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OCTOBER
1992

SPORTS TURF Newsletter

...for better, safer Sports Turf

ING EVENTS

Oct. 28, 1992
reation Facilities Assoc. Facility Safety Plan Fall Workshops at Thunder Bay, London, Nepean, Owen Sound, Oakville, Hamilton.
Contact: O.R.F.A.
1220 Sheppard Ave. E., Suite 210,
NORTH YORK, ON. M2K 2X1
(416) 495-4200

Nov. 2 - Nov. 6, 1992
Turfgrass Management Certificate, Level 2
OLDS College, Alberta
Contact:Department of Extension, Olds College
OLDS, AB. T0M 1P0
(403) 556-8344

Nov. 29 - Dec. 2, 1992
44th Canadian Turfgrass Conference & Trade Show
World Trade & Convention Centre, HALIFAX, NS.
Contact: Conference - Lisa North
Trade Show - Chuck Desveaux
CGSA
5580 Explorer Dr., Ste. 509,
MISSISSAUGA, ON. L4W 4Y1
(416) 602-8873, 1-800-387-1056
FAX: 416-602-1958

Jan. 4 - Jan. 6, 1993
Ontario Turfgrass Symposium & Trade Show
University of Guelph, GUELPH, ON.
Contact: Mr. Kelly Wilson,
Office of Continuing Education, Univ. of Guelph,
GUELPH, ON. N1G 2W1
(519) 824-4120, ext. 3814, FAX: 519-767-0758

Feb. 1 - Feb. 26, 1993
34th Annual Turf Managers' Short Course
University of Guelph, GUELPH, ON.
Contact: University of Guelph,
Office of Continuing Education,
Room 160, Johnston Hall,
GUELPH, ON. N1G 2W1
(519) 767-5000

Professional Development Series for Turf Managers
Feb. 1 - 4, 1993 - Working with the Media and the Public
Feb. 22 - 25, 1993 - Managing People at Work
University of Guelph
Contact: University of Guelph, Room 160, Johnston Hall, GUELPH, ON. N1G 2W1 (519) 767-5000

PRESIDENT'S MESSAGE

The Association Needs Your Help

Over the five year history of our Association the membership has slowly increased from the original 24 members in 1987 to our current membership of 140. We are aware of only three members who have actually resigned, however, many have failed to remit their annual fees. No reasons have been communicated to the Executive Secretary for not responding to invoices.

During the past two years our Executive Secretary has initiated a closer control over the membership records. He now mails an invoice in March with a follow up reminder to delinquents in July. He tells me we have only 12 members, who were paid up on Sept. 1, 1991, that have not responded to this system of invoicing in 1992.

Three provided a reason. What happened to the others? Information from our membership when they move or if they wish to leave the Association would be greatly appreciated.

There is more that can be done. As mentioned notifying the Executive Secretary of the movement of members from one employer to another would aid in maintaining contact. Adding more of your staff to the list is another move members in administrative positions can make. The saving in registration for the Guelph Conference alone more than pays the $20.00 cost of the additional membership. Personal contact and talking to fellow turf managers with organizations other than your own may influence them to join.

Initiatives of the Association - the Newsletter, the Field Managers' Guide, the Video tapes - cost money; and may not be 100% cost recoverable. New initiatives will cost money. In the final analysis our chief source of revenue is membership fees.

The strength of our Association is the membership. The ability of the Association to serve the membership depends on our revenue. Our revenue depends on the number of members. If each of you contribute to building the membership, our revenue and the service we can provide to the membership of the total Association will increase.

Thank you for your assistance.

- Peter Kleschnitzki

IN THIS ISSUE

EDITORIAL

ACCEPTING RISK

In a recent release by the Fertilizer Institute of Ontario a list was provided of the ranking of the risk of injury or illness, based on actuarial estimates, from 30 hazards [see box]. All of us are afraid of surgery, and justifiably so as it ranks 8th in this particular list. But did you realize there is a greater risk from using your lawn mower to cut the grass than from the pesticides used to control the weeds, insects and disease in your grass?!

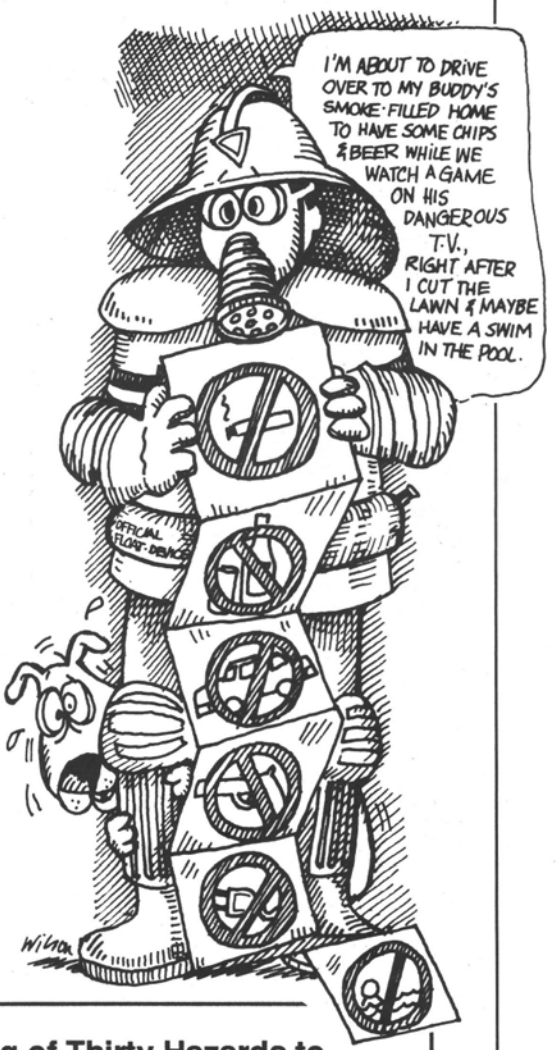
As so often happens, this study made the fundamental error of lumping all pesticides together. Surely the insecticides used for controlling European Chafer create a greater risk than 2,4-D. The old escape "More studies are needed' would be the expected response if you were to question this error.

The report goes on to state that when business and professional people were asked to independently rank the hazards they placed pesticides 15th. The alarming statement was that college students ranked them 4th. Is the future generation not been given the facts at our institutions of higher learning, our institutions of THE TRUTH? Or are they not at an age where they can differentiate THE TRUTH from the rhetoric of the environmental terrorists? The real concern is many of these college students will soon be the developers and administrators of government policy; policy which will reflect the impressions gained in their 'formative years'.

A recent editorial in the *Globe & Mail* (Aug. 12, 1992) suggests zero risk may be, in fact, a cause of risk - economic risk - the lowering of the standard of living of many to the stage where they are subject to all the risks of malnutrition, improper housing, even unsafe sports fields.

Adequate education is the best cure to all this controversy. Needless to say this education must be based on facts. The support the Sports Turf Association has given Greencare Horticultural Association in their effort to set the record straight over the proposals of the Urban Pesticide Caucus is a step in the right direction. But it is only a step. The information contained in the Greencare report "A Scientific Response to the Urban Anti-Pesticide Lobby" must be brought to the attention of all politicians at municipal educational and government levels. Then PESTICIDES will be accepted as number 28 in a group of 30, just as the actuarial estimates place them.

- R.W. Sheard, P.Ag.



The Actuarial Ranking of Thirty Hazards to Human Health and Safety

1. Smoking
2. Alcoholic Beverages
3. Motor Vehicles
4. Handguns
5. Electric Power
6. Motorcycles
7. Swimming
8. Surgery
9. X-rays
10. Railroads
11. General Aviation
12. Large Construction
13. Bicycles
14. Hunting
15. Home Appliances
16. Fire Fighting
17. Police Work
18. Contraceptives
19. Commercial Aviation
20. Nuclear Power
21. Mountain Climbing
22. Power Mowers
23. Scholastic Football
24. Skiing
25. Vaccinations
26. Food Colouring
27. Food Preservatives
28. PESTICIDES
29. Antibiotics
30. Spray Cans

GTI
RESEARCH HIGHLIGHTS

Prof. Mark Sears, Department. of Environmental Biology, University of Guelph and Mr. Fred Vaughn of Vaughn Agricultural Research Services have been cooperating since 1990 on a study of the effectiveness of a number of chemicals for European Chafer control. The studies were conducted on bluegrass growing on golf course fairways and at the Cambridge Research Station over a two year period and included both spring and fall applications.

It is generally accepted that the threshold level is 16 grubs/0.3 m^2. This value may be lower where the turf is stressed due to drought or has insufficient nitrogen.

Sears and Vaughn's data show that when averaged over the series of four experiments Basudin II (Diazinon) was the most effective insecticide (Table 1). Its superiority is also supported by the low range of values between experiments, suggesting it is effective over a range of conditions.

Triumph was equal to Basudin II in effectiveness, however, this chemical is not registered for use on turf in Canada at this time. However, another insecticide which is registered for use on turf in Canada and which gave good control was Trumpet. The higher rate of application of Trumpet appeared necessary to give dependable results. Dursban and Dylox, chemicals available for use on turf, were borderline in effectiveness, both on the basis of their average and on the basis of consistent results.

Their attempts to use parasitic nematodes was interesting. The nematode functions by carrying a disease bacteria into the grub when the nematode burrows into the grub. Of particular promise is the experimental system developed by ICI, GXA 873ICI. Of course this system must be submitted to the rigorous testing systems of the federal and provincial registry bodies the same as any chemical before it will be available on the market.

They also carried out three experiments to evaluate the persistence of control by counting the grubs the spring following fall applications (Table 2). The chemicals which gave good control in the fall continued to be effective the following spring.

Table 1: Insecticides for the control of European Chafer in bluegrass.

Treatment	Formulation	Rate (kg al/ha)	Live Grubs/0.3 sq. m. 25 - 28 days post-treat. Average	Range
Check	-	-	27.8	17.0 - 35.0
Basudin 11	500 EC	7.5	4.5	1.3 - 11.0
Dursban	1 G	2.0	15.5	3.0 - 31.5
Dylox	420 EC	9.0	15.3	4.5 - 38.5
Triumph	1 G	2.3	4.0	3.0 - 6.8
Triumph	480 L	2.3	4.2	2.3 - 6.0
Trumpet	80 WP	3.0	15.5	3.5 - 34.5
Trumpet	80 WP	6.0	8.8	1.0 - 17.8
GXA 873ICI*		5.0 bill.	14.5	9.0 - 18.0
S. carpocapsae*		2.5 bill.	26.3	12.3 - 32.5
S. carpocapsae*		5.0 bill.	22.1	13.0 - 27.8

* parasitic nematode

Table 2: Persistence of European Chafer control over winter by several insecticides.

Treatment	Formulation	Rate (kg al/ha)	Live Grubs/0.3 sq. m. (ave. of 3 expts.) Fall	Spring
Check			31.4	33.6
Basudin II	500 EC	7.5	2.4	6.4
Dursban	1 G	2.0	26.6	25.2
Dylox	420 EC	9.0	18.6	11.8
Triumph	1 G	2.3	5.4	6.9
Triumph	480 L	2.3	3.6	7.7
Trumpet	80 WP	3.0	17.7	16.8
Trumpet	80 WP	6.0	7.5	9.1
GXA 873ICI*		5.0 bill.	16.4	24.0
S. carpocapase*		2.5 bill.	30.9	37.7
S. carpocapase*		5.0 bill.	25.1	39.1

* parasitic nematode

Understanding Turf Management
The sixth in a series by
R.W. Sheard, PhD., P.Ag.

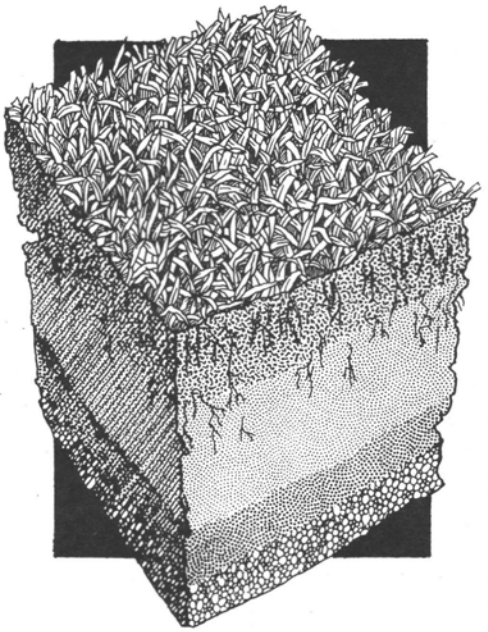
SOIL ORGANIC MATTER

The previous articles in this series dealt with the mineral fraction of the soil and the relationships between the soil minerals, air and water. Mention was made that the total volume of a soil may also contain up to 2.5% by volume of organic matter. While only a minor fraction of the total soil volume, the organic fraction has an influence on the chemical and physical properties to an extent far out of proportion to the small amount present.

Organic matter is the primary factor in increasing the formation and stability of soil aggregates, which in turn improve soil porosity and hence the movement of air and water. As improvement of aggregate stability can be expected from higher levels of organic matter the problems of soil compaction are reduced. The positive influence of organic matter on soil porosity may also increase the amount of plant available water retained in the soil.

It must be remembered, however, that the influence of organic matter on soil aggregate stability only applies to natural soils. Sports fields constructed with a sand rooting zone will see little benefit in moisture relationships from organic matter because sands do not form aggregates.

Organic matter also influences the chemical properties of a soil. It has a very significant effect on the ability of a soil to supply plant nutrients. The significance is partly due to an increased absorption of potassium, calcium, magnesium and other cations and partly because it becomes a source of all elements required for plant



growth as it decomposes. In the latter role organic matter can supply a major portion of the nitrogen and sulphur and 1/3 of the phosphorus required for turf grass production. Organic matter also increases the availability of the micronutrients required for plant growth.

Table 1: The elemental composition of organic matter.

Element	% on dry wt. basis
Hydrogen	3 - 4
Carbon	52 - 60
Oxygen	32 - 38
Nitrogen	4 - 5
Phosphorus	0.4 - 0.6
Sulphur	0.4 - 0.6

Composition

All decomposing remains of animal and vegetable life contribute to the formation of organic matter in soils. They may be insects, bacteria, fungi, plant tops and roots or organic materials such as peat moss added by the turf manager to the system. Since the origin of organic matter is animal and plant life, the elemental composition of the organic matter is similar to the original living organism (Table 1). Of particular importance in the growth of grass is the nitrogen, sulphur and phosphorus contained in the organic matter which may be released for uptake by plants at a later time. Some elements, such as potassium and micronutrients, may increase in surface soils due to the elements being absorbed from lower depths to be deposited at the surface as plant material decomposes.

The elements, carbon, hydrogen, oxygen, nitrogen, sulphur and phosphorus, combine to form organic compounds. Thus the organic compounds found in plant and animal tissue can also be found in soils. The type of compound which is found in the organic material will influence the rate at which it will decompose.

The organic compounds which have been identified in soil organic matter fall in the following groups:

- Sugars and Starches
- Amino Acids and Proteins
- Hemicelluloses
- Cellulose
- Lignin, Fats and Waxes

As one progresses from the first to the last compound in this list the harder it becomes for decomposition to take

place. Thus simple sugar added to a soil will be broken down in a day or two, whereas cellulose, lignin and waxes may require months, if not years.

Thatch has been found to contain a relatively high proportion of cellulose and lignin, hence it does not decompose as readily as grass clippings and tends to accumulate at the soil surface. Likewise the addition of peat moss to a sand rooting zone can be expected to resist decomposition for one or more years because it also contains a high proportion of cellulose and lignin. Nevertheless decomposition of these resistant products eventually takes place to form the highly resistant end product of decomposition known as humus.

Humus

Humus is the end product of organic matter decomposition. It has a very complex and variable chemistry, in fact, the true composition has not been identified by soil chemists. It has an ability to absorb elements on its surface, such as potassium and calcium, required for plant growth, thus retaining them from leaching.

Humus has the ability to make some micronutrients such as copper and zinc more available for uptake by plants through a process known as chelation. Many fertilizers contain chelated micro-nutrients in an attempt to mimic the role of humus in the soil.

When extracted from the soil humus is dark brown to black in colour, a feature which generally makes high organic matter soils dark coloured.

Decomposition

The breakdown or decomposition of organic matter is primarily a microbiological process conducted by the wide diversity of microbial life in the soil and on the surface of the dead plant and animal life. Without this vital, ongoing process the surface of the earth would become covered in a depth of dead organic material and the carbon dioxide, along with other elements, would become tied up and unavailable for further growth of plants.

The environmental factors which control the rate of decomposition of organic matter are the same as those which control the rate of plant growth. Thus if some environmental factor such as a rise in spring temperature increases the rate of grass growth it also increases the rate of organic matter decomposition. In many situations it may increase the release of nitrogen from the organic matter which is required for the greater grass growth. This fact is the basis for the promotion of some organic fertilizers.

Normal organic matter decomposition requires oxygen as it is essentially a burning process the same as a fire but at a much slower rate.

Organic Matter + Microbes + Oxygen = Carbon Dioxide + Water + Microbe Tissue

Removal of oxygen from the system through poor drainage - there are microbes that can live without oxygen - results in incomplete decomposition and the formation of gases other than carbon dioxide, e.g., marsh gas. The formation of peat is a decomposition process where oxygen is excluded by imersion of the dead plant litter in water. Organic matter in poorly drained soils tends to be higher than in well drained soils, in part because decomposition is retarded due to a lack of oxygen. The release of nitrogen and sulphur during the decomposition of organic matter under conditions of low oxygen will be in a form where they are unavailable to plants and where they will be lost from the system.

Since microbes, a living system, are an essential part of the process, temperature is an important factor. The optimum temperature for microbial activity in soil ranges from 30C (86F) to 40C (104F). Most soils under turf will be at the lower end of this range on a sunny summer day. In a cool spring decomposition of organic matter or organic fertilizers may not be rapid enough to equal the nutient demands of a grass plant.

Table 2: The Approximate C\N Ratio and Relative Decomposition Rate of Several Organic Materials.

MATERIAL	C\N RATIO	DECOMPOSITION RATE
Sphagnum Peat	100\1	Very Slow
Thatch	70\1	Slow
Grass Clippings	20\1	Rapid
Humus	10\1	Stable

Soil Organic Matter *Continued from page 5*

Microbial activity is influenced by the pH of the soil. Most microbes function best at neutral to slightly alkaline soil reactions.

The Carbon\Nitrogen Ratio (C\N Ratio)

When organic matter is decomposed under aerobic conditions (adequate oxygen) there is a loss of carbon as carbon dioxide - a gas - from the system and the retention of the nitrogen in the tissue of the microbes or as mineral nitrogen, for example nitrate nitrogen. This process continues until the ratio of carbon to nitrogen remaining in the system reaches a value similar to that of microbial protein which is approximately 10 parts of carbon to 1 part of nitrogen - a C\N ratio of 10. At this point decomposition ceases or becomes very slow because the microbes are now essentially recycling their own tissue. The stable material which remains is known as **humus.**

The C\N ratio and relative decomposition rate of several materials of interest to turf managers are listed in Table 2. With the exception of humus the higher the ratio the slower the rate of decomposition due to a shortage of nitrogen relative to carbon.

Induced Nitrogen Deficiency

The addition of a large amount of an organic material having a wide C\N ratio, for example, a heavy application of peat moss during the reseeding of a compacted goal mouth area, may result in a temporary nitrogen deficiency in the establishing grass. The deficiency occurs because the nitrogen in the soil is being preferentially used in growing new tissue by the microbes as their population explodes due to the large supply of carbon provided by the peat moss. The condition can be easily corrected by the application of soluble nitrogen fertilizer.

Similar conditions can exist during the establishment of turf on sand root zone systems. Thus it is recommended that no more than 10% of the volume of the upper 15 cm of the rooting zone be peat. It must be remembered that in addition to a potential to induce nitrogen deficiency, the peat will eventually decompose and the space occupied by the peat will be occupied by sand or grass roots. It is unlikely the volume of grass roots which may replace the peat will reach 10%.

GREEN CARE RESPONSE

In 1991, a lobby group called "The Urban Pesticides Caucus" was formed with the objective to persuade all municipalities to ban the use of chemicals for so called cosmetic appearances. They circulated a brief entitled 'Regulating the Urban Cosmetic Use of Synthetic Pesticides' to every municipality, and to MLA's, in Ontario.

In response to this group, Green Care commissioned a consulting firm, Ecological Services for Planning, to prepare an evaluation of the statements made in the brief. Their evaluation "A Scientific Response to the Urban Anti-Pesticide Lobby" is now available for the price of **$5.00** payable to:

Green Care Horticultural Association
26 Old Oak Road
ISLINGTON, ON.
M9A 2V8

Your Association considers this rebuttal of the Urban Pesticide Lobby brief a 'must reading' for every turf manager facing restrictions in the use of some of his management tools by misinformed public and legislators. **Be sure to get your copy.**

OTRF Supports Turf Research

In 1992 the Ontario Turfgrass Research Foundation supported research at the Guelph Turfgrass Institute to the amount of $30,000.00. These funds are primarily generated through membership in the Foundation, in which many STA members hold a membership, and through various fund raising efforts of the Foundation. Indirectly each STA member who registers for the 1993 Turfgrass Symposium will also make a small contribution to the Foundation through a profit sharing arrangement between the sponsoring bodies. In 1992 this contribution amounted to $6.65 per STA registrant.

WELCOME TO OUR NEW MEMBERS

Doug James *London PUC*
Mike Regan *London PUC*

Grooming Baseball Fields:

Tips and Techniques

W.R. (Bill) Chestnut
Golf & Turf Products Division
John Deere Ltd.

Ball field grooming needs to provide a safe and acceptable play area that also looks good to stadium management and the ballgame viewers. Providing an infield that yields consistent bounces while still staying within a limited budget is a constant challenge.

Often, the infield area is a specially combined media mix, installed when the field was constructed. The outfield area trends to be natural soil that was in place before construction started. These two field areas may have different drainage and water retention patterns, and require strikingly different maintenance procedures.

Skinned areas should be maintained for firmness, footing uniformity, and resilience.

The composite soil make-up of the skinned areas varies from 80-percent calcined clay and 20-percent sand to 80-percent sand and 20-percent calcined clay. Other variations include agricultural lime for baseline areas and blue clay for the pitcher's mound. Prior to the beginning of play each year, you must bring these skinned areas up to standards, which usually requires adding more material.

Typically, your maintenance routine would include daily light waterings on the skinned surface to maintain softness and scarifying to enhance resilience. Fill, roll, or tamp low spots or infirm areas as necessary. If the soil surface is too wet for play, you may scarify the field to accelerate drying or apply additional calcined clay products to further accelerate the drying process.

The baselines are often worked early in the morning to take advantage of the

moisture from the dew. If moisture is insufficient, you can water lightly to achieve the desired consistency.

Maintenance Methods

One method of working the baseline area is to use a hand rake. Some groundskeepers prefer to rake lengthwise to avoid kicking clay onto the grass. Rake lightly, just scratching the surface enough to fill in the holes. After raking, you can firm the baseline with a turf roller, especially in the areas of heaviest wear - between home and first and first and second bases.

Most groundkeepers use some sort of drag for grooming. Field drags may be old boards or nail drags made of railroad ties with approximately 1,000 nails in them. Use these on the skinned areas of the field and around the mound.

Keep field finishers or drags away from the adjacent turf to ensure that a lip does not form in the grass. Remove any soil that is kicked onto the grass. A stiff bristle broom, flat shovel, high pressure hose or leaf rake will do the job.

When you use a broom or leaf rake the soil is pulled inward toward the baseline. Some field managers prefer a shovel to a broom because they feel the broom tends to push the clay back into the grass. If you use a hose and nozzle to blow the clay off he grass edge, be careful to keep from forming lumps and ridges in the grass.

To avoid creating a lip, make a grass edge cleaning procedure part of daily field care. If necessary, repeat the procedure after pre-game batting and infield practice.

Some field managers will remove the lip by aerating over the problem area, and then rolling it out. If an extensive field lip has been created, you may need more drastic measures. To renovate such areas, use a sod cutter to cut the sod back along the baselines. Remove the sod and excess dirt. Use a level to replace the sod at the proper height. You can use the same procedure on the area around the pitcher's mound.

When conditions are especially hot and dry, it may be beneficial to attach brooms to the back of the traditional nail drag. This allows the nails to dig in well and the broom to smooth and finish the clay in the same step. This method seems to help counteract the compaction a heavy tractor pulling a drag can cause. You can follow with a second drag to create the same cushion effect.

When standing water remains on the skinned area, you can pull a long hose over the area to remove it. Do this as early in the day as possible. If necessary, work a calcined clay conditioner into the baseline pathes to absorb excess water that the hose can not remove.

Later in the day, dragging and turf rolling will firm the surface. A second dragging will put on the finish. You can

improve skinned areas that harden quickly and stay wet for long periods by incorporating a soil conditioner into the top two inches of clay. When rain is threatening, some groundskeepers prefer not to open up the clay by dragging until about an hour prior to practice.

Put the final finish on the skinned surface before each game. For the final finish, hand rake with a specially constructed drag or field finisher. Apply the finish in a spiralling motion, starting at first base working toward third base, in a clockwise or counter clockwise motion. Reverse the patterns each time to prevent uneven spots.

Using Riding Bunker Rakes

When personnel hours are at a premium, riding sand rakes, such as the John Deere 1200 Bunker and Field Rake, can speed the process. Riding sand rakes enable the user to groom and put a finish on ball fields in considerably less time than raking by hand. The operator can even attach a small gang drive reel mower and mow the field.

Using the field rake, scarify the skinned area 1/2-inch deep with the narrow scarifier attachment. The conditioner rake should be in the down position to loosen the soil surface and accelerate drying. You can fill in any low spots by using the 60-inch-wide aluminum blade.

Avoid the grassy areas of the field when dragging, scarifying and finishing to avoid creating a lip at the grass edge. You can pull an aerator behind the rake to aerate and relieve the lip. If the field does not dry sufficiently, use the conditioner rake for the final step. When the field is dry, use the rear-mounted field finisher for this final step. Apply the final finish in a spiralling fashion just as you would using self-built drags.

Checking the Grade

Grade conditions may have gradually altered over the years, affecting drainage. Use a scraper blade for changing the grade of an area or when you renovate a field. You can accomplish additional field care projects quickly and easily by using a field rake.

During the playing season, check field dimensions every two to three weeks, depending on growing conditions. Stretch a string along the baselines and diamond to provide a straight edge. You can use a power edger or sod cutter to recut sharp lines.

Early in the season when there is more grass to remove, you can use a hoe to dig out grassy clumps and fill in low areas with clay. Keeping the clay and grass flush with each other will allow the ball to roll true. In the off-season, you can use glyphosate after the edging procedure to spot treat grass clumps

The Pitcher's Mound

The pitcher's mound is usually constructed of a firmer clay than the rest of the field. Keeping the mound completely flat allows the pitcher to step from the rubber and remain on level ground. You can maintain the mound edges at an approximate 45-degree angle down to the infield.

You can bury mats underneath the clay of both the pitcher's mound and home plate to prevent players from causing extensive damage to the field by digging deep holes. With the flat side of an aluminum rake, you can fill in the batter's box and the catcher's hole.

After each period of play, sweep loose dirt from the holes in the mound and batter's boxes, lightly wet the depressions, add fresh material and tamp down. If problem areas require more than one layer of material, wet and tamp each layer as you apply it. Maintain bullpens in the same manner. Where possible, wet down and cover the mounds until the next practice or game.

Ideally, ball fields will be equipped with irrigation systems. With or without automated irrigation, adjust watering to weather conditions and field use. Keeping turf moist enough for proper growth while keeping the baselines dry is a continuing problem. Highly used areas, such as around home plate, need additional water to combat stress.

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SEEDING RATES

In the July 1992 issue of the *Newsletter* a brief article touched on the number of seeds in a pound of different turf species. In the April, 1991, issue of The Lawn Institute publication *HARVESTS* it is stated that 12 seeds per square inch are required if the desired density of 6 grass plants per square inch are to be achieved in the established turf. Many reasons are given for a 50% establishment rate which include depth of seed coverage, washing by rain, interplant competition, damping-off diseases and 80 to 85% germination of the seed.

The following table converts the number of seeds in a kilogram to the seeding rate required for four common turf species used on sports fields when sown in pure stands. When used as mixtures some adjustment should be made for the relative competitiveness of the species.

The Number of Seeds/Kilogram and the Seeding Rate Required to Produce Six Viable Plants/100 Square Meters in Established Turf.

Turfgrass Species	Seeds/Kilogram	Kilograms Seed /100 m^2
Kentucky Bluegrass	2,865,961	0.659
Fine Fescue	1,102,292	1.687
Perennial Ryegrass	661,375	2.812
Tall Fescue	507,055	3.668

Grass Roots Ball Diamond Maintenance

Properly maintained ball diamonds are necessary to ensure player safety as well as fairness in the sport. Rutted infields and basepaths not only cause the ball to bounce erratically, but may also trip up players. Home plate and pitcher's plate should be set flush with the ground for the same reason.

Most maintenance of ball diamonds such as aerifying, fertilizing, seeding or sodding should be carried out in the fall for a variety of reasons. It allows more time for seed or sod to become established or for fertilizer to work, promoting good vigorous growth before play starts in the spring.

It also lessens the chance of delays in preparing the field because of uncertain spring weather.

Basepaths and Skinned Areas

Power brooms or fire hoses should be used occasionally to remove dirt and surface material from the turf and push it back on to the basepaths and skinned infields. Basepaths and skinned infields should also be edged occasionally to prevent turf from encroaching and to keep the lines neat and distinct.

On occasion, the skinned infield may require blading to level high spots and fill depressions. Compacted surface material should be scarified to loosen it, and then dragged to level. A satisfactory drag can be made from a section of chain link fence, dragged behind a tractor.

Rutting is one of the main problems encountered with basepaths. They should be maintained frequently to prevent them from becoming 'dished' and affecting the direction of the ball.

The areas around the bases should be raked daily if possible, and surface material added to the basepaths when necessary to bring them up to the level of the surrounding infield.

The surface material should also be checked every fall to ensure a proper mixture. The surface should have

enough sand to allow water to drain through it and keep the surface from becoming too sticky when wet or too hard when dry.

The surface must also have enough clay to bind the sand together and keep the surface from blowing. If sand or clay must be added, the infield should be levelled and scarified, the material added and the field dragged.

1) Rototill or gill skinned areas to a depth of 2.5 cm.

2) Rake and float skinned areas with a steel mat, leaving a slight crown for water drainage.

3) If skinned areas are too soft, roll to compact soil, and rake.

4) Fill depressions on skinned surface with silt or suitable surface material.

5) Fill any holes dug in front of the pitcher's plate, and ensure pitcher's plate and home plate are set flush with the ground.

Markings

A variety of materials are used to mark the playing lines on the field.

Hydrated lime has been used in the past to a large extent, but is being replaced by latex paint which is quicker to apply, easier to see and lasts longer. Caution should be exercise when using hydrated lime for safety reasons (Ed. Note: *hydrated lime should not be used due to potential burn of the eyes*).

Other marking methods include mixing limestone with water to make a whitewash; digging trenches and filling them with limestone, or burning the lines into the turf by spraying with a non-selective herbicide to destroy the vegetation, and then chalking the lines. Using the last method allows the lines to remain visible even when the lime is gone, but results in an uneven playing surface.

1) All lines are 5 cm wide.

2)Lay out the field using the dimensions suitable for the level of sport to be played (baseball, softball, slowpitch, etc.). Tie a cord to a large spike or nail placed at the rear point of home plate, stretch it out and attach it to the foul line poles extending out past first and third base.

3) set the line marker on the string and starting at the back of home plate, run it parallel over each 30 cm edge of home plate, extending to the foul line poles for base and foul lines.

4) Use a dry line marker for skinned areas and a wet lime marker for turf areas.

5) Mark in the batters' boxes, catcher's box, on-deck circles, coaches boxes, pitcher's circle. In addition, mark in a 0.9 metre line parallel to and 0.9 metres from the first base line, starting half way between home plate and first base.

6) As a time-saving measure, frames may be constructed of wood to the required dimensions and used to mark in the batters' boxes, removing the need to measure them out each time.

Aeration

The process of aeration promotes the growth of good turf by allowing water, air and nutrients to penetrate the soil and aid in root development, giving the turf greater ability to withstand dry periods.

Aeration is required when constant use of the field causes the soil to become compacted. Rollers or the use of heavy equipment on the field when it is wet can also aggravate the condition. When

compaction develops, it becomes difficult for water, fertilizer and air to enter the soil, and for nutrients to break down into a form useable by the plant.

Ball fields are usually aerated twice a year, in the spring and again in the fall after the playing season is completed. If the ground is too hard for the aerator to penetrate, a light watering will help loosen the soil.

Aeration also alleviates compaction problems in the dirt areas of the ball diamond, and the practice should not be limited to turf only.

After aerating, a topdressing can be applied and the field then dragged to smooth the surface, break up the plugs and fill the holes.

Fertilization

Fertilizers provide the nutrients that turf requires, including nitrogen, phosphorus and potassium.

Types of fertilizer used and rates of application are dependent on the growing conditions, and should be based on periodic soil analysis to determine actual amounts.

Fall applications of fertilizer will provide adequate nutrients at the start of the growing season the following spring, and lighter rates of nitrogen can be applied in the spring and early summer as required to promote healthy turf.

Commercial salt-based fertilizers should be applied evenly and when the turf is dry, to avoid burning. To ensure even distribution, it is best to apply granular fertilizer in two directions, applying half the recommended amount each time.

Reseeding/Resodding

Like other major maintenance practices, reseeding or resodding of worn or damaged turf is best done in the fall. It provides an opportunity for the new grass to become firmly established before it is subjected to use - time that may not be available if seeding or sodding is done in the spring.

Small areas can be reseeded by digging out or scalping the old turf, filling with a mixture of peat, sand and loam, and reseeding.

Large areas or completed fields can be reseeded by aerating thoroughly; overseeding the area; adding 1 to 2.5 cm of peat moss and overseeding again. The field should be dragged and rolled lightly to ensure good contact between the seed and the soil.

In some cases where major renovation is required, a sod cutter should be used to completely remove the old turf, and the field should be graded. Topsoil can then be added and the entire field reseeded.

When building up low areas, 1 to 1.5 cm layers of peat, sand and loam mixtures can be added at a time, seeded and raked. Up to 2.5 cm of soil can be added and the grass below will still grow through.

When resodding, the old turf must be completely removed and the area levelled. Add a proper topsoil mixture, if necessary. Particular attention must be paid to the depth of the new sod, so that when installed, it is level with the surrounding area. All crackers and joints should be topdressed.

Resodding is best done in the fall, at last 3 weeks before freeze-up, to ensure a good bond with the soil before it is subjected to heavy used. However, resodding may be dictated by the availability of the sod.

Watering

The moisture requirements of a ball diamond vary according to a number of factors, including type of soil; amount of natural rainfall; moisture loss through high temperature and winds, and the level of maintenance available.

As a rule, an average of 2.5 cm of water is required per week to maintain good turf growth. Water should be applied only as fast as the soil will absorb it, and until the water has penetrated the top 15 cm of soil.

Timing the watering practices depends largely on when the field is to be used. If the field is used for evening play, watering should take place in early morning so the turf is dry when play starts. Ideally, however, watering is best done in the evening when there is less evaporation and more water will be absorbed into the soil.

Mowing

Mowing frequency should be such that the turf does not grow more than 3.2 cm above the desired height.

Proper grass height is necessary because close mowing and light watering will cause shallow rooting of turf, making it susceptible to heat stress. Grass that's mowed to short may also promote weed growth by reducing the vigour and density of the turf.

Most grasses should be maintained at a height of 3.2 to 6.4 cm, although the recommended height varies with the species of grass.

Methods of mowing the outfield should be alternated to reduce the number of bare spots and encourage dense grass coverage.

With the first method, start at third base and mow down the left field foul line to the fence. The same procedure is followed from first base down the right field foul line to the fence,and from second base out to the centre field fence.

In the other example, the outfield is mowed crosswise, mowing back and forth along the infield edge of the outfield grass, and then working from the outfield edge of the grass toward the infield.

Weed, Disease and Insect Control

Well maintained and established turf is rarely susceptible to weed or disease problems.

The turf should be examined for any signs of weed, disease or insect infestation whenever routine maintenance such as mowing or watering is performed. However, no control should be undertaken without consultation with specialists to ensure an accurate diagnosis of the problem.

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INDUSTRY PROFILE

SYNITURF CORPORATION is a company which has accepted the challenge of assisting turf managers - individuals who have the responsibility of keeping tufgrass in a healthy condition for recreational and aesthetic use - to stay within the limitations imposed by continual budget restraints and the new public environmental awareness and concern.

Turf managers will continue to face many new challenges that may seem contradictory at times. They will be pressured to continue to provide the excellent playing surfaces that have been produced over the last decade while at the same time be restricted, regulated, or even have withdrawn, some of the essential products such as water, fertilizer and chemicals needed to produce safe playing surfaces.

With these pressures starting to affect the availability of their management tools, the turf managers will find it necessary to improve the programing and implementation of their cultural practices. To better program and implement their cultural practices, they must first be able to obtain immediate, pertinent, and accurate data on what is really occurring within the turf environment. They will find it necessary to obtain data on the four major controlling factors of that environment - macro and micro climatic conditions, turfgrass species and cultivars, rootzone characteristics and pest population pressures - and then assimilate them into useful information.

A new technology to assist the turf managers in the assimilation of this information has been developed over the last decade but its ability, availability and importance has only come to light recently. The technology consists of proven computerized micro climate monitoring systems, insect and disease forecasting systems, on-site disease detection and identification systems, water quality and contamination detection systems, soil nutrient availability systems and infrared remote sensing for stress on the plant, unnoticeable to the naked eye.

The data these systems will produce may assist the turf managers in solving many of their new challenges and may also help promote the level of professionalism of their position as well to help move turf grass management from an art to a science. The best quote to substantiate the move from an art to a science was written long ago in 1891 by Lord Kelvin.

"When you can measure what you are speaking about, and express it in numbers, you know something about it; but when you cannot measure it, when you cannot express it in numbers, your knowledge is of a meager and unsatisfactory kind; it may be the beginning of knowledge, but you have scarcely, in your thoughts, advanced to the stage of science."

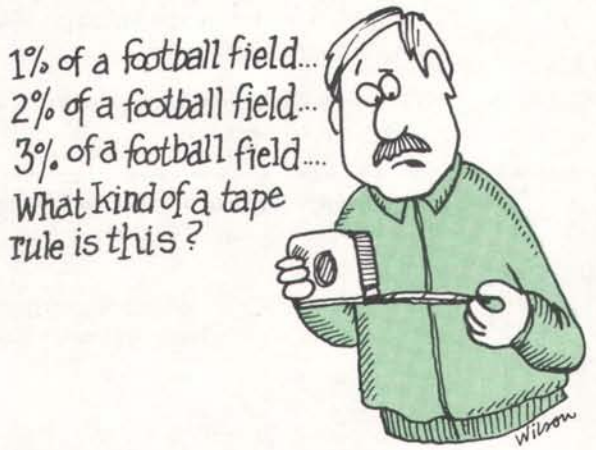
The present turf managers face the new pressures of taking the time and effort to improve their professionalism by becoming more scientific, technological and computer literate. SYNITURF has accepted the challenge of assisting the turf managers by sourcing, developing and providing the basic training and continual back-up necessary to integrate the information producing systems to provide better, safer environmentally friendly turf.

[Ed. Note: The General Manager of SYNITURF is Bruce Calhoun. Bruce is the Past President of the Sports Turf Association.]

UNITS OF MEASUREMENT

While we are all familiar with the British units of measurement - pounds, feet, acres, and have become more accustomed to the metric units - kilograms. meters, hectares, a new unit of measurement related to sport has become common. According to *Globe and Mail* columnist, Edward Clifford, **football field** is now an accepted unit. Examples in a recent issue of the *Globe* are: Barcelona's train station is the size of eight football fields, Kowloon market in Hong Kong has five football fields of food and a freighter grounded in Vancouver harbour was the size of two football fields.

How big is a football field? A Canadian field is 64350 square feet, or 1.47 acres, or 0.58 hectares. Your editor suggests the turf manager would be advised to continue learning metric to calculate his chemical applications and calibrate his equipment.



The Lighter Side of the Lawn

The eighth wonder of the world is the person who can remember the other seven. -Doug Larson

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