

Influence of Autumn Cultural Practices

MAINTAINING YOUR SPORTS FIELDS

There are several maintenance practices that may be performed to improve sports fields for the following year that can help to prevent or decrease winter injury to the turf.

1) Increase surface and subsurface drainage. Much of the winter injury that you recognize as dead areas in early spring can be attributed to ice. Winter thaws tend to accumulate in low lying areas and then refreeze causing turf to die. Topdressing these small depressions with soil that has a little more sand than that in the rootzone is helpful. Large areas that collect water will require some reconstruction.

2) Autumn mowing. Raise the cutting height from one-quarter to one-half inch above that used during the summer. Then for the final mowing of the fall, lower the clipping height a little below the standard summer mowing height. This can make the foliage less prone to snow mould and other winter diseases.

3) Food reserves for winter survival and early spring growth. Late fall fertilization increases turf carbohydrate levels and as a result, increases cold hardiness.

4) Early autumn is a good time to remove thatch and practice core cultivation or

aerification as grass plants respond well by producing vigorous roots and lateral growth which does not require extra mowing. This helps to relieve compaction—particularly after heavy use combined with soaking fall rains.

5) While not perhaps common to many sports fields, fall or late winter is a good time to remove tree branches to thin the canopy (yet without changing the shape of the tree) to allow more light to penetrate the playing surface. Before the leaves fall is a good time to note where shade is the most dense and the turf is thinning. Mulching of leaves when they are dry is an excellent way to provide organic matter to the soil. ♦

— summarized by M. Bladon



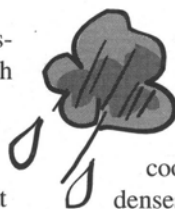
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Weather Facts

Water vapour is the basic atmospheric ingredient from which comes such forms of precipitation as rain, snow, hail, and sleet. These all originate when water vapour is condensed by the cooling process that normally occurs with the expansion of upward-flowing currents of air.

Clouds consisting of myriads of very tiny water droplets are formed. Before the droplets can fall as precipitation of one kind or another, they must grow to a far larger size. It is believed that they do this when the clouds rise to high altitudes and their uppermost portions drop in temperature to a little below freezing. The water droplets do not freeze at first, but they do become supercooled. As the clouds rise to still higher levels, however, some of the droplets are transformed into ice particles



or ice crystals. These too are quite minute, but gradually become larger by taking moisture from the supercooled water droplets which condenses and freezes on them.

The growing action continues until the ice particles become so heavy that they begin to fall. As they drop through the various layers of the atmosphere, they grow even larger by taking moisture from additional supercooled water droplets, and also by joining with other ice particles.

If the temperature of the atmosphere remains below freezing all the way from high altitudes to ground level, the ice crystals will fall as snow. If the lower layers of the atmosphere are above freezing, the snowflakes turn into raindrops. ♦

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News Clips: Head Injuries & the Argos

Head Injuries Leave Lasting Effects According to Study

Chicago – Two or more significant blows to the head while playing sports can harm teenagers' thinking abilities for years to come, according to studies in the United States that suggest such injuries are more serious than some coaches and parents might think.

Nearly 63,000 high school athletes a year suffer mild concussions in the U.S., researchers reported in the *Journal of the American Medical Association*. Young athletes with learning disorders appear to suffer even worse long-term problems from multiple concussions.

"This is a major public health issue that has been given short shrift," said Michael W. Collins, a neuropsychologist in Detroit and a leader of one of the studies. "And this is information parents should know."

Most people still believe that a concussion means getting knocked out, he said. But a concussion is any alteration in mental function after a blow to the head. Signs or symptoms may be subtle—a headache, dizziness, difficulty with balance or

memory, confusion, or a personality change.

One of the studies did not explore the effects of concussions but only how often they occurred in football, wrestling, soccer, basketball, softball, baseball, field hockey, and volleyball at 235 high schools in the U.S. from 1995-96 through 1997-98.

There were 1,219 concussions—63 per cent of them in football—and 99 students suffered two or more, said researchers led by John W. Powell, a professor of kinesiology and an athletic trainer at Michigan State University.

The researchers estimated that more than 62,800 concussions occur among high school students in the U.S. annually in the sports they studied.

It has long been known that multiple mild concussions are more likely than a single episode to lead to long-term problems, and Collins tried to measure the difference in his study.

His research involved 393 U.S. college football players and found that about one in three had suffered a concussion at some

time in the past and one in five had suffered two or more. Those who had suffered two or more were significantly more likely to report continuing problems with headaches, sleep and concentration, and they scored significantly worse on paper-and-pencil tests of the ability to learn words, to think quickly, and to handle complex tasks.

— *Associated Press, The Record, September 8, 1999*

Argos May Have a New Home

The Argos, who may be looking at getting out of the SkyDome after they're sold, are reportedly considering a deal with the Canadian Soccer Association and the Canadian Rugby Union. If the deal comes off, the trio would split the cost of a new natural grass stadium with between 20,000 and 25,000 seats. ♦

— *Leader Post, Regina, September 22, 1999*

Editor's Note: Hurray! Let's hope the Argos move!



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March issue content deadline:

JANUARY 15, 2000

CHRISTOPHER MARK
The President's Desk



As we complete yet another busy athletic field management season, another busy time—the Christmas season—will soon be here. I hope everyone had a successful fall and will enjoy everything the festive season brings to us with family and friends.

Thoughts of Christmas also turn to thoughts of the upcoming Ontario Turfgrass Symposium from January 4-6 at the Regal Constellation Hotel in Toronto. Please remember the Industry Sector and Association Discount box on the registration form where you check the STA as your affiliated association. It is critically important for us to receive funding from the OTS. At this year's event, come out and attend the Municipal Challenge and root for your favourite team. It's organized in a Jeopardy-style game format and is sure to be a lot of fun! Please plan to attend our Annual General Meeting on January 4 at 7:00 p.m. If you would like to join us for dinner, see the details enclosed with the newsletter or call Lee at the STA office.

As I prepared to write this President's Message, it was done with mixed emotions since it is my last dialogue to you, the members. I cannot begin to express how fulfilling it has been to work with such fine Boards of Directors over the years and how committed everyone has been to the Association and our mission of better, safer sports

turf. I have received unbelievable support from so many people and I would be remiss without mentioning individuals like Bob Sheard and Mike Bladon who have been wonderful friends, colleagues, and supporters during my terms as President.

When I think back to the early days when we all marveled at achieving 50 members and had our office in Bob Sheard's basement, I don't think anyone in their wildest dreams ever anticipated we would now be over 200 members, have an Executive Manager to run the Association, an office at the Guelph Turfgrass Institute, a fabulous newsletter which is the best in the industry, sold hundreds and hundreds of educational tapes and books, as well as being a full participant at the OTS. Times have certainly changed.

The Boards of Directors over the years have done some tremendous work and it has been a team effort. The incoming President and new Board will face continuing challenges in the future—primarily the financial position of the Association. Over the last few years, we have operated very close to budget, with no real surplus to invest in future initiatives. A combination of declining revenue from the OTS, maintaining status quo in membership rates though the mid to late 90s due to an economic downturn, and higher costs for the Association, have translated into the present difficult financial position. Unfortunately, it may mean higher rates for members since membership dues and the

OTS are our prime sources of revenue. Bob Sheard is finalizing a new book which we know will be an outstanding educational text and will also provide a much needed revenue injection for the Association. We are hopeful a Trillium grant will offset the initial binding and publishing costs of the book.

Another challenge for the Association will be continuing to attract a dedicated team of Directors who have the time to contribute. Everyone is so busy in their daily work and with family responsibilities and activities, that maintaining a Board of Directors who can dedicate the time to the STA will be a continuing challenge. I have asked numerous people over the years who are dedicated professionals in the turf industry, but they just do not have enough free time to sit on the Board. That is not an excuse, it is reality. We must strive to continue to attract a core group of Directors to lead the STA.

I wish the Sports Turf Association and its members every success in the future and I fully intend to stick around and contribute to that success in other capacities. It has been a pleasure working with and leading such a fine group of individuals over the years.

Best wishes to everyone for a happy, healthy holiday season and may the goodness and spirit of the season remain with everyone in 2000 and beyond. Wishing you better, safer sports turf. ♦

— Chris Mark

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SPORTS TURF SPECIALISTS

Cricket in Canada

Sport Trivia: Did You Know?

Cricket Facts

- Cricket was played in many cities, towns, and villages in the early 1800s.

- The Canada vs. USA cricket match is the oldest annual international sports competition in North America.

- "It isn't cricket"! This expression pays tribute to the high regard the sport has attained in its insistence on fair play.

- Cricket is probably the only active team sport which includes many good players well into their 50s and 60s.

- Because of its origin in Britain, cricket was well-founded throughout the British empire, and flourishes today in most parts of the world.

- The Ontario Cricket Association was formed in 1880, some 95 years after the first games were played. Prior to that, most games were played as "friendly matches," either with nearby villages or cities or touring teams from other cricket-playing countries such as England, Australia, and the U.S.A. The term "friendly match" is still used to refer to a game arranged with another team which is not a league or provincial fixture for points.

- The Canadian Cricket Association was established in 1892. There are currently eight provincial associations who are members of the Canadian Cricket Association—New Brunswick, Nova Scotia, Quebec, Ontario, Manitoba, Saskatch-



ewan, Alberta, and British Columbia. Cricket is played in the other provinces, but not on an organized basis. The Canadian Cricket Association sponsors inter-provincial tournaments at both the senior and junior level and in 1979, in England, a Canadian team played in the World Cup for the first time.

- An annual cricket match is played on Labour Day between the actors from the Stratford Festival and the Shaw Festival Theatres with tea in the afternoon. The game alternates between Stratford and Niagara-on-the-Lake.

- There are more than 200 teams in league play in Ontario and an estimated 50 additional teams who play "friendly cricket," plus several teams playing in private schools. There are still teams waiting for admission to the Toronto Area

Cricket Associations, but a shortage of grounds prevents their joining and being able to accommodate regular fixtures.

— info & pic provided by the Canadian Cricket Association

Canada to Play Host in 2001

Calcutta, India, and Canada will host the International Cricket Council Trophy in the year 2001, ICC president Jagmohan Dalmiya said yesterday. Twenty-five teams from non-test playing countries will participate in the tournament.

Three of them, Kenya, Scotland, and Bangladesh, had participated in the recently concluded cricket World Cup after qualifying at the last ICC trophy contest held in Malaysia two years ago. ♦

— *The National Post*, June 29, 1999

Photo Caption: Players from the Ontario team smile in victory after defeating Quebec in the Atholstan Trophy Annual Contest held at the Governor General's Grounds, Rideau Hall, Ottawa.



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See you at the OTS. Conference details on the back cover of this issue of the Sports Turf Manager!

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SEEDS

The Service Department

STEVE MOORE, NATIONAL MANAGER, TECHNICAL SERVICES, STIHL LIMITED

I was in the doctor's office the other day having him look at my sore arm. When you get a little older and you still play recreational hockey, your body starts to get the odd seizures in the limbs. Now I was a little surprised when he checked my blood pressure, he listened to my heart, he looked in my ears, and shone a light in my eyes. "What does all this have to do with my sore arm," I asked the doctor. He said, "Well first I always have to check you over to see if anything else might have caused the problem in your arm. Do you think I should have cut your arm open to see if something was wrong?" Of course he was right. He was just eliminating most of the problems that were not causing the pain so he could then zero in on what was really wrong.

Good power tool technicians also use this approach. When they first start working on an engine, they don't start taking the unit apart before they've done a full analysis of the problem. They evaluate what the customer has said. They inspect each system of the engine and they eliminate components that cannot have contributed to the failure. Once the technician has done this, he can professionally advise the customer on the cause of the problem and the cost of the repair.

For years STIHL Ltd. has been promoting a simple but thorough troubleshooting method to improve the service you offer your customers. This procedure is designed to give your customer a detailed outline of what was wrong with the machine and what it's going to cost to fix it.

Normally this inspection only takes 15 to 25 minutes and the cost of the inspection would be covered in most shop's minimum estimate charge. The other nice thing about this system is that the tools required for the inspection are few in number and relatively inexpensive. All you need are screw drivers to loosen the various power tool screws, a block of rubber plate for the exhaust port, a plate with a nipple for the intake port, a hook to pull out the fuel filter, a pressure/vacuum pump, and an ignition tester. The total cost for all these tools is less than one month's repairs, and your customer will receive a professional and complete analysis of their power tool.

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1 Inspect the condition of the engine, the piston, cylinder, crankshaft, and bearings. Much of the condition of the engine can be determined simply by removing the muffler and looking for damage to the piston. Using STIHL's Engine Failure Analysis Manual, your technician can tell if the engine overheated, dirt was being ingested, or any of many other defects that were causing problems in the engine. The worst thing your technician can do is waste time and money tuning up an engine if the engine itself is damaged. Who pays for the labour and parts if the engine is not worth repairing after carb kits and spark plugs were put into the machine? Inspect first, repair later!

2 Ignition systems are the most trouble free part of any hand held power tool, yet this is the first component that technicians replace. The Imrie 625 Ignition Analyzer is the best ignition inspection tool on the market. A very simple test using the Imrie 625 will tell you if you have the correct ignition voltage your engine requires. If the voltage you get is to speci-

fication, there is nothing else your technician can do to improve the voltage. If the voltage is too low, there are only a few things that could cause it—normally, this can be determined easily by your technician. The Imrie 625 can also tell your technician if something not related to your ignition system is at fault. The working or running voltage can also be checked. This can tell you if the engine is using more or less than normal voltage. This can mean a problem with the carburetor or several other engine components. Constant use and experience with the Imrie 625 will greatly improve your technician's troubleshooting skills.

3 Check the fuel system. Simply removing the fuel filter and pressurizing the fuel line can tell you a lot about the fuel system. You can check the quality of the fuel, you can inspect the fuel lines, and you can get a sound idea if the carburetor is in good shape simply by pressurizing the fuel line.

A blocked fuel tank vent is a small problem that can cause expensive repairs! Again you

can use a pressure tester to make sure the fuel tank vent is venting. If the fuel tank does not vent, the engine can run lean, overheat, and seize. If your technician does a major engine repair but forgets to check the vent, the unit might seize again ... at your expense!

5 The TECH system also can find external fuel leaks, either a crack in the tank or a leaking fuel cap. Leaking fuel can be a fire hazard, especially if the unit you are repairing is a back pack blower. Here the operator probably would not realize that fuel is dripping down his back.

And finally you can do a pressure and vacuum test with this system. As any two-cycle repair shop knows, pressure and vacuum testing is probably the most important procedure in two-cycle repair. Pressure and vacuum testing checks seals, gaskets, intakes, impulse lines, and crankcase castings. If you do a tune up and do not pressure test the engine, you might overlook a problem

6

4

which could damage the engine a few days after your customer picks up the unit. If they spent \$100 for a tune up, do you think they will want to spend another \$300 or \$400 repairing a damaged engine a few days later?

All dealerships want a profitable repair shop. You cannot have a profitable repair shop if your technicians don't know how to troubleshoot and they don't have the tools to trouble shoot. Do yourself a favour, commit to STIHL's TECH system. Make sure you have the tools and instruct your technicians to use the TECH system on every unit that comes in for repair.

This is a service that can replace your old "Our minimum shop charge is \$XXX" sign and replace it with "We offer STIHL's TECH system to completely analyze your engine's faults for \$XXX." Don't you think that'll make your shop look more professional and become more profitable? ♦

— *The Turf Line News, Volume 153, August/September 1999*

Rugby in Canada—What is it?

CTV SPORTSNET gave the World Cup of Rugby a big pop last month by airing all the games, most of them live, and also replaying the Canadian games in prime time. Hundreds of fans across the country are cheering.

To be fair, the sport is growing in the high schools, although the Canadian Rugby Union membership is not high—33,000 male and 9,000 female participants.

"You're going to get a lot of expatriates watching," said Sportsnet analyst Brian Spanton, a former national team player. "And once the Canadians are out, the local rugby fraternity will continue to watch. But then it's surfers ... You will get people jumping in to see what's going on (interview during World Cup)."

In other words, rugby is a marginal sport, which means Sportsnet's decision to go full throttle was questionable, but

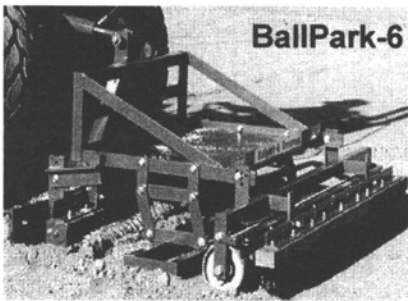
also commendable, because it provided comprehensive coverage of a major international event.

The opening game telecast was fine. The ITV feed from Britain was of the quality one would expect from a top British broadcaster airing a major-league British sport.

But if the idea was to convert channel surfers to fans, Sportsnet needed to tell us what rugby is all about. Sure, we know it's a little like North American football, without the pads and forward pass, but the network would have done well to set aside a minute or two at the start of each game to air a friendly primer. Without making it too complicated, using graphics, perhaps even computer animation, to explain the rules, scoring, and terminology would have been a big help. ♦

— *The Globe and Mail, October 2, 1999*

We've heard a Rumour ... You're about to buy a Groomer!



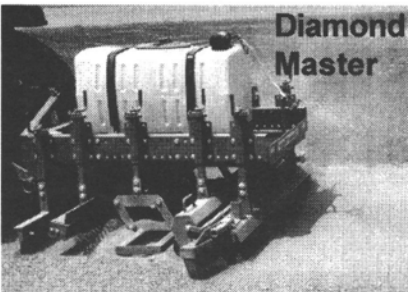
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Sand Sports Fields: Making the Decision

CATHERINE ANDREWS, SPORTS TURF CONSULTANT, NEW ZEALAND SPORTS TURF INSTITUTE, AUCKLAND

Sand carpet sports fields have been built throughout New Zealand, providing surfaces for a variety of sporting codes. The objective of this article is to review the main considerations when making the decision to install a sand carpet field.

Stakeholders of a sports field venue need to be aware of, and understand, the implications of the decision to install a sand carpet field. This will ensure that:

- 1) Stakeholders have realistic expectations of the project and the field's final performance and sustainability.
- 2) Planning the installation of the sand carpet field and associated drainage proceeds in a logical manner, with site investigation work undertaken and the feasibility of all upgrading options considered.
- 3) Clubs are committed to providing the increased maintenance budget and trained turf managers (or management advice) to ensure the continuing success of the upgraded field.

Stakeholders Requirements and Expectations

Field Use

In managing sports fields, it is the 'sustainable level of use' which must be considered. The sustainable level of use is defined as 'that which gives the maximum use of a ground without causing an unacceptable reduction in playing quality.' Auckland City, which manages approximately 40 slit-drained, sand carpet fields reports average increases in use of 100%. Despite this impressive statistic, it must be remembered that sand fields cannot cope with unlimited hours of use and are difficult and expensive to repair once damaged.

A slit-drained, sand carpet sports field is designed to allow surface water to drain quickly after rain stops. It can be expected to be used more quickly after rain than a soil-based field, where the surface may remain wet for days.

Like soil fields however, sand carpet fields must be managed under a sensible usage policy. Clubs must be encouraged to actively control field usage, closing



A slit-drained, sand carpet sports field is designed to allow surface water to drain quickly after rain stops. It can be expected to be used more quickly after rain than a soil-based field, where the surface may remain wet for days.

fields while surface water remains on grounds or where cover becomes sparse. They must discourage unbooked play and rotate practice areas to ensure the continuing success of their sand carpet field.

For some regions, increasing pressure from sports groups for more sports fields is a main influence in the decision to install a sand carpet. For example, Auckland is predicted to grow by 20% in the early years of the 21st century, so in theory, Auckland City will also need at least 20% more sports fields. There is, however, little land available in the central city to accommodate this growth, so sand fields must be considered to increase the hours of play per field.

Playing Surface Quality and Reliability

Even under low use, sports administrators, who must ensure their venue is not turned down for major games or events, will often select a slit-drained, sand carpet installation. The sole reason for this choice is often that their facility must be of a high standard under most weather conditions, with the risk of postponement minimized.

Construction

Construction Costs

Sports administrators often ask the question: "How much will it cost to construct a sand carpet sports field?" In answering this it must be pointed out that all sites are not equal and the availability of suitable materials and design options must be assessed. In addition, the expectations of stakeholders in terms of the quality of the playing surface and the amount of sustainable use must be determined. This in turn will influence cost.

It is unwise to quote a figure taken from the cost of another construction until a feasibility study of the site has been undertaken and design options have been assessed. This preliminary work should be undertaken prior to making the decision to install the drainage system and prior to the preparation of funding applications.

Site Considerations

A comprehensive site assessment must be made in order to determine requirements to upgrade a soil sports field to a sand carpet field. Examples of key features to assess include: the contour of the site, the soil profile, the presence of any existing sub-surface drains, the location of an appropriate outfall, and the presence of public and private services.

For a soil field on a poorly draining, silty soil, the installation of a slit drained sand carpet field may be the difference between no use and reliable weekly use. For a site where winter soil temperatures drop to near zero, ryegrass growth will be limited and the lack of recovery from wear will prevent fields sustaining as intensive use as warmer climates. Thus, the sustainable level of use will be less in the lower South Island than the upper North Island.

Existing field layout also needs consideration. The presence of clay cricket blocks on a slit drained sand carpet field compromises the integrity of the sand overlay adjacent to the blocks. At many first class cricket venues, this is managed by covering the block with raised covers through the winter sports season to keep the clay from becoming wet and muddy.

Material Availability and Design Considerations

The selection of appropriate materials and design of the sand carpet and associated drainage system will affect the performance of the construction. For example, aggregates and sands must be selected for efficient drainage, compatibility between materials, and with consideration to the reliability of supply and cost.

The principle of a sand carpet drainage system is to ensure excess surface water is efficiently transmitted to a sub-surface drainage system or permeable sub-soil layer. It is important to note, however, that there is not one 'recipe' for installing a sand carpet system. With experience, material preferences have changed and specifications for installation have been refined. *By engaging specialist advice, pitfalls encountered in previous sand carpet installations can be minimized and the latest 'sand carpet' technology can be utilized.*

Timing Construction Work

Construction works may be staged to minimize disruption to field use or to accommodate budget allocations. Play should not commence on a sand carpet field until adequate turf cover has stabi-

lized the surface following the application of the final sand topdressing. Thus, clubs need to be aware of disruption to their grounds and the requirement for use to be restricted during the first season following construction.

Maintenance Considerations

While sports administrators may accept the costs of installing a sand carpet field and associated drainage, the additional resources required to manage the field must also be in place. These resources include staff trained in managing sand fields and a higher yearly budget to maintain the field in its intended condition.

Trained Turf Managers

The main aims of sand-based field maintenance identified in a comprehensive review of sand carpet fields undertaken by Auckland City Council in 1997 were listed as:

- 1) Prevention of excess organic gel accumulation at the surface to maintain the permeability of the sand overlay.
- 2) Retention of turf cover to ensure the stability of the surface is preserved and development of areas of easily erodible sand is avoided.
- 3) Maintenance of a high proportion of

roots in the soil beneath the sand overlay to supply nutrients and water to the turf grass plant and to prevent turf shearing away from the underlying soil during use.

- 4) Ability to monitor pest levels and take appropriate action to control high levels of activity.

- 5) A trained turf manager is required to manage fertility, irrigation, thatch control, physical treatment, repair work, and pest control to achieve the above goals.

Maintenance Budget

Additional maintenance inputs (costs) for sand fields include: irrigation (if you pay for water), thatch control, implementing a sand topdressing program, physical treatment, pest management (e.g. Earthworm control, *Poa annua* control), and the repair of divot areas through the playing season. The additional cost of maintaining a sand field over a conventional soil field will vary depending on the level of field maintenance prior to sand carpeting and the type of sand carpet field constructed.

Water Requirements

In regions on the east coast of New Zealand, many soil fields are already irrigated. For other regions, the installation of a sand



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carpet sports field means installing an irrigation system to ensure turf cover is not lost through drier summer months.

In the Auckland region, the use of warm season turf grasses such as cynodon and kikuyu has avoided the need for installing and operating permanent irrigation systems. The use of temporary irrigation systems may still be required for establishment when warm season grasses are initially introduced into the field. In addition, warm season grasses form a turf mat which stabilizes the sand, resulting in less reliance on re-seeding to repair areas of lost cover. Auckland City has also trialed natural zeolite in sand carpet fields to assess its water and nutrient holding benefits.

Chemical Use Policy

One of the main aims identified in the 1997 Auckland City Council review of sand-based fields was the ability to monitor pest levels and take appropriate action to control high levels of activity. Specifically, earthworm activity can quickly result in the contamination of the surface sand layer. The contaminated surface layer

can then seal up when the field is used in wet conditions. In Auckland City, several fields have deteriorated due to 'No-Spray' policies.

Like other regions, Auckland City has adopted a policy on chemical reduction to reduce and probably eventually stop the use of all chemicals. Alternative management strategies must therefore be found to minimize the use of insecticides on sand-based fields. Such strategies include acidifying the soil profile, the use of lower toxicity chemicals, and shifting to the use of low calcium sands for topdressing.

Summary

This article has covered key considerations when making the decision to install a slit-drained sand carpet sports field. These include:

Stakeholders Expectations such as the desired level of field use and the quality of the playing surface required. Managers must ensure stakeholders' expectations from a sand carpet field are realistic, ensuring for example that clubs are aware of the need to control use.

Auckland City has adopted a policy on chemical reduction to reduce the use of all chemicals. Alternative strategies must be found to minimize the use of insecticides on sand-based fields.

Construction Considerations such as the assessment of site characteristics, material availability, and design. Once a specific site is assessed, the cost of construction may be estimated and the time frame for construction work planned. Stakeholders must be made aware of the likely disruption to grounds and restricted use following construction.

Maintenance Considerations such as ensuring staff trained in sand field management are available to manage the field and allocating a satisfactory maintenance budget to ensure the continuing success of the upgraded field. ♦

— *New Zealand Turf Management Journal*, Vol. 13, No. 2, May 1999



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