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Turfgrass

→ Conference Edition

MANAGEMENT

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Travelling Turf Man

New Golf Courses
for Victoria

Salinity Tolerance



Official publication of the
Millennium Turfgrass Conference, June 2000

volume **23**

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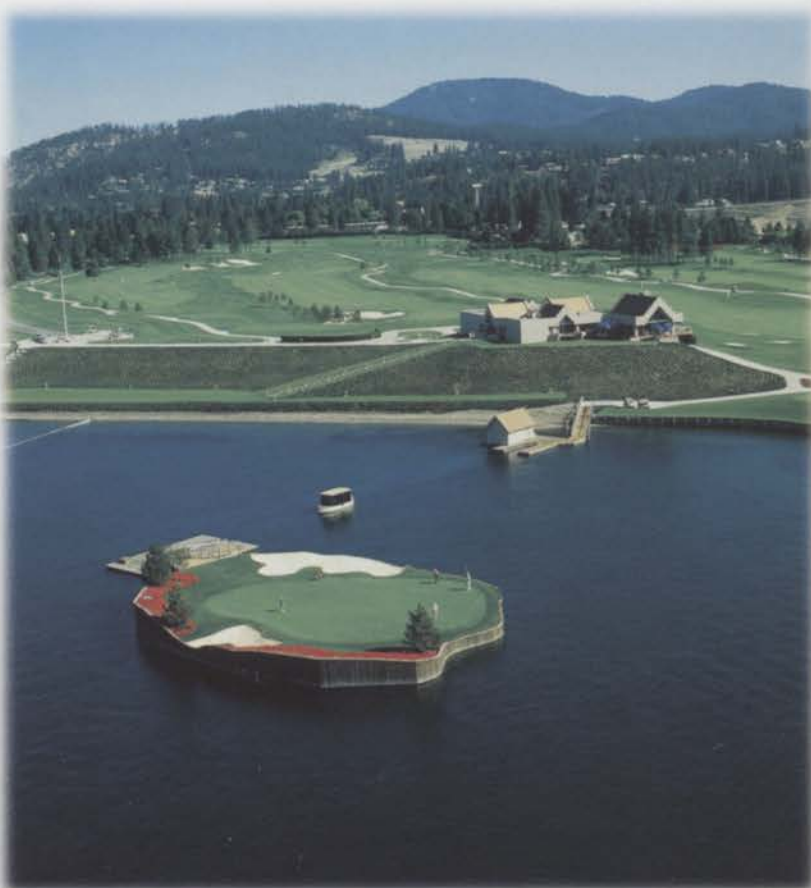
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Brisbane's Tim Notting being carried from the ground after sustaining an injury in round 2 season 1999 against West Coast Eagles at Subiaco Oval. Photo courtesy of All Sport.

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in every edition

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"It's big!"

Welcome to the Conference Edition of Australian Turfgrass Management magazine.

The Millennium Turfgrass Conference is the culmination of well over a years work for Euan Laird and all of the other Steering Committee Members and associated industry groups. The Conference will feature the largest ever Turf Trade Show seen in this country (7,500m²) and the number of delegates attending the various streams of seminars and workshops looks like topping one thousand!

This magazine also is our biggest by far and I would like to thank the companies who continue to be such great supporters.

In this edition we get an update on the numerous golf course constructions underway in Victoria, Steve Cole discusses how a career in turf has rewarded him with travel and cultural diversity and we find out why Hoses aint Hoses.

Drs Graham and Marcelle Stirling introduce a new method to assist in the interpretation of nematode counts and Keith McAuliffe summarizes the requirements of flexible, modern stadiums.

TECH TALK continues, we REVIEW the value of a golf course Master Plan and introducing AGCSATech Update to keep you informed of the activities of the AGCSA's research and diagnostics division.

In RESEARCH, we get the latest from Dr. Ron Duncan on salinity tolerant turf and we feature the work of Dr. John Orchard who has established a link between the higher incidence of injury to AFL players on grounds north of Melbourne. Although not statistically proven, preliminary investigations indicate that ground hardness is the determining factor. Whether our clients are golfers, footballers or horses, as an industry it is important that we embrace this type of work and review our maintenance practices so we continue to deliver the best surface possible.

To all those attending the Conference, enjoy it and I look forward to meeting you on the AGCSA booth. To all our other readers, stay warm because there is plenty to get through!

Phil George

Phil George
Editor



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EDITOR



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▲ Heritage Golf & Country Club

new courses for **GOLF HUNGRY VICTORIANS**

By Phil George

Not only does the appetite of weekend golfers continue to grow but property developers have found quality golf courses to be an effective tool in selling residential property to retiring 'baby boomers' whose idea of paradise is being able to park their golf cart along side their BMW.

What follows is a summary of ongoing and upcoming golf course constructions.

The National and Moonah Links Courses

In an area that must surely now lay claim to some of the finest golf courses in the country, Victorias' Mornington Peninsula has been a construction hot spot for the last year and a half.

The National Golf Club has almost completed the addition of two new 18 hole courses, one designed by Greg Norman Golf Design (The Moonah Course), the other (Ocean Course)

designed by Thompson, Wolveridge and Perrot.

Construction of the Moonah Course began almost 16 months ago and will be handed over to course maintenance contractor Bruce Grant in the middle of July. The fairways were grassed using a 'plug planter' with GN 1 (CT2) grown in NSW. The greens were constructed from a blend of native and 'yellow' sand amended with dynamic lifter at 30 tonnes / ha and sulphur based fertilisers then hydro-

seeded with A4 bentgrass.

Using rubber tracked loaders rather than D4 dozers the TWP designed Ocean Course was built by doing little more than 'fine tuning' the existing landscape and Construction Superintendent Andrew Purchase has been "amazed by how quickly the course has come together". Fairways were grassed in late January with 'Legend' couchgrass using a row planter and greens have been sown with A1

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bentgrass. The course will be ready for hand over by early December. Although the bentgrass varieties are different, Andrew commented on the fact that the greens on the Ocean Course were the easiest to establish and correlates their success to the use of a 'trichoderma' product that gave excellent protection against pythium sp.

Still on the Mornington Peninsula the construction of the 'West Course' on the 36-hole Moonah Links project is well underway. At the time of going to press 13 greens had been constructed and all fairways were shaped. Designed by Thompson, Wolveridge and Perrot the course has the same agronomic specifications as the Nationals Ocean Course. The course will come under the control of the Australian Golf Union and has been set up as 'true tournament course'.

Amstel Golf Club

Four to five years ago the membership at the Amstel golf club in Cranbourne recognised that the existing course needed significant improvement and after a more thorough investigation came to the conclusion that they may in-fact be better off finding another site and starting again.

That is exactly what they have decided to do

and having secured an excellent golf course site only a couple of minutes down the road, construction is set to begin at the end of June under the guidance of Mike Clayton Golf design.

As well as having city views the site is unique in the fact that nearly all the holes will be visible from the clubhouse. Very little earth works are required to sculpt this 'links like' land into an excellent golf course, a feature of which will be the extensive use of native grasses that are indigenous to the site.

Tees and fairways will be sprigged with Legend couchgrass that is being grown on the practice fairway at the existing course. A selection of a bentgrass for the greens has not yet been made but Course Superintendent Neil Craig is currently evaluating A1, A4, G2, L-93, Penlinks and a mixture of Seaside, L-93 and Providence which at the time of writing this article was looking the most promising. Neil expects the project to be completed by June 2002.

13th Beach Golf Links

13th Beach Golf Links is located on the Western side of prestigious Barwon Heads Golf Club on Victorias 'Surf Coast'.

The course is a joint-venture between Duncan Andrews (owner of the Dunes Golf Links) and the McNaughton brothers who are the owners

of the site and who have always dreamt of building a golf course.

Like many new projects, it will be associated with a residential development and will be a 'user pays' course. Construction Superintendent Mark Gahan said they follow a simple philosophy, "make everyone who plays here feel like they are a member".

Work constructing the irrigation dam fed by effluent water from the Black Rock outfall (5km away) began last Spring and work on the actual course, designed Tony Cashmore to flow through this natural sand dune landscape began in February this year.

At the time of my visit in May, 9 holes had been shaped out by Barry Hudson (shaper of the Dunes) under Tony's guidance but by now most of the 18 holes will have been shaped, and the Nimbus II irrigation system installed.

To control wind erosion, pasture grasses will be allowed to establish over winter and will be sprayed out prior to sprigging in Spring with a native couch that dominates the site. This will give Mark a full growing season to to evaluate the native couch and if it proves unacceptable it will be over-planted with something else.

Greens will be constructed using the dune sand from on-site that has been tested and

▼ 1st Tee, The ocean Course.



▼ Moonah Tree, The Moonah Course.



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approved as suitable. Drainage will only be installed where required. A number of bentgrasses are under consideration including: Pennlinks, Viper, A4 and G2.

Knoxfield Prime Life Development

What started 2 years ago as an expression of interest to the Knox City Council over the development of a public golf course has steadily grown into a \$120million dollar project comprised of 450 retirement units, 75 condominiums, a 75 suite hotel and an 18 hole golf course.

The finances for this massive project in the heart of Melbourne's outer east were approved at the end of April and Prime Life Corporation began work on stage one on the 8th of May.

Stage one involves the construction of 197 units and the golf course, due for completion by June 2002. No stranger to building a golf course on a clay flood plain is Course Superintendent Greg Rouke who did such a fine job with Kingston Links which is only a couple of minutes down the road. Like Kingston Links the fairways will be grassed with Santa ana couchgrass and the greens seeded with SR 1019.

Designed by Pacific Coast Design, the course will be heavily wooded, fairways will be

contoured to remove surface water and a feature of the course will be an extensive lake system and an island green at 18.

Hidden Valley Golf Course

Another course designed by Pacific Coast design and currently under construction is the Hidden Valley Golf Course located 50 minutes north of the city on the 'Heytesbury Stud' site formally owned by Robert Holmes a Court.

In addition to the golf course the project also involves the construction of a country club housing estate, world-class equestrian centre, tennis courts, health club and a 150-seat restaurant.

Construction of the golf course commenced in April last year and on Easter Saturday this year, the first nine holes were opened to the members for play.

Constructed to USGA specifications the greens are sown to Pennlinks bentgrass. Tees and fairways were built using the native soils on site and have been stolonised with Santa ana couchgrass. Course Superintendent Mick O'Shanessy who took over from Wayne Dale in May last year after a highly successful stint as the ground manager at AFL Park (Waverley), believes that the course will be in full play by Christmas.

Holes 4, 6, 7 and 8 encounter creek crossings and lakes but the feature of the course is the island green at 18 that has a 90m carry and is only accessible via a pontoon.

I spoke to Mick when he was building the green with the assistance of a barge that had a capacity of 45 tonne but took 20 minutes to reach the Island then another 20 minutes back. "It is a terribly painstaking process but it will be worth it".

Heritage Golf and Country Club

As reported in the last edition of Australian Turfgrass Management magazine "Jewel of the Yarra" construction of the Heritage Golf and Country club in the Yarra Valley is progressing well. All greens have been seeded, fairways have been drained, sanded and sprigged and recently overseeded with Rye Corn to hold them together over winter.

The maintenance shed and all of the irrigation work has also been completed.

In addition to these projects the Greg Norman designed Sanctuary Lake at Pt Cook has only been opened since February and work is set to begin on another 36-hole TWP project at Carrum Downs.

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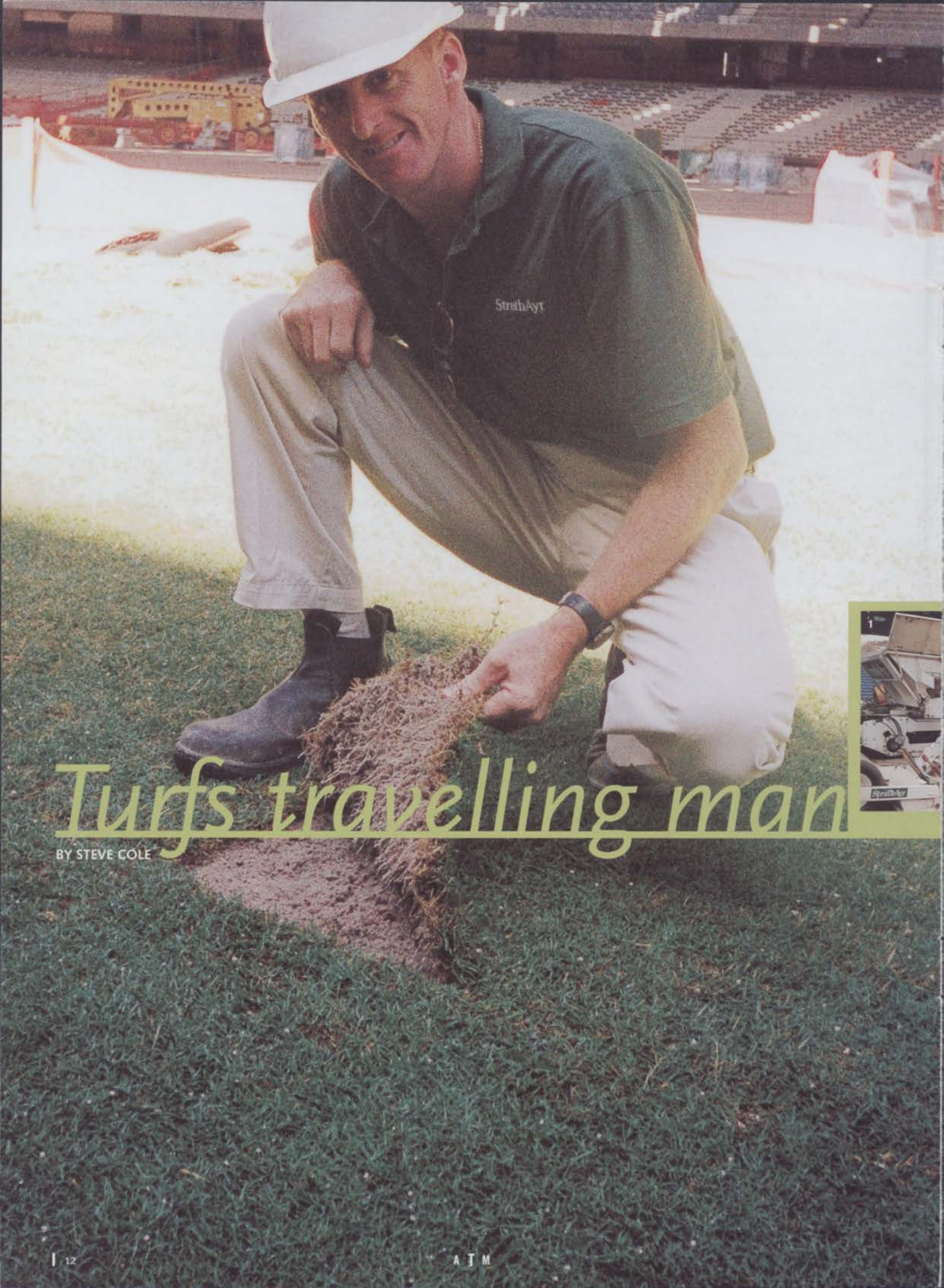
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Turfs travelling man

BY STEVE COLE



Who would have thought that a career begun by shifting water at the Cobram Barooga Golf Club with my Uncle Bill would result in the opportunity to travel the world working in different environments and amongst people of all cultures.

At twenty years of age I was given an early release from my apprenticeship to participate in the Ohio State University exchange program. I found myself in Florida working at John's Island Club at Vero Beach. It was quite a shock going from the relative seclusion of Melbourne's sand belt to a 36 hole course with over forty staff and a maintenance shed that had one extra of everything, just in case! Although I found the experience tremendously valuable, the excesses of the States just wasn't my style and I came home earlier than the maximum allowed stay of eighteen months.

My next foray overseas didn't present itself until only a few years ago when the company who employs me (StrathAyr) developed a

range of equipment that ensured the highly accurate installation of 'Reflex' mesh elements into sand based sports surfaces.

The culture shock suffered earlier in the US was nothing compared to the day I arrived in Cairo, Egypt to project manage the reconstruction of the Military Academy Stadium for the Under 17 World Cup Soccer tournament.

Our machinery had travelled by cargo ship in two forty-foot shipping containers and after numerous delays in the port of Alexandria it finally arrived on site. Although we were working with a local contractor who was able to coordinate the deliveries of sand and turf etc, working with 20 labourers who couldn't speak more than basic English and who struggled with my version of Arabic was an experience that is quite hard to explain.

It is amazing though how after spending a lot of time with a group, communication can become quite efficient even without the use of the spoken word. They seemed to pick up Australian slang very quickly and no matter how frustrated or stressed you might be, it is hard to keep a straight face when you turn to

see half a dozen Egyptians laughing and mimicking your every move.

Working in the Military Academy presented its own unique situations. You had to abandon your passport to gain entry and you were constantly in the presence of nervous looking young men carrying automatic weapons. As you could imagine, this creates quite an unsettling environment.

On one occasion we had been working quite late and were heading through the academy grounds when, without warning, a group of soldiers jumped out onto the road in front of us with guns drawn, yelling in Arabic. All we could do was raise our hands and shout back, "stadium - stadium!" They seemed to understand and I figured that they were simply using us as 'target practice'.

You can draw some interesting parallels where, the end result and the tasks involved in achieving the finished product are the same, but how you get there is dramatically different. During construction at the Colonial Stadium in Melbourne, even a brand new extension lead

Profile



1 - 'Body Shock' - Hampton Park, Glasgow. 2 - Military Academy Stadium, Cairo. 3 - Converted shipping containers serve as home for Bangladeshi workers.



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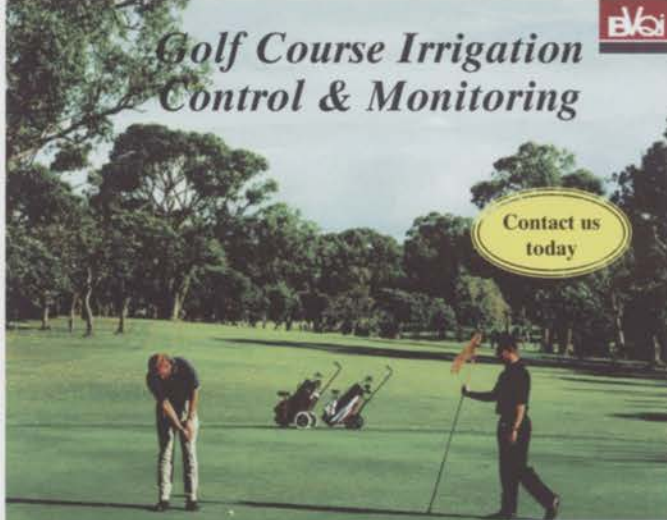
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has to be tagged as 'OK' by an electrician while in places such as Singapore and Cairo, locals preferred to simply cut the plug off and shove the cable straight into the wall socket. Even welding was done with no eye protection. When offered sunglasses they indicated that they were useless as they couldn't see what they were doing!

The next two projects that I was fortunate enough to be involved with were the new Kranji Racecourse in Singapore and the reconstruction of the Scottish National Soccer Stadium at Hampden Park in Scotland.

While in Singapore I worked with labourers from Bangladesh who helped us install two completely new racetracks. Spending six months with these people allowed us to get to know some of them quite well and gave us a new perspective on our life in Australia and made us realise how much we take for granted.

These Bangladeshi workers pay a labour agency thousands of dollars to find them work in Singapore and once there the agency collects a large percentage of their earnings as a commission. Keeping just enough to survive, whatever is left over gets sent home to support their large families.

Whilst on site, the labourers lived in converted shipping containers stacked three high and housing up to 16 men each.

After several weeks under extremely high humidity and temperatures that hovered in the high 30's it was a 'body shock' to step off the plane in Glasgow in late 1998 to a temperature of minus four degrees. The local contractors were just starting to spread sand at Hampton Park but had to stop that morning because the sand had frozen solid! They looked at me quite puzzled as I wandered around picking up slabs of frozen sand. Obviously, to them this was nothing new.

The start of a UK winter is not the ideal time to commence construction of a sportsfield, but this world is not always ideal and sometimes you just have to do what you have to do.

The next four weeks were spent pouring hot water over the conveyor belts of varying machines and covering the next days work area with plastic sheets so that we could remove the overnight snow falls. The turf was supplied by Lindum Turf based in York, often we had to 'defrost' the turf before we were able to unroll it.

Even with the difficulties of a winter construction and tight schedules, the job was completed on time and was ready to host the Scottish FA Cup between the Glasgow Rangers and Glasgow Celtic in May last year.

From looking after golf courses through to turf farming and sports surface construction, the opportunities in this industry are limitless and can be extremely rewarding. I have many friends who have worked in other countries as accountants and the like, but very few ever get the satisfaction of watching an event like the FA Cup, thinking, "I built that!"

Steve Cole is employed by StrathAyr as their Sales and Production Manager.



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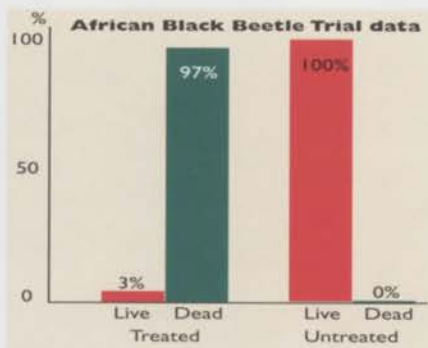
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A scarab beetle which has been invaded by nematodes. Once inside, the nematode release a bacterium which kills the insect rapidly.



Trial work conducted at Peninsula Golf Club, Feb - March 1999, supervised by CSIRO and the VGA.

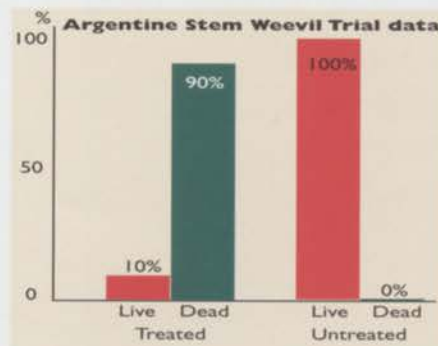
Fully replicated trial with control plots and live/dead insect counts - world first



Dr Robbin Bedding and Karen Butler inspecting turf damage beneath a playing field.

This technology is developed by a group within CSIRO Entomology led by Dr Robbin Bedding who is a leading authority worldwide on the use of ENs (Entomopathogenic Nematodes) to control insect pests.

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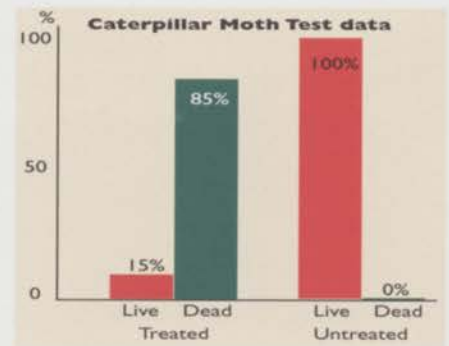


Trial work conducted at Tullamarine Golf Club, Summer 1999-2000, supervised by CSIRO and the VGA.

Full trial with control plots and live/dead insect counts - world first

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Golf Course Master Planning

BY RICK O'LOUGHLIN

As discussed in the last edition of REVIEW "Planning For Success", corporations the world over have long recognized the need for a comprehensive business and marketing plan.

"Better to plan for change than have changed forced upon you"

This plan may include the company structure, objectives, strategies, labour force requirements, financial budgets, competition, marketing and future growth. Areas addressed in this plan set out in detail the duties and responsibilities required of each employee and department so there can be no confusion as to what is required of them for the company to achieve success.

With golf course and facility maintenance expenditure requiring in some instances up to seventy-five percent of the clubs finances, how many committees can honestly say to the membership that the future planning and development of the course and amenities has been given the appropriate consideration?

All well-established courses should have a Master Plan to coordinate future upgrading works and avoid wasteful expenditure. As committee members and superintendents come and go, each will inevitably try to exert their personal philosophy as to how they interpret comments on perceived perennial problems or compliments on how the course should be maintained, presented and played.

A well prepared and presented Master Plan ensures that all future developments avoid 'ad hoc' wasteful expenditure. It also has the

ability to direct future committee members and course staff to the expected outcome, negating whims and personal philosophies.

What is a Master Plan?

The master planning process, as implemented in golf course upgrading can be seen as a pivotal element in the creation and representation of a clear vision. It is the most effective way to satisfy the needs and ideals of the club member and course architect and acts as a catalyst or a common bridge that will combine the good ideas of the Superintendent, Greens Director, Committee member and the Golf Course Architect.

The master planning process will ensure that your course and facilities yield their full potential by addressing issues such as:

- ▶ Safety
- ▶ Drainage
- ▶ Amenities
- ▶ Cart paths
- ▶ Real estate
- ▶ Car parking and clubhouse surrounds
- ▶ Water storage and irrigation



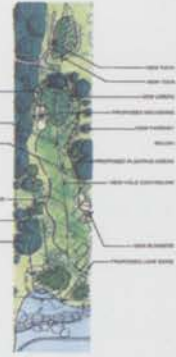
- ▶ Practice facilities and maintenance buildings
- ▶ Environment
- ▶ Turf quality and type
- ▶ Landscape planting guidelines

The master Plan will:

- ▶ Maximise site opportunities
- ▶ Provide a unique marketing tool
- ▶ Negate the whim of changing committees and course staff
- ▶ Ensure consistency in terms of design, character and landscape.
- ▶ Have due regard for any other issues unique to your situation, location and environment.
- ▶ Provide the ability to plan works in



SCORECARD				
HOLE	PAR	1	2	3
1	4	5	4	3
2	5	4	3	4
3	4	3	4	5
4	5	4	3	4
5	4	3	4	5
6	5	4	3	4
7	4	3	4	5
8	5	4	3	4
9	4	3	4	5
10	5	4	3	4
11	4	3	4	5
12	5	4	3	4
13	4	3	4	5
14	5	4	3	4
15	4	3	4	5
16	5	4	3	4
17	4	3	4	5
18	5	4	3	4
TOTAL 71 2811				



NOTES:
1. THIS PLAN IS A CONCEPTUAL ONLY AND SUBJECT TO FINAL DETAIL DESIGN.
2. COURSE AND HOLE LOCATIONS, DISTANCES AND DIMENSIONS ARE APPROXIMATE.
3. HOLE LOCATIONS AND DIMENSIONS ARE APPROXIMATE.
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advance and allow appropriate budget allocation.

- ▶ Provide your club with a historical document that can be viewed as a road map to achieving a goal.
- ▶ Ensure that any redesign work or course alterations will minimize disruption to normal play and the clubs ability to maintain its revenue stream.

The Master Plan will give committee members and course staff (current and future), a very clear visual and historical asset. It will assist in any future development on your course and help chart the most direct and cost effective way to achieve the end product.

Good Golf Courses are just that because money was spent wisely on design and construction in the first instance (Rollin).

Practical Benefits

Developing a Master Plan will clarify priorities and keep the entire organisation moving in the right direction.

It is a scenario seen all too often that clubs in an attempt to save money, choose not to invest in a Master Plan. This often results in the exact opposite occurring, where money is spent on work, which has to be either redone or is destroyed by the progression of further works. Therefore, it is the clubs with the least amount of disposable income that stand to benefit most by having a good Master Plan in place.

Either way, a Master Plan is in effect an insurance policy. Even if the work takes years to complete, stage by stage, it is the best way to monitor and plan these alterations.

Save for those few 'timeless gems', all golf courses can be improved. Therefore, some type of Master Plan is bound to be an asset.

This may take the form of a purely historical record to be referred to periodically or may detail major course reconstruction scheduled to occur over a number of years.

Whatever the case, every golf course and their guardians need a direction in which to work and grow.

A golf course is not a static entity, it is constantly evolving and provides an array of benefits to the club member, their guests, visitors and the broader community. One of the true marvels of our game is that its arena is ever changing. A Master Plan is the best way to ensure that all the human help assisting these changes have direction and are focused for the greater good, in conjunction with nature and in the best spirit of the game.

There is no place for amateurism in golf course redesign (Professor James B. Beard).

Rick O'Loughlin is in charge of special projects with Ross C Watson P/L.

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Mineral nutrient requirements

Plant growth depends on access to a supply of water, carbon dioxide, oxygen, photosynthetically active radiation (a component of "sunlight"), and a range of mineral nutrients.

BRIEF HISTORY OF FERTILISERS

Improvements in knowledge on plant physiology towards the end of the 19th century resulted in the development of fertilisers such as potash and superphosphate to improve crop yields. Inorganic nitrogen fertilisers were later developed and used widely in European agriculture. However, farmers in Australia found that crops on some soils remained unproductive despite additions of nitrogen, phosphorus, and potassium fertilisers. Plants showed symptoms of tissue damage, and microbiologists from Europe suggested that a disease organism must be involved. A group of scientists from Adelaide identified the cause as manganese deficiency. This discovery led to research world-wide on the use of many other elements to correct crop disorders. This in turn gave rise to the development of fertilisers to supply both "macronutrients" and "micronutrients".

ESSENTIAL MACRO- AND MICRO-NUTRIENTS FOR PLANTS

Macronutrient is the term given to those elements required in relatively high concentrations in plant tissues.

Micronutrient is the term given to elements required only in small amounts. The essential macro- and micro-nutrients found in plant tissues, and average tissue concentrations, are given in Table 1.

Table 1

List of essential nutrients for plant growth. The average concentration of each element found in dried shoot tissues from plants supplied with adequate nutrients is also given. Taken from Marschner (1995) in Mineral Nutrition of Higher Plants, Academic Press. Tissue concentrations can vary widely depending on plant species and environmental conditions, so these data should not be used as standards for tissue tests.

MACRONUTRIENTS (% BY WEIGHT)		
ELEMENT	SYMBOL	AVERAGE CONCENTRATION
Nitrogen	N	1.5
Potassium	K	1.0
Calcium	Ca	0.5
Magnesium	Mg	0.2
Phosphorus	P	0.2
Sulphur	S	0.1
MICRONUTRIENTS (PPM, OR MG/KG)		
Chloride	Cl	100
Iron	Fe	100
Manganese	Mn	50
Zinc	Zn	20
Boron	B	20
Copper	Cu	6
Nickel	Ni	0.1
Molybdenum	Mo	0.1

The term "essential nutrient" is used to describe elements that are:

- necessary for a plant to complete its life cycle, and
- perform a function which can not be replaced by another element.

The elements are essential for plant life since they are either:

- Directly involved in plant metabolism; for example as a component of an essential plant constituent (e.g. nitrogen in amino acids and proteins).
- Required for a distinct metabolic step (e.g. manganese is a co-factor in several enzyme reactions).

Some elements are termed "beneficial" nutrients. These are not essential since plants can complete their life cycle without them. One example is silicon, which can stimulate growth when supplied to some (but not all) species.

Not all elements are essential or beneficial to plant growth; some can be toxic. For example, aluminium can be highly toxic in acidic soils and sodium can be toxic when at high concentrations (e.g. in saline soils or salt-affected irrigation water). A typical dose-response curve for plant growth when supplied with any mineral element is shown in figure 1.

Figure 1

RESPONSE OF PLANT GROWTH TO NUTRIENT SUPPLY

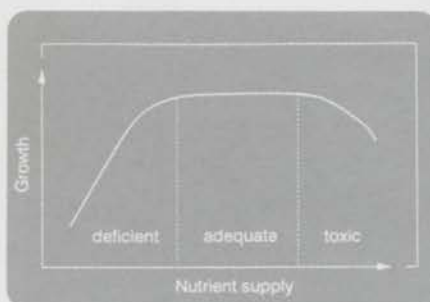


Figure 1 ▶ Graph showing the generalised relationship between rate of nutrient supply and plant growth. The three stages of the relationship (deficient, adequate, and toxic) are discussed in the text.

Plate 1 ▶ Photograph showing symptoms of iron deficiency in Kikuyu growing on an alkali coastal sand in Western Australia. The leaf chlorosis was corrected by a subsequent foliar application of soluble iron. Photograph courtesy of Ken Johnston, Sports Turf Technology, Perth, WA.

in plants

The response curve of plant growth to nutrient supply has three defined regions (figure 1). In the deficient range, plant growth increases with additional nutrient supply. In the adequate range, growth reaches a maximum and remains unaffected by the supply of additional nutrient. In the toxic range, plant growth declines with increasing nutrient supply.

In turf culture, like in other plant management systems, the desired nutrient supply is achieved by fertiliser applications. Efficient use of the applied nutrients should be one objective of turf managers, since this minimises nutrient losses and subsequent impacts on the environment. Information on nutrient availability in the soil and on the nutrient status of the plants, via soil and tissue testing, can aid management decisions and improve efficiency of fertiliser use.

DIAGNOSIS OF NUTRIENT DISORDERS


The occurrence of visible symptoms usually only applies in cases of severe deficiency or toxicity. The growth rate of any plant would have decreased substantially prior to the development of symptoms. Furthermore, diagnosis of

nutrient disorders in field-grown plants based on visible symptoms can be complicated, due to possible interactions of multiple factors (e.g. other deficiencies, diseases and damage from other sources). Any diagnosis is aided by information on fertiliser history, soil pH, weather conditions, and recent management of the area.

The transport physiology of the nutrient in question will determine the tissue in which the symptoms appear. Deficiency symptoms for "phloem mobile" elements (e.g. nitrogen) appear in the older leaves since the elements are re-translocated to the new growth; whereas for "phloem immobile" elements (e.g. calcium) symptoms develop in the young leaves. In some cases (e.g. iron deficiency; see plate 1) the symptoms are so obvious that a management recommendation (e.g. foliar spray of an iron source) can be given in a short time frame. In many cases soil and plant tissue tests will be required.

SOIL AND PLANT ANALYSIS AS MANAGEMENT TOOLS

Soil analyses will provide information on the potential availability of nutrients for uptake by plant roots. Plant tissue



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Plate 1 - Evidence of iron deficiency in Kikuyu.

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Corinda Bowls Club



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analysis reflect the actual nutritional status of a plant. The two approaches are used in combination to provide information on nutrient status in a plant-soil system.

The use of chemical analyses of plant materials for diagnostic purposes requires strict standardisation of sampling procedures and the availability of suitable reference data for the species of interest. The sampling procedure required depends on the reason the sample is being taken (Table 2), and the appropriate tissue to be sampled will depend on whether, or not, the target nutrient(s) are phloem mobile (e.g. sample young or old leaves). Steps must be taken to avoid potential contamination from several sources. Despite these complications plant tissue analyses, when used appropriately, are a valuable tool for turf managers.

REASON	SAMPLING OPTIONS	COMPARISONS TO BE MADE
Diagnosis	Defined tissue 'Good' and "poor" plants	Standards Against each other
Monitoring	Defined tissue and time (seasonal or yearly)	Standards Previous data to see trends over time

Table 2 - Summary of common reasons for taking plant tissue samples for elemental analyses. Modified from Robinson (1993) in Australian Journal of Experimental Agriculture 33:1007-1014.

Dr. Tim Colmer is a lecturer in Plant Sciences at the University of Western Australia. Dr. Colmer co-ordinates the Turfgrass Research at UWA, a program in collaboration with industry.



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▼ Hoses are critical to the operation of modern equipment, and there are significant differences between hoses built for specific functions

HOSES AINT HOSES

BY SCOTT R. NESBITT

The differences between various kinds of hoses are big enough to change the performance, reliability and even the safety of engine-powered equipment used in all phases of golf course maintenance. A basic understanding of the difference between hoses helps assure that you'll use hose that's right for the application, and avoid creating problems when replacing the hoses that originally came on your equipment.

Equipment ranging from chain saws to trucks use three basic categories of hose: fuel, hydraulic, coolant and vacuum.

A hose has three layers, and each plays a major role in hose performance.

The outside of a hose is mostly there to protect the inner parts, which actually do the work. Automotive-grade hose covers are often made of material that accepts abrasion, tolerates hot air and ozone, and resists the grease and oil often found around engines. But the cover may have little resistance to gasoline or diesel fuel.

Inside the cover is a reinforcing layer that resists the pressure of the hose contents. This fabric wrapper varies depending on pressure requirements. A fuel hose typically handles 50 to 75 psi (pounds per square inch), while a heater hose handles about 70 to 125 psi. Hydraulic hoses use a steel wrapper to handle pressure of several thousand psi. Vacuum hoses are built to handle only 50 psi or less, and many

small vacuum hoses don't have a wrapper.

Finally, at the center of the hose, is the tube that carries the fluid. Most hose inner tubes are made from synthetic rubber or thermoplastics. These materials are factory-blended for specific properties, so even though two tubes may be from the same chemical family, they may perform very differently because of the way the compounds were blended.



◀ A cut section of hose reveals the three major parts: The inner tube, the reinforcing braid to help the tube resist pressure and the outer wrapper that protects the braid and inner tube from mechanical damage.

Hot water hose tubes are commonly from the chemical family called EPDM (ethylene-propylene-diene-terpolymer). The EPDM group is excellent for handling the cooling system's mixture of water and ethylene glycol, but breaks down from exposure to oil and gasoline.

On the other hand, fuel lines and hydraulic lines, often have an inner tube made of nitrile (acrylonitrile-butadiene) family, which is very resistant to oil, gasoline and diesel fuel. However, a nitrile compounded for fuel handling won't necessarily tolerate the high

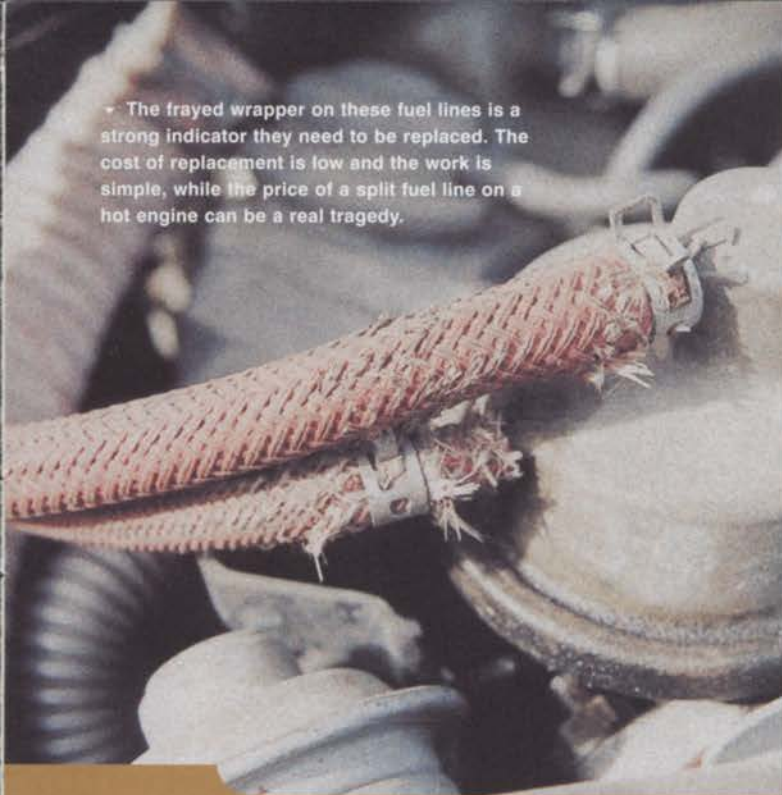
heat and chemical mix in the cooling system.

So how do you select proper replacement hoses? You can be confident in hoses that come from the original-equipment manufacturer (OEM), but you don't always have the time or budget for that. Reputable aftermarket hose gives assurance of performance by conforming to standards from the Society of Automotive Engineers (SAE). Fuel hose will often bear a label referring to SAE 30R7, while hydraulic hose falls under the 100R standard. If the hose isn't labelled and the supplier doesn't have documentation on SAE conformance, shop elsewhere.

Finding correct replacement hose becomes a lot murkier with small hoses under 1/4-inch outside diameter, because these hoses often lack the outer covering and are simply too small to carry a grade or application label. A clear vinyl tube designed for windshield washer fluid will quickly fail when used for a string trimmer fuel line, even though it look exactly the same. Small black tubing meant for vacuum lines may rapidly rupture when used for diesel fuel return lines mounted to fuel injectors. The best course, short of ordering the OEM part, is to rely on specialty supply houses that carry well-documented bulk tubing meant for the fuel-handling applications.

It is critical with these small fuel lines to make sure that a replacement hose will actually

➤ The frayed wrapper on these fuel lines is a strong indicator they need to be replaced. The cost of replacement is low and the work is simple, while the price of a split fuel line on a hot engine can be a real tragedy.



tolerate fuel. The aromatic hydrocarbons that make gasoline evaporate quickly are notorious for leaching plasticizers out of plastic compounds, resulting in a stiff hose that cracks easily. Special caution must be exercised in metropolitan areas that are required by air pollution laws to have ethanol and MTBE (methyl tertiary butyl ether) in the gasoline. These chemicals produce cleaner exhaust, but can really chew away at some fuel line materials, especially those on equipment made before the air pollution law came into effect.



➤ Materials are specifically selected for the intended application for hoses and tubing. These three, from left to right, include black synthetic rubber suited for vacuum lines; a red silicone tube for hot crankcase fumes; and a clear vinyl tube suited only for carrying unheated, un-pressurised water.

Emission laws have also spawned an explosion of small water hoses that carry water to various components and sensors used by the engine. With the extension of emission laws to off-road equipment, there is a new wave of specialized emission control hoses showing up on a lot of engines going into golf course service.

These new hoses are often in the 1/4 to 3/8-inch size range used for fuel hoses, but they demand a hose made to take the high temperatures of the cooling system, or the hot corrosive petroleum fumes from the crankcase. Some larger parts suppliers are starting to carry aftermarket hoses for these special applications. But until that market segment matures, the smart course is to stick with replacement parts from the company that made the machine or the engine, and play it safe with those hoses.

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• Seed head control	Better putting surfaces Less visual disruption
• Species conversion	Shifting dominance from Poa to Bentgrass Poa control without surface disruption

Species Conversion (making Bentgrass dominant over Poa)

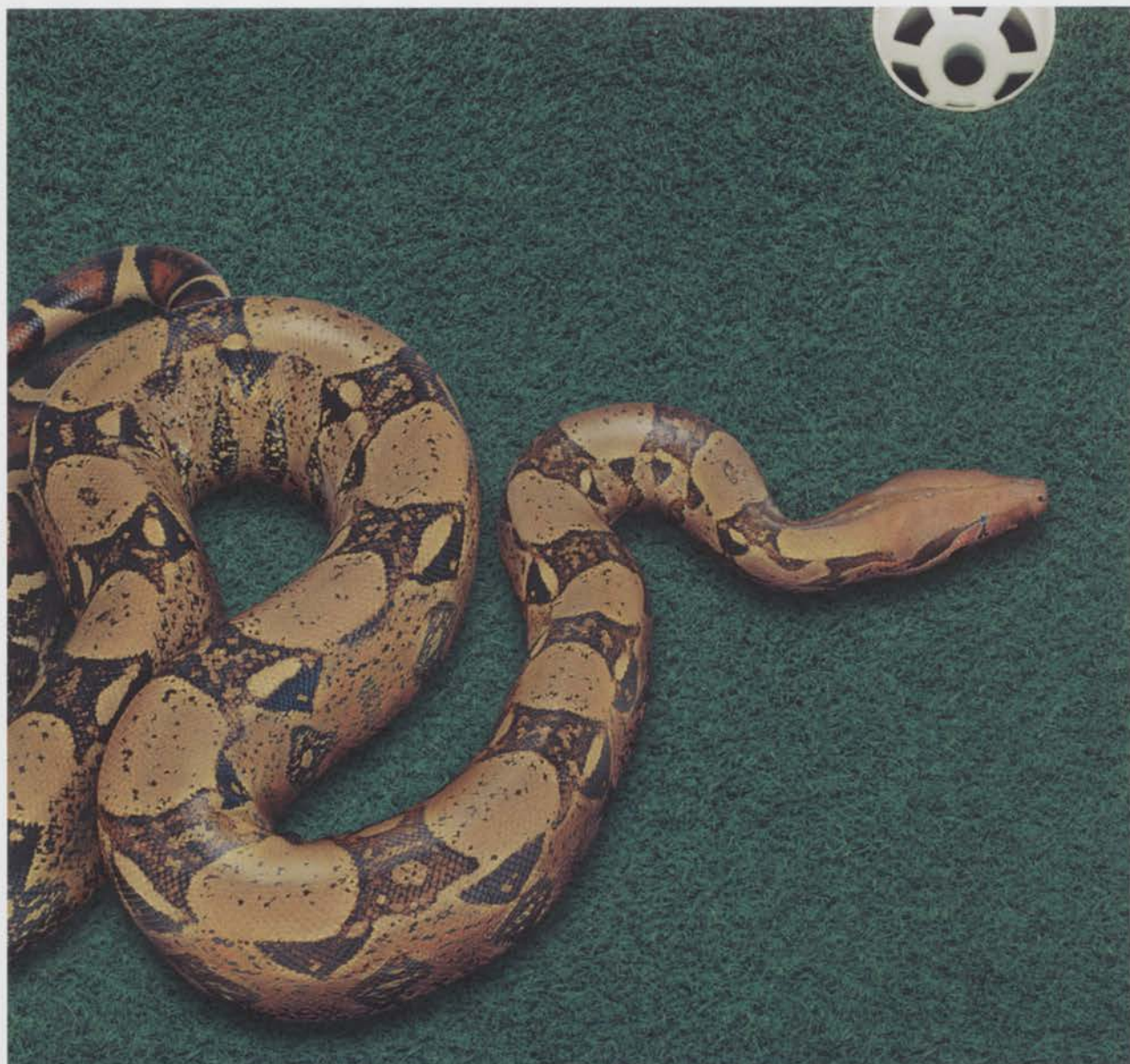
The superintendents that are having the most success with TGR for species conversion are using it as part of a total management program. Key to this program is multiple TGR applications in Spring and Autumn, to shift competitive advantage in favour of Bentgrass when it is actively growing. Other components of their total strategy include the following:

- Minimal surface disruption in Autumn. Autumn is the key time for Poa annua establishment - scarifying and coring both serve to enhance Poa annua germination. Surface disturbance renovation should be confined where possible to Spring. If aeration is necessary in Autumn then hydrojet or needle mini-tyes can minimise surface disturbance.
- Thatch build up is managed by using TGR in Spring and Autumn along with regular dusting - 3 to 4 weeks. This is extremely important as it reduces the need to renovate for thatch control in Autumn.
- TGR rate selection is varied but in general 1/2 to 2/3 rates every 4-6 weeks give best transition, as the Bentgrass will keep growing actively while Poa is being suppressed.
- Pre-emergents such as Exporsan or Poa annua control agents such as Endothal are not recommended because they have the potential to thin the surface or slow Bentgrass root development. This can weaken the Bentgrass sward and eventually provide an opening for the Poa annua.

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by Robert Cooper



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Salinity Tolerance of *Paspalum vaginatum* and *Cynodon* spp. Genotypes

G. Lee, R.R. Duncan and R.N. Carrow

Salt-affected soils impact nearly 10% of the land surface and 50% of all irrigated land in the world¹. Increasingly, turfgrasses are being grown on salt-affected sites due to a combination of factors, including: numerous golf courses constructed on coastal sites exposed to salt spray, flooding, and salt water intrusion; greater use of effluent (wastewater) and other non-potable water sources; turf established on existing salt-affected soils; and emphasis on water conservation practices where leaching of salts may be less prevalent. An important approach to growing turfgrasses on salt-affected areas is to develop grasses with better salinity tolerance.



THE STUDY

In 1993 Dr. Ron Duncan initiated a breeding/genetics program to develop seashore paspalum (SP, saltwater couch; *Paspalum vaginatum*) for turfgrass areas; with initial emphasis on use in salt-affected sites. Other researchers had demonstrated that SP ecotypes could be found that exhibited better salinity tolerance than Adalayd SP or hybrid couches (hybrid bermudagrasses)^{2,4} which were considered the most salt tolerant warm-season grasses currently available. Thus, one of the first objectives was to make a world-wide collection of SP ecotypes with over 300 collected selections plus ecotypes created by tissue culture techniques. The next phase was to assess the salinity tolerance of 90 ecotypes along with several hybrid couches.

In the first greenhouse study, 5cm diameter plugs in 20 cm deep cone-shaped pots, filled with sand, were emerged up to the

turfgrass crown into solutions (aerated). These solutions were gradually adjusted to various solution salinity levels of E_{Ce} or EC_w = 1, 9, 17, 25, 33, and 41 dSm⁻¹ (seawater is EC_w = 54 dSm⁻¹). After 8 weeks exposure to a salinity level, grasses were harvested and divided in shoot, crown, and root tissues; dried and weighed.

ASSESSMENT OF SALINITY TOLERANCE

Traditional methods of assessing plant salinity tolerance presented numerous problems. Firstly, methods were initially developed for glycophyte (salt-sensitive) plants that rarely grow well at the salinity levels proposed. Hence, for halophyte (salt tolerant) species, a much wider range of evaluating for salinity tolerance was required. Second, the growth response of halophytes to increasing levels of salinity is much different to that of glycophytes. A third problem with traditional salt assessment criteria was reliance on top

growth data only. For perennial turfgrasses, development and maintenance of a viable, extensive root system is essential for long-term sustainability under salt stress; and must be included in the assessment and salt tolerance classification processes. Finally, grasses that can tolerate both salinity and wear must have an adequate inherent growth rate at high salinity to recover from wear stress. Thus, using absolute or actual growth rather than a percent based criteria for turfgrasses allows evaluation of actual growth at the highest salt levels.

Since traditional salinity tolerance assessment criteria were inadequate, our study consisted of two objectives: a) determine the salinity tolerance level of each grass which would also indicate the tolerance range of *Paspalum vaginatum* as a species, as well as salinity tolerance of each ecotype; and b) develop appropriate assessment and salt tolerance classification criteria for halophyte grasses.

RESULTS

Salinity Assessment Criteria

Various plant parameters measured to assist in evaluation of salinity tolerance were:

* Shoot growth at ECe of 1, 9, 17, 25, 33, and 41 dSm⁻¹ (seawater = 54 dSm⁻¹); threshold ECe; maximum inherent growth, which is the growth at threshold ECe; ECe at 50% growth reduction; and leaf firing at ECe 41 dSm⁻¹.

* Root growth was determined in a similar manner as shoot growth except for leaf firing.

* Crown growth. Growth at ECe 1 and 41 dSm⁻¹; and ratio of growth at ECe 1 and EC 41.

* Total plant growth. Similar to shoot growth measurements except for leaf firing.

One approach to determining salinity tolerance was to include all of the above aspects by noting the percent of times an ecotype ranked in the highest (best) statistical category for all parameters. In Table 2, this information is presented for six saltwater couches and for hybrid couches from two studies (ie, the current study, No. 1, and study 2, a later study that included salinity up to 50 dSm⁻¹). The most tolerant ecotypes were HI 36 and HI 101, followed by Sea Isle 2000 and Sea Isle 1. The lowest salinity tolerant cultivars were TifSport (hybrid couch)

and Adalayd (lowest tolerance among SP ecotypes found to date) - it should be noted that these still rank as very tolerant by the traditional ranking scale of Maas3.

Of most practical importance in evaluating salinity tolerance of an ecotype was absolute shoot growth at ECe 0 and ECe 41 dSm⁻¹, and the maximum growth which occurs at the threshold ECe. (Table 1). Similar values for root growth were also very important (Table 2). In addition, the degree of leaf firing at ECe 41 dSm⁻¹ was useful. When incorporating all these aspects together, the salinity tolerance ranking presented in Table 1 was developed.

Grass	Shoot Growth ECe dSm ⁻¹ = 0	ECe 41 dSm ⁻¹	Threshold ECe ^z	Maximum Growth at Thres. ECe	Leaf Firing ^y At ECe 41 dSm ⁻¹	Salinity Tolerance Rank ^x	Comments ^w
	g	dSm ⁻¹	g	%			
HI 36	.61	.30	9	.77	6	VT+++	Fairway type
HI 101	.43	.30	10	.57	3	VT+++	Fairway type
Sea Isle 2000	.61	.26	6	.83	5	VT++	Green type
Sea Isle 1	.70	.22	11	.80	6	VT++	Fairway type
TifEagle	.10	.06	12	.39	38	VT+	Green type
Tifway	.11	.09	7	.23	31	VT+	Fairway type
Excalibur	.36	.10	6	.44	26	VT	Coarse type
Tifgreen	.20	.13	6	.33	30	VT	Green type
TifSport	.12	.06	9	.19	35	VT	Fairway type
Adalayd	.24	.08	4	.26	20	VT	Coarse type
LSD (0.5) =	.25	.08	7	-	7		
F-Test	***	***	0.39	-	**		

Table 1. Shoot (topgrowth) performance of six saltwater couches (seashore paspalums) and four couches (bermudagrasses) under salinity levels of 0 to 41 dSm⁻¹.

^z Threshold ECe is the salinity level at which growth starts to decline in response to increasing salinity. It is also the salinity at which maximum growth occurs for halophytes.

^y Leaf firing: percent of leaves exhibiting visual symptoms of chlorosis or actual tissue desiccation at ECe 41 dSm⁻¹.

^x Salinity tolerance ranking by Maas3 and Carrow and Duncan:

Very Sensitive <1.5 dSm⁻¹ ECe Very Tolerant 10.1 - 15

Mod. Sensitive 1.6 - 3.0 VT + 15.1 - 25

Mod. Tolerant 3.1 - 6.0 VT ++ 25.1 - 40

Tolerant 6.0 - 10.0 VT +++ 40.1 - 54

^w All fairway SP ecotypes are similar to Tifway couch in shoot density and are similar or darker green in colour. Sea Isle 1000, a greens type, has density intermediate between Tifgreen and TifEagle, and a dark green colour.



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Grass	Root Growth	ECe	Maximum Growth	Times Ranked In The Top (Best) Statistical Category ^a		
	dSm ⁻¹ = O	41	Threshold	At	Study 1	Study 2
			ECe	Thres. ECe	ECe 41 max	ECe 50 max
	g	dSm ⁻¹	g	%		
HI 36	.39	.45	9	.49	81	100
HI 101	.40	.39	9	.52	81	87
Sea Isle 2000	.40	.36	7	.54	48	65
Sea Isle 1	.42	.32	4	.49	33	61
TiffEagle	.38	.28	8	.46	33	-
Tifway	.22	.23	10	.42	24	-
Excalibar	.41	.31	5	.43	5	-
Tifgreen	.30	.24	5	.36	5	-
TifSport	.21	.15	4	.26	0	-
Adalayd	.20	.13	5	.21	0	9
LSD (-05)	.15	.11	8	-	-	-
F-test	***	***	0.83	-	-	-

Table 2. Root growth responses to salinity and number of times a ecotype ranked in the top (best) statistical category for shoot, root, crown, and total plant growth measurements.

^a In both studies 23 measurements were made of shoot, root, crown, and total plant growth parameters in response to salinity. Study 1 had an ECe maximum level of 41 dSm⁻¹ and study a maximum of 50 dSm⁻¹.

Hybrid Couches

Among the four hybrid couches, Tifway and TiffEagle were somewhat more salt tolerant than Tifgreen or TifSport. None of the hybrid couches provided sufficient shoot growth, root growth, or leaf firing resistance to persist above about ECe 25 dSm⁻¹. If irrigation water had an ECw of 25 dSm⁻¹, it could only be used for these grasses: a) if continuous leaching prevented ECe values above 25 dSm⁻¹ from occurring; b) traffic control would be important due to the reduction in growth rate and, therefore, more wear injury caused by salinity stress; and c) the rootzone was maintained near field capacity to minimize salt-induced drought (physiological drought).

Saltwater Couches

The six saltwater couches represent the range observed across all 90 SP ecotypes. Adalayd and Excalibar had the lowest salinity tolerance of the SP ecotypes with tolerance up to ECe of 10 to 15 dSm⁻¹. A wide range in salinity tolerance was found in this species, including ecotypes that exhibit good quality and growth at above the 30 to 35 dSm⁻¹ limit suggested by previous studies on a SP2,4. The best ecotypes from this study (Study 1) were incorporated into a second study where a higher ECe was used (ECe = 50 dSm⁻¹) and specific salinity tolerance mechanisms were investigated. The second study confirmed that some SP ecotypes (about 5% of SP ecotypes tested) can perform at the 40 to 50 dSm⁻¹ range with proper management of salts.

ADDITIONAL REQUIREMENTS

The release of two SP (Sea Isle 2000, Sea Isle 1) with very high salinity tolerances for use in sites where other grasses have failed presents

interesting management challenges - ie, how to manage the salts, and how to manage the grass. Thus the "Seashore Paspalum Release Program" has involved several components:

- * Release of the 2 grasses for commercial vegetative production in August 1999 and subsequent licensing by May 2000. Availability of material by 2001.

- * Development of an in-depth book on how to manage salt-affected soils and irrigation water. R.N. Carrow and R.R. Duncan. 1998. Salt-Affected Turfgrass Sites: Assessment and Management. Ann Arbor Press, Chelsea, MI.

- * Development of a book (ie, the "operational manual") on management of seashore paspalum as a turfgrass. R.R. Duncan and R.N. Carrow. 2000. Seashore Paspalum: The Environmental Grass. Ann Arbor Press, Chelsea, MI.

- * A 2-day workshop on "Salt-Affected Turfgrass Sites" presented in conjunction with Golf Course Super. Assn. Of Amer., and other groups as requested. A 1-day workshop on "Seaside Paspalum Management on Golf Courses".

- * An extensive web-site was developed by R.R. Duncan and R.N. Carrow on seashore paspalum at www.griffin.peachnet.edu/cssci/turf/paspalum/paspalum.htm.

- * A series of in-depth articles in the USGA Green Section Record on water quality issues - ie, when to treat irrigation water; effluent irrigation; seawater irrigation; water quality interpretation and assessment; leaching, etc (see www.USGA.org); enter the "Green Section" section; enter "USGA



Sea Isle 2000 practice green

Green Section Record" articles of issues 37 (6); 38 (1); 38 (2); 38 (3); and 38 (4).

With these informational resources being "released" at the same time as high quality seashore paspalum cultivars, we believe this will greatly assist turfgrass managers in understanding this grass, its potential uses, and management. Research is continuing on many different aspects including: wear tolerance and mechanisms; halophyte salinity tolerance mechanisms; drought tolerance/water use/rooting; acid soil tolerance; low light intensity performance; pest management and resistance; response and management under different irrigation water quality regimes, etc.

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RESEARCH



The 'northern bias' for injuries in the Australian Football League

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▲ Matthew Primus in obvious distress being carried off the ground after injuring his knee in round 3 at the Gabba. The injury would see him miss the rest of season '99.

Abstract

The Australian Football League surveyed injuries between 1992 and 1998. There were 4681 injuries, that satisfied the definition of missing a regular season game, over 97060 player weeks. Players from teams in Northern states were slightly (14%) more likely to be injured than players from teams in Victoria (RR 1.14, 95% CI 1.07-1.21). There was no significant difference in the risk for any of the categories of upper limb, trunk or head and neck injuries. Many of the lower limb injury categories had greater incidence in players from Northern teams, including ankle injuries (RR 1.71, 95% CI 1.36-2.15), anterior cruciate ligament injuries (RR 1.71, 95% CI 1.13-2.58), groin and hip injuries (RR 1.48, 95% CI 1.23-1.79), calf strains (RR 1.35, 95% CI 1.02-1.77) and quadriceps strains (RR 1.32, 95% CI 1.03-1.71). The majority of these injuries had a non-contact mechanism. Lower limb stress fractures did not show a significant difference between groups, although these injuries were infrequent. This was a correlation study only and further research is required to explain the mechanism of these increased risks. Ground hardness, shoe-surface traction, grass types, shoe selection, training methods and frequent travel are all factors which may have contributed to these findings.

Introduction

The relationship between injuries and ground conditions has become very topical in Australia in recent years due to statistics which have been published as part of the Australia Football League (AFL) injury survey. The Australian Football League Medical Officers Association have followed the paradigm of Van Mechelen [13] which states that injury surveillance is a critical first step towards injury prevention. Injury surveillance has been continuous and consistent since the 1992 AFL season. In addition, the AFL administration has undertaken an injury audit of sorts since 1988, as payments to players who miss games through injury are monitored. The standard AFL player contract allows all players who were playing senior AFL football and then miss games through injury or illness to be granted a payment to compensate them, as if they were playing.

The AFL competition was formed from the Victorian Football League (VFL). Prior to 1982, all VFL teams were based in Victoria, which is Australia's southernmost mainland state. Teams have relocated or been added to the competition so that there are now six teams based outside Victoria ('Northern teams'), with 10 teams based in Victoria ('Victorian teams').

In the early years of the AFL injury survey, it was noticed that the Northern teams were reporting more injuries than the Victorian teams. The definition of an injury in these early years included all injuries that caused players to miss games, but also injuries that prevented players from training fully. The survey coordinators were unsure whether there may have been a bias for Northern teams to be more likely to report injuries because they spent more time with their players, as the teams travelled by plane together for many away matches in Victoria. However, the same discrepancy between Northern and Victorian teams also existed when viewing the AFL injury payments to players. Table 1 shows that every year the Northern teams have paid more injury game payments, on average, than the Victorian teams. There is no reporting bias in these figures, as it is compulsory to pay an injury payment to all players who miss games through injury, and the AFL has a record of which players were missing games through injury. After considering that the AFL's own injury records were free from an important



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bias that may have existed in the injury surveillance system, the official injury survey definition was changed.

Methods

The methods for the AFL injury survey are stated in the present tense as they are ongoing. The survey definition of an injury is "an injury or medical condition that causes a player to miss a regular season match". Injuries exist on the database that were reported by teams but did not cause players to miss games and these injuries have not been included in reports since 1996. The change in definition (made in 1996) was retrospective (as detail for injuries from 1992-1995 about missed playing time was available). This study only considers injuries that satisfy the survey definition.

The method of reporting is that at the end of each season, a team medical official sends injury information (in a database or spreadsheet format) to the AFL injury survey coordinator. Games which players have missed through injury are checked with the AFL administration records. Teams are prompted to submit a record for any player who missed a game through injury if there was no injury record originally submitted. Conversely, injuries which were submitted that did not cause missed games are marked on the database as 'unofficial' and not included in survey reports. The major strength of this injury definition is that it is objective, can be verified independently and is consistent between teams and from year to year.

Injury incidence (the rate of new injuries over a

Table 1 - Comparison of senior injury payments (yearly average) between Victorian and Northern teams

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Victorian teams	82	92	88	87	72	58	72	77	88	86
Northern teams	106	98	113	91	88	73	79	95	94	110

given time period) considers only injuries that occur during the regular season. Injury incidence is calculated with number of injuries as the numerator and number of player weeks as in the denominator. The unit for injury incidence reported in this paper will be number of injuries per team per season. This unit (injuries/team/season) is used as it is a more meaningful concept than injuries per 1000 player weeks. A regular season is played over 22 weeks (one match per week) and a team is considered to have 40 players on its roster. The unit of injuries/team/season can be converted to a unit of injuries/1000 player weeks by multiplying by 1.136, which is $1000/(40 \times 22)$. Injuries/1000 player weeks is equivalent to injuries/1000 player matches as there is one match per week, although the former is more accurate as training injuries are included.

Once a player returns to play from an injury, the injury is considered to have recovered and that injury record is closed. If the player re-injures the same structure subsequent to returning to play in a match, it is considered a further incidence of injury (a recurrence). If a player re-injures the same body part at training before returning to play in a match, it is considered a continuation of the original injury and it does not contribute further to injury incidence.

Injury prevalence considers injuries that cause regular season matches to be missed,

irrespective of when the injury occurred (previous season, off season, pre-season or regular season). Injury prevalence is reported in the annual AFL injury reports but is not relevant to this particular study.

The objective of this study was to compare the relative incidence of injuries between Northern and Victorian teams. Total injury incidence was compared, as were specific injury categories which were formed from pooling similar diagnoses. The injury diagnoses were grouped to allow large numbers in each category. If smaller categories were used, the power of each comparison would have been poor, and confidence intervals would have been large. Lower limb injuries were the most common, so the category diagnoses for these were more specific (e.g. hamstring strains) than injury categories from the other parts of the body (e.g. shoulder joint injuries).

Relative Risk (RR) was calculated by dividing Northern injury incidence by Victorian injury incidence. The 95% confidence intervals for relative risk were calculated using a Taylor series expansion (formulae shown in Figure 1).

Results

Between 1992 and 1998 there were 4681 injuries that satisfied the survey definition. During this period there were 1361 AFL players included as part of the survey, who played 4495 player seasons, and a total of

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$$RR = \frac{\text{injuries}_{\text{northern}} \times \text{player weeks}_{\text{victorian}}}{\text{player weeks}_{\text{northern}} \times \text{injuries}_{\text{victorian}}}$$

$$95\%CI = RR \exp \left(\pm 1.96 \times \sqrt{\left(\frac{1}{\text{injuries}_{\text{vic}}} + \frac{1}{\text{injuries}_{\text{ntb}}} + \frac{1}{\text{player weeks}_{\text{vic}}} + \frac{1}{\text{player weeks}_{\text{ntb}}} \right)} \right)$$

Figure 1-4 Calculation of relative risk and confidence intervals

97060 player weeks. The injury incidence was 4681x1000/97060 or 48.2 injuries per 1000 player weeks. This is equivalent to 42.5 injuries per team per season.

Table 2 shows the relative risk (with 95% confidence intervals) for injury incidence of Northern teams compared to Victorian teams. The unit shown for injury incidence is injuries per team per season. Hamstring strains were the most common injury in both groups, followed by groin and hip injuries. The third most common injury category for Victorian teams was back and buttock injuries, whereas for Northern teams it was ankle joint injuries.

Many lower limb injuries showed a significantly increased risk in players from Northern teams, including ankle injuries, knee Anterior Cruciate Ligament (ACL) and cartilage injuries, quadriceps, calf and groin strains. The majority of these injuries had a mechanism not involving player-to-player contact. There was no significant difference between any of the categories of upper limb, trunk or head and neck injuries. No injuries showed a significantly increased risk in Victorian team players, although hamstring strains and back and buttock injuries showed a non-significant trend to being more common in Victorian team players.

Discussion

These results show an increased incidence in the Northern-based teams of the AFL for lower limb injuries that do not involve player-to-player contact. There are many factors that could be responsible for explaining this increase. The weather is warmer in the Northern states during winter, so grounds are generally harder. Players tend to choose moulded-sole boots when playing in Northern venues, compared to screw-in soles when playing in Victoria in winter. Warm-season grasses such as couch (bermuda) grass (*Cynodon dactylon*) predominate in Northern venues, whereas Victoria is in a traditional weather zone, and rye grass (*Lolium perenne*) is the major species. Because of the warmer weather, it is possible that Northern teams train harder and longer in winter because of

Table 2- Comparison of injury incidence in Victorian and non-Victorian teams (1992-1998) (injuries/team/season).

Injury Category	Victorian incidence	Northern incidence	Relative risk (RR) N:V	95% RR Confidence	
				Low	High
Concussion	0.9	0.9	1.00	0.65	1.53
Other head & neck injuries	0.9	1.1	1.29	0.87	1.93
Shoulder joint injuries	1.0	1.1	1.10	0.75	1.63
Acromioclavicular joint injuries	0.9	1.1	1.21	0.81	1.81
Upper limb fractures	1.8	1.6	0.88	0.64	1.2
Other upper limb injuries	0.6	0.6	1.04	0.62	1.73
Trunk injuries	1.2	1.2	0.97	0.68	1.39
Back & buttock injuries	2.5	2.0	0.81	0.62	1.07
Groin & hip injuries	3.5	5.2	1.48*	1.23	1.79
Hamstring strain injuries	8.0	7.2	0.90	0.78	1.04
Quadriceps strain injuries	2.0	2.7	1.32*	1.03	1.71
Anterior cruciate ligament injuries	0.7	1.1	1.71*	1.13	2.58
Knee medial injuries	1.2	1.1	0.87	0.60	1.27
Posterior cruciate ligament injuries	0.6	0.4	0.72	0.40	1.30
Knee cartilage/degenerative injuries	1.3	1.9	1.45*	1.06	1.98
Other knee injuries	1.2	2.0	1.66*	1.21	2.26
Leg fractures	0.4	0.6	1.36	0.80	2.29
Leg stress fractures	0.3	0.4	1.11	0.54	2.31
Calf muscle strain injuries	1.8	2.4	1.35*	1.02	1.77
Lower limb haematomas ('corks')	1.8	2.2	1.19	0.90	1.58
Foot fractures (incl. stress fractures)	0.7	0.5	0.76	0.45	1.29
Ankle joint injuries	2.2	3.8	1.71*	1.36	2.15
Other lower limb injuries	1.8	1.5	0.85	0.62	1.17
Medical illnesses	1.8	1.8	1.03	0.76	1.39
TOTAL of all diagnosed injuries	39.1	44.4	1.14*	1.07	1.21

An asterisk (*) indicates significantly higher risk of injury for Northern teams ($p < 0.05$ or 95% confidence).

the more benign conditions. It is also possible that injury management and prevention is better in Victoria than elsewhere in Australia, although it would be unusual if this were the case for lower limb injuries and not for injuries in other parts of the body.

Injuries are traditionally divided into contact and non-contact mechanisms, in which case contact refers to player-to-player contact. Some of the forces involved in a 'non-contact' injury are transmitted from the playing surface to the injured body part, which gives a basis in theory as to why ground hardness may be a risk factor for these injuries.

A study was commenced in 1997 to measure ground conditions at AFL venues, to see whether ground hardness could account for the differences in injury rates between the Northern and Victorian teams. This study received significant publicity in 1998 and there was some pressure on ground managers to intervene to prepare softer grounds in 1999. This in fact occurred, and recent results

Category	1998 1999	
	* Incidence fell by >0.2 in 1999	
TOTAL INJURIES PER TEAM	40.9	38.0*
Concussion	0.7	0.5
Other head & neck injuries	0.9	1.0
Shoulder joint injuries	0.8	0.7
Acromioclavicular joint injuries	0.7	0.6
Upper limb fractures	2.2	2.0
Other upper limb injuries	0.6	0.5
Trunk injuries	0.7	1.6
Back & buttock injuries	2.0	1.9
Groin & hip injuries	4.0	3.3*
Hamstring strain injuries	7.1	7.9
Quadriceps strain injuries	2.8	2.5*
Knee medial ligament injuries	1.2	1.2
Anterior cruciate ligament injuries	0.5	0.4
Posterior cruciate ligament injuries	0.3	0.8
Knee cartilage/degenerative injuries	1.4	1.1*
Other knee injuries	1.3	1.4
Calf muscle strain injuries	2.4	1.7*
Leg fractures	0.5	0.5
Leg stress fractures	0.4	0.1*
Ankle joint injuries	3.4	2.3*
Lower limb haematomas ('corks')	2.0	1.9
Foot fractures (incl. stress fractures)	0.5	1.1
Other lower limb injuries	1.5	1.5
Medical illnesses	3.0	1.4*

Table 3- Comparison of AFL injury incidence from 1998-1999 (injuries/team/season)

from the recently-released AFL injury survey [8] showed a reduction in injuries in 1999 compared to 1998 (Table 3). The pattern of injuries which showed a reduction in 1999 was very similar to those injuries that are generally more common in Northern teams. This is an interesting finding, but does not constitute strong scientific evidence that ground hardness is a risk factor for these injuries. Direct measurement of game day conditions constitutes far stronger evidence - to date this has been reported with respect to ACL injuries and weather conditions [9], but not ground hardness readings. Table 4 lists the current state of evidence regarding injuries and ground conditions in the AFL. It is worth noting that grounds may be expected to be harder this year, as the AFL season has been brought forward one month to avoid a clash with the Olympic Games in Sydney.

A recent article was published comparing the Penetrometer and Clegg hammers for measuring ground hardness [4]. A Clegg hammer uses a smaller effective weight than the Penetrometer and hence is influenced more by the grass and thatch, whereas the Penetrometer reading is influenced more by the soil. Further comparison of these devices is advised to determine which, if either of them, is best able to assess injury risk.

Table 4 - Current state of evidence regarding ground conditions and AFL injuries

HYPOTHESIS	EVIDENCE	ACTION
Lower limb injuries are more common in Northern States in the AFL	This is almost certainly scientific fact (evidence presented in this article)	AFL is studying ground conditions to see whether these can explain some of the observed differences
Ground conditions are responsible for the differences in injury risk in various states	This is likely but not certain - other factors may also be responsible	AFL grounds have had Penetrometer readings taken before matches since 1998
The Penetrometer is the best device for measuring ground hardness	The relevance to injury risk of both the Penetrometer and the Clegg hammer is unknown. Further study is required to assess both these devices.	The Penetrometer was chosen as it is the 'gold standard' in the Australian racing industry. There is no 'gold standard' for football grounds as we are unaware of any competition in the world that routinely measures all grounds
Couch grass is a risk factor for ACL injury due to higher shoe-surface traction	This is a popular theory but can't be tested until there is a reliable device for measuring shoe-surface traction.	The AFL will assess any proposed devices for measuring shear-stress and, if a reliable device is found, will add this to its routine in the future.

Related studies have been performed in other sports. The best comparisons between natural grass and artificial turf (which is generally a harder surface) in the NFL have arisen from the official injury surveillance studies (summarised in Table 5). Bramwell et al. found a higher rate of injury on artificial turf than natural grass over an American football season, with the difference occurring later in the season, when the natural grass surfaces (in Seattle) became softer due to climatic conditions [3]. Andresen et al. found that injuries on muddy or wet surfaces (NG) were less frequent than on good or hard surfaces in Wisconsin [1]. Scranton et al. found that the surface was described as good or dry for the vast majority of non-contact ACL injuries in the NFL, although no direct measurement of ground hardness was made [12].



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One study of injuries in Australian horse racing found a much greater incidence of equine injury on fast compared to heavy tracks [2]. Penetrometer readings have been taken for many years in this sport, and have been preferred to Clegg hammer readings [7].

Table 5 • Current state of evidence regarding ground conditions and injury in other sports


HYPOTHESIS	EVIDENCE	ACTION
Artificial turf is a risk factor for lower limb injury in the NFL	Astroturf moderately increases the risk of ankle injuries [10], and has a minimal effect on knee injuries [11]	The NFL continues to monitor injuries each year in a sophisticated injury surveillance system
NFL players don't like playing on artificial turf as they perceive it to be too hard	Player surveys consistently show that artificial turf is very unpopular [14]	Many NFL stadiums are reverting from artificial turf to natural grass [5]
Long stops are a risk factor for ACL injuries compared to moulded soles	There is one study that suggests that long stops are a risk factor for ACL injuries [6]	Players are more concerned with performance (not slipping over) than a possible reduction of injury risk. They will continue to use long stops in slippery conditions
Horses are more likely to be injured when the tracks are hard	There is one Australian study that strongly supports this hypothesis [2]	It is rare to see racecourses prepare 'fast' tracks in recent years. A good to dead track is considered more ideal

Conclusion

Lower limb non-contact injuries are more common in Northern AFL teams than Victorian teams. This is an important finding and has prompted further research into ground conditions at AFL venues. Ground conditions such as hardness and grass cover may subsequently be shown to be associated with increased injury risk, but other confounding factors may also contribute to the different injury rates. 🌧️

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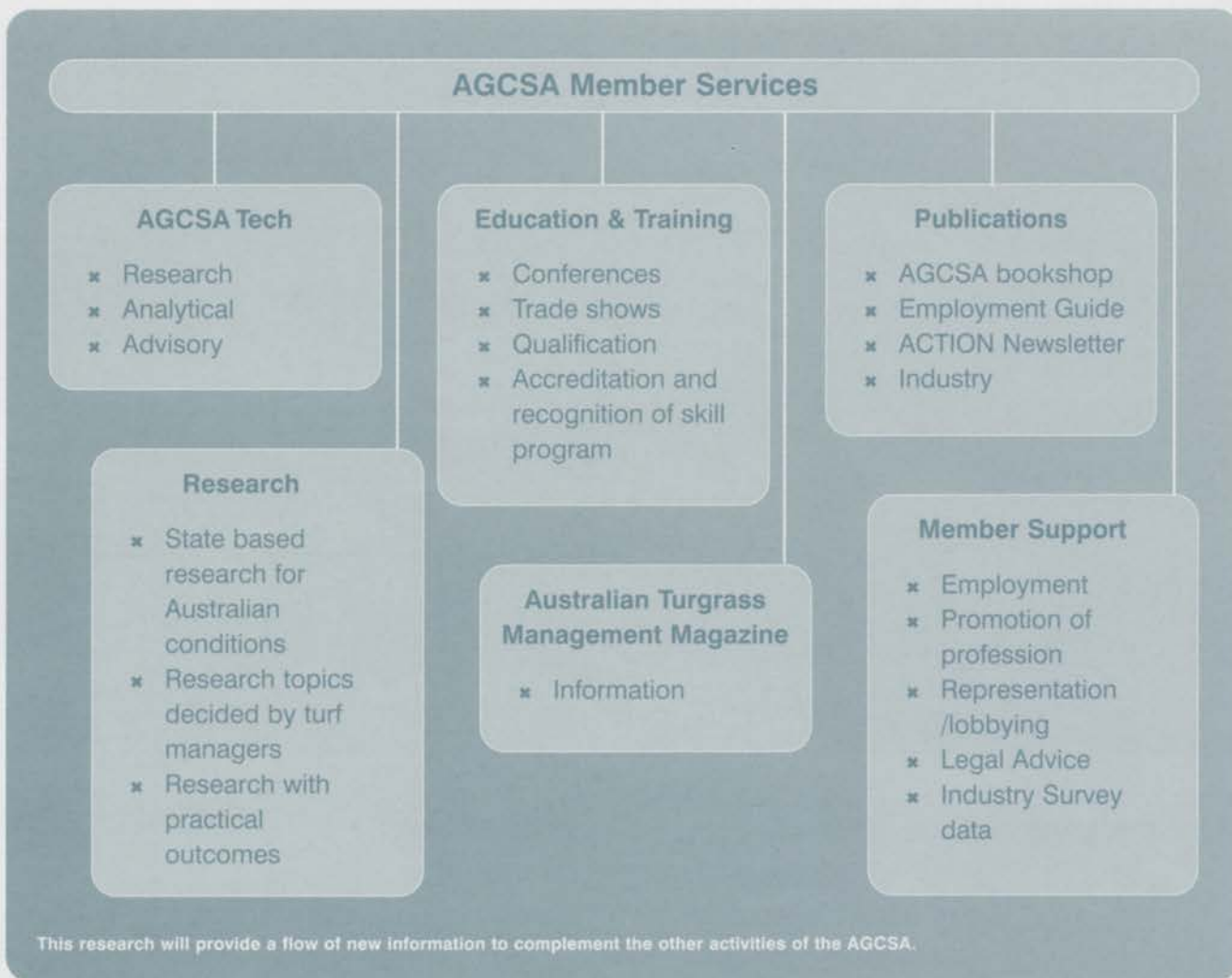
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Ready, Willing and Able

By John Neylan [Manager, Technical and Advisory Services, AGCSATech]

After months of planning and preparation, AGCSATech, the AGCSA's new research, and technical advisory division is ready for launch at the Millennium Turfgrass Conference in June. AGCSATech was formed to support AGCSA Members, complement the existing functions of the AGCSA (fig. 1), and to assist in raising funds for turfgrass research.





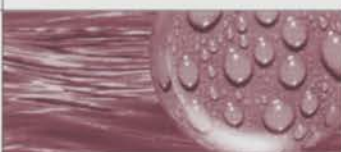

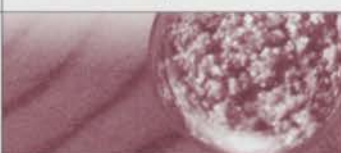
The soil testing package incorporates a convenient soil test kit that includes sample bags, sampling instructions and a pre-addressed post bag for sending the samples to the laboratory. These soil testing kits will be sent to all AGCSA members and golf clubs. Some allied trade companies have

also decided to use the AGCSA as their preferred analytical testing service and you will be able to source these test kits from their representatives. Whether you send the kits direct to AGCSA or you access the kit through a trade company, the AGCSA will provide you, the client with an independent

report. This reporting procedure is now operational and will provide a more personalized report that is easy to read, provides a historical record and is completely independent in its recommendations. To ensure these recommendations are at the forefront of

modern turf management techniques, there has been an exhaustive review of the literature on recent soils research which has shown a number of better ways to amend your soil to provide optimum turf growing conditions.

The other diagnostic services provided include;

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| 2] | 
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| 3] | 
Water analysis |
| 4] | 
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| 5] | 
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Aligning ourselves with the best expertise available, these diagnostic services will provide the highest level of technical support available.

For many years Australia has lacked any continuity in developing a solid research program. Any profits generated through the operation of AGCSATech will be used to fund research projects. With the support of established funding bodies such as the Horticultural Research and Development Corporation (HRDC), this is seen as a practical means to provide a continuity of research. The AGCSA has already allocated funds towards establishing two research projects.

In addition, there is a proposal in with the Queensland EPA to develop an "Eco-efficiency" manual and training course for Queensland golf courses. This is an initiative of the Qld EPA to ensure that golf course activities meet environmental best practice standards. This project is only possible where the Qld EPA has a partner that is an industry organization. The AGCSA and the Queensland Golf Course Superintendents' Associations will provide this necessary link as well as the manpower and industry knowledge required to undertake such a project.

AGCSATech offers an independent advisory service that encourages a pro-active approach to turf management. Our key consultancy package provides a more objective and analytical means of assessment, that over time will remove much of the subjective and anecdotal comment that is often associated with turf management. This is a program for the well organized turf manager that wants to

objectively monitor turf performance over time. We believe that this will provide a very important planning tool.

AGCSATech will also be available to undertake problem solving consultancies, prepare specifications and provide project management where required.

There is an increasing requirement for golf clubs to demonstrate that they are environmentally sound. The development of Environmental Management Plans (EMP's) for golf courses is another key advisory service provide by AGCSATech and three are already underway.

Research is only successful if the results of that research is put in the hands of those who need it. Through the AGCSA workshop series and the Australian Turfgrass Management magazine, AGCSATech will implement a highly effective extension program.

The new service provides an important expansion in AGCSA member services. From June 2000 AGCSATech will be put to the test and we look forward to helping you produce better quality turf surfaces.



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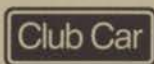
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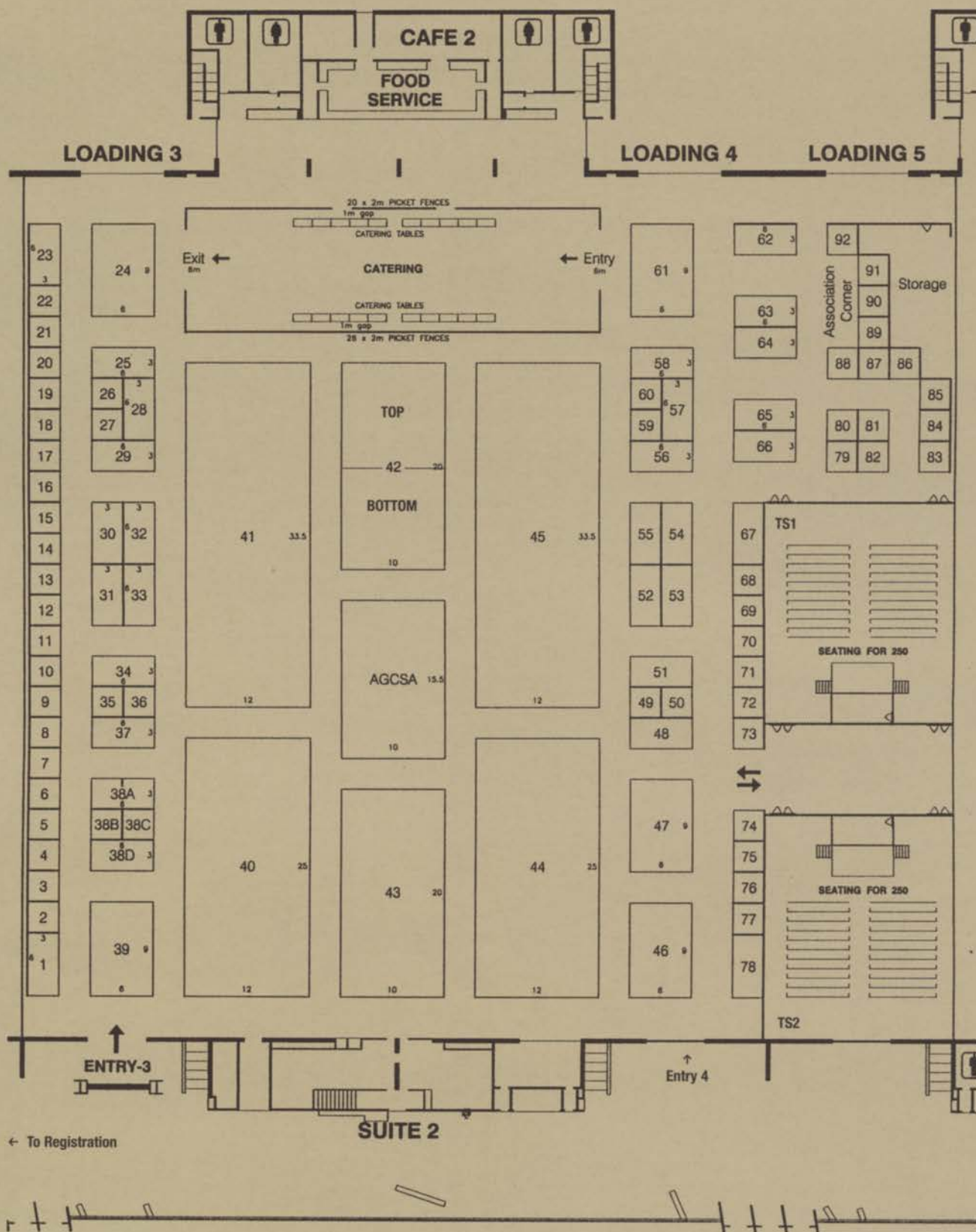
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38 B	Greenmaw
29	Haifa Chemicals
62	Hardi Turf
64	HG Turf
16	Holmesglen Institute of TAFE
56	Hortex
1-2	Hunter Golf
58	JFB Agencies
TS1	Workshop Room 1

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41	John Deere
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59-60	Turfcare Supplies
11-12	Turfgrids
43	Turfwell Sales
TS2	Workshop Room 2

General Information and Secretariat Details

Delegates attending the conference must pick up their registration packs prior to attending any of the conference activities. The registration packs include a detailed conference program, name badges, conference satchel, information on Melbourne and sponsors material.

Registration Desks will be operational during the following times:

Sunday June 4th:

2.30pm-5.00pm

Level 2, Melbourne Exhibition Centre

5.15pm-7.00pm

Palladium Foyer, Crown Entertainment Complex

Monday June 5th:

7.00am-9.00am

Palladium Foyer, Crown Entertainment Complex

9.00am-5.00pm

Level 2, Melbourne Exhibition Centre

Tuesday June 6th:

7.00am-5.00pm

Level 2, Melbourne Exhibition Centre

Wednesday June 7th:

7.00am-5.00pm

Level 2, Melbourne Exhibition Centre

Thursday June 8th:

7.00am-5.00pm

Level 2, Melbourne Exhibition Centre

Opening Session

The entire turfgrass industry comes together for the Opening Session of the Millennium Turfgrass Conference. Commencing at 8.00am in the Crown Palladium Ballroom, the Opening Session is open to all conference streams and all exhibitors and their staff.

Welcoming Cocktail Reception

The Welcoming Cocktail Reception will commence at 6.00pm in the River Rooms of the Crown Entertainment Complex.

This function is included in the Golf, and Mechanics registration and is an optional extra for all other streams. Exhibitors holding full exhibitor staff registrations are also entitled to attend.

Dress code is jacket and tie.

Conference Dinner

This is an optional extra for all conference streams and exhibitors. To be held in the Crown Palladium Ballroom and with entertainers, Rachel Berger and the Funky Film Express, this is sure to be a huge night. The night kicks off at 6.00pm on Wednesday June 7th for pre-dinner drinks. Dress code is jacket and tie.

Buses Pre- and Post Conference Tours

All buses for the pre- and post- conference tours will depart from the Centra Hotel. Details can be obtained from the enquiries desk.

Buses for the Racing, Bowls and Mechanics Tours

These buses will depart from the front of the Melbourne Exhibition Centre.

Exhibitor Listing [Alphabetical]

Booth #20 ACI INDUSTRIAL MINERALS

ACI industrial minerals is a leading sand supplier to the Turf Industry throughout Australia. At the turfgrass conference, ACI will be displaying a range of sands that are currently being used at several of Australia's major sporting venues. Sands displayed are used in various sporting applications from golf greens, tees and bunkers to bowling greens, tennis courts, race tracks and sports grounds.

Booth #26+27 AQUASEEDING

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Come and see Bill Leggatt and the team at booth 26+27, where you will also see the latest turf e-commerce site www.lawnguide.com.au.

Booth #91 AUSTRALIAN TURF EQUIPMENT TECHNICIANS ASSOCIATION

The Australian Turf Equipment Technicians Association sees the Millennium Turfgrass Conference as an opportunity for a complete learning experience, both for the technician, their superintendent and club. Our members are keen to meet the challenge of developing a more professional, progressive and cost-efficient workshop, a goal we are working towards through the networking now available in our association. All the major machinery supply companies have been extremely pro-active in the upgrading of their own workshops, having recognized the importance of a well managed, well-equipped workshop. The support these companies have shown our association has been very encouraging. The association is committed to the ongoing training of our members. However, we equally realize the importance of working with the club superintendent, management and committee to achieve recognition of the value of this training and networking. We would like, therefore, to extend an invitation to any interested parties to introduce themselves to one of our members or committeemen for any further information, or perhaps to arrange an invitation to one of our lectures. Hoping to see you there.

BOOTH #Centre AUSTRALIAN GOLF COURSE SUPERINTENDENTS ASSOCIATION

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- ▶ See the latest testing techniques used to solve your turf problems.
- ▶ Access the new AGCSATech soil testing kits
- ▶ Hear how to have your existing skills recognised with an AGCSA Qualification
- ▶ Learn how to access the world - wide web through AGCSA Online web site
- ▶ Study the comprehensive display of turf management books on offer through the



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- ▶ Discover the careers open to turf managers
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- ▶ Talk to an AGCSA Board or staff member about what you would like the AGCSA to be doing on your behalf.

Booth #7 ANCO SEED AND TURF PTY LTD

For over two decades, Anco has been producing quality instant turf for Melbourne's landscapers, golf course superintendents and public. With farms located at Lyndhurst, Clyde and Fiveways to the city's southeast and at Torquay near Geelong, Anco is able to provide excellent service to not only the metropolitan area, but to all of Victoria. Our turf range includes several cool season blends (Tall Fescue, Kentucky Bluegrass / Ryegrass blend and All Rounder - a blend of Bluegrass, Rye and fine Fescue) and warm season turf (Santa Ana Couch, Wintergreen Couch and Kikuyu). Several varieties of creeping bentgrasses are also produced. Samples of our turf will be on display at the trade show. All Anco turf is grown on

fumigated, sandy loam soils, in order to provide a weed free product. Anco is also able to grow any variety or blend under contract, as well as providing a contract laying service.

Booth #31

ARTHUR YATES & CO. LTD.

Arthur Yates and Company is now able to offer a full range of nutritional products to care for your turf. Floranid Slow Release, Nutricote controlled release and Dynamic Lifter are all available to meet your specifications, and our association with BASF also has widespread benefits we can pass on to you. Other specialty products include liquid lime, Wiltnot antitranspirant, and surrender moss and algicide.

Booth # 48 BHM MACHINERY

As a turf grass professional, it is your job to ensure that the greens, grounds and race tracks are kept at their finest all year round. The Soil Reliever can help you accomplish this. The Soil Reliever Deep Tyne Aerator is the only specially designed aerator on the market. With features such as on the go depth adjustment,

straight tyne arms and split driven crank, it makes the Soil Reliever fast, efficient and effective, with very low maintenance. There are five models of Soil Relievers to choose from. The first is the SR48, ideal for golf courses wishing to aerate greens, tees, surrounds and fairways. The 60", 72" and 80" models are all designed for heavy duty aeration on fairways, playing fields and race tracks, yet are delicate enough to aerate greens. Then there is the Rhino 54" aerator, which is designed specifically for the aeration of greens and tees. All Soil Relievers have the ability to fit both solid and coring tyres.

Booth #85 BIRDS AUSTRALIA

Many golf course superintendents have developed plans that include wildlife conservation and wider environmental issues. But while it is clear that birds, in particular, are drawn to habitats created on golf courses, it is not known what effect construction and management is having on native populations. In 2000, Birds Australia, with the support of the AGCSA and the AGU will conduct surveys to determine the impact of golf courses on native species, their habitats, breeding patterns and distribution. Birds on Golf Courses is designed to be an enjoyable activity for members and a valuable member relations exercise for golf clubs as well as a vital contribution to Birds Australia's national database on native birds and their habitats.

Booth #74+75 BSF GOLF MANAGEMENT

- ▶ Sales ▶ Service and repairs
- ▶ Turf machinery management contracts
- ▶ Golf course management contracts

BSF Golf Management, which comprises BSF Commercial Mowers and Golf Course Management Systems, is the premier provider of:-

- ▶ Sales of new turf machinery;
- ▶ Sales of quality reconditioned turf machinery;
- ▶ On-site service and repairs to turf machinery;
- ▶ Sale of spare parts;
- ▶ Professional advice on all brands of turf machinery;
- ▶ Turf machinery management contracts;
- ▶ Total golf course management contracts

The machinery arm of the Company, BSF Commercial Mowers, operates a number of five year turf machinery management

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You can be assured of unrivalled knowledge and service. Contact our Sales Manager, David Briggs.



Features of our harvesters include floating head, electric depth control, cross conveyor, floating brush kit, hydraulic roll-up system and the unrivalled Hallmarket Coulter Kit, allowing clean, tidy edges whatever the weather and many other features.

For more information, contact David Briggs at

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E-mail: info@hallmarket.co.uk

contracts. This concept has been developed in Australia by the Company which currently has 12 golf clubs on contracts, under which BSF provides, new, all of the dedicated machinery under a fixed term contract. Regular weekly maintenance service is carried out, with all parts and labour included in the monthly contract price. An important aspect of these contracts is the provision of specialist service and backup to what is becoming a highly technical part of golf course management, which allows turf management staff to attend to concentrate on presenting the best possible golf course. The Company is the largest employer of turf machinery technicians and qualified Superintendents in Australia. The golf course arm of the Company, **Golf Course Management Systems**, operates several total turf management contracts at Council and Government operated golf courses. These contracts offer a comprehensive, cost-effective and high quality package; GCMS provides all qualified staff, machinery, materials and expertise to cover all aspects of turf

management. BSF Golf Management is a new name which incorporates all the services now offered by this unique Company. For obligation free quotes, call:- BSF GOLF MANAGEMENT, UNIT 6/11 MCLELLAN STREET, BAYSWATER, VIC. 3153, AUSTRALIA TEL. 61 3 9761 0457 FAX: 61 3 9762 3262 EMAIL: bsfgolf@bigpond.com.au, WEBSITE: www.bsfgolf.com.au

Booth #69-70

B.K. MACHINERY SALES

B.K. Machinery sales will be displaying the latest technology in Golf Green Rollers. Further to that we will have our range of Turfgear Bowling Green equipment, namely, the Hydro-roll, Hydro-mow, Broom & Groom Machine and 10 Hole Drilling Machine and on display will also be the unique mower work station - designed to lift any 30" Bowling Green Mower into a safe working position. Some of the range of Greenline Spare Parts will also be on display along with fuel safe containers, tyres, groomer blades, verti blades, etc.

Booth #28 BETTER METHODS - STANDARD GOLF

Two new hand Levelawns will be shown for the first time. The 760mm and 920mm. They replace the 30" & 36" respectively. The design modification retains all the good features of the earlier models - flexibility to cope with undulating greens and open top channels to trap small stones - yet the new models are far more robust, will last longer and represent better value. Come and compare the new with the old. Our stainless steel Handy Sampler has proved so popular overseas that we have been able to cut production costs, improve quality and include a practical storage box all at no extra cost. This little tool deserves to be in every Super's kit. New from Standard Golf to be shown in Australia for the first time are the ST 2000 Non-Stick Putting Cups. Available in plastic and aluminium, the new design makes sticking ferrules a thing of the past. The very latest item, just released in USA, is the Standard Golf Weed-Pro. This hand held herbicide applicator makes weed control simple. It will be available here shortly, so come and secure your order from the first



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BRISBANE

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MELBOURNE

Ph (03) 9380 8888

PERTH

Ph (08) 9452 7777

batch to be imported.

Booth # 54 CENTROGEN (WEEDBUG)

In January 2000, Weedbug Services officially changed its name to Centrogen, a move that reflected the setting of a new strategic direction for the company. The tag 'initiatives for a better earth' was adopted to complement the new name. Centrogen began working in the field of weed management some 5 years ago. Its initial functions were to address and treat the noxious weed hot spots. The business moved into treating golf courses, parks and sports fields for unwanted tall weed species, a function that still exists today. On display, you will find the Weedbug technology which has been specifically designed to remove problem grasses including Parramatta, Onion, Brome, and Rye, among others from couch, and other low growing turf species. This technology also enables a number of broadleaf weeds, to be controlled in an environmentally sustainable manner. Importantly, the Weedbug technology is an **Australian design**, simple and extremely effective. It is **not** a product for sale and only recently has become available throughout the various turf maintenance markets.

Booth #78 channelTurf

channelTurf is the industry's first online purchasing service developed specifically for the turf industry. It provides turf professionals with internet access to their supplier group in one place, at one time, 24 hours a day, 7 days a week. By using channelTurf, the buyer can eliminate separate purchase orders, faxing and phone calls, and gain greater control over the time spent in ordering. The buyer logs on to the site through a user name and password, which activates the file which contains his negotiated pricing. Moving through the catalogues, the buyer selects the goods and quantities to be ordered, thus building a master purchase order. When finished, the buyer checks out and each purchase order is transmitted independently to each supplier. Suppliers then confirm the order via fax or email. For suppliers, channelTurf delivers a clean, legible order each time. The service integrates with the back-end system so that double entry is eliminated. Studies show that processing the order, just from the in-house

effort, can cost up to \$25.00 per order. channelTurf can reduce that cost to less than \$10.00 per order. Stop by channelTurf at Booth 78 for a demonstration and see the future of the turf industry.

Booth #44 CHEMTURF PTY LTD THIS IS HUGE

CLUB CHEMTURF is one step beyond anything else you will experience at the Millennium Turfgrass Conference Trade Show. Incorporating the popular CAFE CHEMTURF, **CLUB CHEMTURF** will be the location to sit, relax and discover the latest turf management products and services over a hot coffee. At your service will be one of our experienced sales staff, well trained in the latest in turf management products and techniques. At **CLUB CHEMTURF** you will witness the launch of the next generation of controlled release turf fertilizers, the Novex range from Lesco. The Novex range incorporates the unique Matrix technology that delivers "more of the good stuff". Also showing at **CLUB CHEMTURF** will be the latest information on Water Management, Fertilizers, Analytical Services, Irrigation, Pest Management and much, much more. All supported by some of the world's biggest names in turf management. **CLUB CHEMTURF**, with its friendly atmosphere and exciting program is sure to be the meeting place at the trade show. So come and see the future during the Millennium Turfgrass Conference as the future will be on display at **CLUB CHEMTURF, stand # 44. See you at the Club!**

Booth # 55 CHIPCO/AVENTIS

Chipco is the wholly owned turf care division of Aventis Environmental Science. Aventis has been formed from the world wide merger of Rhone Poulenc and Hoescht. This merger has brought the AgrEvo range of turf products to the Chipco stable. Much has been achieved since Chipco's Australian launch in late 1994:

- Developing a high quality service network to provide national coverage of Australia's professional turf maintenance markets;
- Forging a strategic alliance to include Bayer Australia's turf care brands in our portfolio of products such as the Rohm and Haas and Dow AgroSciences range;
- Launching major new brands such as Bayer's Merit Turf, Chipco Choice, Chipco

Fore Flo and Chipco Aliette Signature;

- Sponsoring the AGCSA Claude Crockford Environmental Award;
- Building a strong commitment to R&D, stewardship, safety, and to the use of low-dose and infrequently-applied chemicals within an 'Integrated Turf Management' regime.

These developments aid Chipco's collaborative relationships with customers where our focus is on the discovery, development and delivery of practical turf care solutions that capture extra value. Chipco is proud to be part of the Millennium Turfgrass Conference.

Booth #20 CLUB CAR

Club Car Pty. Ltd. will be displaying a range of turf Utility Vehicles, two of which have not been seen at a National Turfgrass Seminar previously. Club Car are proud to announce that probably the most significant entrant into the Utility Vehicle market in Australia will be launched in Perth. The product, XRT272, was first seen in the G.C.S.A.A. Turfshow in Orlando, Florida and received rave reviews from the Superintendents. The influence of Ingersoll Rand in the design and production of the XRT272 is evident and shows the commitment Club Car have to further develop products suited to the Turf market.

This product has been extensively tested and refined with the input of Golf Course Superintendents. A test drive will clearly demonstrate how the combination of features have been combined to create:-

- Confidence Inspiring Extra Traction on Demand
- Unsurpassed Long-Pulling, Hill Climbing Power
- Serious Stopping Power for Peace of Mind
- Superior Suspension and Steering Unheard of from a Utility Vehicle

We at Club Car look forward to enjoying a great seminar at Burswood Hotel with you, so drop in at Stand 20 and talk to Geoff or Gary from Club Car Australia, or Kevin from Club Car Augusta.

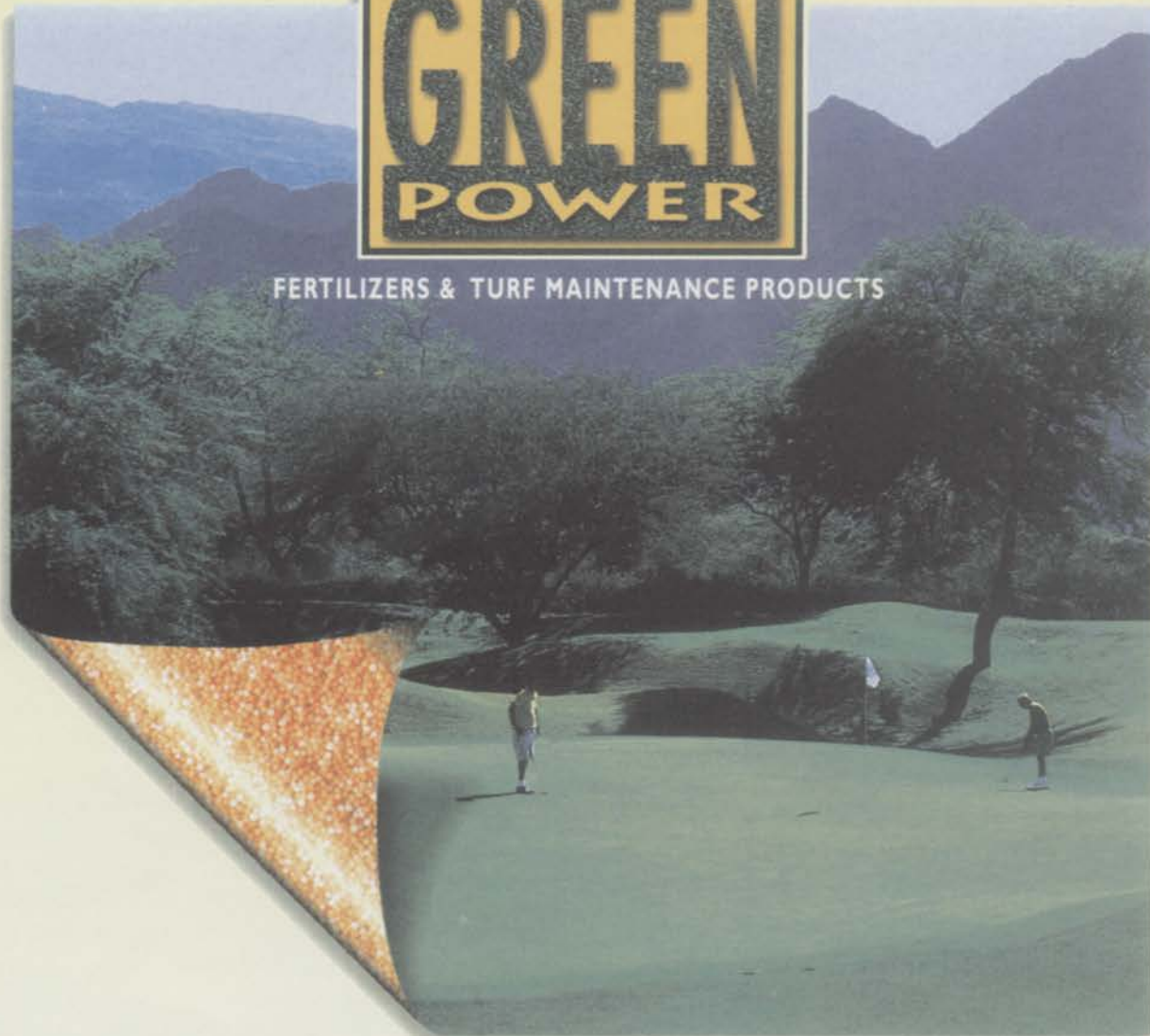
Booth #3 & 4 CONTROLLED SPRINKLER SUPPLIES

Controlled Sprinkler Supplies was established by Hal and Pamela Collins in September 1978. Since that time the company has developed into a national operation with the establishment of sales offices and warehouse





FERTILIZERS & TURF MAINTENANCE PRODUCTS



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polyfeed	water soluble N-P-K fertilizers.
humigreen	humus-based active soil conditioner.

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facilities in Perth, Adelaide, Melbourne, Sydney and Brisbane. Today, CSS maintains an extensive portfolio of quality products representing world-recognised companies, these include:

- ▶ Hunter (USA) - *Sprinklers, valves and controllers*
- ▶ Rainbird (USA) - *Contractor/Commercial sprinklers, valves and controllers*
- ▶ Spears (USA) - *PVC pressure fittings*
- ▶ Naan (Israel) - *Agriculture sprinklers*
- ▶ Weathermatic (USA) - *Control systems*
- ▶ Tonick Watering (UK) - *Control systems*
- ▶ Baccara (Israel) - *Solenoid valves*
- ▶ Alprene (Italy) - *Compression fittings for poly pipe*
- ▶ Flo (USA) - *PVC repair fittings*
- ▶ Carson (USA) - *Structural foam valve boxes*
- ▶ Tavit (Israel) - *Threaded poly fittings & micro products*
- ▶ Irrrometer (USA) - *Moisture measuring instruments*
- ▶ Heliotrope (USA) - *Solar powered controllers*

The company has primarily been a supplier into the commercial turf and landscape irrigation market, however with appointments of key personnel and specialised equipment this will enable a greater focus to be given to the golf area through the irrigation professional.

Booth #25 RHS CONVAULT AUSTRALIA PTY. LTD.

Convault Australia PTY. LTD. manufacturers of the Convault range of Protected Above Ground Storage Tanks for fuels are displaying a typical tank and dispensing unit. The Convault technology designed and developed in the U.S., but now manufactured in Australia, enables all fuels to be stored safely above ground. Convault tanks are approved by Workcover Authorities and other regulatory bodies all around Australia. These tanks, now overcome difficulties golf clubs and other sporting facilities face in meeting the regulatory requirements for storing fuels safely. Also of course the environmental problems of storing fuels underground are overcome by using Convault Protected Tanks. The Convault technology employs a secondary containment which prevents fuels escaping to the environment should the primary tank ever leak. The tanks outer shell consisting of 150mm thick reinforced concrete provides the two to four hour fire rating as well as

protection from vehicle and ballistic impact. The Convault exhibit will show an example of a real occasion where protection from fire has been proven. The exhibit will also show a Fill-Rite dispensing unit mounted to a Convault tank which has approval to pump fuel to Australian Standards. The Fill-Rite range of dispensing units includes manual and DC, or AC electric pumps.

Booth # 21, 22, 23 COUNTRY CLUB INTERNATIONAL

Country Club International are the major Australian suppliers of golf range equipment from Europe and USA plus specialist suppliers of environmentally friendly chemical spray equipment, 3-point linkage quick hitchers, environmental chemicals, netting for impact and high safety screens, golf course signage and rubber paving. Companies represented include Range Servant Sweden, Redden Netting USA, Pro Turf Golf Mats, Enviromist, Soil Zyne, Flexitact Pacific, Netting Australia, Groovy Signs, Derone Enterprises USA, Triangle Hitch Norway, Herbi Spayers and a range of associated lines. Offices are based in Melbourne and the Gold Coast with agents in Singapore, Hong Kong, NSW and South Australia.

Booth # 81+82 CROPLANDS EQUIPMENT PTY LTD

As a company long involved in the machinery side of chemical and fertiliser application, Croplands Equipment has a good depth of understanding and knowledge of spray application. Croplands Equipment was started in 1972, originating in New Zealand supplying sprayers specifically for the demands of the export-driven horticultural markets there. Within a few years, a full range of equipment was being marketed by this innovative company, including export markets in the US and Australia.

Croplands Equipment in Australia was launched in 1988 as a division of Nufarm, and has grown almost ten-fold in the last 12 years. The products marketed now include anything from spray nozzles to very large trailing and self-propelled sprayers for grain and cotton. Some new and exciting application technology is also part of the Croplands range, including the latest in anti-drift nozzles and GPS-compatible spray controllers for Agriculture, Horticulture and the Turf market. Although

always able to supply a good range for turf and amenity markets, some new and innovative products have been developed through one of Croplands trusted suppliers and are now available to the industry. Such products include fully de-mountable tank/boom options, front mounted units, trailing and linkage sprayers, and a full range of knapsack and spot sprayers. This is on top of all the accessories and safety equipment needed to get spraying done safely and efficiently. For any enquires for further information, contact Croplands Equipment directly on 1800 999 162.

Booth #52 DGE

David Golf & Engineering welcomes everyone to the Millennium Turfgrass Conference. As continuing our lead as Australia's number 1 golf course hardware company we will be featuring new and upgraded products. Included in this will be a new revolutionised putting cut and holecutter. Our range is the most extensive in the industry with in excess of 250 products. Also featuring will be Rubaroc flooring, the most comfortable golf surface ever walked on. David Golf has been appointed official distributor for E-Z-GO and will feature the new ST350 Utility Vehicle. The ST350 is a breed apart from other utility vehicles with its heavy duty suspension and rack and pinion steering providing comfort and better handling in the roughest terrain. Our representatives Australia Wide will be on hand and willing to discuss any of your golf course or golf driving range requirements. Looking forward to seeing you at the David Golf stand during the Millennium Conference.

Booth #32 DRAKE EXTRUSION

Loksand™ is made by Drake Extrusion Ltd., the world leader in rootzone stabilization system. The unique, crimped profile of Loksand fibre will bring back the bounce and give lasting load bearing durability to high wear areas of turf and sand surfaces. Typical sites benefiting from Loksand™ performance are football pitches i.e. Auckland City Council, Preston North End in UK, Jade Stdm and Carisbrook Stdm in NZ, Shark Park in NSW, ANZ Stdm in Brisbane. Equestrian Surfaces: Loksand™ creates a perfect all-weather equestrian surfaces and has been widely used for dressage areas and road-crossings at racecourses. For general landscaping,

Loksand™ is equally in demand for load bearing "green-roads" for emergency and service vehicle access and as a reinforcing agent to prevent damage to verges and roundabouts. Check us out and test our Loksand plots on Stand 32.

Booth #33 DINT AUSTRALIA

DINT Australia is expanding rapidly throughout Australia, most recently in Victoria where we now have a warehouse and Sales Representative. We are the foremost Golf Course Equipment supplier and manufacturer and we are always looking for and designing new, improved products. Our products are made only from the finest Australian made materials. We have many products ranging from putting cups to park benches and signage. The DINT name is well respected in the golfing industry and over future years more and more products will be available with the DINT name and a common philosophy will prevail. Our products will remain Australian Made, top quality and fairly priced. DINT Australia, the One Stop Shop ... Keeping

Your Course In Play. Visit our website at www.dint.com.au.

Booth #18+19 ECOGROW AUSTRALIA

Ecogrow will be exhibiting its Ground breaking Bio control technology for Insect pests of turf....a world first and an Australian Success story. This environmentally friendly technology using Entomo Pathogenic (Insect Killing) Nematodes has been researched and developed by the CSIRO here in Australia and is being commercialised by Ecogrow Australia Pty Limited a wholly owned Australian company. Featuring our World Best "African Black Beetle control" our ground breaking Argentine Stem Weevil control with a 95% control achieved in two weeks as well as our excellent Billbug and Argentine Scarab and Lepidoptera controls. Following on from our fully replicated trial work for Black beetle and Billbug last year we have conducted test applications across Australia, which achieved results consistent with the replicated trial data. This is now a fully proven technology. The Stem weevil

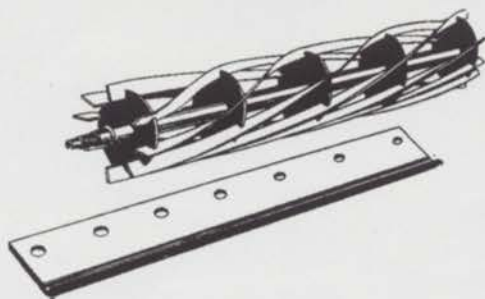
replicated trials conducted in association with Phil Ford and the VGA were concluded in April this year. After an exhaustive search for a trial site with sufficient populations to verify earlier successful trial work, we now have full trial data on a site with high insect pest activity. The results of these will be on display. Our products are now fully commercial and we are taking orders for commercial quantities for next season. Our turf consultants David Nickson and David Westall will be available on the stand for the duration of the show and anyone wishing to reserve time with either of them should contact them at the office (02) 9389 0888. We will have product for all to see under a microscope. We hope to announce a major R&D initiative at the show as well as some commercial changes aimed to make our products and technology more widely available to the Australian market.

Booth # 61 GLOBE AUSTRALIA

Globe Australia P/L are a major supplier of pesticides, fertilisers, turf seed, application equipment, protective clothing

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High Quality Bottom Blades and Cutting Cylinders
To Suit most popular makes and models



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and golf course accessories to the recreational turf market.

This year, Globe have made a major commitment to the AGCS Conference and will have a significant presence (booth 61) at the trade show. The booth will focus on Globe's major trading partners and their various product ranges including:

PESTICIDES

▶ Aventis (Chipco & Bayer) ▶ Barmac ▶ Colin Campbell ▶ Crop Care (ICI) ▶ Monsanto ▶ Nufarm

FERTILISERS

▶ Barmac ▶ Debco ▶ Dynamic Lifter ▶ Incitec ▶ Patons ▶ Scotts ▶ Yates

SEED

▶ Turf Seed Inc. ▶ Tee-2-Green ▶ Pyne Gould ▶ Guinness ▶ Scotts ▶ Wrightsons

TOOLS

▶ ARS ▶ Better Methods

PROTECTION

▶ Breathalon ▶ Peltor ▶ Sundstrom

APPLICATION

▶ Chapin ▶ Draxit ▶ Prizelawn ▶ Scotts ▶ Silvan

GOLF COURSE ACCESSORIES

▶ DGE ▶ Par Aide ▶ Standard Golf

Globe will launch a variety of new and exciting products at this show including Ever White Putting Cups, Unbreakable Plastic Chain, Scotts Combination product with Ronstar, the Barmac Autofert liquid fertiliser range, an exciting range of soil wetting agents and more.

Globe have had a year of solid growth, particularly in Western Australia where Danny Hambelton joined the group. In Wagga Wagga, Garry Clark has recently become a full time representative and in Sydney, Roy Spinks has joined the ranks to add a focus to the turf farm market. The growth has led to some internal promotions with Andrew Knox becoming General Manager and Alan Shields, State Sales Manager for NSW

Booth #49 GOLF AND BOWLING MACHINERY

Golf and Bowling Machinery has commenced the new millennium with an exciting range of new equipment. We are now the Australian distributor of Steiner Quick Hitch, the revolutionary quick hitch attachments allow the use of a single prime mover for many

applications. We offer a flexible finance plan T.A.P. and tailored to suit many needs.

Our remanufactured equipment offers new machine benefits for a fraction of new machine prices. Look forward to seeing you at our exhibit.

Booth #17 GOLF & SPORTS TURF AUSTRALIA

Golf & Sports Turf Australia is committed to meeting the needs of turf practitioners, supers and greenkeepers by bringing them the best and most up to date technical information possible. Comprised of high calibre articles contributed by leading technical writers in their fields, including the writers at Sports Turf consultants, editorial also contains current news, views and reports from around the world. Added to this is TURFAX, the eight-page newsletter written and produced by the 'guru' of turf, Dr James Beard. Golf & Sports Turf Australia is a proud supporter of the TurfGrass Association of Australia. Joining the TGAA entitles members to receive our publication free of charge. Visit our stand to see demonstrations and FREE diagnosis of turf diseases - **BRING YOUR SAMPLES.**

FREE TURFAX samples. FREE web page linked to the Golf & Sports Turf site for all new and existing subscribers who visit the stand. Golf & Sports Turf Australia is audited twice a year by the Circulation Audit Board (CAB), a completely independent body, ensuring that circulation figures quoted are 100% correct.

Booth # 38D GRADEN TURF MACHINERY

The Graden range of Scarifiers (Verticutters) are becoming known all over the world for their strength, speed, simplicity and quality of cut. On display will be the GS04 Scarifier; a self-propelled walk-behind unit excellent for de-thatching and aerating golf greens and tees, bowling greens, playing fields, tennis courts, in fact any turf area in need of rejuvenation. Also on display is the Graden Swing-Wing Scarifier, a PTO driven tractor-mounted machine with a 1.5m operating width designed for large area scarifying. It is ideal for golf fairways with its semi-articulated cutting heads allowing it to contour to the undulations of a fairway rather than skimming over or scalping your valuable turf. The aggressive and yet very precise cutting quality

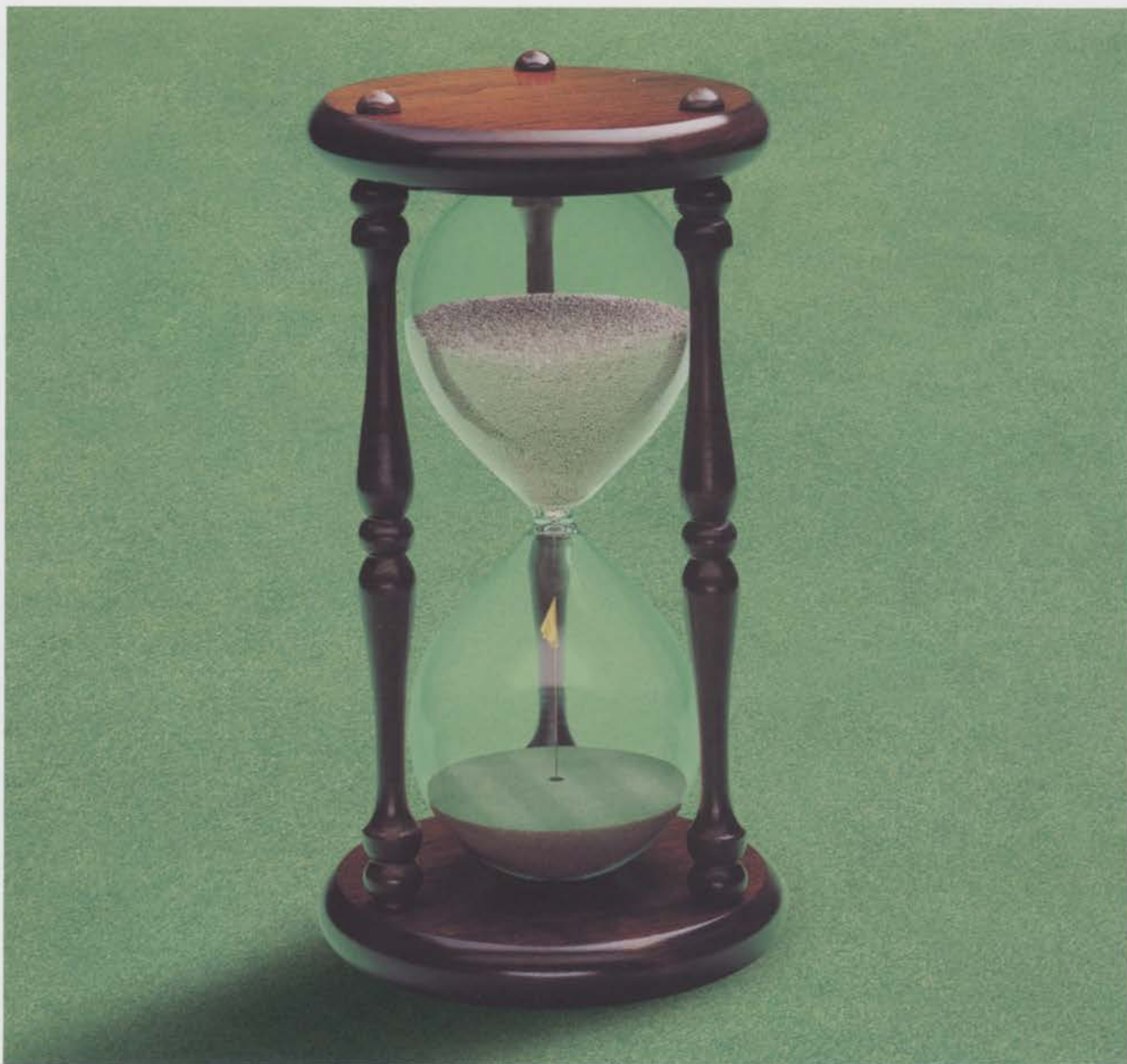
of our machines pulls out a mountain of thatch but leaves a clean line with minimal disturbance, allowing you to get back on your playing surface quicker. So visit our stand and see for yourself why Graden scarifiers are the hottest equipment in the golf industry today. Contact Details: Graden Turf Machinery, PO Box 29, Somerton VIC 3062, Phone: (03) 9305 3400 Facsimile: (03) 9305 3995 Email: graden@net2000.com.au

Booth # 42 (TOP SECTION) GREENCARE INDUSTRIES PTY. LTD.

As we embrace a new Millennium, Greencare Industries strives to deliver the ultimate products for the Turf Aeration Industry. Committed to specialising in this field, Greencare has delivered world-renowned names such as the CoreMaster *12, CoreMaster *6 ECO and ShatterMaster series for almost two decades. This Millennium will see Greencare continuing to develop products pushing technological boundaries within the industry. With the Greencare Research and Development team one hundred and fifty percent committed to you and your aeration needs, it is not surprising that Greencare will be leading the new frontier in turf aeration. So for more information about Greencare's latest product developments and our existing proven range visit our display at booth #42.

Field Services

Established since 1981, Greencare Field Services has demonstrated its ability to provide high quality Care and Renovation Services to the Turf Industry. Whether a Golf Course, Bowling Club, Tennis Club, Sports Field, Racing Track, Park, Private Business or Residence, we are aware that our performance is critical to you and your organisation. Holding the title of Australia's largest and most renowned turf renovation specialists our reputation for always delivering the highest quality and utmost professionalism supersedes us. Greencare Field Services is committed to continuously expanding its range of equipment and services available to meet with your requirements. Many of the machines in our range are exclusively designed and purpose-built by Greencare. Enabling all Greencare Field Services Representatives access to immediate back-up service and assistance on the job. Greencare's current services include: Core Aeration using hollow or solid tines of up to 6" (150mm) deep; Deep



TIMING IS EVERYTHING

There are two problems with most commercially available turf fertilisers. Either they provide fast initial response with poor residual feeding, or they provide long residual feeding with poor initial response. That's why it's time to change to Contec, the new range of Scotts slow release, synthetic-organic fertilisers that provide you with the best of both worlds: fast initial response, and a lasting supply of nitrogen as well as other essential elements for continuous and healthy growth. To further meet your needs, Scotts Contec slow release fertilisers come in a range of formulae that feed for 6 to 12 weeks.

Scotts.
Contec™
SLOW RELEASE FERTILISER

FOR MORE INFORMATION, CONTACT YOUR SCOTT'S DISTRIBUTOR OR SCOTT'S AUSTRALIA ON 1800 789 338

Tine Aeration using hollow or solid tines to depths up to 16" (400mm); Deep Slice Shatter Aeration using blades to depths up to 12" (300mm); Deep Drilling using augers to depths up to 14" (350mm); Scarifying (sweeping available); Turf Cutting; Shaving (bobcat clean-up and tipping facilities available); Top Dressing (bobcat loading facilities available); Bobcat work (general); Fertilizer and Chemical application; Gassing; Laser Levelling; Turf (application of new) and Complete or Custom Renovations. Just come and visit Chris and the boys on booth #42 for more information and bookings.

Booth # 67 GREENGROUP

GreenGroup is a company like no other within the Australian Turf Industry. Founded on the principles of Environmental Sustainability, GreenGroup seeks to develop responsible environmental management of turf without compromising quality. Unlike other mainstream turf supply companies that have "token environmental policy". Green Group does not sell chemicals and is not distracted with menial products designed to improve sales. Dedicated to Research and Development our products are readily accepted throughout Australia and abroad because of their proven results. Come visit our stand for more information on; Wastewater Treatment, Biological Control, Organic amendments, Environmental Fertilisers, Chemical Storage Facilities. Come and meet Dr John Hunt and find out why Trichoderma is sweeping Australia by storm, you won't be disappointed.

Booth #15 THE GREEN HORTICULTURAL GROUP

The Green Horticultural core business directive is to offer a "Complete Sportsfield Solution". Specialising in the construction, reconstruction, maintenance and renovation through to the programming and managing of all turf amenities. Equipment such as cylinder mowers, large rollamowers, the new model Vertidrain, scarifying and vacuum units allow The Green Horticultural Group to undertake specialist turf maintenance. The Green Horticultural Group offer other products and services which cover Golf courses, Council turf amenities,

Racecourses, waste depots, mining sites and development sites such as environment services, landscaping and horticultural contracting.

The Green Horticultural Group also offer specialised spreading Services which has the latest technology in spreading equipment. The spreading vehicle is fully computerised with balloon floatation tyres for minimal ground pressure. A wide range of materials can be spread including soils, fertilizers, mulches and powdered soil ameliorants.

All products are undertaken with strict quality control measures which ensures the works will be carried out to specification the first time and on time.

Booth 38B GREENMAW

Greenmaw was formed in 1975 to undertake the specialist work of golf course construction. Greenmaw has since developed into a leading construction and maintenance company, building courses in Australia, Thailand, Malaysia, Indonesia and at the home of golf, St. Andrews Scotland. At this years Millennium Turfgrass Conference and Golf Exhibition Greenmaw will be exhibiting its photo library of recent construction and maintenance projects. Photos of the National Golf Club's Links Development and the Moonah Links Development will form an interesting part of the display. The National Golf Clubs Links Development, comprising of two courses, one designed by Greg Norman Golf and the other by Thomson, Wolveridge & Perrett, are currently in post construction by Greenmaw. The Moonah Links Development, currently under construction by Greenmaw, will be the home of the AGU and the AIS golf program.

Greenmaw will take this opportunity to highlight its environmental services for the turf and agricultural industries. Ranging from bioremediation to environmental audits, Greenmaw can assist clubs and agriculturists in responsible management their environment. Qualified staff will be on hand at the exhibition to provide information about Greenmaw's wide range of services and products.

Booth #29 HAIFA CHEMICALS LIMITED

Haifa Chemicals have released the **GREENPOWER** range of fertilizers to ease the challenge facing Course Superintendents, groundsman and contractors. Preparing a

quality, health playing surface with excellent durability is no easy task. The **GREENPOWER** range does all that and more. **Multigreen** (For better feeding), all the essential nutrients for 4 months of feeding, in formulations for year round balanced nutrition. Controlled release Nitrogen and Potassium, with Potassium in form of Potassium Nitrate - mini or granular. **Polyfeed** (For prompt response), with more "spoon feeding" being practiced, the completely water soluble NPK plus micro-nutrient formulations of **POLYFEED** are an added supplement or alternative to Controlled Release products and can be applied through irrigation systems or as a foliar spray. **Multi-K** (For tougher foliage and better roots), Potassium Nitrate enhances turf wear, disease resistance and frost damage. Multi-K is available in prills and mini-prills and is sulphate free, another advantage in your fight against "blacklayer". The range is now available in Australia. **Call and visit with the Haifa Chemicals and Multifert team on Stand No. 29 at the Millennium Turfgrass Conference and Exhibition and join the QUALITY REVOLUTION.**

Booth #62 HARDI TURF

Hardi Spraying Equipment is the world's leading manufacturer of sprayers and spraying equipment, with over forty years of research and development. Hardi's focus is on the need for quality products, which ensure efficient, timely and precise plant protection. With branches and factories in every state of Australia, Hardi offers a comprehensive range of truckster and tractor-mounted sprayers with standard features to do the job precisely and economically, plus a huge array of options to make tasks easier. From small wheelbarrows with handguns to the ultimate turf sprayer - the truckster-mounted **Hardi Turf Eagle** - with triplet nozzles, electric controls, foam markers and Pilot computer controller, Hardi is the leader in modern spray technology. Hardi Spraying Equipment is the Australian distributor for **Windfoil**, patented sprayers which virtually eliminate spray drift. Available in sizes from the push-along 1 metre wide model to 6 metre tractor-mounted units, the Windfoil gives curators great flexibility in their spray programmes. Drift studies have confirmed that off-target deposits are kept to less than 0.5% even as wind speed increases. The drift control of the shroud/aerofoil/curtain combination makes it practical to spray in the

wind, reducing the uncertainty of day-to-day management on the course, at the same time increasing safety. Because of the importance of minimising downtime for turf curators, should a breakdown occur, a wide range of Hardi parts and components are kept in stock at each of the state factories at all times.

Booth # 64 H.G. TURF PTY LTD

HG Turf is an Australian owned family company specialising in the production and marketing of turf sod and turf seed. The company produces and supplies both warm season (couch) and cool season grasses to the sports industry and domestic markets. The company is also involved in the construction and installation of Stadium turf fields. This development has led to the successful collaboration of HG Turf and The Motz Group in Australia and New Zealand. The Group has recently been awarded the following Stadium contracts:

- Gabba Field Reconstruction - 20,000 sqm March 2000
- MCG Soccer Pitch Installation - 8,400 sqm

September 2000

- Stadium Australia Athletic Field and
- Soccer Pitch Installation - 8,000 sqm September 2000

The above installations incorporate the world renowned Motz Stabilised Playing Surface. The unique design combines a tufted mat and natural grass to provide superior playability, toughness and transportability. The product is harvested in 1m wide x 10m long big rolls, each weighing 750kgs. Critically, upon installation the Motz Turf is immediately playable and may be rotated in the field like carpet tiles.

The Group is also involved in field reconstruction and installs the High Performance Gravity (HPG) Field Drainage System and the Prescription Athletic Turf (PAT) Field Drainage System. Contact: Mr Hamish Sutherland, Managing Director, HG Turf Pty Ltd, Phone 61-3-5773 4372.

Booth #16 HOLMESGLEN INSTITUTE OF TAFE

Holmesglen Institute of TAFE will be

promoting a number of Horticultural Training Programs which can be delivered at our Waverley Campus or on-site. These programs range from Certificate II in Horticulture (pre apprenticeship), Certificate III in Horticulture (new apprenticeship) covering landscape, parks and gardens, Turf Management and Nursery, to Certificate IV in Horticulture (Parks and Gardens and Turf Management), Diploma in Horticulture (Parks and Gardens, Turf Management). We will also be promoting a range of consultancy services which include: urban irrigation, landscaping, clay paver laying, garden design marketing, tree care and surgery, use of chemicals, retail nursery, general horticulture, interior plantscaping, turf management.

Booth #56 HORTEX AUSTRALIA PTY. LTD.

Hortex is a leading Marketer and Supplier of water management, plant nutrition and plant protection products to the horticultural, and Turf industry. Unique products such as RainSaver, MoisturAid, Sprayfast, Seasol, Earthcare 2000 and Earthcare CLC are



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532 CORNWALLS ROAD, WINDSOR

quickly establishing a reputation as credible, value for money products that work. Stocked by Leading Distributors in each state, ensures the products are always only a phone call away. At the conference be sure to look them up on stand 18. General Manager, Rob Reynolds, National Sales Manager, Peter Quessy and Qld. State Manager, Rick Keene are looking forward to meeting you. While you're there, be sure to check out some of their exciting products like RainSaver, the world's best super absorbent slow release water crystal which greatly improves plant growth, health and survival. MoisturAid, the ultimate, easy to use, cost effective granular wetting agent. SprayFast, a unique spray adjuvant that improves the performance of almost all foliar applied chemicals, Seasol, Earthcare 2000 and Earthcare CLC organic liquids based on seaweed, that are so much more than fertilisers. Dynamic in their action, they stimulate plants on a hormonal level and enhance the chemical, structural and biological nature of the soil.

Booth # 1 and 2 HUNTER GOLF

For nearly two decades, seeing the Hunter name on irrigation products has meant a sign of unsurpassed performance and professionalism. As the world's leading producer of gear driven sprinklers, Hunter Industries has become the favoured name for irrigation systems...from residential to commercial properties to famous sports fields and leading golf courses. As the 21st Century begins, Hunter has dedicated itself to the golf course irrigation market, with a commitment of company resources aimed at making Hunter golf the standard by which all other companies will be measured. After all it is what you'd expect for a leader. It's what you'd expect from Hunter. Visit our stand and witness first hand the comprehensive range of Hunter Golf Central Controls, Satellites, Rotors and Valves. Ask about true Two-Way Communications, Two-Way Radio, Data Retrieval and more. In the commercial range, come and see our new range of Controllers including the ICC which features a remote control option, the 1-60 rotors with Precision Distribution Control, ICV and PGV Valves, as well as our other industry benchmark products. As a proud sponsor of the Millennium Turfgrass Conference & Exhibition, Hunter Industries invites you to come and see what's new from "The Irrigation Innovators" at Stands 1 and 2.

Booth #58 J F B CUSTOM GOLF PRODUCTS AUSTRALIA

- ▶ FLAGPOLES ▶ FLAGS ▶ TEE MARKERS
- ▶ BALLWASHERS ▶ LITTER BINS
- ▶ BOOTCLEANERS ▶ CUPS ▶ SIGNAGE
- ▶ AND A WIDE RANGE OF COURSE MAINTENANCE TOOLS

Free catalogue available at stand.

J F B has been operating since 1986 and is fully Australian owned and operated. We supply many Golf Courses within Australia and New Zealand with quality products at realistic prices both direct and via Distributors.

New products to be released at the 2000 Conference.

Our **HEXAGON TURF PLUGGER** is foot operated and cuts to a depth of 80mm. The cut is hexagon shaped and allows no gaps or overlays between each plug. (Very simple to use).

GOLF COURSE EMERGENCY INTERCOM A solar powered unit: "No wires": two way simple to use communication: minimum maintenance: provides safety for club members and visitors. Economically priced. *There will be a working unit on display at the Show.*

ADJUSTABLE SPRINKLER HEAD

TRIMMER... will fit any brushcutter head. Will not damage sprinkler head. Adjustment to size required is a simple, fast procedure.

Booth # 76 J. H. Williams & Sons

J. H. Williams & Sons, Murwillumbah, NSW will be featuring their exclusive turf seed product line from Pennington Seed, Inc. / Seeds West, Inc., U.S.A. The turf seed product line includes advanced turf-type Bermuda couch varieties from seed, 'Sydney' and 'Mohawk', the first fine textured hybrid Bermuda couch from seed, 'Princess', the leading turf-type tall fescue in U.S. NTEP trials, 'Plantation' and 'Sonata', the dark green, fine leaf perennial ryegrass. These high performing varieties were especially selected for distribution in Australia and New Zealand for their exceptional turfgrass qualities and outstanding attributes such as dark green colour, wear tolerance and surface playability. They are recommended for new turf and turf renovations such as sports fields, polo fields, racetracks, golf courses, parks, schools, premium home lawns and commercial applications. Mr. Ben Coombe, agronomist and

turf and agricultural seed sales representative from J. H. Williams and Miss Brenda Dossey, agronomist and Vice President of Sales from Pennington Seed, Inc. / Seeds West, Inc., U.S.A. will be on hand to answer your questions about their products and discuss the needs of your future turf plantings. In addition to the turf seed products, J. H. Williams will also display information about their full range of specialty temperate, tropical and sub-tropical grasses and legumes, mixes and custom blends for erosion control and revegetation.

Booth # 41 JOHN DEERE

John Deere Gold & Turf is proud to be associated with the Millennium Turfgrass Conference. The majority of the John Deere Golf and Turf range, as well as a sample of our other lawn care equipment will be available for you to inspect. Brand new, never before seen products will be on display including the soon-to-be-released Electric Gator utility vehicle, and the ProGator heavy duty utility vehicle with its optional sprayer and top dresser attachments. Also on display will be our new B Series Fairway Mowers including a new 10 blade option on the cutting units, the TC125 debris collection unit, both diesel and petrol versions of the 2500 Tri-Plex Greens Mower, and the 2653A surrounds mower. Other new products on the John Deere stand include the WAFM 1620 wide area flex mower, a 51 HP unit which comes with a contour following 96" Lastec deck, the F1145 outfront mower equipped with a 72" Lastec articulated deck to avoid scalping, and the new mid-mount Z-Trak zero turning-radius mower. Have a look at some of the John Deere children's toys, and the John Deere Golf range of clothing, and find out more about TPC at Deere Run built for the John Deere Classic, (Illinois, USA) or ask a John Deere Credit Representative about the benefits of our Master Lease programme or just how flexible all of our finance packages can be. Speak to your local John Deere Golf and turf dealer sales person, a company representative, or a representative from Turf Care, John Deere Golf and turf headquarters, in Raleigh, North Carolina, and help yourself to brochures detailing all of the John Deere product. We look forward to seeing you there.

Booth # 77 K & B ADAMS

K & B Adams Turf will have on display our complete range of Turf Products - Fertilizers,

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Please call in and see us at **Booth 43**

Millennium Turfgrass Conference & Trade Exhibition

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9 & 11hp Pedestrian Scarifiers



30" Bowling Green Mower



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Call in and see us at our booth for personal and friendly advice about your machinery requirements and register with us for future product releases



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Fungicides, Insecticides, Wetting Agents, Turf Seeds and Accessories. We will have information and brochures on our range of Lange-Slow Release Fertilizers, EZI Wet Granulated Wetting Agent and Blazon Spray Pattern Indicator. Our staff will be present at our stand for any additional information that may be required.

Booth #71 KURANDA MANUFACTURING

We will be displaying two of our smaller Super Soppers: the 'Sandpiper' and the 'Minnow'. There will be a working demonstration of the Minnow, showing its superior ability to pick up and remove water from playing surfaces. The Sandpiper, our most popular model world-wide, will be on static display. Also a video will be playing continuously to demonstrate the Whale Super Sopper in action, as used around the world at leading cricket stadiums and football grounds. Brochures will be available for distribution. Skilled and friendly sales staff will be available for the entire exhibition to answer any technical questions. Complimentary caps will be included in items for distribution.

Booth # 88 MANOEUVRE MOW

Presenting to the golf course and sports turf industry machinery with the capability to "RECYCLE and RENOVATE" in the one pass a truly revolutionary concept. Manoeuvre Mow Pty Ltd a specialist sports field construction and maintenance equipment supply company of 40yrs experience is proud to introduce the brain child of Ko Rodenburg.

Ko (hence the name "KORO") is the hands on parks superintendent for Rotterdam Municipality in The Netherlands creator of this highly economical environmentally friendly sports field renovation/maintenance system. "THE RECYCLING DRESSER" (3 models). These machines harvest topsoil from within the profile recycling it as top dressing whilst fracturing the profile to a depth of up to 200mm. Major costly soil purchases are slashed with positive progress towards eliminating profile layering problems. The 225 Contractor model at maximum cut is capable of harvesting and re-using 63m³ per h/a = a 6mm top-dressing. Shaving or "Fraising" as it is known in Holland is carried out at the end of the football playing season. Its purpose is to remove superfluous ruts and remove up to 90% of the shallower rooted Poa annua ready

for spring field rejuvenation. This is where the Recycling Dresser is implemented in preparation for re-grassing. This machine is an excellent tool for sod removal up to 50mm deep to prepare for re-turfing, stolen harvesting, shaving for spring removal of Ryegrass in Couch and Kikuyu, and general dethatching.

MANOEUVRE MOW and KORO saves money, environmentally friendly its practical and it works.

Booth #38 (c) M.E.Y. EQUIPMENT

M.E.Y. Equipment is a WA company that manufactures and services commercial turf machinery, with a focus on reliability and quality workmanship. **MOWERS** - self-propelled walk behind cylinder mowers from 20" to 36" cutting width, including specialist models for cricket wickets, tennis courts, golf greens and bowling green surrounds.

VERTIMOWERS - self-propelled with twin clutch and catcher. **STOLON PLANTER** - self-propelled stolon planters for new lawn propagation and repair. **EDGERS** - robust lawn edgers for lawns, verges, paths, paving, golf bunkers etc. **CYLINDERS & BOTTOM BLADES**

- manufactured from the best quality Sheffield steel for all brands of mowers - we make to your sample and requirements. **NEW PRODUCTS** - Infra Red Weedeaters which

produce temperatures in excess of 1000° C. These can treat localised specific weed problems in quality turf surfaces to the chemical free control of paths and paved areas.

Wheelie Vacuums for clean up litter problems from cans and bottles to hot dogs! Low cost, labour saving solution to the inevitable litter problems associated with major sporting events.

Booth #63 MILLIKEN CHEMICALS

Milliken Turf Products is a leading supplier of specialty products for turfgrass management. Since 1981, we have offered solutions to the key problems facing turfgrass managers. From BlazonR Spray Pattern Indicator, our non-staining colorant for accurate spray applications, to InvigorateTM Soil Conditioner, a liquid polymer system for drainage improvements, Milliken Turf Products has developed a targeted offering. We have focused on bringing to market those product solutions that will improve the quality and performance of turf. The addition of the

Emerald Isle line of products for Soil, Stress, Thatch and Nutrition Management, the addition of PSA Plus, as well as the opportunity to distribute the Green Releaf from Sybron line of Microbial Solutions brings us ever closer to complete alignment with turfgrass management needs. Our product / application focus areas are as follows:

Bioremediation: Microbial and enzyme based products for dealing with difficult management problems such as thatch and aquatic algae.

BioStimulant: These products provide growth enhancement over and above standard NPK nutrient inputs - Non-nutritional growth enhancers.

Emerald Isle Nutri-Rational Foliars: Our newest line of products designed to deliver major and minor nutrients to the plant when root uptake is compromised.

Foliar Nutrition: The entire class of materials we offer that enter the turf plant through the leaves rather than through the roots.

Green Releaf Specific Microbial Solutions: Working with Sybron, we now offer the entire range of Green-Releaf.

Soil Conditioners and Soil Amendments

Spray Pattern Indicators

Booth # 30 MULTI-CORE

MULTI-CORE® has recently added the world renowned **York Rakes and Brooms** to its range and entered into an exclusive agreement with York Modern Corporation in the USA.

The extensive range of York Rakes has a model to match the horsepower and hitching requirements of your tow vehicle. Ranging from 1.2 metre to 3 metre width units York Rakes can be used for general clean up, landscaping around greens, green surrounds and tees, as well as construction work. They break up and mulch soil, grade and level, fill in low spots, spread topsoil quickly and evenly and distribute crushed stone and gravel. **The York Broom Range** includes pedestrian, tractor-mounted and front loader units and are ideal for general clean up, core clean up, leaf removal and de-thatching. Any additional modifications to the **York Range**, such as special hydraulic adaptation, are being carried out locally by Multi-Core. **MULTI-CORE®** will display the pedestrian **Multi-Core Greenkeeper** (new & re-conditioned models). Special show

offer on manufacturers re-condition service, and rental. Also a full range of tyres to suit most aerators, and backlappers for mower reels.

Booth # 53 OASIS TURF

Oasis Turf is now recognised as the leading supplier of fertilisers in Australia. Our range includes Growth Products slow release liquids, organic chelated micronutrients, soil amendments and biological inoculates. Oasis Turf also has national distribution of the ROOTS range of products, which includes 123 Premix, Stand Up, and NoBurn organic wetting agent. These products together with the Scotts range, which Oasis Turf is a distributor for, gives Superintendents the best choice of nutritional packages to choose from. Oasis Turf will also be displaying the Drencher Gun, 123 Premix, and NoBurn pellets, which has been an innovation that turf managers have quickly accepted. The manufacturers will be on our booth at the show, to explain further the innovations and technologies that Oasis Turf brings to our industry.

Booth #7 ORGANIC CROP PROTECTANTS PTY LTD

Beneficial Fungi and Bacteria Products. New and exciting organic sand/topdressing amendments. **SAND-AID** and **FUMAFERT**. Turf Plant Biostimulants including Amenoground Acordian SSE. The world's first Soil Humectant, Hydretain Turf. The tried and proven performer in spray adjuvants Synentra Oil plus our new formulation Synentra Horti Oil.

Booth # 25LHS ORIGIN ENERGY Atarus Ranger

- An open flame weed control device which incorporates the following features and innovations:
- An environmentally responsible time and cost saving tool for the control of weeds in all turf and outdoor parkland applications.
- An ideal tool for use on bunkers faces and edges, eliminates unsightly chemical indicator dyes on bunker sand, allows harder and cleaner edge definition, eliminates weed chipping and minimises erosion potential.

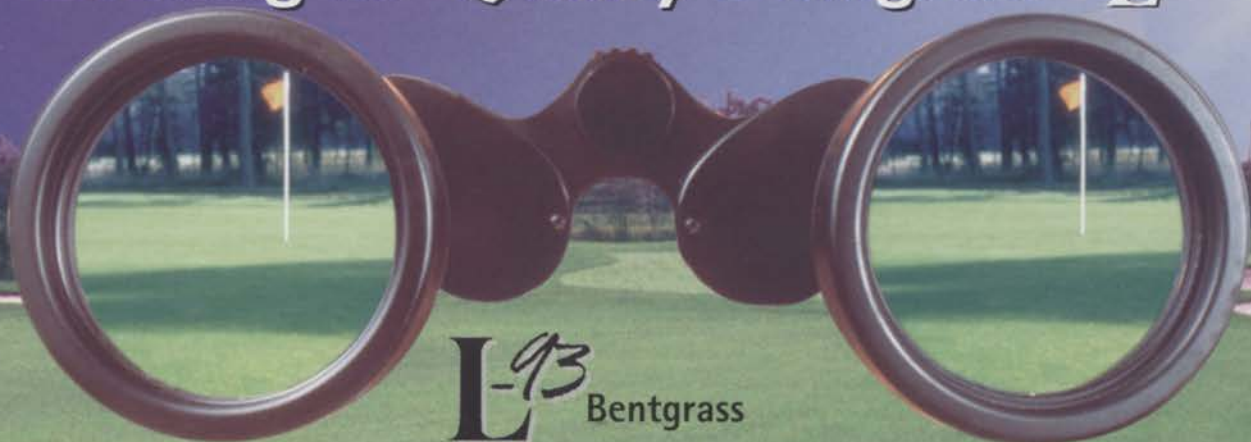
- Great around drainage pits/outlets and reduces staff exposure to venomous spiders.

Features

- 3kg lightweight aluminium gas cylinder giving up to 45 minutes usage.
- Patented system to ensure use of all available fuel without loss of performance.
- Broad flame pattern with separate finger touch booster flame control for stubborn and woody weeds.
- Unit is balanced by the cylinder being opposite the burner head and comes complete with shoulder harness for ease in extended use.

Atarus Stinger V640 is the latest in thermal weed control for use with all terrain vehicles and is configured for use on fence lines. The unit utilises the patented Water Quenched Combustion technology using special burners to generate steam, combines the steam with the hot gases and air to give the best possible medium for speed of application and lowest fire potential.

Looking for Quality Bentgrass - L⁹³



L⁹³ Bentgrass

- Number 1 for overall turf performance in the recent USA NTEP trials
- Reduces fungicide applications due to its exceptional disease resistance
 - Aggressive establishment to combat Poa invasion
- Dense, fine textured leaf, however not prone to excessive thatch

L⁹³
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email: michael@heritageseeds.com.au

Booth #73 PARKLANDS TRADING

Parklands Trading Company Pty Ltd, family run and owned company, are proud of the distinction of having been judged one of the top 500 private companies in NSW for the past three years. Importers and distributors of powered Lawn and Garden products, Parklands distribute the multi-purpose Amazone Groundkeeper. This fits most tractors, and with unique "no-tool quick change" blades is capable of scarifying, mowing and vacuuming either separately or simultaneously. Having also enjoyed an association with Tanaka for over 30 years, Parklands have an impressive line-up of Brushcutters, Lawnedgers, Hedgetrimmers, Chainsaws, Extended reach Pruners and Hedgetrimmers, Portable Augers, Pumps, Engine Drills and Cutt-off Saws, built for both Homeowners and Professionals. Tanaka is tough and reliable.

Also distributed by Parklands...

the expansive range of Oleo-Mac products, including Chainsaws, Cutt-off saws, Pumps, Brushcutters, Hedgetrimmers, Portable Augers and MisterBlowers, offers alternatives not encompassed by the Tanaka range.

Oleo-Mac produce Europe's Best...

Rounding out machinery distributed by Parklands, is the fleet of manufacture's brand Ride-on and Walk-behind Mowers from Murray, the revolutionary style Chipper/Mulcher/Shredders, by Caravaggi.

Parklands Trading Company Pty Ltd., is exhibiting a product range from all the above manufactures at Stand 73.

Booth # 38A, LHS PARKREC PERSONNEL

PARKREC Personnel is a Labour Hire / Recruitment agency who can provide a personalised and professional service in the Park, Horticultural, Arboricultural, Nursery, Landscaping, Environmental Management and Turf Industries. PARKREC specialise in the supply of qualified and unqualified capable personnel for the temporary, casual and contract labour market. PARKREC has a comprehensive listing of people encompassing a wide range of skills and expertise from labourers through to team leaders/foreman and management. If you are in need of additional or replacement staff please give us a

call. Staff are employed by PARKREC and are covered for WorkCover and superannuation. Employees are paid award rates. Rates and testimonials can be supplied on request. Should you require any further information or wish to discuss your staffing needs please do not hesitate to let us know. The agency will provide you with personnel who will help you to maintain a high quality service to meet your needs and the challenges of today's competitive environment.

Booth # 38A LHS PAUL F. JONES & ASSOCIATES PTY. LTD.

Paul F. Jones & Associates Pty. Ltd., established in 1985 provides irrigation design and consulting services on an independent and freelance basis both in Australia and around the world. The Company is a members of the IAA, AGCSA, ASIC (American Society of Irrigation Consultants) and is also an official Landscape Irrigation Auditor. The services provided by the Company include System Design, Tender Documentation (including Layout, Control System, Pump Station Plans, Specifications and Installation Details), Tender Evaluation, System Staking, Supervision of Installation, Contract Administration, System Evaluation and System Audits. A New and Exciting service that the Company is launching at the Millennium Turf Conference is to provide Asset Mapping anywhere on the globe. This service makes use of GPS (Global Positioning Satellites) technology to prepare accurate documentation of Golf Courses, Sportsfields, Parks or any Asset or feature. Asset Mapping provides accurate locations of site features e.g. Irrigation System (As Built), Drainage, Plantings, Hardscapes, Furniture, Signs, Utility Services and any other equipment or feature.

A GIS (Geographical Information System) will link attributes to each Asset or Feature, providing detailed information into data banks and give the operator the ability to manage those assets by keeping historical records, transferring information or even producing work orders. Information can be provided in a variety of formats including colored hard copy plans, electronically in Autocad compatible files with all Feature Groups on separate layers.

Booth #50 PGG SEEDS

PGG Seeds have been serving the professional turf manager for 20 years. In this time a

number of cool season turf grass varieties have been introduced to the market which have been specifically bred to provide optimum performance in the unique temperate oceanic climate of south eastern Australia and New Zealand. A mild winter and a love of outdoor sports means that Australasian sporting facilities are required to perform year round. The advent of professional sport also increases the pressure on turf managers to provide facilities which assist players to 'show their best' every game. With 20 years experience in breeding specialist grass varieties for Australasian turf professionals PGG Seeds continue to lead the way in innovative cool season turf grass development. Meet with key PGG Seeds staff during the Conference on stand No. 50 and find out the latest breeding programmes and innovations from PGG Seeds Plant Breeder Dr Alan Stewart. Also take the opportunity to discuss the latest results from PGG Seeds extensive turfgrass evaluation programmes in Australia and New Zealand with PGG Seeds Turf Agronomist Ian McKendry.

PGG Seeds - Your short cut to proven turf solutions

Booth #79 PUMPMATE

Aeration Equipment for lakes, ponds, and dams to minimise the effects of algae and assist aquaculture. As well as a range of equipment to control iron and sulphate bacteria which affect the working of pumps and bores also a new chemical will be displayed which is used in the redevelopment of bores affected by the growth of iron and sulphate bacteria. It provides a form of short-term control of biofouling.

Booth # 47 RAIN BIRD

More than 60 years ago, Rain Bird was founded with a single purpose in mind — to transform the science of irrigation technology into a tool for effective water resource management. From this idea, a company with its superior irrigation products began a course of leadership that continues today. Rain Bird is now geared and ready for the new millennium and the challenges the 21st century will bring to irrigation - especially to Australian golf courses and recreation facilities. Today at Rain Bird, our sole commitment is to irrigation. As industry leaders we apply advanced technologies to better meet the irrigation needs of the golf world — and it shows. Visit the

Rain Bird stand at the Millennium Turfgrass Conference and view the latest in Central Irrigation Control technology, Cirrus, Nimbus II and Stratus II Eagle rotor enhancements and the new TG-25 rotor and Rain Bird swing joints. All Rain Bird products are designed and tested according to strict quality standards and backed by Rain Bird's worldwide network of distributors and Authorised Service Centres. At every step, Rain Bird focuses on the most efficient use possible of the planet's most valuable resource — WATER.

Booth #51 RAINMAN IRRIGATION CONTROL SYSTEMS

RAINMAN Greenkeeper is a flexible irrigation control system designed for the golf course industry. Our high quality irrigation controller is capable of operating in the harshest of environments and is designed and manufactured in Australia. We will be demonstrating how **RAINMAN** Greenkeeper offers **Control-in-One** by providing both an irrigation control and monitoring solution and an effective management tool that can be further customised to suit your course requirements. User-defined inputs can be incorporated into the system to monitor and record data such as pressure, flow, wind, temperature, moisture, rainfall, evapotranspiration (ET) and pump performance etc. Our demonstration will prove how easy programming **RAINMAN** controllers is and how changes can also be made from a centralised computer.

RAINMAN Project Information Sheets will be

available which will give a better understanding of how adaptable our controllers and control systems are to a variety of applications.

Booth #57, 65, 66 REDEXIM - CHARTERHOUSE

The first sit-on Verti-Drain model, reaching a depth of 150 mm's, is a fast and manoeuvrable machine and will first be introduced. This model completes the range of 13 Verti-Drain models including the world's deepest aerator (600 mm's - Verti-Drain 405.250) to the fastest (4.2 km/h - Verti-Drain Mustang). Various Verti-Drain models will be on display. An ingenious core-collector will be on display too, a device for collecting the cores without scalping the sensitive turf surface. The Verti-Seed overseeder injects seed or chemicals, with minimal disturbance to the surface while insuring over 90% of the seed to be injected in the ground. The Turf Tidy is a sweeper, scarifier and mower all in one robust machine. The sturdy walk behind Pedestrian Scarifier, which collects the debris in a catcher, is another "first" on the AGCSA Show. Contact person: Peter Ellis, tel. 0419310546

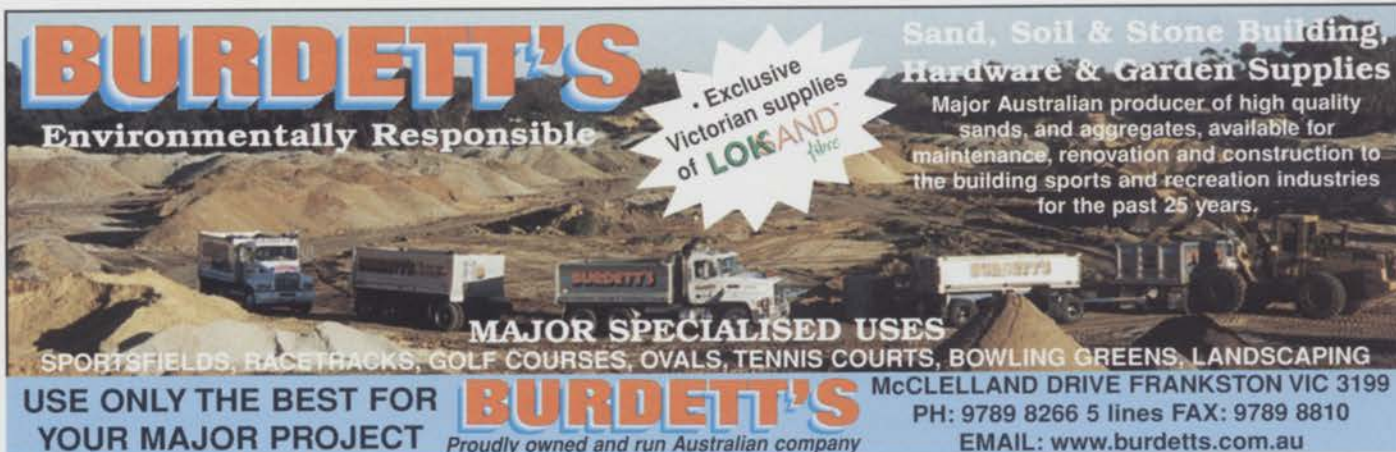
Booth #10 SCANOZ TRADING

Scanoz Trading is a major supplier to Victoria's booming Golf Industry. It is the authorised distributor of **Club Car** golf cars and transportation and utility vehicles

throughout the state and currently supplies vehicles to a number of major golf courses as well as commercial and industrial establishments. Used vehicles are also available as well as vehicles for short term hire. Scanoz also supplies quality innovative golf greens keeping equipment to many of Australia's leading golf courses. Scanoz manufactures its own range of products under the name Budline and works closely with local suppliers such as Custom Golf, Country Club International and Signet to supply products to many metropolitan and country courses. These products include flag sticks, flags, tee markers, bins, rakes, furniture, drinking fountains and course signage. **Councils** in particular are finding our furniture and recycled plastic drinking fountains to be extremely durable and aesthetically pleasing. Scanoz is also the recognised Victorian distributor for **Ace Scooters**, a division of Mobility Products P/L Australia, a company owned and operated by the Club Car Australia group. **Ace Scooters** provide electric convenience vehicles (scooters) to enable the elderly and disabled to continue their involvement in the community. For all your golf car and transportation requirements as well as greens keeping needs, Scanoz can provide the most up to date and exciting product range available in the marketplace today.

Booth # 39 SCOTTS AUSTRALIA

The Scotts Company is the world's leading producer of turf and horticultural fertiliser



BURDETT'S
Environmentally Responsible

Exclusive Victorian supplies of **LOKAND**

MAJOR SPECIALISED USES
SPORTSFIELDS, RACETRACKS, GOLF COURSES, OVALS, TENNIS COURTS, BOWLING GREENS, LANDSCAPING

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products offering over 500 different products including controlled release fertilisers, proprietary seed varieties, plant protection products, organic products and applicators throughout the world. Scotts Australia welcomes golf superintendents and turf managers to our stand. Discuss the latest development in the turfgrass industry with Australia's leading agronomic professionals and discover why over 5,000 of the world's top golf course superintendents rely on Scotts products. Since Scotts Australia introduced the Contec technology, largely replacing HD and Triaform technologies, the products have enjoyed great acceptance in the marketplace and a resulting increase in usage of methylene urea. Contec offers the best of both worlds! Contec slow release fertilisers provide fast initial response and a lasting supply of Nitrogen as well as other essential elements, ensuring continuous and healthy plant growth. Scotts combination technology has captured the imagination of the Australasian turf market. Scotts has added new products to their range of combination fertiliser and plant protection products, including fertiliser plus Ronstar. This complements Scotts existing product offer of fertiliser plus Pendimethalin, for broad-spectrum pre-emergent control of hard to kill weeds, and fertiliser plus Dicot Weed Control III for post-emergent control of dicot weeds. Scotts fertiliser with TGR (Turf Growth Regulator) is now proven to effectively restrict Poa annua, and Scotts have also released Turf Enhancer which tightens bentgrass putting greens as well as effectively reducing Poa seed heads without compromising the quality of putting surfaces. Visit us at our stand or call your local Scotts distributor for further information.

Booth #5+6 SILVAN PUMPS and SPRAYERS

Silvan is a specialist manufacturing company with world leading expertise in crop protection and related equipment. Established in 1962, Silvan is an Australian owned company specialising in the development of new improved spraying technology and equipment. Silvan manufactures a full range of equipment from small sprayers to suit ATV Bikes, all the way up to large tractor sprayers. Silvan will exhibit its "New Release" Turf Sprayers - designed specifically to meet the requirements

of the turf industry.

- Cushman Tray Sprayer featuring 400lt tank, electric fold boom, electric on/off spray controls chemical filling coupling, Honda Petrol Engine.
- 200lt x 2 Saddle Mount Tractor Sprayer with electric fold boom.
- All new 6mt/8mt wide spray boom, 12VDC operation fold with electric actuators, galvanised construction, stainless steel spraylines.
- Pressure Washer - 240V.
- Range of 12VDC sprayers
- Range of Accessories to suit turf market.

Silvan's range also includes finishing mowers, mulchers and fertilizer spreaders as well as an extensive range of spraying equipment.

Booth # 86 SEED INDUSTRY ASSOCIATION OF AUSTRALIA

The SIAA comprises nearly 200 corporate members covering all aspects of the seed industry. The aim of the SIAA is to be the peak Seed industry body. The SIAA Lawn and Turf Seed group was established in 1997 as a committee and comprises 15 SIAA corporate members, and almost all the major turf seed distributors in Australia. The SIAA and HRDC joined forces in 1998 to establish AUSTEP, the Australian Turfseed Evaluation Program for Perennial Ryegrass. In this trial, two trial sites were sown in Melbourne featuring 55 entries, replicated in a randomised block design with each plot being 1mx1.5m in size. To learn more about the Austep trials and the SIAA drop into booth #86 at the Millennium Turfgrass Conference.

Booth # 9 SIMPLOT TURF & HORTICULTURE

Simplot Turf and Horticulture is one of the largest producers and suppliers of commercial fertiliser and seed to the Turf and Horticulture Industries. On display in the booth will be samples, technical information on Simplot Turf and Horticulture's brands, BEST Professional Turf Products, APEX Professional Horticultural and Jacklin Seed. Simplot Turf and Horticulture offers top quality internationally recognized brands supported by technical expertise, a strong research and development program and professional distribution.

Booth #89 SOCIETY OF AUSTRALIAN GOLF COURSE ARCHITECTS

The Society was formed in 1989 by a group of Australian Golf Course Architects with the likeminded purpose of forming a society of fellow practitioners who would meet regularly to exchange ideas and experiences, encourage the highest standard of design and construction among its members, whilst further advancing the status of the profession. The Society has been active in promoting the benefits of golf to the environment and publishes an annual magazine on the topic of gold course design - "The Journal". Society members provide a full range of client services, with a special emphasis on the creation of course redevelopment master plans for existing golf clubs. Please call into our booth to have a friendly chat with our members.

Booth #13, 14 SPRAYGRO LIQUID FERTILIZERS

SPRAYGRO offers a full range of liquid chelated trace elements and liquid NPK blends. SPRAYGRO is at the forefront in liquid technology in all facets. New to our range are:

- COMPANION - a new patented liquid biological control alternative to chemical fungicides. Containing Bacillus Subtilis GBO3 a beneficial soil microorganism that quickly colonizes in the soil. It crowds out invading pathogens and produces a natural antibiotic as it grows. Extensive university testing in USA found that COMPANION reduces root and crown fungal diseases by 30% to 72% when used by itself and 96% when used in combination with a chemical at much reduced rates.
- NITRO 30 - liquid slow release nitrogen containing short and medium chained methylene nitrogen polymers. NITRO 30 contains more slow release (85%) nitrogen than any other liquid and providing 10-12 week release. NITRO 30 has the lowest salt index (0%), low biuret, no phytotoxicity, extremely low volatilization and resists leaching because it is tacky.
- REDUCER - is a pH acidifier which is suitable as a water treatment additive. REDUCER will lower pH and reduce the problems associated with water sources containing high levels of bicarbonate. REDUCER's organic chelating agent will release locked up trace elements. REDUCER

Soil Wetter will counteract dry spot.
Produced and manufactured in Australia.

Booth #46 StrathAyr International SportsTurf Team

The StrathAyr International SportsTurf Team is a strong exclusive group of turf producers currently represented by 18 licensees in 7 countries. The Australian team members are exhibiting together at the Millennium Conference:

- ▶ StrathAyr Turf Systems, Melbourne
- ▶ Jimboomba Turf Group, Brisbane
- ▶ Tropical Lawns, Mackay Turf Supplies
- ▶ Lowlands Lawn Turf, Sydney
- ▶ M Collins & Sons, Sydney
- ▶ Mackay Turf Supplies, Mackay

Together we solve turfgrass problems Australia wide.

The Team is demonstrating a number of innovative turfgrass products including:

- ▶ BAyr Root Turf – soil free turf
- ▶ Legend couchgrass – high performance couchgrass
- ▶ STAYturf – natural erosion control
- ▶ StrathAyr SquAyr – solid slabs of mature turf
- ▶ StrathAyr MegAyr Turf – fast, efficient turf replacement
- ▶ SmartMark – removable line marking systems
- ▶ StrathAyr System – natural allweather turf system
- ▶ StrathAyr Portable Pitch – for rapid changeover between sports

We look forward to meeting with you and discussing your turfgrass needs.

Booth #72 STATE UNIVERSITY INTERNSHIPS IN THE U.S.A.

Ohio State University in Columbus Ohio, USA in cooperation with The University of Melbourne, have been recruiting turfgrass trainees from Australia for twenty years. We will be attending the Millennium turfgrass conference (booth # 72) to advise and recruit potential turfgrass trainees who are single, have finished their four year apprenticeship or equivalent and who are between the ages of 19 to 28. Potential candidates must be drug free, have a clean driver's license and be willing to come up to the States for a minimum of one year. All expenses incurred will be recouped due to the fact that all internship positions are paid more than

THE SELF-PROPELLED VERTI-DRAIN® MODEL 7007

The self-propelled Verti-Drain 7007 penetrates the soil with its 150 mm long tines deeper than conventional aerators. This manoeuvrable and fast Verti-Drain can be equipped with both hollow coring tines and solid tines. Ground pressure is minimal.



Australian Consultant: Peter Ellis

Tel. 03-4552827 Mob. 0419-310546 Fax 03-4552573
 NSW : Verti-Drain NSW, West Ryde 02-98074377 Fax: 02-98095963
 VIC : Glenmac Sales and Service, Knorrfield 03-97638255 Fax: 03-97634367
 J.B. Scott, Geelong 03-52779366 Fax: 03-52786268
 QLD : G.L. Palm Equipment, Acacia Ridge 07-32777599 Fax: 07-38751575
 SA : Squiers Sales & Service, Summertown 08-83903017 Fax: 08-83903404
 WA : McIntosh & Son, Perth 08-94782400 Fax: 08-94791475
 TAS : Westco, Cambridge 03-62485304 Fax: 03-62485345
 Southern Turf Specialists, Huonville 03-62641448 Fax: 03-62643446



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minimum wage. We have an excellent choice of quality golf courses in both warm and cool season areas. Housing, meals and uniforms are provided in most cases. Assistance with visas and health insurance will be provided by the University. Opportunities to attend short courses/take classes at Ohio State are available to all who are qualified/interested during the internship. Excellent job opportunities have opened up for past trainees. Stop by and talk with Mike O'Keeffe and some of the past trainees at Booth # 72.

Booth #83

SUPATURF (AUST) PTY LTD

Supaturf will not only be displaying a variety of line marking machines, liquids and accessories for turf surfaces but launching two new products. All Supaturf marking machines have been updated to an easy and improved wiring system. Our machines vary in method and capacity providing the operator with an easy, lightweight and quick method of marking. Some of the accessories have also been updated and are designed to target specific needs according to the surface usage. All Supaturf liquids are environmentally safe and have a safety data sheet corresponding to each type of liquid available. Each liquid has a particular function and is easy to mix and is durable. Our services in the line-marking field have also expanded as we branch out into initial and re-marking for sports grounds.

Launching of 2 new products -

'THE GOLF MARKER' - for the GUR and cart markings on a golf course. This machine comes in two different sizes and there is the option of a mini boom spray accessory for fertilising and greening purposes on the golf course.

'ERASABLE LIQUID' - a fantastic, exciting new liquid designed purely to be erased from turf. This liquid recently labelled - 'smart mark' - can be transferred onto turf in any colour, and then be erased when required, either to allow the grass to breathe or for the re-mark of a different code from one day to the next on the multi-use grounds. We look forward to seeing you at the conference and showing you our latest model upgrades and new products.

Booth # 40 TEXTRON TURF CARE GROUP

The Textron Turf Care Group will again be a major exhibitor at this year's conference. The

display will feature products from our four market heading brands:

- ▶ Cushman ▶ Jacobsen ▶ Ransomes
- ▶ Ryan

Cushman

From Cushman we will be releasing the all-new Envirojet Sub-surface Injection System, which enables controlled applications to be made at or below the root zone, and eliminates environmentally hazardous run-off and over-spray. The latest series of the world renowned Cushman System Vehicles will also be prominently displayed, including a customised spray system designed for our Trucksters by Silvan, plus the 10.4KW (14h.p) Hawk run-a-bout which is available in either Petrol or Electric.



Jacobsen

From Jacobsen we will be releasing the all-new Greensking VI Triplex Greens Mower, the latest model of the 1900 series Tri-King Trim Mower, the highly prized LF3800 Fairway Mower and the truly awesome HR9016 Wide-Area Tri-deck Rotary with 67KW (90h.p.) of brute strength. "The Beast" has 5m width of cut and is height adjustable from 2.5 to 14cm. Don't miss having a look at "The Beast".

Ransomes

From Ransomes we will have the leading heavy duty 5 Gang Reel Mower, the commander 3510. 38KW (51h.p.) 3.5 meter cut available with Sports cutter or Magna Heads, with or without Cab, the Commander is truly versatile and suited for all forms of general turf maintenance. Other key products from Ransomes will include the E-Plex 11 all Electric Greens Mower complete with Power Steering, the reliable T'Plex 185 Surrounds Mower and the popular 728 Outfront Rotary.

Ryan

From Ryan you will see Sod Cutters, Renovation and Aeration Equipment, whilst

from Turfco we will have the Model F15B Walk-a-head Top Dresser and the all-new Model SP1530 Tow Behind Broadcast Top Dresser. Capable of a Top Dressing Speed of 12.8KM/H (8 m.p.h.) with a Hopper Capacity of .6cm (21CB/FT), the SP1530 is designed for the true Turf Professional.

Textron Turf Care Group has the most extensive range of professional Turf Care maintenance equipment available. You are cordially invited to visit our display at Stand 40 any time during the Millennium Turfgrass conference.

Booth #45 TORO TOTAL SOLUTIONS

Serving Our Customers for 85 Years

Since its founding, Toro has walked side by side with its customers through backyards, golf courses and racetracks, as well as sports fields, campuses and community parks. Each day begins and ends with the same driving question: How can Toro serve its customer?

Toro provides an integrated approach to turf management that is unmatched by its competitors. Toro's unique, extensive, quality line of maintenance equipment products includes mowers, aerators, sprayers, vehicles, plus high tech irrigation systems such as computerised controllers, valves, sprinkler heads, fertigation, and agricultural irrigation emitters and tape. Customers are diverse, including golf course superintendents, sports field and facility groundskeepers, landscape contractors, growers and homeowners. Toro came of age with the turf industry, developing a strong partnership with superintendents and turf managers for most of the company's 85 years. Toro has listened and learned from this partnership, developing a legacy of turf excellence to help customers meet the changing demands of golf courses, sports fields, landscapes, and homescapes. Finally, Toro believes its leadership and success brings with it a responsibility to give back to the industry and the communities where Toro does business. A portion of every purchase is returned to the turf industry and the people it serves.

New Toro Products include:

Procore 660 Aerator has a popular 60" width, perfect for any area, including tees, greens, fairways, roughs, sports fields and parks. Rugged triple bent design for durability and performance in tough applications.

Workman 2100 New Light Cargo and People

mover has an innovative new concept with focus on traction, comfort and durability.

Reelmaster 5500 New style fairway cutting unit. High productivity with large diameter reels, large tyres and turbo diesel engine.

Greensmaster 3250 Premium diesel powered triplex greensmower with improved cooling, new suspension system and easier 3WD installation.

Multi Pro 1100 With the effortless power steering and 45 inch turning radius, the Multi Pro 1100 is a highly manoeuvrable, compact vehicle that gets you in and out of the tightest areas with ease.

Greensmaster 1000 Quiet and smooth Kawasaki OHV engine with a unique forward weight design, logically placed controls and split drive drums with differential permit easier turning.

Reelmaster 6000 A true lightweight, mid-sized fairway mower with superb quality of cut and up to 10 acres per hour productivity.

Booth # 80 TRIANGLE FILTRATION and IRRIGATION

Products on Display Include:

Filtomat - Automatic Self-Cleaning Water Filtration Systems.

Geoflow - Rootguard® Subsurface Drip Irrigation.

ITC - Fertigation equipment, Hydraulic and Electric pumps.

Triangle Filtration and Irrigation are exhibiting on stand No. 80 with a comprehensive range of Filtration equipment, Sub-Surface drip irrigation Technology and Fertigation pump equipment. Filtomat® fully automatic self cleaning screen filters are suitable for all types of irrigation systems including spray, mini sprinklers and drip irrigation. Filtomat® filters are available from 50mm - 400mm with filtration levels down to 50 micron. Filtomat® are Industry leaders renowned for their reliability and durability. Geoflow, Rootguard® subsurface drip irrigation (SDI) technology is specifically designed for installation below ground. The problems of root intrusion with SDI is eliminated by the impregnation of the drip emitter with the root inhibiting herbicide Treflan. The expected life of the Treflan inhibitor is 15-20 plus years. Applications

for sub-surface irrigation include turf, landscape, agricultural and waste water reuse. ITC fertigation equipment have a complete range of hydraulic and electric piston operated pumps for the injection of chemicals and additives. The Injection pumps can be fully automated through a controller and flow metres or adjusted manually as a proportion to flow. 17 Hinkler Rd Mordialloc Vic 3195

Telephone (03) 9580 2122 Fax (03) 9580 3131 Email triangle@filtomat.com.au

Key Personnel

Managing Director Wally Menke
Marketing Manager Gary Horton

Booth #68 TurfCraft International Magazine

TurfCraft International has been providing timely, relevant information to turf managers and personnel across Australia and overseas for more than 13 years. The magazine has assembled a list of writers including Peter McMaugh, Rod Riley, Lin Hambleton, Ken Johnston, David Nickson and Jon Scott who can provide technical and case study articles relevant to those involved in every section of



Sports Sand Solutions from ACI Industrial Minerals

Mixed for golf tees and greens, **layered** for improved wear and drainage for sports grounds and race tracks or **bunkered** to meet USGA specifications – ACI Industrial Minerals sands keep proving their value at some of the world's great sporting venues.

For solutions which improve your turf's performance don't forget to talk to Australia's sand specialists.

We have helped to improve the Melbourne Cricket Ground, Moonee Valley Racecourse, Parramatta Football Stadium, bowling greens and golf courses around

Australia and golf courses in Guam and Hawaii.

Talk to us about: Root Zone Mix
Permeable Sand
Sports 40 Sand
and Bunker Sand

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the turf industry. The Greenkeeper's Planner section of **TurfCraft** has given turf practitioners the opportunity to relate in their own words what they are aiming to achieve in their job. Recent planners include: Rod Fenton, Queenscliff GC; Richard Winter, WACA; Rob Millington, The Vines at Reynella GC; Graeme Logan, Stadium Australia; Colin Groch, Merimbulah-Imlay BC; Danny Gilligan, Tasmania GC. **TurfCraft's** buyer's guides include: chemicals; machinery; construction and design and education.

For 13 years **TurfCraft** has been providing free space to turf associations to enable them to communicate with their members. **TurfCraft** is a proud sponsor of the Millennium Turfgrass conference as well as numerous state and national events. Alastair Dowie and Tony Tiernan invite all readers to call in and see them at the **TurfCraft** stand at the conference.

Booth #11, 12 TURFGRIDS

Superior playing surfaces for Sporting Arenas, Racetracks in fact any sporting activity played on natural turf. How do you achieve this? with **TURFGRIDS**. The Evergreen Group will be displaying at booth 11, 12 how you can achieve maximum play from your sports facility and producing a surface that is safe and sure footed for players, athletes and thoroughbreds. The **Turfgrid** System provides multi-use for all sports arenas. With load bearing qualities, excellent drainage and a surface that is described as "firm, level and not too hard". The **Turfgrid** System outperforms traditional sports profiles, with healthy and vigorous root development, increased shear strength, providing an All Weather playing surface second to none both nationally and internationally. **Turfgrids** have provided successful turf systems for a wide range of applications ... Sportsfields, Racetracks, Athletic Tracks, Overflow Carparks and Event Staging Lawns. Recent successful installations have been: Viking Park, Erindale, ACT, York Park, Launceston, Tasmania, Orana Park, NSW. From a full sand base system to sportsfield high wear areas, the **Turfgrid** System can be tailored to meet your specifications and project requirements. See us at booth 11, 12, Millennium Turfgrass Conference: Contact Terence Fithall

0418 547 667.

Booth #92 TURFGRASS ASSOCIATION OF AUSTRALIA

The Turf Grass Association of Australia is a non-profit industry body that represents turf practitioners, curators, ground managers, superintendents and groundsman. Our membership is also made up of industry representatives from soil, seed, instant turf and machinery suppliers. In addition we have very close links to the Victorian Cricket Association, Melbourne University and TAFE colleges which offer education in horticultural studies. Our main objective is to offer quality personal development and educational seminars that will assist our members in keeping abreast of new developments within this specialised field, and maintain awareness of industry standards and safety guidelines. Now in our eleventh year we feel that our association is meeting its Aims & Objectives, and through our quarterly newsletter and various publications, keeping our members informed and up to date. We look forward to greeting anyone with an interest in turf at our stand during the Millennium Conference. We are a member driven association, therefore Committee persons will be on hand to chat and take any suggestions on how we can improve our services to our entire membership.

Booth # 59 + 60 TURFCARE SUPPLIES

The **Turfcare** group extended an open invitation to all our supporters, valued clients and potential clients to visit our stand (no's 59-60) at the Millennium Turfgrass Conference. The **Turfcare** group has lead the way in the distribution of environmentally friendly products and will continue to find and bring forward new ideas and technology to be used strategically by the Turf manager. Our flagship to the **Trichoprotection** system introduced in June 1998 based on the **Trichoderma** species of beneficial fungi that minimize the impact of such disease as **Fusarium** etc. The **Turfcare** group is committed to bring to the marketplace alternative methods you the Turf manager can make conscious decisions to alternate between Biological and traditional Turf protection products.

The **Trichoprotection** range consists of: -

- ▶ **Trichopel.P.** - Soil conditioning pellet
- ▶ **Trichoflow Turf** - *Trichoderma* species
- Wettable powder**

- ▶ **Carbo Aid** - Complex carbohydrate base
- Microbial food supplement**
- ▶ **Vaminoe** - Root inoculation granule used in construction

In addition to this Owen McCarron the area manager for **Agrichem** will be in attendance to discuss your individual nutritional requirements. **Agrichem** distribute a range of Chelated Traco Elements

- E.g.
- Supa Iron
 - Supa Mang
 - Supa Mag etc.

Agrichem Manufacturing Industries Pty Ltd is Australia's leading manufacturer of liquid fertiliser specifically designed for Turfgrass management. This unique range of products gives the superintendent ultimate control of grass establishment, growth and colour. These products (Australian made) combined with infield expertise provides to the market the most comprehensive program for quality turf.

The combination of **Agrichem** and Owen's industry knowledge provides turf professionals with on-call nutrition advice and expertise. With the support of **Turfcare** Supplies, **Agrichem** intends to remain at the forefront of nutrition advice for the turf industry. So come up and say hello, we look forward to seeing you there.

Booth #24 Turf Link Australia

TURF LINK AUSTRALIA PTY LTD are pleased to display the following equipment.

Ty-Crop MH400 Materials Handler/Top Dresser

Versatile 3 tonne unit with interchangeable (no tools) delivery options for any material. A very handy construction tool.

Ty-Crop Quick Pass 270 Top Dresser

Designed for Greens this small capacity top dresser with optional self contained hydraulics and a choice of spreader attachments (for light dusting to heavy applications) makes the **Quick Pass** the most versatile unit available.

Lastec Articulator Mower 721XR

Fully floating 7 individual cutter decks for the ultimate in tractor drawn No Scalp mowing. Ideal contour roughs mower for large areas.

Lastec Articulator Mower 621ER

Three 42" fully floating cutter decks, bat wing design, tractor drawn 3 point hitch mounted,

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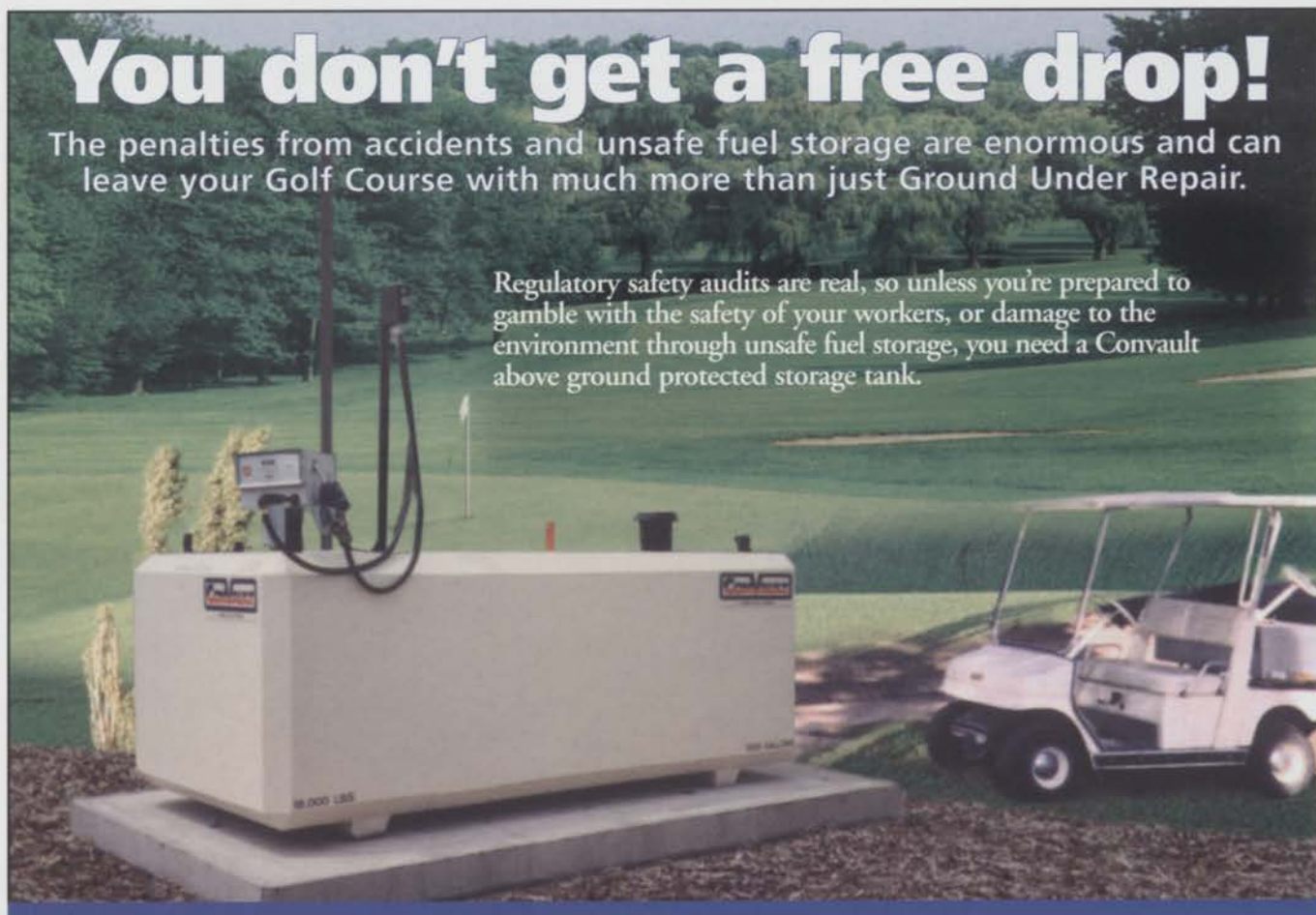
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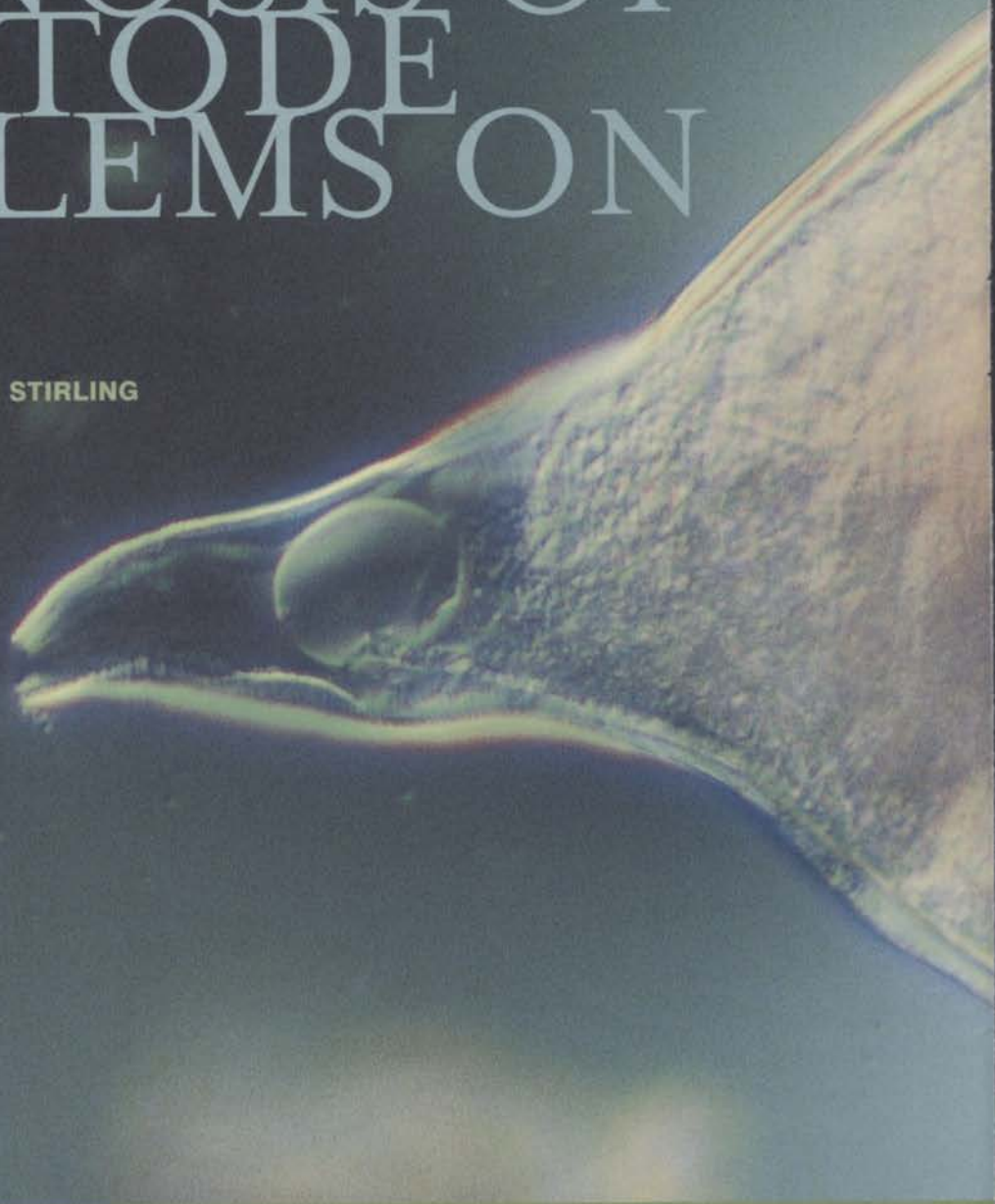
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DIAGNOSIS OF NEMATODE PROBLEMS ON TURF

BY DRS GRAHAM AND MARCELLE STIRLING



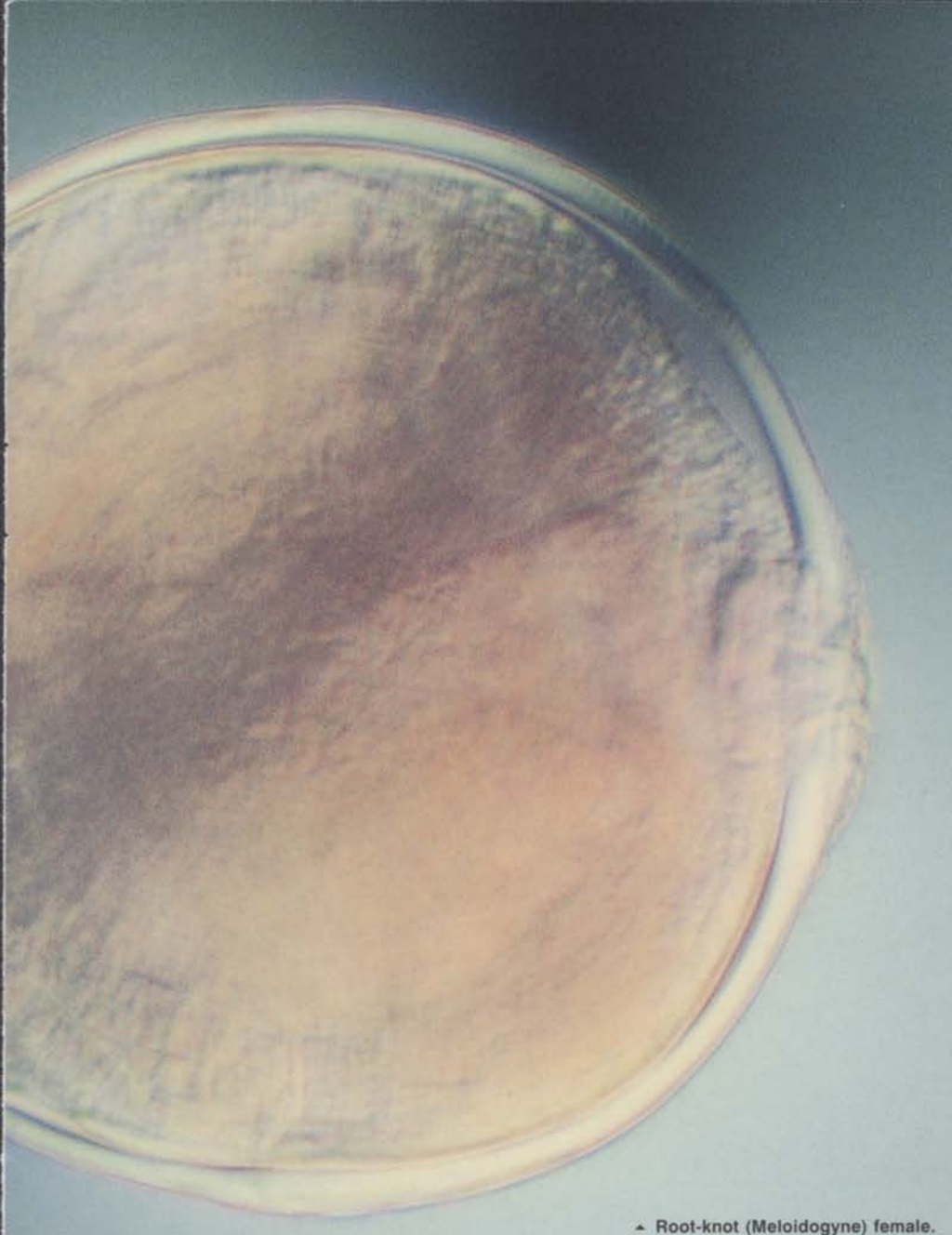
Golf course superintendents who send samples to a laboratory for nematode analysis may find the results are difficult to interpret, as many different nematode species may be present and counts are given for all of them. This article provides a brief guide on how to interpret the information provided.

Nematode species differ in their importance

More than 30 nematode species attack turf in Australia, and between 4 and 8 species will usually be present on most golf greens. Although all these species feed on turfgrass roots, the nematodes vary considerably in their capacity to cause damage. Some can cause severe damage at very low population densities, while others must be present in large numbers before damage occurs. Table 1 ranks the most common nematodes according to their pathogenicity.

Developing a hazard index from nematode counts

Because there is always a mixture of highly pathogenic and less damaging nematodes in soil samples from turf, the collective impact of all these nematodes must be determined when diagnosing nematode problems. We do this by calculating a hazard index from the nematode counts. The hazard index is a single figure that is usually between 0 and 7. It indicates the potential for damage from all the nematodes found in a sample.



▲ Root-knot (Meloidogyne) female.

Table 1 • Nematode genera attacking turfgrass ranked according to their pathogenicity (i.e. their capacity to cause damage to roots).

RATING	EFFECTS	NEMATODES
Very high	Limit root elongation at low population densities.	Needle (Paralongidorus), dagger (Xiphinema), cyst (Heterodera)
High	Produce specific symptoms (stunting, forking, lesions) at moderate population densities.	Stubby (Paratrichodorus), sting (Belonolaimus), lesion (Pratylenchus)
Moderate	The root system becomes unthrifty and lacks fine roots when high nematode densities are present.	Sheath (Hemicycliophora), lance (Hoplolaimus), ring, (various genera, including Criconemella), stunt (Tylenchorhynchus)
Low	Cause little damage, even at very high densities.	Spiral (various genera, including Helicotylenchus), reniform (Rotylenchulus), root-knot (Meloidogyne)



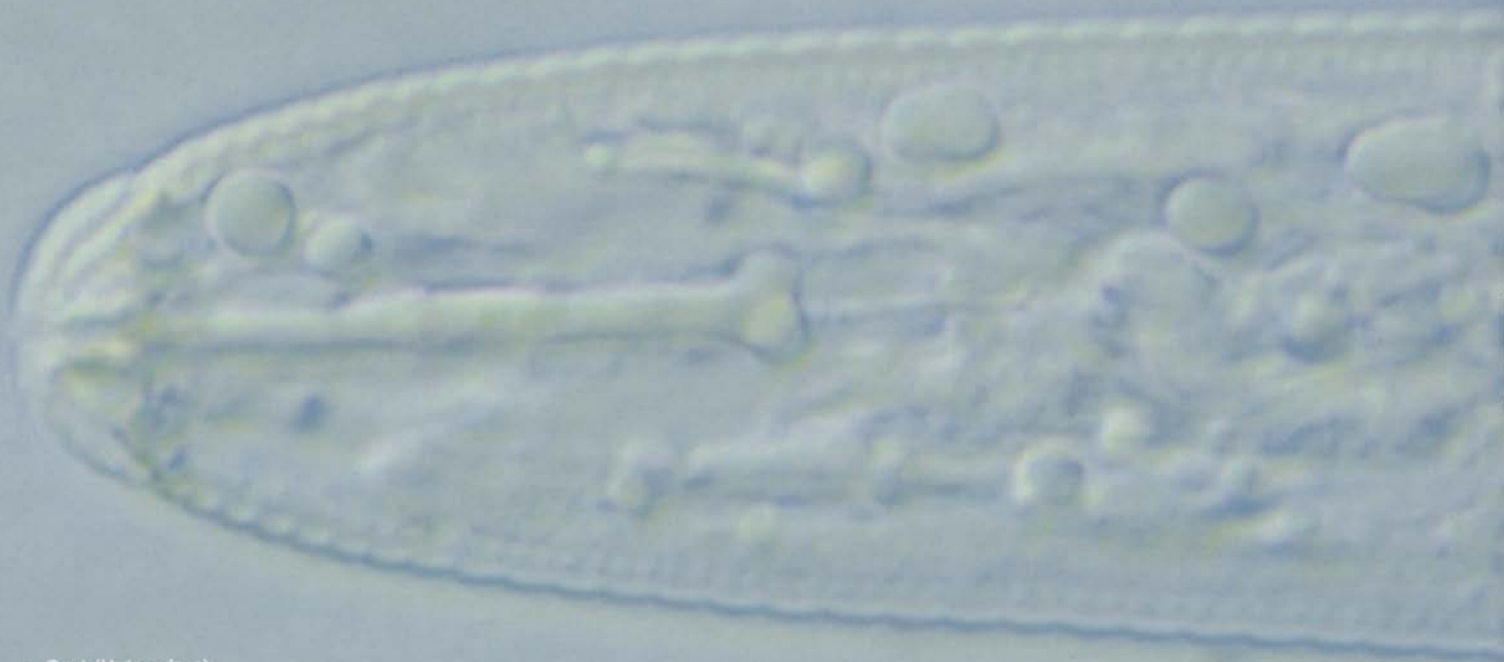
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▲ Cyst (Heterodera).



▲ Root-knot (Meloidogyne) female.

Photo's courtesy of Lila Nambiar Institute for Horticultural Development Agriculture Victoria.

Table 2 ▼ Relationship between hazard index and likely effects of nematodes.

HAZARD INDEX	INTERPRETATION
<1.5	Low nematode population density. Nematodes are unlikely to affect growth.
1.6-3.0	Moderate nematode population density. Some reduction in root function is likely.
3.1-6.0	High nematode population density. Considerable root damage could be expected.
>6.1	Very high nematode population density. Severe nematode damage is likely.

Effects of factors other than nematodes

The hazard index is a useful guide to whether nematodes are likely to be causing root damage in a given situation. However, when the index is being used to make management decisions, it cannot be viewed in isolation from the many other factors that influence turf growth. A green with a moderate or high hazard index, for example, may continue to thrive while it is well managed, whereas its nematode-damaged root system may be unable to cope when a stress is imposed (e.g. inadequate nutrition, excessive mowing, high summer temperatures). Thus to fully interpret the results of a nematode analysis, the possible role of environmental and stress factors needs to be considered.

Drs. Graham and Marcelle Stirling specialise in soil-borne diseases of many crops, including turf and are directors of Biological Crop Protection, Brisbane.

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Modern stadia management means multi-use

BY KEITH MCAULIFFE

New high tech. stadia are sprouting up all over the world. Australia and New Zealand are no exceptions, with projects such as Stadium Australia, The Docklands Stadium and the Wellington Westpac Trust Stadium offering venues of the highest class.

The opportunity to have a stadium dedicated to just one sport is a real luxury, afforded by only a few. For most venues the reality is that they must be multi-use in order to survive. Stadia management must seek to maximise revenue via any conceivable way, which could mean a football match one day and a cricket match, concert or equestrian event the next.

A requirement to maximise use of the playing surface has long been part of the Australasian sports scene. Grounds at all levels of sport have needed to contend with football (either rugby union, league or Australian rules) over the winter (wet) months, then switching to cricket during the summer (dry) season. The delicate relationship that existed between both codes seemed to be accepted as part of life. However, the relationship now appears to be on the

rocks, with each group (particularly football) chasing a larger slice of the action and a longer season, with the inevitable encroachment into the traditional domain of the other. For several of our premier venues, the situation appears close to melting point.

The cost of erecting a major sports stadium runs into the 100's of millions of dollars. When one considers the interest payments alone it is easy to see why stadium owners need to maximise usage. Modern stadia management is big business, and growing competition means that it gets harder to make a return on the investment.

Take the new Wellington Stadium (opened in January 2000) as an example. In the first three months of use the venue hosted several international cricket matches, three different forms of football, a military tattoo, concerts and public open days. The Wellington Stadium is no different to hundreds like it around the world, with maximising use the name of the game.

Maximising use of the facility is one side of the coin. The other is how will the playing surface cope with the intensive programme. For the Turf Manager, increased amount and diversity of use means not only more

challenges but inevitably more ulcers. The Turf Manager knows that it is only a matter of time before the demand for greater intensity of use exceeds the ability of the surface to cope. It is only when the surface fails, affecting a major event, that all and sundry fully appreciate that a natural turf surface is a biological system with a finite usage capacity. The realisation hits home that the playing surface and its requirements must receive higher priority in the planning and scheduling of events, and not just be an afterthought.

Management of a multi-use stadium playing surface must place a great emphasis on risk management. Management needs to consider everything that could possibly go wrong when preparing for an event and develop measures to counter potential problems. Events need to be planned out well in advance and an investment made in systems which minimise risk or maximise flexibility. There is a wide array of new technology available to help the Turf Manager cope with multi-use.

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Wellington Stadium

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and Turfgrids, are well known in the Australasian turf industry. Even though there has been relatively wide-spread use made of turf reinforcing products, there is a need for further independent research to identify the benefits and constraints of the respective products and to identify the niche of each product.

Turf Protection Systems

There are several commercially available systems which are laid over the surface during concerts and other high intensity uses in order to protect the underlying turf. Other turf protection systems are designed to protect the turf against inclement weather, such as excessive rain or frost.

Again, there is a need for independent research to evaluate the range of products available and to determine the best ways of managing each system.

Turf Replacement Systems

It is a sign of the times that the design of many of our new stadia (or stadia upgrades) results in limited natural light reaching the turf surface. Poor light (and in turn poor growth conditions) simply compounds any pressures that may

already exist. In many cases the only remedy is to routinely replace the worn or damaged turf areas.

There are several options available for rapid replacement of turf. Some stadia adopt the traditional sod laying approach, albeit generally opting for deeper (for stability reasons) and wider turf (for speed) cut.

In other cases modularised turf replacement systems have been developed, which allow slabs or trays of turf to be moved in and out of the stadium as and when needed. Although generally expensive, the modular turf replacement system offer a great degree of flexibility.

The Portable Cricket pitch

As previously mentioned, football and cricket have long been potential competitors for use of playing surfaces in this part of the world. The recent development of professional rugby football and the need to extend the football playing season has now brought the situation of ground allocation to a head at several NZ venues, such as Jade Stadium in Christchurch. With both sports having completely contrasting requirements of the playing surface (cricket requires a compacted clay surface located in the very centre of the arena), it is inevitable that a new approach and new technology is needed if both codes wish to continue using the one arena.

One solution that has been trialed over the last two seasons is the use of a portable cricket pitch. There are working examples of the portable cricket pitch in both New Zealand (Jade Stadium)

and Australia (MCG, Colonial Stadium, GABBA and North Sydney Oval).

The standard portable cricket pitch concept involves using large modules of clay-based turf (preferably a full-sized strip) that are prepared outside of the playing arena and placed into the centre of the ground for the cricket match. Once the match is finished the module is removed and a sand-based module brought in to match the outfield conditions.

There are the inevitable costs and hassles associated with such new technology. But the concept does work, and we believe it will ultimately be the best option for our non-dedicated cricket venues.

Summary

When one looks at the operations of a major sports stadium it becomes apparent that the playing surface costs (both construction and maintenance) represent only a very small part of the total outlay. It is little wonder then that most of our premier stadia indulge in turf practices that can only be considered absurd under normal circumstances. Spending a few \$100,000 a year on surface maintenance is certainly going to be cheaper than investing millions of dollars building another venue.

Maintaining a multi-use stadium is a major challenge for Turf Managers. In order for them to succeed they will need to be given access to a full gambit of new technology, including turf protection systems, turf reinforcement products, turf replacement systems and the latest in turf management technology.

Keith McAuliffe is the Chief Executive Officer of the New Zealand Sports Turf Institute

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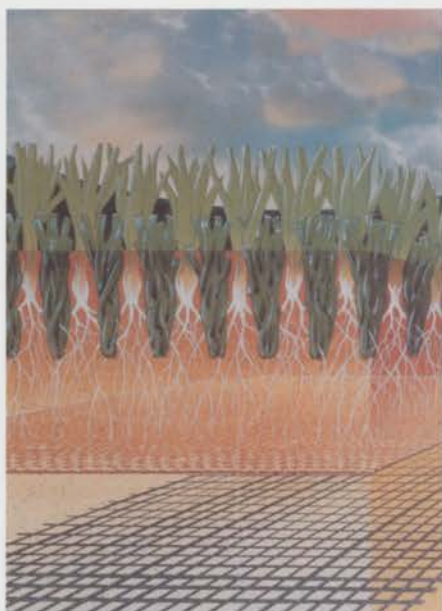
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On the morning of Friday 5th of May, Col Fitzgerald suffered a massive heart attack taking him suddenly and tragically from us.

Col has been totally involved and committed to the industry for the last 18 years having got a start in greenkeeping as an apprentice at the Wagga City Golf Course in 1981. He was soon made superintendent then moved on to become Superintendent at South Molle Island Golf Club from 1985-87. In 1987 he became the head greenkeeper at the University of NSW but it didn't take Globe Australia long to realise that Col was a young man going places and in 1989 they employed him as a Sales Representative.

Col's irrepressible enthusiasm and his love for the industry and those involved in it ensured that he rapidly became one of the best in the business and 95 he travelled to Melbourne as State Sales Manager (Vic, SA and Tas) for Chipco.

He missed NSW and his beloved Rugby League and so moved home in 1997 for a brief stint as State Manager for Turf & Irrigation before forming a partnership with

Shane Summerhayes and long time friend Alan Simpson, creating Turfcare NSW P/L.

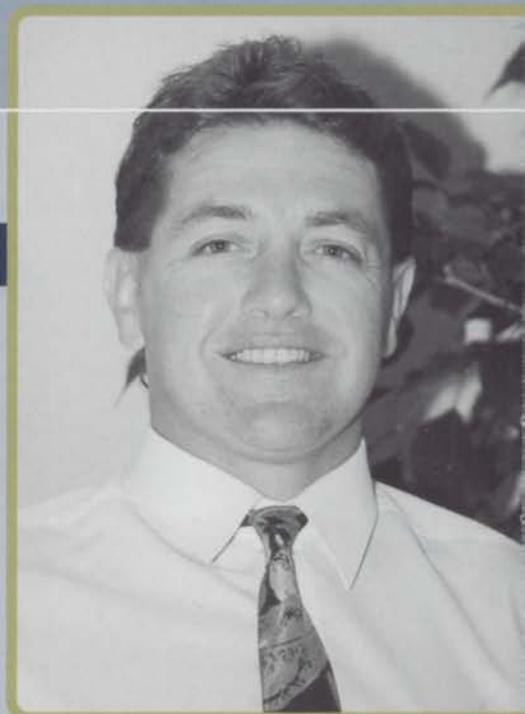
Colin was the driving force behind the venture and together with Shane took the business from nothing to a company with significant market share and influence.

Since his untimely death, calls have flooded in from all over the country and from his many mates overseas all offering their support and wanting to express their grief. Although it comes as no surprise to those who truly knew him, the most remarkable thing is that nearly everyone is able to tell a story about how he had impacted on their lives in some way.

One particularly close friend made the comment that "if it had to happen, why couldn't it have happened after the Conference? – Atleast we could have had just one more week together"

I know there are many who feel exactly the same way but the real tragedy in all this is that Fitzzy had 'done the hard yards' and was at a stage where he could sit back and enjoy everything that was special to him.

Col was not long married to his lovely wife



Fiona and as if he couldn't puff out his chest any further, he was tremendously proud in the knowledge that Fiona is expecting the birth of their first child.

Quite simply, Col was a legend in the industry and though never forgotten he will be sadly missed by all.

To Fiona and 'Little Col': One behalf of the entire industry, our deepest sympathies are with you.

There is a trust fund set up for 'Little Col' and donations will be gratefully accepted. For further details call Shane Summerhayes on (02) 9684 6611.

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channel-sports.com Pty Ltd, a Sydney-based developer of business-to-business (B2B) e-commerce services for the sports industry, announces the launch of www.channelturf.com.au, the first B2B service for Australia's turf industry.

The service provides course superintendents and other turf professionals with an online purchasing capability that saves time and decreases transaction costs. channelTurf does not re-sell product – it establishes a direct trading connection between buyers and suppliers. The buyer can create one master purchase order from the product catalogues represented, or issue a request for price quotes. Registered buyers, who are nominated by their suppliers, gain access through a user name and password, which then triggers any negotiated pricing. The service is free to buyers. Suppliers pay a set transaction fee per order fulfilled, regardless of the order's dollar value.

channel-sports also announces the appointment of John Goedemans, a former product manager for River Sands Pty Ltd, to the position of Business Development Manager for channelTurf.

channelTurf will be launched at the Millennium Turfgrass Conference and will demonstrate the service at Booth 78.

For more information, please contact:

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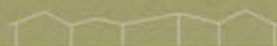
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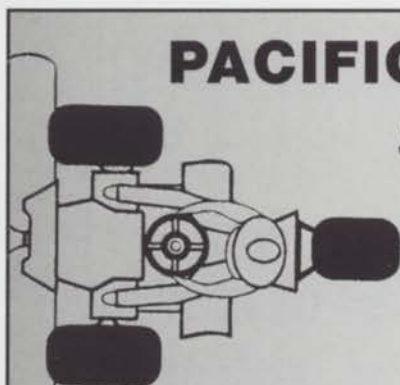
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Practical Golf Course Maintenance

- The Magic of Greenkeeping

By G Witteveen and M Bavier

book **br** review

Brett Williamson

Cronulla Golf Club

Following extensive world travel indicating that the fundamentals of greenkeeping differed little from country to country, two American golf course superintendents developed a seminar titled the 'Magic of Greenkeeping'. The seminar has now been shown in over four countries and due to its success, the authors were inspired to write this book.

All the main topics of maintaining a golf course are covered in this twenty-one chapter book. Early material covers cutting and cultivating operations with chapters on cutting greens, tees, fairways and rough. Other chapters cover topics such as water, fertiliser, topdressing and drainage. Later chapters cover management operations with chapters on people, tools and the turf care center. As you would expect given that the authors have more than eighty years experience in golf course management between them, each chapter is extremely thorough.

The appendix includes handy sections on job descriptions, and there are examples of maintenance practices throughout the book and there is a section titled "General

Information for All Employees" that would be useful for new employees in particular.

Wherever the authors felt it necessary, they sort the advice from the other experts in their field. A perfect example of this is the chapter on sand bunkers and their maintenance where the authors sought the views of Walter Woods the long time links supervisor at St. Andrews.

The book is full of step-by-step guides on construction and maintenance topics, making the book an excellent training guide. Also, the fact that the book was written during the late nineties means that the information is up to date. Pictures, although black and white are both plentiful and well utilized throughout the book.

The book was enjoyable to read and I found the information extremely useful and at times entertaining, such as the section on how to talk someone out of getting you to build a putting green in their backyard!

This book flows from chapter to chapter, and as the title suggests it is extremely practical and the enthusiasm of the authors encourages you to keep on reading.

I believe that the book would be an

excellent addition to any golf course maintenance facility and makes an excellent manual for new employees in particular.

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Toro came of age with the turf industry, developing a strong partnership with superintendents and turf managers for most of the company's 85 years. Toro has listened and learned from this partnership, developing a legacy of turf excellence to help customers meet the changing demands of golf courses, sports fields, landscapes, and homescapes.

Finally Toro believes its leadership and success brings with it a responsibility to give back to the industry and the communities where Toro does business. A portion of every purchase is returned to the turf industry and the people it serves.



TORO

President's Pen

Well, it is hard to believe that another year has come and gone so quickly and that the long awaited Millennium Turfgrass Conference is finally upon us. The conference is certainly the biggest that this country has ever seen, with over 1000 delegates to attend and a trade show that is in the order of 7500 square metres (1.5 times larger than Brisbane). I would like to thank all those who are supporting the conference either delegates, sponsors or exhibitors as without your support these events would not be possible.

As all members would be aware the AGCSA will launch the new arm of the Association, AGCSATech at the conference. The Association has been very fortunate to have secured the services of John Neylan who brings a wealth of knowledge and experience. This is a tremendous service that adds value to your membership. For all those people who may have some concerns

regarding technical advice sort by clubs, let me make it quite clear that without the incumbent superintendents' consent (member or non member) we will not undertake the work.

The AGM of the association is also upcoming, with nominations having closed in April. As there was only the required amount of nominations received there will be no need for an election. As a current board member I can draw two conclusions from this;

- 1) That there is an overwhelming vote of confidence in the current board or
- 2) That the membership do not really care.

For the long term viability of the association I hope it is the first.

This marks the 9th edition of Australian Turfgrass Management and we feel that the magazine reflects the professionalism of the Industry. The support from all

sectors of the Industry has been exceptional and it is very important that the members support those organisations that support "your magazine".

As usual at this time of year I have many people to thank and I will start with my wife and family for their continued understanding and support. To the Committee of The Barwon Heads Golf Club, Steven Hewitt (Assistant) and all the staff my sincere thanks. I would also like to thank Andrew Davis (Manager) who is about to leave Barwon Heads to take up a new position in the golf industry, his advice and input over the past 10 years has been invaluable. Finally thanks to Euan and all the staff at the office who serve the Association so well.

I look forward to catching up at the Conference

Peter Frewin
President, AGCSA



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FNQGCSA

With the wet season and cyclones finally behind us and good weather ahead, some serious course works can begin at last.

After two and a half metres of rain in three months it's a relief to have dry firm ground and sunshine around us.

The 2000 Tropical Horticultural Trade Days event, which this year was moved forward to May and once again held at Cluden Park Racecourse in Townsville, was a great success. The stands were kept busy by the many trade visitors on the Monday and the general public who were invited for the first time on the Tuesday.

This years seminars offered a balance of Turf and Horticultural speakers Inc John O'Dell "Royal Sydney Golf Club", Colin Campbell, Victoria Lane, Peter Bell "John Deere" and Tom Wyatt "Horticultural Consultants".

John Deere and Toro performed machinery demonstrations throughout the day.

The Dinner Dance held at the Townsville RSL was once again a great success with the one hundred and eighty guests enjoying a fantastic Seafood Buffet, prizes, music and dancing.

The Tuesday morning was set aside as a membership drive breakfast for the FNQGCSA at Cluden Park Race Course. It was successful and third time lucky with all previous attempts either rained or cycloned out.

The John Deere Cup was once again held at Townsville Golf Club on the Tuesday Afternoon with a full field.

The event will be held again in 2001 and we would like to see involvement from interstate members.

Special thanks to our sponsors, John Deere, Searles, Scotts, Toro, McCrackens, Yates, GCP and Rochdale.

Hope to see you in the tropics next year.

Paul Earnshaw
FNQGCSA, President

GCSAWA

With the biggest turfgrass conference ever held in Australia upon us I wish all delegates a safe and enlightening trip.

It has been a busy autumn here in the west starting with Round 3 of the John Deere Super Series at Gosnells. With over 40 players the day was well contested on a magnificently presented course. I believe Alan Devlin is still recovering from his missed putt at the third, which left him chipping back onto the green. Don't worry Al you will get over it.

Congratulations must go to Trent Rowden of Gosnells Golf Course. Trent won the best-indentured apprentice award at the annual TAFE award night held at Doubleview Bowling Club on the 24th March.

The Annual Management Challenge was held at the Hillview Golf Club on the 9th of May. Once again it was good to see this event being well supported by so many clubs.

On the 29th May our Annual General Meeting was held at the exclusive Mt Lawley Golf Club. With no changes to the committee I would like to thank all members for their continual support.

In an effort to unite our metropolitan and south-west state members. A three-day seminar has been organized for the 13th-15th of August in Margaret River.

Confirmed presenters are John Neylan and Peter William as well as a host of local speakers. Further details will be provided to all WA state members very shortly. This event is one not to be missed.

Rob MacDonald
President, GCSAWA

NSWGCSA

As predicted in the last issue, the drought like condition in and around Sydney finished with record rainfall. The excessive rainfall interrupted many a greens renovation and contributed to various disease outbreaks. Even the indestructible Kikuyu grass suffered, with many Superintendents observing *Culvaria* sp. detracting from the normally pristine Kikuyu surface!

The annual NSW Championship day was held recently at Castle Hill Country Club, with the course in magnificent condition and our sponsor, Patons Fertiliser ensuring a great day was had by all. Martyn Black, host Superintendent, must be

congratulated on the condition of the course, with heavy rain and the removal of the 'Tournament Circus' only several weeks earlier. Patons Fertiliser generously provided our guest speaker Mr Brain Doyle, who literally had them rolling in the isles.

Various Clubs around NSW are in the process of having Master Plans prepared for their courses. One can only hope they take the next step and see their plans to fruition. The results of Clubs including Castle Hill, demonstrate how successful Master Plans can be when completed. (See the article on page 6).

Thanks are extended to Peter Frewin and Euan Laird for their visit in late March explaining the position of the AGCSA in their open discussion group open to all A class members. It was unfortunate more members could not find the time to take advantage of the opportunity, but all those present seemed to leave happy with the meeting.

Mark Parker
President, NSWGCSA

SAGCSA

The AGCSA roving seminar was popular and very topical - water quality and how to overcome poor water. Dr Ali Harivandi is a very entertaining and informative speaker.

Our field day at Flagstaff Hill was well attended and we had a great lunch provided by our sponsors Piber Nicholls (BBQ Snapper). Course Super Gary Day showed us and spoke about their Couch program with front 9 nearly completed, also his POA program using Scotts POA Restrictor which has improved bent into greens by 50%. Andrew Stenton then gave us a rundown on Pieber Nicholls (Textron Agent) products and new releases.

On April 13 we held the Toro and Cooper Cups at the very well presented Murray Bridge Golf Course, good job Mal and your boys. The Toro Cup was won by Kym Treager from Berri Golf Club on a countback. The team from Murray Bridge won the Cooper Cup quite convincingly. A big thank you to Don and Brian from Toro and John, Daryl and Chris from Coopers. Congratulations to our nominees for the

AGCSA Awards: Michael Nicholls - Claude Crockford Award, Dean Goldsack - Distinguished Service Award and Peter Foreman - Graduate of the Year Award.

See you all in Melbourne at the Conference.

Bob Dellow

President, SAGCSA

TGCSA

Tassie Golf Supers have experienced the driest summer/autumn period for many years, with water storage in most areas completely exhausted. The Australian amateur was recently hosted at Royal Hobart Golf Club and Tasmania Golf Club. Steve Lewis and Danny Gilligan did a remarkable job to present their respective courses in pristine condition.

GST is just around the corner so consider its impact on our association, as well as our course budgets etc.

I am sure the AGCSA will be looking for support from all association members with the service that will soon be provided such as soil analysis and agronomic consultancy. I feel the service provided will be beneficial to all turf managers, so lets get behind it.

Fresh back from his Scholarship experience in the USA, Mark Snooks - 21C Riverside Golf Club will have some great ideas to implement on home turf. Mark has spent 12 months at Kingsmill Country Club - Virginia USA.

Our next gathering will be in July.

Phil Hill

President, TGCSA

TGAA (VIC)

The time has arrived to be part of the biggest event the TGAA has ever presented. We have had a huge response from the turf professionals all over the country that have registered for the Sportsfield Stream of activities. These lucky people will be guaranteed a fabulous time whilst in Melbourne.

If you haven't registered please contact our office for information on how to be

part of this event even for one day.

Those registered should read the main information brochure (published in previous issues) for details pertaining to dress codes, registration and Monday mornings grand opening session at Crowns Palladium Ballroom.

I am looking forward to meeting all of you, so don't hesitate to make contact with me or any of the committee at our TGAA booth in the trade show. Our booth will have TGAA application forms and provision for membership renewal payments, website information & the opportunity for some great give aways. This will be a pivotal point for queries and information on all facets of the TGAA so come on and say hello.

The Victorian Irrigation Supplies Boat Cruise (TGAA member's reception) on Tuesday at 5.30pm - 7.30pm is open to all attending the Conference for \$40. Bookings through the office. Come and join us for a relaxing trip down the Yarra with the other delegates and their partners. All Welcome.

The TGAA conference committee has performed a huge job in presenting this event and would like to acknowledge the support from the AGCSA who have underwritten the Conference and the other turf associations who are taking part.

The TGAA would like to wish sponsors, delegates and members a wonderful experience and enjoy the show!

Robert Savedra

President, TGAA (Vic)

TGAA (ACT)

Firstly, congratulations to Dwaine Joanknecht for being the winner of the Chemturf Study Award for students doing turf management at the Canberra Institute of Technology (CIT). As the proud winner, Dwaine will receive an all expenses paid trip to the Millennium Conference thanks to Chemturf. All finalists should be applauded for the high quality of work submitted and for enthusiasm shown during interviews. This award wouldn't have been possible if it weren't for the

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efforts of Stephen Heskett who, through the TGAA, got the award started.

The Horticultural section of the CIT is offering classes for a level 4 Certificate in Turf Management. Many who have waited for this opportunity should apply. The course is scheduled to commence on the 26th of April and emphasis will be placed on training in the workplace environment.

In Association news, the bus tour to Homebush Bay was a great success. The main turf related Olympic sites and many others were visited. Thanks to Paul Janssens, our secretary, for organizing the trip.

"Till next time, Agrostologists".

Justin AK Haslam

Committee, TGAA (ACT)

VGA REPORT

The VGA has had some very good news lately with a substantial grant from the state government. This means that the VGA has a lot more money to spend on its members. One of the first things on the agenda is a

VGA website that will allow the world to discover that we are the oldest association of our type in the world. The website will be revealed at the VGA stand at the Millennium Turfgrass Conference and Trade Exhibition.

The VGA would like to wish Toby Lumsden, our vice president, the very best of luck in working in England at the Uxbridge Sports Club, Toby was given the contact through the TGAA and AGCSA.

The VGA will be running a Chemcert course (formerly Farm Chemical Users Course). The enrolment forms will be available on the VGA stand at the Millennium Turfgrass Conference. For further information ring myself (Matt Scott on: 0419 179 567, or Peter Barron on: 0417 551 135).

We now have all the nominations for the greenkeeper of the year award. The committee are presently sorting through the nominations: the winner will be announced at the Millennium Turfgrass Conference in June.

Matt Scott

Vice President, VGA

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