UNDERSTANDING TURF MANAGEMENT
The eighth in a series by
R.W. Sheard, Ph.D., P.Ag.

SOIL REACTION - pH

Much has been written about the soil reaction or pH. Many sports field managers lose countless hours of sleep worrying about the results of a lab analysis which indicated a high or a low pH. Understanding what is meant by soil reaction and its implications in grass production can save many hours of that lost sleep.

What does pH mean?

pH is a measure of the relative acidity or alkalinity of the soil and is measured by a pH meter in negative logarithmic units from 1 (very acid) to 14 (very alkaline). In physical chemistry terms pH is a measure of the hydrogen ion concentration in the soil solution. The lower the pH value the greater the concentration of hydrogen ions, that is, the more acid the soil . A neutral soil is one that has a pH of 7.0. Because the measuring system is logarithmic, a soil with a pH of 6.0 is 10 times as acid as one with a pH of 7.0. Likewise a soil with a pH of 5.0 is 100 times as acid as a neutral soil.

Soils in Canada, in their natural state, range in pH from 3.5 to 9.0. The acid soils are primarily sands which have being growing coniferous forests for centuries. Soils of pH 8.5 or greater are usually associated with the saline soils in the prairie regions of Western Canada which contain relatively high amounts of soluble salts.

Most Ontario soils have developed from materials of limestone origin and have a near neutral pH. Most Western Canadian soils also tend to be neutral or alkaline in reaction whereas soils in the Maritime provinces tend to be acid. Therefore, in Ontario, most sports fields constructed from local materials can be expected to have a pH near 7.0. An alkaline reaction is also usually associated with the sands used for construction or topdressing if they are obtained in Southern Ontario. Sands from the Canadian Shield, however, may be acid due to the granites and other igneous rocks from which they were formed.

With time, usually measured in decades, all soils become more acid. There are five basic factors which contribute to this slow acidification of soils.

- The formation of hydrogen ions during root respiration and microbial breakdown of organic matter.
- The conversion of ammonium nitrogen to nitrate nitrogen when ammonium fertilizers are used.
- The addition of elemental sulphur to a soil.
- The breakdown of clay minerals in the soil and the subsequent liberation of aluminum which reacts with water to produce hydrogen. This breakdown speeds up as the soil becomes more acid.
- The leaching losses of calcium and magnesium which have a neutralizing effect on the hydrogen.

Obviously, the greater the biological activity such as root growth, the greater the leaching (excess irrigation), the more ammonium fertilizers and elemental sulphur that is added to a sports field, the more quickly it will become acid. In sports fields which contain significant amounts of clay and organic matter, however, the acidification process is counteracted by a phenomena known as buffering capacity. The buffering of a soil means the ability of the soil to resist a change in pH. Buffering capacity is due to the cation exchange ability of the clays and humus which will be described in a latter article. It must be remembered, however, that fields constructed on acid sands can become more acid relatively rapidly.

The effect of pH on grass

Why is the pH of the rooting zone considered a problem? The hydrogen concentration (pH) is not the direct problem as plants have been successfully grown at pH 3.0 in solution culture when all the nutrients are controlled and provided in a soluble form. The primary problem is that the pH of the soil has a significant influence on the ability of elements required for grass growth to be dissolved in the soil water. If, through a change in pH they become insoluble, or soluble at rates less than that required to supply the grass, a pH-derived, nutritional problem is created. If, on the other hand, they become too soluble, a toxicity problem is created.

Table 1 lists the pH at which the various nutrients required for grass growth are most soluble. With the exception of iron and manganese a neutral pH would be the most desirable.

Table 1: The influence of pH on the solubility of the nutrients required for plant growth.

Nutrient	Most Soluble pH Range	Least Soluble pH Range
Nitrogen	6.5 - 8.0	5.5 and lower
Phosphorus	6.5 - 7.2	less than 6.5, over 7.2
Potassium	6.5 - 8.5	6.5 and lower
Calcium	7.0 - 8.5	6.5 and lower
Magnesium	7.0 - 8.5	6.5 and lower
Sulphur	6.5 - 8.5	5.5 and lower
Iron	3.5 - 6.0	greater than 6.0
Manganese	4.5 - 6.5	greater than 6.0
Boron	5.0 - 7.0	less than 5.0, over 7.5
Zinc	5.0 - 7.0	greater than 6.0
Copper	5.0 - 7.0	greater than 6.0

The most widely discussed problem of pH in soils and its effect on plant nutrition is phosphorus availability. The solubility of phosphorus reaches a maximum between pH 6.5 and 7.2. Above 7.2 the solubility decreases due to the formation of relatively insoluble compounds of calcium and magnesium; below 6.5 the solubility decreases due to the formation of relatively insoluble compounds of iron, aluminium and manganese. All forms of phosphorus found in the soil have a low solubility in water, however, it takes time, measured in months or years for the phosphorus to reach the low solubility such as that found in the original phosphate mineral, apatite. The further the pH deviates from the optimum the less time required to form the very insoluble forms. Therefore, a program of regular phosphate fertilization, based on an approved soil testing procedure, is a more realistic approach to pH than an attempt to change the pH.

The lower concentration of nitrogen and sulphur in the soil solution at a pH less than 5.5 is due to the decrease in the activity of soil microbes that convert the various nitrogen and sulphur forms in the soil to the forms which a grass root can absorb. Iron and manganese increase in solubility as the pH falls. In fact, one of the major reasons for liming a soil to increase the pH is to reduce the solubility of manganese which can be toxic to grass roots at high concentrations.

The four minor elements, iron, manganese, zinc and copper decrease in solubility as the pH rises above 6.0, causing unnecessary concern for field managers whose soils are testing 7.5. The concern is unnecessary in most cases because these are minor elements; elements required in very small amounts for plant growth. Only a few species, grass not being one of them, respond to applications of these minor elements, even at a pH greater than 8.0. If a response is to be found, it will be on sands, very low in organic matter. Grass species have a very low requirement for boron and it has never been reported as a deficiency problem. However, in saline conditions in arid regions on soils with a pH above 8.0, boron may become soluble enough to be toxic.

Changing the pH

Changing the pH is not a simple procedure. If one wishes to increase the pH of an acid soil to the neutral range it is necessary to add a liming material, generally calcitic or dolomitic limestone. The dolomitic form of limestone is used where a magnesium deficiency is know to occur because it is a mixture of calcium carbonate and magnesium carbonate. Two other liming materials, quicklime and hydrated lime, may also be used but caution in their application must be taken because they are caustic to the eyes and skin.

Limestone is very slowly soluble in water, thus it is necessary to use very finely ground material - 85% should pass a 100-mesh screen. Because limestone is slowly soluble, it is best mixed with the soil materials for the upper 15 cm of the rooting zone prior to construction of a sports field. Application to an existing field may require several years to show an affect below the first few centimetres. To speed up the penetration of the liming materials applications should be made during a coring operation.

To determine the amount of limestone to apply it is necessary to do a standard pH measurement. If the value is below the desired target pH for the turf, i.e., 6.0, the a second pH measurement known as the 'buffer pH' is made. The buffer pH reflects the difference in soil buffering capacity of soils due to their different clay and humus contents. For example a high organic matter, clay soil will require more limestone to change the pH one unit than a sand. The amount of limestone required to raise the pH to the target pH is shown in Table 2.

The turf species used in Canada do very well at a target pH of 6.0, hence the addition of limestone is seldom required. Table 3 outlines the preferred pH range for these species.

Some turf managers want to lower the pH of a soil which reads 7.8 or greater. It has never been shown that there is an advantage to doing so and the expense is prohibitive. There may, however, be localized horticultural situations where lowering the pH is desirable, such as the growth of azaleas. The materials which may be used are elemental sulphur, aluminum sulphate and sphagnum peat. Sphagnum peat generally has a pH between 2.5 and 3.0

The amount of sulphur or aluminum sulphate required to adjust the pH of the top 15 cm of soil to pH 7.0 is recorded in Table 4.

Table 3: The preferred pH range for the common turfgrass species grown in Canada.

Species	Preferred pH Range
Kentucky bluegrass	6.0 - 7.6
Colonial bentgrass	6.0 - 7.0
Creeping bentgrass	6.0 - 7.0
Creeping red fescue	5.5 - 6.5
Ryegrass	6.0 - 7.0

Table 2: The lime requirement to correct soil acidity based on the target pH and the buffer pH.

Buffer pH	Target pH = 6.5	Target pH = 6.0
	(tonne material/hectare)	
7.0	2	0
6.5	3	2
6.0	9	6
5.5	17	12
5.0	20	20

Table 4: The amount of elemental sulphur *or* aluminum sulphate required to lower the pH to 7.0.

Initial pH	Elemental Sulphur			Aluminum Sulphate		
	Sand	Loam	Clay	Sand	Loam	Clay
			($kg/100m^2$)			
8.0	11.0	22.0	40.7	22.0	44.0	66.0
7.5	6.6	13.2	17.6	11.0	22.0	33.0

In summary it must be emphasized that materials to directly alter the pH should never be applied unless a pH determination has been made. Furthermore the pH should seldom be a concern for the turf manager. If it becomes excessively high (over pH 7.8) then be alerted to the possible requirement for a higher phosphorus test to satisfy the requirements of the grass. If the pH falls below 5.5 be prepared to apply some limestone during coring. In between enjoy a good night's sleep.

The Sports Turf Association welcomes new members:

Don Bridgman
Cambridge Parks

J.T. Dawson
McMaster University

Andrew Gaydon
Shemin Nurseries

Larry Glover
Belleville Parks

John Gravett
Turfecs, Guelph

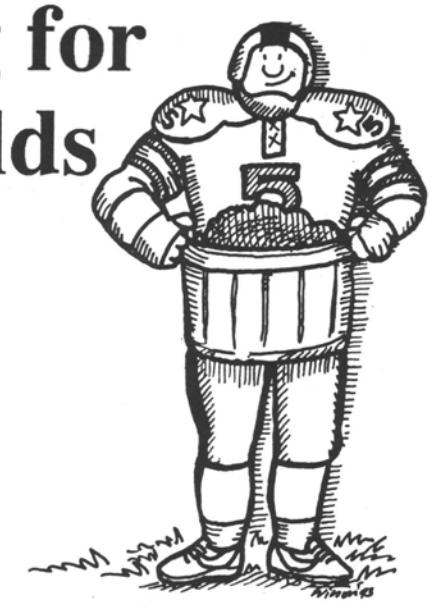
Russell Loney
Loney Landscaping

Robert MacAuley
Univ. of P.E.I.

Christian Prud'homme
Pelouse Sante, Que

Dennis Weagant
Belleville Parks

Composting for Athletic Fields



Michael J. Bladon
Grounds Dept., Univ. of Guelph

Benefits of Composting

The principal benefit of composting is to recover or recycle biodegradable materials from agricultural, industrial and municipal waste streams in an environmentally acceptable manner to produce a useful, marketable product.

A second benefit is that the end product (compost) is a safe material which may easily be transported using regular commercial vehicles. The resulting material has many advantages and can be used in many ways.

For example, there is now evidence that compost can be used to suppress plant diseases, stabilize soil pH and impede the movement and uptake by plants of toxic metals such as cadmium and lead.

Furthermore, reclamation of strip mines, mine tailings and the rejuvenation of salt-damaged soil along roadways may be aided. In addition, compost recycles the plant nutrients so less fertilizer is needed.

Finally, the use of compost on sports fields for topdressing, construction or renovation instead of peat moss is important in two ways. It will help to preserve wetlands from which peat is harvested. Generally this harvest is a irreversible process with the destruction of the wetlands. The destruction of wetlands is now a serious environmental issue, especially among the wildlife people.

Peat moss is very expensive - compost is a much more reasonable economic alternative, in fact some landscape architects are including compost in their specifications. In a survey conducted by the lawn and landscape industry, the respondents categorized themselves as:

- 71.3% being generators of lawn waste (clippings, leaves, branches,
- 34.8% being collectors of lawn waste, and
- 33.0% being composters of lawn waste.

Of those contractors that were surveyed who collected waste and generated compost, 66% indicated they use it themselves, 26.3% gave the material away, and 7.3% sold the compost.

Getting Started

First of all, depending on where you live, obtain a copy of the Provincial Government Guidelines for aerobic composting. It will be apparent from reading these guidelines that in order to generate good compost you need a recipe which includes: air, moisture, correct C:N ratio, temperature and pH balance. Finally you will need at least an acre of land for every 1,000 tonnes of yard waste.

Air: The bacteria which break down organic matter are called aerobic because they need oxygen. Lack of aeration, because the pile is too wet, packed to tight, or is too large, can cause it to become anaerobic which can create odours objectionable to neighbours. Furthermore, anaerobic composting does not create sufficient heat (min. of 55° C) to kill weed seeds and various pathogens. So turning, and hence aerating, the pile during the composting process will provide the oxygen necessary for the aerobic bacteria.

Moist, Not Wet: If the pile becomes too dry, bacterial production is inhibited and the composting process is slowed. Forty to 60 percent moisture is recommended. The material should be damp to the touch but you should be able to squeeze only a drop or two of moisture from a handful. Adding water is easy, however, the extraction of it is impractical. The addition of dry leaves, sawdust, newspaper, or simply turning, will help to dry a wet pile.

Temperature: If all of the above has been accomplished then the pile should heat naturally to at least 55° C, allowing decomposition in the shortest period of time. With open piles a minimum of ten days at this temperature is needed; with 'in vessel' (enclosed) operations a minimum of 3 days is needed. Below these temperatures the decomposition will slow. Most harmful pathogens are destroyed and weed seeds are killed at 55° C. The process is self regulating because if the temperature rises above 55° C many microbes will die and the pile will cool down. It may also be cooled down water or by turning.

Carbon:Nitrogen Ratio: The ideal C:N ratio for composting is 25-35 parts of carbon (C) to one part of nitrogen (N), with an average of 30:1. A high C:N ratio will slow the process, due to lack of nitrogen for protein synthesis and bacterial reproduction. A low C:N ratio (less than 20) reduces bacterial reproduction because of a lack of carbon - the energy source for the bacteria. At a ratio of 12:1 further bacterial breakdown of the material ceases.

The following values may be used as a guide for materials to use to raise or lower the C:N ratio of the pile.

Grass Clippings	19:1
Leaves	30-50:1
Leaves (Autumn)	50-80:1
Wood, Sawdust	300-700:1
Paper	150-200:1
Bark	100-150:1
Straw	80:1
Cow Manure*	20:1
Horse Manure*	25:1

* depends on kind and amount of bedding used.

Balancing the pH: pH is very important but very difficult to control particularly once the composting process has begun. Most lawn and garden wastes will result in a neutral pH. High acid pine needles may be added to lower the pH, however, they can also inhibit the growth of some bacteria. Lime may be added to raise the pH, but only under extreme conditions and is seldom required.

Amount of material required for topdressing operations.

Depth (inches)	for 1000 sq. ft. (cubic yards)	for one acre
1/4"	0.78	34
1/2"	1.56	68
3/4"	2.34	102
1"	3.12	136
2"	6.24	272
Area of some sports fields	**acres**	**hectares**
Football	2.38	95
Soccer	2.35	94

Compost as a Topdressing

The first step is to provide a thin uniform layer over the established turf. Any of the commercial topdressers will provide a uniform amount directly to the surface, which produces less odour and mess. It helps to level the surface of the field and aids in seed germination. Hence it is a good practice to apply the compost in conjunction with aeration and seeding. Compost will increase the organic matter in the soil in addition to providing greater resilience and less compaction. It will also increase the water holding capacity of the soil.

It is a good idea to run the compost through a screener to insure a fine material that will not only filter down through the turf to the crown area but also be free of debris and stones which may injure the athlete.

Future for Compost

There are more than 200 municipal waste composting plants in operation in Europe. In North America, however, they are much fewer. In the United States there are about 12 that are turning municipal waste into compost: most of these are small-scale operations. Portland, Oregon and Fort Lauderdale, Florida, started operations last year which will compost 600 tons of municipal garbage per day.

Our landfills are reaching capacity and many are already refusing manures and yard wastes. In Ontario we will see larger, more sophisticated operations. The City of Etobicoke produces some 8,600 tonnes of compost per year. They rent a tub grinder for two weeks every year to process the material. The City of Toronto has a large 'in vessel' (enclosed) operation.

All these operations will be controlled by governments. Composting is new as a commercial venture so the procedures will be subject to regulations for solid waste processing and quality. Because of regulations, new sites will be difficult to establish. However, shredders, tub grinders, mixers, screeners will soon become standard equipment in our cities and towns.

The problem then becomes how to make best use of this material. Certainly dumping it in a landfill site is a waste of a valuable organic material. While much of the volume may be used on home gardens and on sports fields, it may be necessary to utilize a large portion on agricultural land.

(This article is a summary of the address presented by Mike Bladon at the 1993 Turfgrass Symposium at Guelph.)

A SECOND SUCCESS

Turfgrass Symposium Grows in Quality and Quantity

The registration at the 1993 Guelph Turfgrass Symposium swelled to 886 from the 560 who registered in 1992. The largest increase was from the turf managers of the future, the student registrants, as whose numbers increased from 80 to 229. These numbers do not include the 301 people who attended the Trade Show only and the over 200 people who manned the exhibits. The number of STA menbers in attendance remained the same at 41.

While numbers are a statistical measure of success, the speaker program was equally well received. Over 400 people listened to Dr. James Beard trace the development of the turfgrass industry over the passed 50 years and project its development into the next century. Likewise, each of the Concurrent Seminars was well attended. Subjects ranging from 'Team Building' by Dr. Lynda Pinnington to 'Using Weather Information for Smart Turf Management' by Prof. Terry Gillespie gave attendees a wide range of subject matter to choose from.

The Sports Turf Association hosted three very well attended, half-day sessions where 10 speakers covered various subjects of interest to field managers. The theme of the Wednesday morning session on water was attended by registrants from all aspects of turf, golf superintendents, lawn care professionals and sod growers in addition to sports field managers. In this session Prof. Gillespie enlarged on the water budget concept of irrigation scheduling which was featured in the last Newsletter; Andrew Gaydon discussed the latest in equipment to apply water; Bill Wardle outlined regulations which the government has, or may, impose; and Tom Clancy reviewed what happens when city politicians cut the water line to your sports fields when drought strikes.

Make your plans now to attend next year's Symposium. It will be held January 5th, 6th and 7th. The Organizing Committee is already working to give you a better program. The other good news is *the registration fee will not change and parking is free.*

GTI Research Hilites

Professors Jack Eggens, Tom Hsiang and Ken Carey, with the assistance of graduate student Xuecai Liu, reported in the 1992 GTI Research Report on a two-year trial with some new organic nitrogen fertilizers.

They introduced the report by stating "Societal concerns regarding environmental quality are prompting the development and use of various kinds of organic amendments to reduce or replace inorganic fertilizer and synthetic pesticide use. These amendments come from a number of sources and they may include slow release of nutritive components, protection from or enhancement of the turfgrass microflora, or addition of different types of living or non-living organic elements."

One of the materials they compared to the standard nitrogen sources, ammonium nitrate and sulphur-coated urea was the 'RINGER' products. These materials are produced from poultry feather meal, blood meal, wheat germ, sulphate of potash and bone meal. They also contain selected proprietary strains of the bacteria, *Bacillus subtilis* and *Bacillus spp.*, and other selected soil microbes related to *Trichoderma viride*. These microorganisms may have a competitive or antagonistic influence on pathogenic organisms which affect turf.

The materials compared and the rate of nitrogen application are listed in Table 1. Alginate is a marine kelp material of little nitrogen value whereas Sandaid is a unspecified marine plant material of similar analysis. They are reported to contain micro elements and other compounds of benefit to turf.

The materials were applied every four weeks beginning June 5, 1991 and June 12, 1992 until September, followed by a dormant application in November for a total of six applications per year.

With the exception of Milorganite, the spring colour of the turf was directly related to the nitrogen applied during the previous year. There was a trend for the Ringer products to provide slightly better spring colour than the inorganic forms of nitrogen. Turf quality, measured on the 12th of August, 1992, was

Table 1: The rate of application of several organic materials on Kentucky bluegrass and ratings of turf colour and quality.

Material	Nutrient Analysis	Application Rate Material	Application Rate Nitrogen	Spring Colour	Turf Quality
	(N-P-K)	(kg/100 m^2)		(1 - 9*)	
Control	-	-	-	1.0	5.3
Ammonium Nitrate	34-0-0	1.3	0.44	4.0	7.5
S-coated Urea	45-0-0	1.5	0.52	4.0	7.0
Milorganite	6-2-0	7.4	0.44	2.0	6.5
Ringer Lawn Restorer	9-4-4	4.9	0.44	4.5	7.8
Ringer Turf Restorer	10-2-6	4.9	0.49	4.5	8.0
Bovamura	-	0.5 L	-	1.0	6.0
Alginate	1-0-2	10.0	0.01	1.0	6.0
Sandaid	1-0-2	10.0	0.01	1.0	5.5

* Evaluation scores were from 1 to 9: 1 = poor, 5 = acceptable and 9 = excellent. Spring colour ratings were made April 30, 1992. Quality ratings were taken from the Aug. 12, 1992 measurements.

Table 2: The effect of the soil amendments on the microbialpopulation in the thatch and soil under bluegrass.

Material	Bacteria Thatch	Bacteria Soil	Fungi Thatch	Fungi Soil	Thatch Depth
	(propagules per gram soil x 10^6)				(mm)
Control	273	65	65	24	15.7
Ammonium Nitrate	263	49	132	42	14.4
S-coated Urea	390	58	87	22	14.9
Milorganite	268	56	87	32	16.0
Ringer Lawn Restore	576	87	160	43	13.3
Ringer Turf Restore	494	66	108	37	13.2
Bovamura	199	42	103	16	14.2
Sandaid	296	86	77	29	13.6
Alginate	221	76	72	19	15.7

similar for all materials providing 0.44 kg of N/100m^2 with the exception of Milorganite which rated a full point lower.

Plots treated with Ringer Turf Restore or Ringer Lawn Restore had significantly higher microbial populations in the thatch layer. There was a tendency for the application of nitrogen to reduce the thickness of the thatch and for the thatch reduction to be greater where the Ringer materials, or Sandaid, were used. The data would suggest that the enhanced microbial population was effective in reducing thatch in the bluegrass.

Editorial Note: Relative to inorganic nitrogen and conventional cultivation techniques for turf quality and thatch control, the final assessment of these new materials rests with the turf manager who must balance cost with their performance based on $/kg of N and a reduced need for thatch control.

IN MEMORIAM

The Association was saddened to learn of the death of Scott Richmond, in his 35th year as a result of a snowmobile accident on Saturday, Jan. 30, 1993. Scott was Vice President - Sales for Hutcheson Sand & Mixes of Huntsville. Hutcheson's wish to express their thanks to those who assisted in teaching Scott his skills in preparing mixes for better turf. The Association regrets the loss of a valued member of the turf industry.

Pest Diagnostic Clinic on the Move

The Pest Diagnostic Clinic has moved to the new OMAF Laboratory Services Building on Stone Road in Guelph.

This Clinic offers a diagnostic service to turf managers whose turf may have disease, insect and nutritional problems. If you are not sure what your problem is it is good policy to have a positive identification by this service prior to commencing any treatment. Contact the clinic with regard to protocol for sampling and costs of the service before taking any action. It can save many dollars from incorrect application of chemicals.

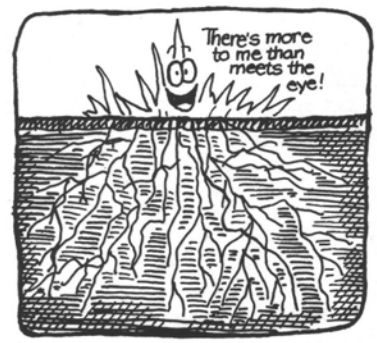
Contact: Pest Diagnostic Clinic,
Ag. & Food Laboratory Services Centre,
P.O. Box 3650,
95 Stone Road W., Zone 2,
Guelph, ON.
N1H 8J7

(519) 767-6256

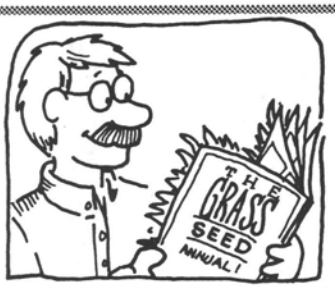
GRASS CLIPPINGS

- Many animal activities (humans included) create harmful gasses such as carbon dioxide, ozone and methane. Grasses, however, absorb carbon dioxide to survive and replace it with oxygen, vital to the respiration of all animals.

- An area of turf, 50 ft. by 50 ft., generates sufficient oxygen in a day to meet the needs of a family of four.
- Grass produces about 200 pounds of dry clippings per 1,000 square feet per year. If allowed to decay on the surface, they will release 10 pounds of nitrogen, 8 pounds of potassium and 0.8 pounds of phosphorus to the growing grass.
- Studies at Penn State found the runoff and leachate obtained two days after man-applied fertilizer and pesticides provided cleaner water than what government agencies require for drinking water.
- 90% of the weight of a grass plant is in its roots, making it a very efficient system for stabilizing soils.



GRASS SEEDS



- available from the major seed companies in Ontario

The Sports Turf Association strongly recommends to athletic field managers that they use only improved cultivars of species that have been tested and found superior under local conditions.

	SUPPLIER					
Species	**BISHOP**	**PICKSEED**	**ONTARIO**	**OSECO**	**ROTHWELL**	**SPEARE**
Kentucky Blue	Adelphi Baron Barzan Eclipse Liberty Limousine Midnight Nassau Regent	Alpine America Banff Bronco Cheri Crest Entopper Fylking Indigo Nugget Touchdown	Argyle Baron Barzan Classic Eclipse Geronimo Harmony Liberty Nassau Park	Classic Cypress Gnome Haga Nimbus Nublue Midnight Sydsport Supranova	Adelphi Ampellia Argyle Broadway Challenger Chateau Classic Cynthia Eclipse Estate Glade Harmony Huntsville Julia Midnight Monopoly Nustar Ram 1 Regent S-21 Sabre Scenic Sophia Suffolk Welcome	Baron Eclipse Georgetown Liberty Limousine Lofts 1757 Nassau Regent
Ryegrass	Competitor Envy Omega II Palmer Sovereign Spectacular	Blazer II Dasher II Edge Express Fiesta II Lowgrow	Competitor Envy Palmer II Repell Seville Yorktown II	APM Delaware Dimension Gator Pinnacle	All Star Brenda Mondial Pebble Beach Ranger Seville SR 4000 SR 4100 SR 4200 Surprise	Competitor Envy Omega II Palmer II Repell Saturn Sovereign Yorktown III
Fescue: Creeping Red	Franklin Vista	Jasper	Fortress Franklin Vista	Fortress Shademaster	Flyer Finelawn I	Franklin Vista
Fescue: Chewings	Jamestown Koket	Victory	Jamestown II Koket	Banner Bridgeport Center Koket Wilma Waldorf	Barfalla Luster SR 5000	Jamestown Koket
Fescue: Hard	Reliant Serra	Spartan	Biljart Reliant Serra	Biljart	Scaldis SR 3000 Silvana	Reliant Serra
Fescue: Sheeps	MX86		MX86			MX86
Fescue: Tall	Emperor Jaguar II Rebel II	Crossfire Mini Mustang Team Jr.	Emperor Falcon Jaguar II Rebel Jr. Williamette	Bonsai Crewcut Twilight	Arid Shenandoah	Emperor Jaguar II Rebel Jr. Tribute
Bentgrass: Colonial		Exeter		Boral Tracenta	Bardo Tracenta	
Bentgrass: Creeping	Emerald Penncross Pennlink	National	Highland Penncross Pennlink Penneagle Seaside SR 1020	Cobra Emerald Putter	Penncross Pennlink Penneagle Prominent Providence Putter SR 1020	Southshore
Poa trivialis		Colt	Laser Sabre	Cypress		
Weeping Alkali	Fults	Fults				
Misc. Species		Reten red top	Canada blue			

New Products

a compilation of new products and services available in the Sports Turf Field

Bridgeport Chewings Fescue

OSECO Inc., Brampton, ON. is pleased to announce that Bridgeport Chewings Fescue has been selected to enhance our line of cultivar turf seeds.

Bridgeport is a new and distinct, very dark green, Chewings Fescue. It has excellent resistance to leafspot and powdery mildew. It has good resistance to red thread and stem rust.

Bridgeport produces excellent quality turf that stands up well against extended drought, high temperatures and winter desiccation.

Versatile, durable Bridgeport does well in shade and its ability to withstand heavy traffic makes it a natural choice for sportsfields.

It also has one of the highest endophyte ratings in the industry making Bridgeport a leader in insect resistance.

Ample supply of seed is now available for immediate shipment from OSECO Inc., Brampton, ON.

Providence Creeping Bentgrass

Providence creeping bentgrass is a 5-clone genetic development which makes it the most genetically diverse bentgrass on the market. In 1991 Providence was rated the # 1 bentgrass for greens, tees and fairways in the N.T.E.P. trials.

Providence has a very upright, fine textured growth habit. Hence there is less grain development on greens and less vertical mowing and grooming is required. With less grain a truer putting surface is obtained. The cultivar has an intense rooting habit which leads to rapid divot and ballmark recovery.

This bentgrass has extremely good heat and cold tolerance making it an excellent selection for Canada's cold climate. It has a massive root development leading to an ability to withstand high summer temperatures and reduced water requirements.

Its colour is a rich dark green which reduces the nitrogen demand to maintain good colour on a green.

Providence has excellent dollar spot resistance. It has improved Pythium resistance and good Fusarium resistance.

The cultivar is being marketed in Canada by Rothwell Seeds Limited, Lindsay, ON.

Athletic Field Aerator

Ransomes America Corporation is pleased to introduce the new Cushman GA60 Reciprocating Athletic Field Aerator. The GA60 is designed to work behind any current model of Cushman 3, or 4-wheel Turf Truckster, or any agricultural tractor with approximate 40 horsepower rating. The Cushman GA60 raises and lowers hydraulically and operates with a 33 horsepower liquid cooled engine. It is capable of aerifying up to 1.3 acres per hour at a coring depth of 4 inches.

The unit is available through G.C. Duke Equipment Ltd., Burlington, ON.

Cushman GA60 Reciprocating Athletic Field Aerator

New Product Releases

Futura 2000 "EEE" Tall Fescue

Futura 2000 "EEE" is an Endophyte Enhanced Excellence Certified Seed Blend developed by Pickseed of three tall fescues - Dasher II, Edge and Express.

The term 'endophyte' is taken from the term for an organism living in the interior "endo" of a plant "phyte". This organism is part of the *Acremonium* family. The original research was stimulated by poor animal performance on forage-type tall fescue due to the buildup of alkaloids, caused by the fungus *Acremonium coenophialum* in the plants.

In New Zealand it was found that entire pastures were populated with perennial ryegrass with a high endophyte content. This had evolved by natural dominance because the plants without the fungus, and hence the alkaloids, were being eliminated by the insect, *Listronotus bonariensis*. Turf and amenity grass breeders soon saw repeatable results in turf plots where high endophyte containing varieties were withstanding the attacks of Sod Webworm, Billbugs and Chinch Bugs.

It should be noted that the endophytes are present in the crowns and leaves of plants, but not in the roots. Hence root feeders, such as white grubs, will not be affected.

The final "E" of EEE is for Excellence. The three component varieties, Dasher II, Edge and Express, are all state-of-the-art varieties for turf quality, disease resistance and persistence.

The Chinch Bug and Billbug resistant Futura 2000 "EEE" is available throughout the Pickseed network of distribution across Canada and the U.S.A.

Light Energized Irrigation Technology Solatrol Water Management Controller

The LEIT 8000 collects extremely low levels of ambient light and focuses it onto a high-efficiency photovoltaic module for conversion into electrical energy, eliminating the need for AC power and troublesome batteries. This stored energy powers the system day and night, in any weather conditions worldwide.

The computer's stored energy is used to control Solatrol; Micropower Solenoid Actuators. These are interchangeable on many brands and styles of valves, both brass and plastic in all sizes.

Automatic monthly budgeting and multiple splits of watering durations, springe cycles, frost wipes, deep soaks, excluded times - these and many more features are available with the push of a button. The LEIT 8000's exclusive water management features maximize water savings and minimize runoff. The computer even logs its own operations, so users can easily track watering history.

The LEIT 8000 computer is backed by a factory direct 5-year replacement warranty and is available from Aquamaster Irrigation Products, 1-800-268-6826

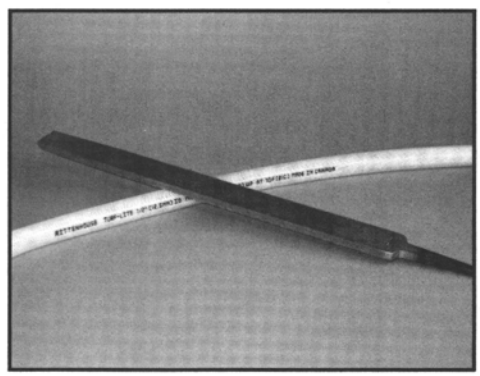
Turf-Lite Spray Hose

Rittenhouse Sprayers is pleased to introduce the Rittenhouse Turf-Lite spray hose, the first of it's kind in Canada.

This is the toughest hose we have ever sold in our 79 year history. Try wearing it out with a file ... not easy. Then try your existing spray hose ... not hard. You'll be surprised!

Not only is it tough, it is only half the weight of standard spray hose. Even with it's light weight, weakening due to kinks is a thing of the past due to a superior resistance to memory bends.

A 250 psi working pressure, along with chemical resistance second to none, makes this hose the choice for all turf applications and root feeding, as well as most tree and shrub spraying.



Rittenhouse Turf-Lite Spray Hose