to evaluate cultivation program effectiveness.

In conclusion, cultivation programs evolve by long-term experience on a particular site (i.e., trial and error); using what someone else has found effective; using the "latest" device with hopes it will be the right operation; or by a careful analysis of the problem, evaluation of different options and correct use of various procedures.

The main reason that better cultivation programs have not evolved are:

- Difficulty in determining the primary soil physical problem(s) present on a site.
- A lack of specific, comparative data on how each cultivation method influences soil physical conditions and turfgrass growth.

Historically, growers have had to rely on empirical observation to determine the relative effectiveness of different techniques. In recent years, research projects supported by the USGA Green Section at Michigan State University and the University of Georgia have greatly increased our knowledge about various methods. Much of this information will be published over the next year.

Because soil physical problems exist on almost all golf courses and cultivation is a main tool to alleviate these problems, the development of a sound cultivation program is important. The same logical and scientific approach used in formulating cultivation programs as with other cultural practices will result in improved and more efficient cultivation and better turf.

[Reproduced from *Golf Course Management*, Vol. 58, August, 1990]

Report from Down Under

by Pam Charbonneau, OMAFRA Turfgrass Advisor

In August of this year I had the opportunity to take part in the Mid-Conference meeting of the Board of Directors of the International Turfgrass Society (ITS) in Sydney, Australia. The major focus of the society, which was founded in 1969, is to host the "International Turfgrass Research Conference" (ITRC). This conference is held every four years, and a different country from around the world hosts the event. The mid-conference meeting was held in Sydney, Australia, because they are the hosts of the 8th ITRC to be held in July, 1997. My involvement with this organization stems from the fact that Canada has offered to host the 9th International Turfgrass Research Conference to be held in 2001 in Toronto and I have volunteered to be one of the key organizers. The Board of Directors of the Sports Turf Association awarding me a travel grant toward the cost of my travel which made it possible for me to attend this meeting. This travel grant was greatly appreciated.

I would like to give the Sports Turf Association membership some information about the International Turfgrass Society as well as some technical highlights from my trip to Australia. As I mentioned the Society sponsors a turf research conference every four years. Of note at the last ITRC held in Palm Beach, Florida, was the number of papers presented on sports turf. There was a half day symposia on "Quantification of Surface Characteristics of Sports Fields" where 7 papers were presented. The reason that I mention this is that when the ITRC is held in Canada this will be an excellent opportunity to hear world renown researchers talk about their work on sports fields. I know 2001 seems a long way down the road, but it will be upon us before we know it.

As a board member of ITS, I sit on the Board of Directors with Directors from the United States, New Zealand, Australia, Japan, Denmark, France and England. Our task at the Mid-Conference meeting was to help organize the conference for 1997. The ITRC is a week long conference with a one day field trip to turf sites of interest in the middle of the week.

We had the opportunity to visit several potential sites which could be included in the ITRC turf tour in Sydney. All of these sites were growing warm season turfgrasses. Our tour visited the Royal Botanic Gardens where there are several turf species demonstration plots, the Australian Golf Club where there are some replicated turf variety trials, Sydney Race Track which has a turfed track, the Olympic Warm-up Track and the Australian Turfgrass Research Institute which is a self-supporting institute. This institute offers consulting, soil testing, pest diagnosis as well as research testing of new turf products and pesticides. There is a lot of interest in turf at the moment in Australia because of the fact that they are hosting the Olympics in the year 2000.

Much of the interesting information from my trip to Australia was gleaned from conversations with ITS board members. We are all familiar with the project which involved moving turfgrass to the Pontiac Silverdome for World Cup 1994 which was headed up by Trey Rogers of Michigan State University. There were also projects undertaken for World Cup 1994 which involved putting in temporary sod over artificial turf in stadiums such as Meadowlands Stadium in New Jersey and Giants Stadium in New York. These techniques involves placing plywood on top of the artificial turf followed by up to three layers of polyethylene and geotextiles. The agronomists had to guarantee that at the end of the soccer games that the artificial turf would be as good as new. The geotextiles were topped with a layer of sand anywhere from 3-10 inches and then large rolls of bermudagrass sod were laid on top. Bermudagrass is not normally grown in the Northeast but it was felt that they would withstand the wear and the temperatures better that cool season turf species. This all took place from a month to 3 weeks before the soccer games. At the end of the games the organizers had as little as 24 hours in some cases to bring the fields back to artificial turf. Since the World Cup of soccer there have been several exhibition soccer games which have taken place in the U.S. featuring European teams. At these events artificial turf has been covered and thin layers of sand (as little as 3 inches have been brought in) and thick cut sod (1.5 inches) has been placed on top. Dr. Jim Watson of Toro International will be talking about some of these projects in his keynote speech at the upcoming 1996 Ontario Turfgrass Symposium.

Dr. Jim Watson also reported on work being done at Michigan State University on use of crumb rubber (recycled tires which have been ground up) as a topdressing for heavy wear areas in sports fields. A one time application on 1/4 inch provides good protection of turfgrass crowns from wear. This also has been useful for high traffic areas in passive parks and golf courses where cart traffic is heavy. This technique could easily be adopted by Ontario sports turf managers.

Researchers from New Zealand are conducting trials on a new type of turf which consists of natural grass grown into a synthetic matting on a sand base. The result is a surface with the playability of natural grass with the wear resistance and durability of synthetic turf. This type of turf is compatible with a Prescription Athletic Turf system or any other field construction, provided there is good drainage. Maintenance practices are very similar to a natural turf field, however the field could not be aerated but could be verticut to control thatch. Water use may be less because the mat provides a barrier which slows down evapotranspiration. Optimum mowing height for this type of system is 1 1/2 inches which is similar to a natural turf field. There are two fields in the United States which have this system - Rice Stadium at the University of Utah and University of California at Los Angeles practice field. This system also shows promise for golf tees and walk-off areas near greens. (see following article)

New Zealand has also developed protocols for measuring the quality of sports turf surfaces. The idea behind this is to have a minimum standard for sports field surfaces. If a field falls below the minimum the teams are not obligated to use the field. The motivation is to provide a high quality, safe playing surface for all athletes.

The ITS board member from Japan reported on the current economic recession in Japan. Although golf course construction is down by 20% there is an increase in interest in sports field construction. This has partly been triggered by the fact that Japan will be hosting the World Cup Soccer tournament in the year 2002.

As you can see there are many new products and techniques being investigated around the world to make your job as turf managers easier, or more challenging. By the time 2001 arrives there will be many more innovations. I hope many of you will mark your calendars for the 9th International Turfgrass Research Conference to be held in Toronto in July 2001. Again, I want to thank the Sports Turf Association for making this trip possible.

The Best of Two Worlds?

Terry McIver
Editor, Landscape Management

Natural and Synthetic Turf Joined for Divot-free Playing Surface.

Proponents from both the artificial and natural turf will be thrilled with the latest ally in athletic turf surfaces: SportGrass.

The invention of sport field expert Jerry Bergevin, president of Turf Systems International, SportGrass consists of natural grass growing into a synthetic matting. Grass grows down through the synthetic backing and in between fibrulated synthetic strands, which protect the crown and roots of the plant.

The results is a surface with playability of natural grass and the wear resistance and durability characteristics of synthetic turf. The natural turf cushions the impact of sports activity, and the artificial turf and matting below act as an anchor to reduce - if not eliminate - divots.

SportsGrass is available as sod, or it can be established on site, as it was this past summer at the University of Utah's Rice Stadium, the first major SportsGrass installation in the U.S.

Brian Nelson, director of buildings and grounds at the university, says the field has held up "extremely well" after practices and two full games. A pregerminated ryegrass mix was used to fill in minimal wear areas - which the company says should be expected - but Nelson reports there were "no divots whatsoever."

SportsGrass needs five to six weeks to establish, after which the grass has grown above the height of the plastic blades, and the roots have formed a mass of interconnecting fibres in the soil.

SYNTHETIC SECRET - The key to field stability seems to lie in the type of synthetic material used. SportsGrass uses Desso DLW synthetic turf, manufactured by Desso DLW Sports Systems, Int., headquartered in Germany.

"SportsGrass is basically the same material as a sand-filled synthetic turf. "All we've done is modify the material." says Bergevin. The artificial turf is made out of polyethylene, which is softer than polypropylene or nylon, and has a more grass-like feel.

"The fibre is thicker," says Bergiven, "and I don't allow them to use the secondary latex backing because that makes it impervious (to air and water and gas exchange)."

"SportGrass is stabilized horizontally and vertically, which is very important," says Gundolf Becker, U.S. marketing manager for Desso DLW. "SportGrass is stabilized horizontally by the backing," explains Becker, "to distribute the load. Vertically, it's stabilized by the fibres."

Bergevin says SportGrass are compatible with a Prescription Athletic Turf system or any other viable field construction, provided there is good drainage.

SHORT GROWING SEASON - Bergevin realizes that playing on a newly established field is not always the best treatment for tender young seedlings. "Generally," he admits , "you like to have a full growing season. But it will survive fine as long as they don't play on it too much. The second season it will be great."

"We're still doing lot of testing," says SportGrass Marketing Manager Donny Jones, who adds that he's had inquires on how SportGrass can be used at golf driving ranges and in tee boxes. "it's working well in high traffic, walk-off areas on test golf areas," says Jones. "We're almost there for tees, but the main focus is ball fields."

SODDED VARIETY - Three thousand square feet of SportGrass sod were recently installed at a UCLA practice field. Dave Ashman, facilities director, is most impressed with SportGrass's "instant playability."

"The sodded material gave us such an advantage because you didn't have to wait to get on it," says Ashman. "It gives the team a competitive advantage and gives them a safe environment. It may not be the final answer, but it's close."

Bergevin cautions against thinking of SportGrass as a "perfect" turf, but he says it still is subject to the pests which plaque normal turf, but without the problem of root-feeding insects.

"It's still 100 percent natural turf," reminds Bergevin, but he adds that he doubts pest problems will appear in the same degree of severity as they can on a field that does not have the artificial underbelly.

AIR CONDITIONED - An added feature of Rice Stadium field is the SubAir cooling system. Developed by Augusta National superintendent Marsh Benson, SubAir picks up cooler air from the tunnels below the stands and blows it through the subsurface drainage system to oxygenate and cool the turf.

Eric Chapman specializes in nutrient movement through sand-based profiles. He's consulted with Bergevin during the Utah SportsGrass establishment phase, and gives the field high marks.

"There would never be a need to aerify if you maintain an aggressive verticutting and thatch control program via nutrition, catching clippings and irrigation," says Chapman. Verticutting is advised at the rate of four to six times a year.

"There may be some management changes in water use because the mat actually provides a barrier against evaporation," suggests Chapman. "It may be that this field uses less water in the long run because of the barrier to evaporation."

EARLY FERTILITY PROGRAM - Chapman explains that during establishment a granular fertilizer was used,

continued on page 10

The Best of Two Worlds
continued from page 9

one that contained a bit more soluble nitrogen rather than a full-blown slow-release product.

"It's young field," reminds Chapman, "and as in sand-based situations, the microbiological activity needed for breakdown of slow-release materials isn't there yet. So we're using more of quick-release fertilizer for now. They'll be able to use a blend of nitrogen that has more slow-release as the field ages.

Optimum playing height for SportsGrass is one-and-one-half inches.

[Reproduced from *Landscape Management,* October, 1995, pp 8G &G]

Reel Grinding for Turf Health, Beauty

by Don Lindenfelser
John Deere Ltd., Golf & Turf Division

Reel mowers are precision machines that need daily maintenance to retain the turfgrass's well-groomed appearance. The scissor-like shearing action of a reel mower is only possible if the reel and bedknife are sharp and the proper reel-to-bedknife clearance is maintained.

Cutting action begins as the bedknife positions the grass to be cut at the cutting edge. The reel then pulls the grass toward the bedknife where it is sheared by the cutting edges as they pass one another.

For the grass to be cut at the proper height, it must contact a bedknife with the proper angle at the cutting edge, so you should grind a 5 percent relief angle on the front face of the bedknife. Without a relief angle, the blade of grass will contact the lower edge of the bedknife and bend over at too much of an angle prior to being cut. When mowing greens, where very small cuts are being taken, an improperly aligned bedknife may not capture the grass at all, and no grass will be cut.

Close examination of the reel-to-bedknife relationship reveals two square edges passing one another with approximately .002 of an inch clearance. This clearance is necessary because:

- If the reel contacts the bedknife, the square (sharp) edge of the reel and bedknife will roll over, becoming dull.
- Contact between the reel and bedknife generates heat which can distort the shape of the bedknife, and cause the bedknife to draw closer to the reel, resulting in the cutting surfaces rolling over more, and more heat being generated in the bedknife.
- Drag produced by an improperly adjusted cutting unit may result in an unacceptable clip ratio, undue strain on drive mechanism and premature wear of the cutting unit.

Reel and bedknife grinding - Reel and bedknife grinding are used to:

- restore the cylindrical shape of a reel that has become cone-shaped due to improper adjustment of the reel-to-bedknife clearance or due to worn reel bearings;
- restore the edge when the grass is not being cut across the entire length of the bedknife due to nicked blades;
- restore the edge when the lack of frequent backlapping allowed the edge to be rounded beyond the capability of the backlapping procedure to restore the edge; and
- restore the edge when the reel-to-bedknife clearance has been improperly adjusted allowing the reel to contact the bedknife.

Relief grinding - Relief grinding restores the factory relief angle to prolong cutting unit life and promote fast between grind sharpening (lapping). To grind a cutting unit without relief is doing half the job, and maintenance costs will increase due to the constant metal-to-metal contact of the "flat" ground reel blade.