UNDERSTANDING TURF MANAGEMENT
The seventh in a series by
R.W. Sheard, PhD., P.Ag.

SOIL NITROGEN

Although there are some 14 elements required for the growth of grass, *NITROGEN* is the key to successful grass production.

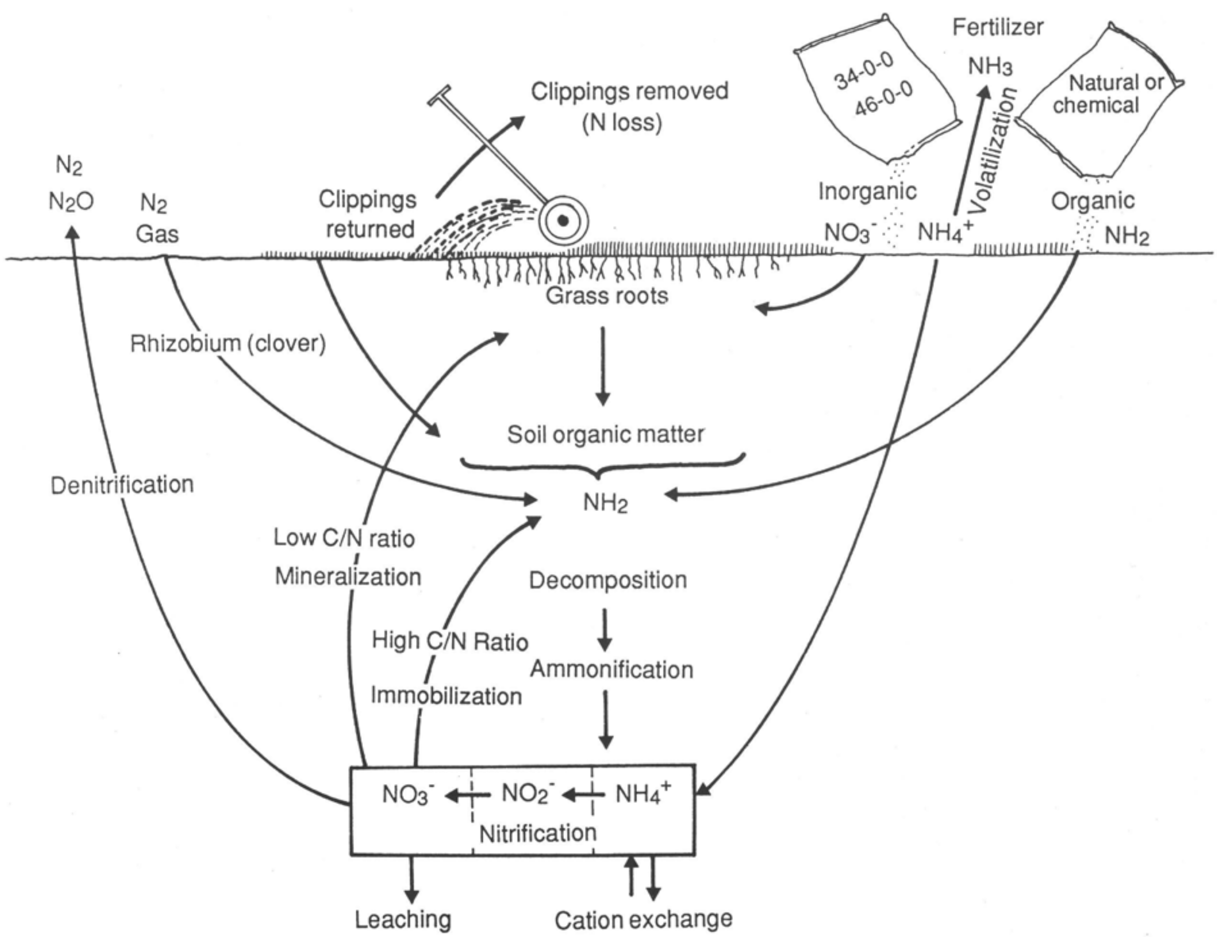
Nitrogen is found in all protein. Proteins are fundamental to life as all enzyme systems contain protein. Protein also functions as a storage of energy, such as in the seeds of some herbaceous plants.

In the practical world nitrogen imparts the desirable green colour to turf, increases the growth rate of leaves, stimulates tiller initiation and improves root regrowth. Although nitrogen is a part of the chlorophyll molecule in grass, improving the nitrogen nutrition may improve colour more by increasing the rate of emergence of new leaf blade than by increasing the chlorophyll content of the leaf.

Excessive nitrogen, however, can be detrimental to turf. A high level of nitrogen may favour leaf development to such a degree that rooting is decreased. Likewise it may depress the storage of root reserves as more of the photosynthate is channelled into protein which will favour new leaf growth. Soluble nitrogen compounds may also accumulate in the leaves, which increases the likelihood of disease by being a ready source of nitrogen for the pathogen. This condition is often referred to as increasing the succulence of the plant.

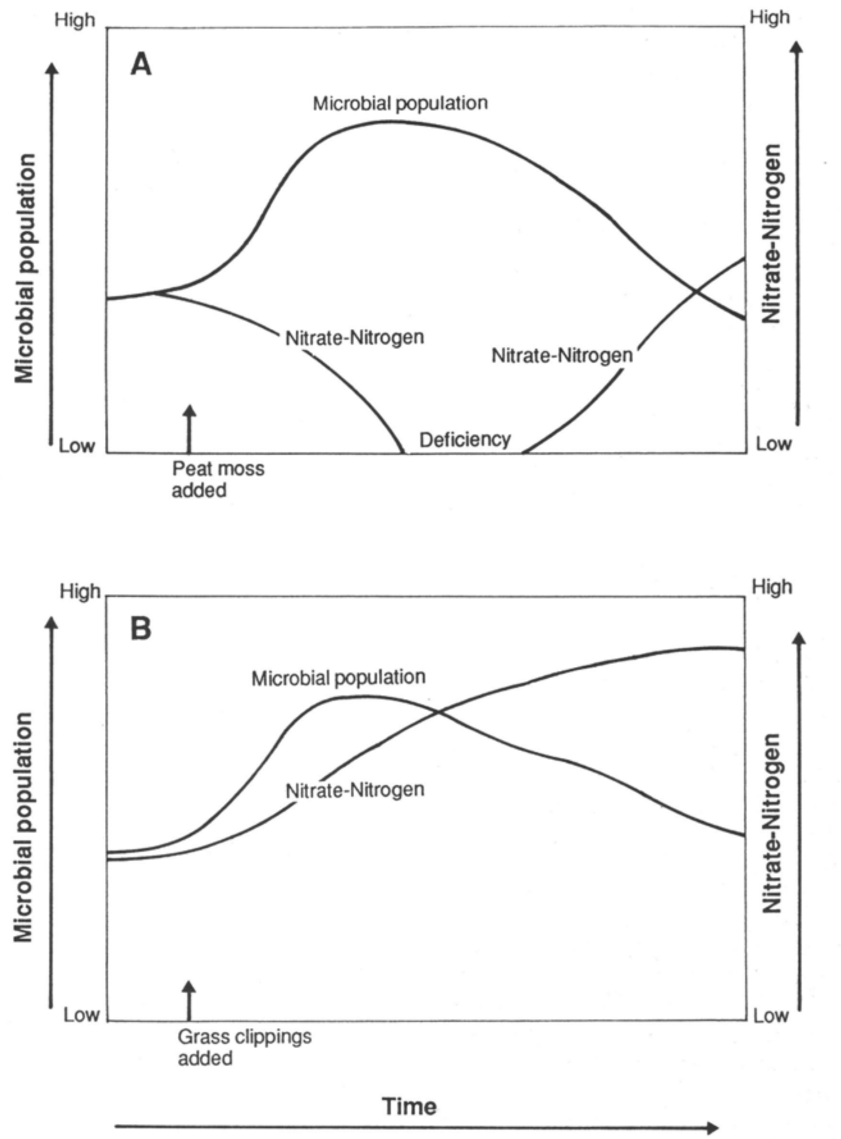
In the last article of this series it was stated that soil organic matter supplied a major portion of the nitrogen required for turf growth. In fact, any area of turf not receiving nitrogen fertilizer is depending on the release of nitrogen

Fig. 1: *The Nitrogen Cycle:* an illustration of the processes involved in the conversion of organic to mineral forms.



from the organic matter for its growth. In the majority of cases the rate of release is not rapid enough to support a vigorous stand and the stand becomes thin and prone to weed invasion.

Fig. 2: The influence of the carbon/nitrogen ratio on the soil microbial population and the availability of nitrogen.



The release of nitrogen from organic matter is a dynamic process, dependent on the environmental conditions for the diverse population of microorganisms that live in the soil. Many of these environmental conditions are the same as the conditions which influence the growth of grass; such as temperature, moisture, even the supply of nitrogen.

To illustrate the dynamic nature of nitrogen in the soil a diagram known as the *Nitrogen Cycle* is often used (Fig. 1).

Central to the cycle is the soil organic matter. Organic matter contains protein; hence it contains nitrogen. Grass roots can not absorb the nitrogen as protein, therefore it must be converted to a form which the roots will absorb. This form is *nitrate-nitrogen.* The conversion from protein nitrogen to nitrate-nitrogen is carried out by the microbial population which decompose the organic matter, convert the amino-nitrogen of the protein to ammonia-nitrogen, which in turn is converted to nitrate-nitrogen.

An interesting comparison of the plant and animal systems is found in their use of nitrogen. Man must obtain his nitrogen in what the chemist calls the reduced form as protein, either from a plant or an animal source. Nitrate-nitrogen is toxic to man. In contrast a plant can not use protein nitrogen, but must have its nitrogen in the oxidized nitrate or ammonium form. Furthermore the grass plant does not have direct access to the 87% of the atmosphere which is nitrogen. The essential intermediary in these vital conversion is the soil microbe.

The pivotal point in the nitrogen transformations in the soil is the step called *nitrification.* Nitrification is a two-step conversion of ammonia-nitrogen (NH_4^+) to nitrite-nitrogen (NO_2^-) and then to nitrate-nitrogen (NO_3^-). Very low levels of nitrite-nitrogen are found in soils because it is very rapidly converted to nitrate- nitrogen. Two specific bacteria, found in all aerated soils, carry out these conversions.

With the exception of nitrate forms such as calcium nitrate, all fertilizer added to the soil must go through this pivotal conversion. Even one half of an ammonium nitrate source of nitrogen, the ammonium, must go through this process to be available for uptake by the grass. The oft stated claim that organic sources of nitrogen are non-chemical and hence superior to 'chemical fertilizers' is not the full truth because the soil microbes must convert the organic material to nitrate-nitrogen before it is of any value to the grass. They do, however, have an advantage of restricting the rate of conversion to nitrate-nitrogen and hence reduce the potential for leaching.

The reliance on microbial conversion imparts the 'slow release' properties on many nitrogen sources. Under favourable conditions of temperature and moisture the conversion of ammonium-nitrogen to nitrate-nitrogen will be complete in 7-10 days. The conversion of ureaform or 'Milorgonite' to nitrate-nitrogen will take weeks or months and may never be complete.

When nitrogen is in the nitrate form it is highly soluble in water and will be carried downward in the percolating ground water. It should be the objective of every turf manager to not add to the amount of percolating ground water by excessive irrigation. Likewise it should be his objective to minimize the amount of excess nitrate-nitrogen that exists in the rooting zone by careful attention to the rate, frequency and form of nitrogen he uses.

When nitrogen is in the ammonium form (NH_4^+) it is known as a cation, a positively charged ion which may be absorbed by the clay and humus in the soil. In this form the nitrogen is not subject to leaching, however, the soil microbes still have the opportunity to convert it to nitrate which will subsequently be absorbed by the grass.

Nitrogen which is in the ammonia form (NH_3), a gas often called anhydrous ammonia, may be lost to the atmosphere by a process called *volatilization.* The loss is only of concern where urea fertilizer is the nitrogen source. The process is intensified where urea is applied to grass in warm, humid weather and the loss can reach values of 12-15% of the applied nitrogen. The conversion may be avoided by application immediately prior to a rain or where irrigation is applied within 24 hours.

Under poorly drained conditions nitrogen may also be lost to the atmosphere through a process called *denitrification.* A group of microbes which flourish in soils devoid of oxygen convert nitrate-nitrogen to elemental nitrogen (N_2) or nitrous oxide (N_2O) which are gases and diffuse to the atmosphere. Thus good drainage contributes significantly to the efficiency of nitrogen use.

Although a grass plant is not capable of using the bountiful supply of nitrogen in the atmosphere, plants known as legumes can. They are plants which have growths, known as nodules, which form on the root and which are the habitat of a special bacteria, Rhizobium. The plant serves as the host for the bacteria and through the symbiotic relationship of providing food to the bacteria, receives a major portion of its nitrogen from the atmosphere. Clovers are a typical legume. When the clover plant dies and becomes part of the organic matter the nitrogen becomes available to the grass through the decomposition and nitrification processes described above. The source is of little value to turf managers as they frequently remove the clover as a weed.

An important factor in grass nitrogen nutrition is the relative amount of carbon and nitrogen in any organic amendments which may be top dressed onto the turf. The relative amount is commonly referred to as the C/N ratio.

In Table 2 of the last article of this series, humus, the stable end product of decomposition, is listed as having a C/N ratio of 10/1. That is, on analysis it will be found to have 10 parts of carbon to every one part of nitrogen. This ratio is approximately the same as found in the microbial cells which break down the organic matter and they are unable to reduce the amount of carbon below the level in their own protoplasm. Whenever the carbon content of the soil is increased above this level microbial activity is also increased because the carbon acts as their food source and they multiply.

When an organic source high in carbon is added to the rooting zone an explosion in the microbial population can occur, if there is sufficient nitrogen available to allow them to generate the protein needed for their cells. When the organic source is low in nitrogen, such as in sphagnum peat, the microbes will absorb the majority of the nitrogen in the rooting zone and the grass will become nitrogen deficient through a process known as immobilization (Fig. 2). The condition is known as induced nitrogen deficiency and will continue until the C/N ratio drops below 20. To speed up recovery or to counteract the deficiency, supplemental nitrogen in an inorganic form should be added.

When a source of organic matter with a low C/N ratio, such as grass clippings, is added a similar explosion in the population may occur (Fig. 2). However, no deficiency of nitrogen is seen in the grass because there is sufficient nitrogen in the clippings to provide the requirements of the microbes without withdrawing any from rooting zone. The process is often referred to as mineralization of nitrogen. As the carbon breaks down and the microbial population returns to normal the extra nitrogen from the clippings returns to the soil, to be utilized by the grass to absorb.

Induced nitrogen deficiency may occur where excessive rates of peat are added to a rooting zone mix during construction in order to generate the required porosity and moisture characteristics in the mix. The nitrogen deficiency may be easily corrected by fertilizer use. As the carbon is converted to carbon dioxide and lost to the atmosphere, however, the space occupied by the organic matter is backfilled with mineral material and the density of the rooting zone will rise. The short term advantage in porosity and moisture characteristics will disappear and compaction becomes a more serious problem.

A water budget for irrigation scheduling

by R.W. Sheard,
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There are many reasons why water is essential for turf growth: for the formation of sugar during photosynthesis, for the dissolution and absorption of plant nutrients from the soil, for the moderation of leaf temperature through transpiration or syringing, and others. Likewise there are many reasons why excessive water is detrimental to turf growth: lack of aeration resulting in reduced root growth and eventually reduced top growth, greater susceptibility to disease, increased compaction,and increased leaching of plant nutrients, to cite a few.

Water is supplied through rainfall or irrigation. Rainfall cannot be controlled, therefore it is essential that the turf manager has a system whereby irrigation can be scheduled to supplement rainfall. Modern automated irrigation systems greatly reduce the labour involved in irrigation, however, one or more of the disadvantages associated with excess water may easily result from "set the clock and forget it" automated systems. What is needed is a system whereby the turf manager may "set the clock" but at the same time change the settings to accommodate rainfall and changing weather conditions.

The installation of moisture sensing devices in the soil has been used to predict water requirements. The moisture block, which provides an electrical resistance reading, is most sensitive in relatively dry soils and is subject to significant salt effects. Another moisture sensing device is known as a tensiometer: a device which is sensitive at soil moisture level desirable for turf. Unfortunately the tensiometer has installation characteristics which interfere with other turf maintenance operations. It also requires considerable maintenance to give reliable data and must be removed every fall and reinstalled below the surface in the spring.

A water budget system offers a third alternative as a guide for when to irrigate. The budget is based on water gains by a turf area through rainfall and irrigation and water losses from a turf area through evapotranspiration (ET) and drainage.

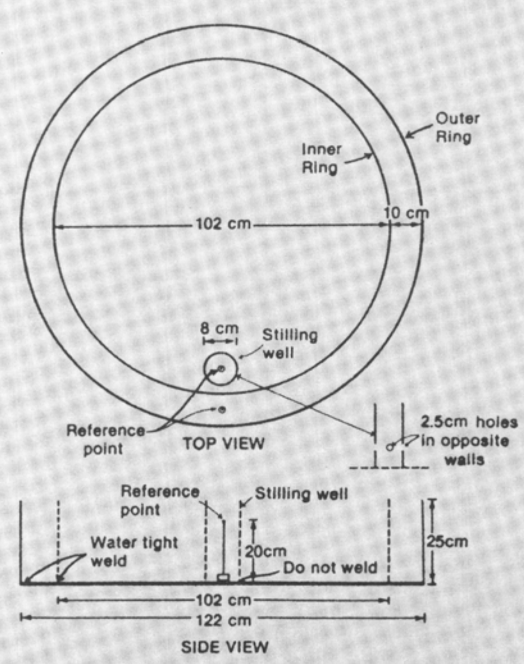
The water gains as rainfall are measured by the placement of several plastic rain gauges in open areas around the golf course. To measure irrigation water gains it is necessary to obtain a calibration of the system used on each green. A calibration can be obtained by removing the tops from ten juice cans and randomly placing them on the green. Water is collected for a 30-minute irrigation period. Assuming a standard 1360 ml can having a surface area of 86.6 cm, the total collection of water in the ten cans, measured as grams or millilitres, is divided by 86.6 to give the mm of added water in 30 minutes. Division of the mm of added water by the number of minutes of irrigation provides an irrigation rate of mm of water per minute.

Water loss by ET is not easy to measure but may be estimated from meterological measurements and observations or by evaporation from a pan of water. The evaporation pan procedure is more accurate but requires some expenditure in equipment. The eva-poration pan is a circular pan constructed from 2.4 mm thick mild steel and measuring 122 cm in diameter and 25 cm deep (Fig. 1). Ten cm inside the outer ring a second ring ring is welded to the base to provide a water tight seal. An 8-cm diameter by 25 -cm deep stilling well stands near the edge of the inner com-

Table 1: How to calculate pan evaporation.

Weather Situation	Formula for Pan Evaporation in mm.
1. No rain. Added 'A' g or ml of water to pan to get correct level	$\frac{A}{817}$
2. Small rain of 'R' mm. Added 'A' g or ml of water to pan to get correct level	$R + \frac{A}{817}$
3. Big rain of 'R' mm. Took 'E' g or ml of water from pan to get correct level	$R - \frac{E}{817}$

Fig. 1: A diagram of an evaporation pan for estimating evapotranspiration.



partment. A sharp pointed brass rod, anchored in a lead base block and adjusted to a total length of 20 cm is placed in the centre of the stilling well. A similar pointed brass rod is placed between the inner and outer rings. The evaporation pan is placed on a slatted platform 10 cm above ground level in a non-shaded area, open to the free flow of the wind.

Water is added to the inner and outer compartments to bring the water up to the level where the point of the brass rod just breaks the water surface. A few crystals of copper sulphate (bluestone) are added to prevent algae growth. Each morning the weight of water (g) or volume of water (ml) required to bring the water level back to that point in the inner compartment is measured. If rain during the previous 24 hours has exceeded the amount of ET, the amount of water which must be removed to return the water to the point is recorded. To obtain the ET value it is necessary to subtract the amount of water which was removed from the amount of rainfall, both in mm. When the rainfall is less than ET, the amount of rainfall is added to the mm of water used to re-level the inner tank to give the total ET for the previous day. The amount of water removed or added in mm is obtained by dividing the weight (g), or volume (ml), of water removed or added by 817 which is 1/10 the surface area of the inner compartment (Table 1).

Table 2: Correction factors for adjusting pan evaporation to grass ET.

Month	Correction Factor*
May	0.55
June	0.65
July	0.75
August	0.75
September	0.55
October	0.45

* Pan Evaporation X Correction Factor = Grass ET.

Evaporation from a water surface in the pan is greater than from grass leaves, hence a correction factor must be applied to give grass ET. Measurements made at the microgreens at the Cambridge Research Station indicate the factor changes with time of season from 0.55 to 0.75 (Table 2).

An alternative, but less accurate, method for estimating grass ET is to record daytime weather conditions such as sunshine, temperature, wind velocity and humidity. Visual estimates of the variables except temperature, may be used in conjunction with Table 3 to estimate pan evaporation, to which the correction factors found in Table 2 are applied to provide rough estimates of grass ET.

Finally, to develop a water budget it is necessary to estimate the amount of plant available water retained in the rooting zone of the turf. The estimates may be known for sand rooting systems where the water characteristics of the sand were determined prior to construction. Alternatively the volume of plant available water may be computed from a knowledge of the bulk density and the percent silt and clay in samples from greens and fairways.

It is generally accepted that irrigation should occur when 50% of the plant available water has been lost through ET. At that time sufficient water should be added to raise the water content of the rooting zone back to slightly above field capacity; any water in addition to this amount will be wasted through drainage loss.

Having established an estimate of the volume of plant available water in the rooting zone a water budget may be set up which is analogous to a daily interest savings account at a bank. A value equivalent to 50% of the plant available water serves as the water budget base line which must not be exceeded if water stress to the turf is to be avoided (minimum bank balance). Water removed from the rooting zone by grass ET (cheques written) is recorded daily and subtracted from the estimate of plant available water (Table 4). When rainfall occurs it is added to the plant available water balance (pay cheque deposited). When the balance approaches the water Budget base line sufficient irrigation must be applied to return the budget to the plant available water level (lottery winnings). When rainfall or rainfall plus irrigation occur which supply more water than necessary to raise the budget above the plant available water level the difference will be lost as drainage water (income tax paid) and the budget will remain at the plant available water level. An example of a water budget for a green having a storage capacity of 40 mm of water and a water budget base line of 20 mm is provided in Table 4. Personal computer buffs will find their water budget system for irrigation scheduling another use they can make of the computer.

The microgreen installation at the Cambridge Research Station offered an opportunity to evaluate the water budget system. During 1983, a particularly warm and dry season, daily

Table 3: Estimators for pan evaporation based on observed weather conditions.

	One p.m. Weather Observations			Estimated Pan
Sunshine	Temperature	Humidity*	Wind**	Evaporation (mm)
Full	Greater than 23 C	Low	High	8.0
Full	Greater than 23 C	Low	Low	7.5
Full	Greater then 23 C	High	High	7.0
Full	Greater than 23 C	High	Low	6.5
Full	Less than 23 C	Low	High	6.5
Full	Less than 23 C	Low	Low	6.0
Full	Less than 23 C	High	High	5.5
Full	Less than 23 C	High	Low	5.0
Cloudy	Greater than 23 C	Low	High	5.0
Cloudy	Greater than 23 C	Low	Low	4.5
Cloudy	Greater than 23 C	High	High	4.0
Cloudy	Greater than 23 C	High	Low	3.5
Cloudy	Less than 23 C	Low	High	3.5
Cloudy	Less than 23 C	Low	Low	3.0
Cloudy	Less than 23 C	High	High	2.5
Cloudy	Less than 23 C	High	Low	2.0

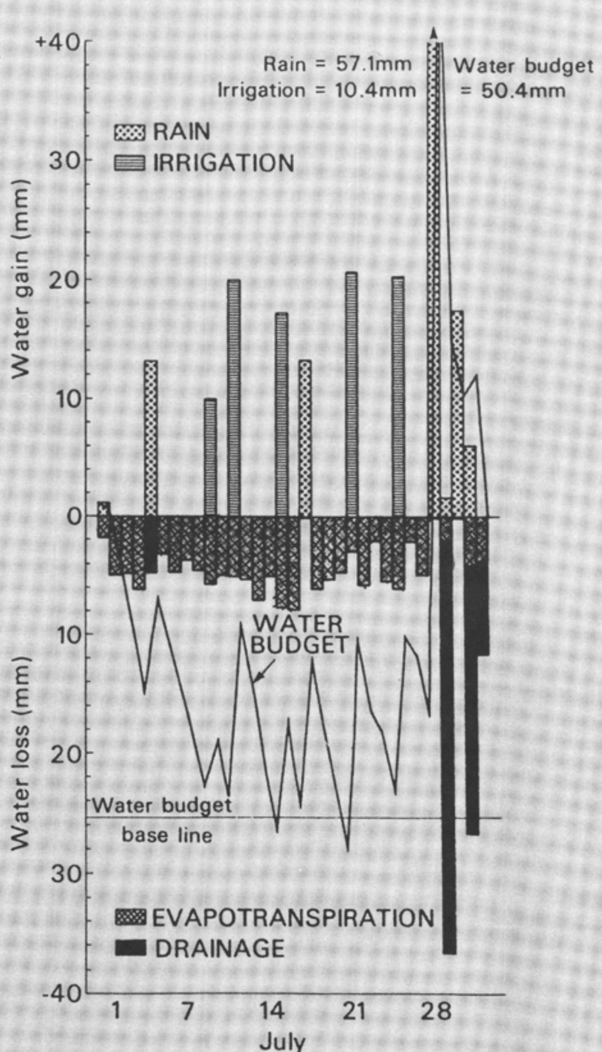
*Low = clear sky, unlimited visibility: High = smog, haze, fog.
** Low = leaves and small branches moving; High = tree tops moving.

Table 4: A hypothetical water budget record sheet for sand rooting zone having a water storage of 40 mm of plant available water in the rooting zone at the time records start.

	Water Input*			Water Output*	
Date	Rainfall	Irrigation	Evaporation	Drainage	Balance
			(mm)		
Aug. 7	-	-	-6.0	-	34.0
Aug. 8	+3.0	-	-2.6	-	34.4
Aug. 9	-	-	-6.O	-	28.4
Aug. 10	-	-	-5.25	-	23.15
Aug. 11	-	+15.0	-4.2	-	33.95
Aug. 12	+18.0	-	-3.0	8.95	40.00
Aug. 13	-	-	-4.0	-	36.0
Aug. 14	-	-	-2.8	-	33.2

*All measurements made at 9:00 a.m.

Fig. 2: The water input through rain and irrigation and loss through evapotranspiration and drainage during July,1983, on the micro greens at the Cambridge Research Station.



records of pan evaporation, rainfall, irrigation and drainage loss were used to schedule irrigation. A plot of the data for the period of June 30 to Aug. 1 is shown in Figure 2. The sand in the microgreens had an estimated storage capacity of 50 mm of plant available water in a 30 cm depth, hence at 50% use of plant available water irrigation should occur when 25 mm of water has been consumed by plant growth. On June 30 the budget indicated a positive value of +0.7 mm, a value which fell to -23 mm by July 8 when it approached the water budget base line which signalled the need for irrigation.

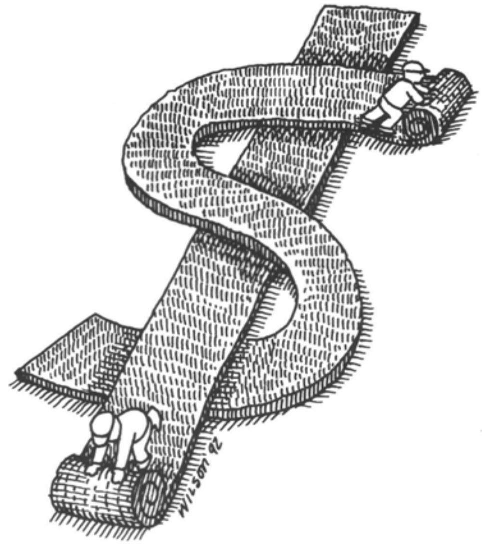
During the period June 30 to Aug. 1 irrigation was used six times and rain occurred six times, primarily as a heavy 57.4 mm rain on July 28 and lesser amounts on the three subsequent days. Note that irrigation was not required every day, even on a sand rooting zone. The maximum ET was about 8 mm, thus a storage of 25 mm of water would provide sufficient water for a three days without irrigation.

The July 28 rain was preceded by 10.4 mm of irrigation which had been called for by the water budget. As a result a drainage loss of 69 mm occurred over the following days as the rainfall continued. Such occurrences can not always be avoided as it's impossible to predict the intensity and duration of summer storms.

GRASS CLIPPINGS

- Researchers at Texas A&M University have quantified the cooling effect of turfgrass, noting that on a sunny day the turf will reduce surface temperatures by 30-40 degrees-F in comparison to bare soil.
- Through the extensive and intertwined system of leaves and roots, the turfgrass acreage in the U.S. is estimated to trap some 12 million tons of dust and dirt annually.
- One acre of grass will absorb hundreds of pounds of fossil fuel-created sulphur dioxide in a single year.

BETTER, SAFER SPORTS TURF FOR YOUR DOLLAR



Many municipalities have staff who maintain turf on sports fields in the parks and a separate staff who maintain the turf at the public and high schools. There is often duplication of equipment and standards for maintenance. Safety standards may vary widely between the different jurisdictions.

In 1979, the Town of Oakville enter into a reciprocal agreement with the public school board. Under the agreement the Parks and Recreation Department was to maintain the outside properties of all school sites in the Town of Oakville so that community groups could use the schools under the direction of the Recreation Department without cost.

It was agreed that the maintenance should include all grass cutting, fertilizing, keeping the playgrounds safe by doing minor repairs where necessary, and keeping the sports fields safe and in playable condition. The sports field maintenance included Gilling of diamonds, lining of soccer and football fields, plus maintaining the irrigation systems.

Over the years less funds were available through the school board for major projects and the necessary upgrading of the sports fields. The result was a steady decline in the conditions of all sports fields. In previous years the Parks Operations had undertaken surveys of the condition of the sports fields and made recommendations for upgrading, but the funds were not always available.

In April of 1992 the Parks staff undertook another survey and wrote a report. This time they involved the Board of Education from the beginning in making one of the following three recommendation for each field:

a) continue to maintain the facility under the present standards,

b) repair or renovate the facility to bring it up to safe and acceptable standards, or

c) recommend that the facility should be no longer used due to safety reasons until brought up to safe and playable condition.

A task force was established with the public school board to assess the report and implement the findings of the inspection and to generate a plan of action. The following are the guidelines for the task force.

1. The task force to consist of:

- one staff member from the physical education high school facility,
- one staff member from the physical education elementary facility or a principal,
- one staff member from the Parks and Recreation registration staff,
- one staff member from the Parks Operations staff,

2. The task force was to discuss the report on the conditions of the facilities and its recommendations to find a suitable solution to:

- developing a new maintenance procedure suitable for the general use and purpose of high school and elementary school facilities,
- how the recommended renovation and maintenance procedures should be funded,
- set a budget for the recommended renovations a short and long term basis,
- improve communications through regular meetings and seminars which would benefit the entire program,
- find ways to take facilities out of play for renovation for a period of one year, or alternative methods allowing enough time to do maintenance, and
- find an alternative process or method to maintain or to establish school open space areas to keep them safe, useable and playable.

3. Develop budgets and specifications for the development of drainage and irrigation systems for the high school football fields.

4. Develop budgets and specifications for drainage systems for high school soccer fields.

This task force would develop a detailed weekly maintenance program and budget for each facility, i.e., a high school irrigated football field. The maintenance budget would detail the cutting schedule, herbicide applications, aeration/topdressing operations. overseeding and fertilizer programs for a year. It would also address materials, materials, equipment and manpower requirements. The average estimated cost for one irrigated, high school football field was $3,600.00, whereas the cost of an elementary school field was estimated at $1,375.00. Any renovation procedures required to improve the safety or useability of a specific field would be an additional cost.

The Parks and Recreation staff believe this approach will vastly improve the overall condition of the turf on Oakville sports facilities without an increase in total budget by eliminating the duplication of effort. Similar discussions are now underway with the Separate School Board.

WORKING TOGETHER

The Wellington County Separate School Board and the Guelph Parks and Recreation Dept. are working together to develop 10 acres of land into a sports complex. The land will contain two soccer fields and an all-weather running track. The plan is to have the facility available by 1995. In addition discussions are under way for the development of a second, but smaller, parcel in a similar joint venture.

GTI RESEARCH HILITE

Prof. Chris Hall, Prof. Jack Eggens, Ms. Karen Sagan and Dr. Ken Carey have been cooperating for the past three years on non-herbicide weed control for turf. They believed that which turfgrass species or cultivar was planted, and the nitrogen regime which is used in the maintenance of the turf will have significant effects on the invasion of the turf by broadleaf weeds.

Previous work had demonstrated that increasing the mowing height from one inch to three inches significantly reduced the weed infestation on Kentucky bluegrass. Nitrogen fertility tended to have a variable effect.

In this experiment several cultivars of Kentucky bluegrass, perennial ryegrass, Chewings fescue, hard fescue and tall fescue were compared under four levels of nitrogen. The nitrogen levels were (a) no application over the three years, (b) 0.5 kg N/ 100 m^2 as a dormant November application, (c) a split treatment of 0.5 kg N/m^2 in May and in November, and (d) a split application of 0.25 kg in May, 0.25 kg in August and 0.50 kg in November. A mowing height of 1.5 inches was used.

The plots were rated visually for broad leaf weed invasion on a scale of 1 - 5 with 5 being a heavy infestation of more than 50% of the plot area. The visual estimates were checked against area-quadrat estimates to ensure reliability. The ratings were made on nineteen occasions over a three year period which began with establishment of the new turf.

Kentucky bluegrass was the least resistant species, followed by the fine fescues (Table 1). Both tall fescue and perennial ryegrass were relatively resistant to broadleaf weed invasion. The difference in resistance to invasion was largely a result of differences in the rate of establishment. Kentucky bluegrass and the fine fescues germinated relatively slowly, and the broadleaf weeds were easily able to establish in the new turf.

Significant differences were also observed between cultivars of a species, particularly among the bluegrasses and the fine fescues. Victory fine fescue ranked two full units superior to Agram fescue. Likewise Touchdown Kentucky bluegrass was a unit better than American. The poorest ryegrass or tall fescue was still superior to any of the bluegrass or fescues.

The level of nitrogen nutrition had a significant effect on the weed resistance in all species (Table 2). Increasing the nitrogen nutrition and distributing the nutrition more evenly over the season reduced the weed infestation in all species. Kentucky bluegrass showed the strongest response to nitrogen. The tall fescue and perennial ryegrass showed the least improvement from nitrogen fertilization and remained relatively weed free, even without nitrogen.

In conclusion low weed environments may be maintained through selection of the appropriate grass species and cultivar; species which germinate rapidly and maintain a dense turf. Adequate nitrogen nutrition is an important factor in maintaining a low weed population.

Table 1: A comparison of the broadleaf weed infestation of six turf species.

Turf Species	Rating
	(rating of 0 to 5, 5 = 50%+ of plot area)
Tall fescue	0.66
Perennial ryegrass	0.71
Kentucky bluegrass	2.03
Creeping red fescue	1.27
Hard fescu	1.92
Chewings fescue	1.95

Table 2: Improved nitrogen nutrition aids in improving the resistance of turf species to broadleaf weed infestation.

Nitrogen Nutrition	Tall Fescue	Ryegrass	Bluegrass	Fine Fescue
	(rating of 0 to 5, 5 = 50% of plot area)			
No nitrogen	1.09	1.16	3.00	2.20
0.5 kg dormant	0.59	0.89	2.28	1.59
0.5 kg in May 0.5 kg dormant	0.50	0.54	1.75	1.32
0.25 kg in May 0.25 kg in August 0.50 kg dormant	0.49	0.34	1.21	1.14

THE OTTAWA SAGA
Non Use of Herbicides

by Dick Standish,
Parks Manager, City of Ottawa

For those in the world that do not know, the City of Ottawa stopped using herbicides in 1978. Many reports were produced and the 2,4-D issue was discussed repeatedly and the ban was upheld by Council year after year.

By the early 1980's weed growth had continued and alternative weed control methods were being studied. Grants were offered to the user groups of the sports facilities to carry out a hand-weed project. Several groups took this opportunity to gain financially with the grant system but did not adequately perform weed control. The weeds were growing in the outfield of a ball diamond which had hard, compact ground that would support weed growth but little turf.

The greater percentage of weeds consisted of dandelions, plantains and knotweed, which are difficult to remove with the root system. Consequently, the user groups were just removing the top growth and not the root, therefore not completing an adequate weed program. Most of the groups became discouraged before completing half of the outfield. As the area was 80-90% weeds there was just bare ground left. This weed control method did not prove satisfactory.

The city looked for assistance in 1982 from the Guelph Turfgrass Institute. Dr. Lee Burpee, Dr. Chris Hall and Mr. Pat Tucker visited Ottawa and toured some of our green space to acquire a first hand knowledge of the existing conditions. A report was produced which stressed the importance of a good turf management program (aerating, dethatching, fertilizing, top dressing and overseeding), complete with limited use of herbicides. The report was accepted and the turf management program was instituted in 1983, but with "no" herbicide use.

The turf management program continued throughout the 1980's with the percentage of weed cover increasing and the turf cover decreasing.

In 1991, as most parks were weed covered, the turf management the turf management program was only carried out on newly developed parks and will continue until they become weed infested.

The Guelph Turfgrass Institute was approached for a return visit in 1992 to again review the present condition and recommend what course of action we should take. (*Ed. Note:* That report may be briefly summarized in five words - "what was bad is worse").

The surprising thing is there are few complaints from the user groups regarding the existing field conditions. All facilities are booked full-time for the season, regardless of the conditions and the weather.

The positive side is that the facilities are used fully with very few complaints regarding the surface condition (turf?).

Is it bad to have playing fields that are totally weed covered if they are used to the maximum?

(Reprinted from: *Green Sward* 13: No. 2, pp. 12, April, 1992)

1992 SPORTS TURF FIELD DAY

The 5th Annual Sports Turf Association Field Day was hosted by the University of Western Ontario on June 17, 1992. This year the Field Day was moved outside the golden horseshoe to London in an effort to reach the many turf managers and equipment distributors in southwestern Ontario. The event was well attended, with sunny skies and warm Western hospitality ensuring delegates and distributors a pleasant, informative day.

Our keynote speaker was Dr. Jack Eggens of the University of Guelph. True to form, Dr. Eggens held his audience captive; striking fear into some turf managers maintenance programs, while reassuring others. He was well received and provided many insightful comments and observations regarding sportsfield turf maintenance programs. His hands-on knowledge and congenial wit kept all delegates entertained and on the edge of their seats throughout the presentation.

The morning session offered a panel discussion with speakers representing the private, municipal and educational sectors. Mr. Doug James from the London Public Utilities Commission spoke on their operations and the methods and success at keeping the public informed about their maintenance schedules. Mr. Ron Barnes from the London Board of Education articulated his turf maintenance program and their system of communication, especially in regard to herbicide spraying, between the Board and users of the sports facilities. Mr. Vic Palmer from the Green Team gave an informative discussion on the various facets of private industry, its challenges and rewards. One dominant theme which surfaced in each of the speakers presentations was the need for superior communications between the public and municipalities, school boards and private contractors. Furthermore, in these times of fiscal restraint, it is important for all turf managers to ensure the public are receiving value from the turf maintenance programs; and be proactive in maintaining harmonious relationships between turf managers and users of recreational or sports turf.

We were fortunate to have an excellent indoor trade display and outdoor equipment demonstration. There was a broad spectrum of horticultural products and a full range of turf equipment. Sincere thanks to our valued suppliers whose participation is integral to the success of our Field Day.

Special thanks to our host, Jim Galbraith, and his staff for all their hard work on the Field Day. It was a job well done.

Once again our thanks to all who attended the Field Day and we will see you at York University in June, 1993.

Chris Mark, STA Director
Field Day Coordinator