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PROCEEDINGS

Royal Australian Institute of Parks and Recreation

SEMINAR

"Turfgrass Maintenance and Modern Construction"

October 23rd, 1985.

STRATHAYR IS PLEASED TO HOST TODAYS R.A.I.R. SEMINAR.

WE ARE COMMITTED TO MAKE EVERY EFFORT TO HELP ENCOURAGE THE IMPLEMENTATION OF MODERN TURFGRASS TECHNOLOGY IN AUSTRALIA. BRINGING TOGETHER TODAYS SPEAKERS WILL OBVIOUSLY BE BENEFICIAL IN THIS REGARD.

WE RECOGNISE THE COMPLEXITY OF YOUR JOB AS TURFGRASS MANAGERS AND BELIEVE THAT WE HAVE A MUTUAL ROLE IN HELPING SOLVE THE PROBLEMS THAT TODAYS USEAGE PRESSURES AND COMMUNITY EXPECTATIONS CAUSE.

BY KEEPING IN TOUCH WITH RESEARCH AND PRACTICAL DEVELOPMENTS WITHIN AUSTRALIA AND OVERSEAS WE ENDEAVOUR TO ENSURE THAT OUR CLIENTS RECEIVE THE BENEFIT OF THE LATEST DEVELOPMENTS BUILT INTO OUR PRODUCT.

SEEING IS BELIEVING - TODAYS INSPECTION OF THE EXTREMELY HEAVILY TRAFFICKED PLAYGROUND AT

ST. MICHAELS GRAMMAR SCHOOL,
REDAN STREET,
ST. KILDA.

WILL DEMONSTRATE MANY ASPECTS COVERED AT THIS SEMINAR.

BILL G. CASIMATY
GENERAL MANAGER
STRATHAYR INSTANT LAWN

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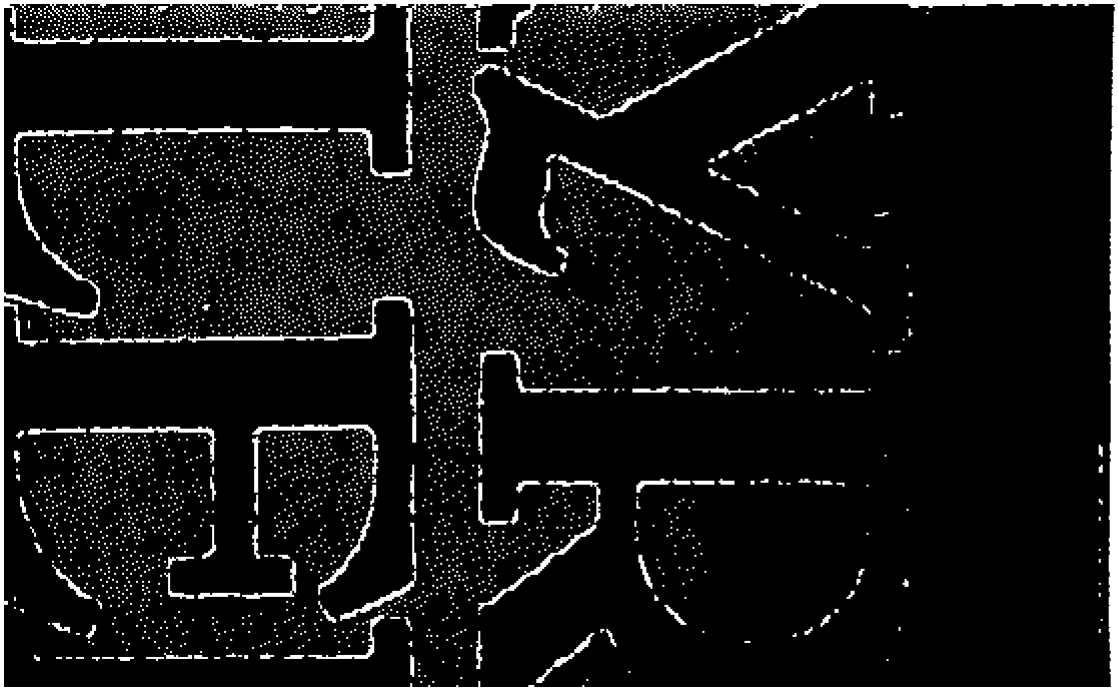

RECENT DEVELOPMENTS IN TURFGRASS RESEARCH

Terry Woodcock, Officer-in-charge, Turf Research and Advisory Institute.

Talk given at R.A.I.P.R. Turfgrass seminar Wednesday October 23, Windsor.

A number of aspects of interest on my recent overseas trip revolved around grass breeding for economic characteristics such as mowing, wear and shade tolerance. Playing quality, disease management, growth regulation and weed control were other areas of current research that were discussed.

1. Breeding for economic characteristics

(a) Testing site selection.

When most cultivar testing sites have been chosen in the past they have been on the better soil types and given optimum amounts of fertiliser and water. This trend is changing and testing is now being done over a range of sites which give less than ideal conditions for growth. This is important for grasses tested under our conditions as there is little point in testing a grass required for roadside use under optimum conditions when nutrition will be low and summer drought likely in the field. Many useful grasses for marginal areas may have been overlooked in the past.

(b) Growth.

Selection of different grasses for specific situations is important as increased mowing greatly increases the cost of maintenance in some areas. Creeping-red fescue has a growth rate that is half that of perennial ryegrass but may not suit the situation or use. Within cultivars there are differences in growth rates. This is very obvious in the turf type ryegrasses and we usually use a blend of two or three types so that we utilise different growth characteristics in a sportsfield situation. In a low-use amenity area it may be that a grass monostand is adequate for the particular site or a slow growing blend of grasses. With low fertility in roadside situations the hard and tall fescues will have a place, some other grass types will respond well to very poor soils and low fertiliser regimes. There is a good potential for selecting and developing cultivars that exhibit these characteristics that in the past may not have been selected for. Some more acid soil tolerant Kentucky bluegrass varieties have already been recognised.

Plants with lower water use such as the couches will be further investigated as will those that rapidly recover after dry conditions such as Dawson red fescue and Victorian Perennial ryegrass.

Disease and insect resistance will also be of increased importance to limit the use of pesticide applied to the turf.

We will still have a large emphasis on selecting high maintenance grasses for premier situations but great improvements in this area are not likely to be made over the next few years.

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(c) Wear.

For wear tolerance the Europeans are still basically relying on perennial ryegrass but are looking more closely at some of the red fescue cultivars. The overall aim is to increase wear tolerance and durability of the grass surface to maintain density and hence lower the requirement for overseeding and maintenance costs.

(d) Shade.

Not a great deal of emphasis is being placed on breeding for shade tolerance possibly because it is of limited market potential. In shaded conditions with heavy wear alternative non grass surfaces are utilised.

2. Playing quality: Turf Performance

Extensive studies are being undertaken by the Sports Turf Research Institute in England on playing quality and turf performance. This work involves more intensive studies into surface friction, bounce resilience, spin and other factors involved with cricket, soccer and tennis.

Playing surface properties such as friction for smooth soled shoes, traction with studded boots and sheer strength related to ripping and turning are being studied in some depth.

Another important factor which they are investigating relates to player injury and the resilience and abrasiveness of the surfaces that are used for different sports. The difference in injury level is most apparent between synthetics and natural surfaces but can be related to other factors such as grass height and thatch depth. It will be interesting to assess this work when the project is completed.

Sand based constructions are being utilised for premier stadiums but the use factor is strictly controlled and limited at one stadium to three matches per fortnight with no practice allowed. The benefit of these well drained constructions is that no play is lost due to inclement weather.

3. Disease Management

Research on disease management is also coming under closer scrutiny in the quest to reduce the maintenance cost of producing good quality turf.
High levels of nutrients such as nitrogen have been used in the past and have promoted excessively weak grass that is prone to disease and wear. Fertiliser overuse is now being looked at more critically with the view to reducing some of the levels used in the U.S.A. in particular.

Oversowing annually is a common routine practice to poorly grassed areas but in situations where there is already an adequate grass cover this oversowing may increase turf density to such an extent that damping becomes inevitable.

The selected height of cut can also increase or alleviate stress on the grass. On most sportsfield surfaces low cutting will induce a stress that renders the grass more susceptible to disease attack and thus produces a poor playing surface.

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Strategic use of fungicides rather than the some of the current uninformed use is important. The effects of the fungicide on the target disease causing organisms is no longer the only factor to be considered but also the side effects on other soil flora and fauna, resistance and pollution aspects.

4. Weed Control and Chemical Growth Regulator

Integration of cultural techniques (many developed before herbicides) with use of selective herbicides is now becoming a sophisticated cost efficient method of weed control. The properties of many of the existing chemicals have not been fully tested in the turf industry but more specific information is now becoming available.

Growth regulators such as maleic hydrazide for use on turf grasses have been known and tested for 35 years, however they are still not widely utilised throughout the world and are rarely used in Australia. Recent chemicals such as mefluidide can eliminate up to six mowings in a year but are infrequently used due to excessive discolouration and cost. New compounds have been developed to maintain the green colour and reduce growth but will not suppress seed head production. Further research on these growth regulators is being undertaken to make them useful for growth control and cost effective.

There are no new wonders on the horizon in the turf industry. The chemicals and management techniques that we have at present are likely to remain the same for some time but the integration and precision with which we use the tools at our disposal can be increased greatly with subsequent cost savings. Use of these techniques should also lead to improved sports and amenity areas when the greater knowledge of the technology involved is utilised.

"HIGH USE SPORTSGROUNDS" - OVERSEAS TRENDS

BILL CASIMATY.

SPORTS GROUNDS CONSTRUCTED WITH CONVENTIONAL SOILS OFTEN HAVE REASONABLE DRAINAGE CHARACTERISTICS FOR THE FIRST FEW YEARS OF THEIR LIFE. THE NATURAL SOIL CRUMB STRUCTURE HOLDS A MIXTURE OF PARTICLES OF VARYING SIZE IN EACH CRUMB. HOWEVER IF PLAYERS CONTINUALLY STIR UP SOIL IN WET CONDITIONS THIS CRUMB STRUCTURE IS PROGRESSIVELY DESTROYED.

THE FINER PARTICLES FLOAT TO THE SURFACE RESULTING IN A MUD SLURRY IN WET CONDITIONS OR A HARD CONCRETE LIKE SURFACE IN DRY WEATHER.

AS SOILS TEND TO BE MADE UP OF MATERIAL OF VARYING PARTICLE SIZE ONCE THE CRUMB STRUCTURE IS DESTROYED THE CEMENT PRINCIPLE APPLIES. I.E. THE FINE PARTICLES FILL THE VOIDS BETWEEN THE COARSER PARTICLES LEADING TO COMPACTION AND LACK OF AERATION.

THE PRINCIPLE OF SAND BASED CONSTRUCTION SYSTEMS IS THAT THERE SHOULD BE AS LITTLE VARIATION IN SAND PARTICLE SIZE AS POSSIBLE. IF WE IMAGINE MILLIONS OF TINY BALL BEARINGS OF IDENTICAL SIZE - UNLESS THE BALL BEARINGS WERE CRUSHED-IT WOULD BE IMPOSSIBLE TO COMPACT THEM - AIR SPACES WOULD EXIST AROUND EACH BALL BEARING AND WATER WOULD INFILTRATE THROUGH THEM. THIS PRINCIPLE SHOULD APPLY WITH THE SAND USED.

SAND BASED CONSTRUCTION TECHNOLOGY INVOLVES.

A. SAND SELECTION - FACTORS INVOLVED ARE PARTICLE SIZE, INFILTRATION RATE UNDER VARIOUS LEVELS OF COMPACTION, CAPILLARY AND NON CAPILLARY PORE SPACE AND DEGRADATION PROPERTIES OF THE SAND PARTICLES.

B. ENGINEERING DESIGN - DEPTH OF SAND, SIZE AND SPACING OF DRAINS HAVE TO MATCH THE REQUIRED RAINFALL INTENSITY THAT ONE WISHES TO ACCOMMODATE E.G. YOU MAY BE HAPPY TO ACCEPT THAT A RAINSTORM OF A ONE YEAR IN TEN FREQUENCY WILL CAUSE CANCELLATION OF PLAY.

C. COMPROMISE - A BALANCE HAS TO BE ACHIEVED. IF THE GROUND IS TOO WELL DRAINED THERE WILL BE SUMMER WATERING PROBLEMS AND NUTRIENT RETENTION PROBLEMS. THE ACTUAL INFILTRATION RATE REQUIRED WILL DEPEND NOT ONLY ON THE LOCAL RAINFALL PATTERN BUT ALSO ON THE PLANNED USE OF THE GROUND. A PRESTIGE HIGH USE VENUE WILL REQUIRE A GREATER INFILTRATION RATE.

VARIOUS SAND BASED SYSTEMS DEVELOPED IN THE U.S.A. FOLLOWING THE SYNTHETIC TURF DEVELOPMENTS. DURING THE EARLY 70'S THERE WAS A RUSH AWAY FROM MUD FIELDS TO SYNTHETIC SURFACES/ HOWEVER PROGRESSIVELY THE INJURY COMPONENT WAS RECOGNISED TO BE MUCH HIGHER ON SYNTHETIC SURFACES. IT IS A QUESTION OF WHETHER THE SURFACE TEARS BEFORE THE PLAYERS LIGAMENTS TEAR. IF A NATURAL TURF SURFACE IS TORN IT WILL REGENERATE (ESPECIALLY IF THE CORRECT GRASSES ARE USED) BUT OF COURSE SYNTHETIC SURFACES CANNOT BE ALLOWED TO TEAR.

THUS THE TREND IN THE U.S. HAS BEEN → MUD → SYNTHETIC → SAND BASED TURF.

ALL PRESENT TODAY ARE INVOLVED WITH NATURAL TURF AND I BELIEVE THAT IT IS OUR COLLECTIVE JOB TO AVOID THIS VERY EXPENSIVE CYCLE IN AUSTRALIA.

THERE IS NO DOUBT THAT SYNTHETIC SURFACES HAVE THEIR PLACE. I.E. TENNIS COURTS, ATHLETIC TRACKS, LOW GRADE CRICKET WICKETS ETC. ALSO THERE WILL BE SOME HOCKEY FIELDS BUT IN GENERAL FOR VIGOROUS SPORTS I AM CONFIDENT THAT WE CAN COLLECTIVELY PROVIDE MORE APPROPRIATE SURFACES.

THE INJURY FACTOR ON SYNTHETIC SURFACES HAS CAUSED THE COST OF PLAYER INSURANCE IN THE U.S.A. TO BE DOUBLE THE NORMAL RATE IF THE TEAMS HOME GROUND IS SYNTHETIC. OTHER PROBLEMS HAVE BEEN HEAT (IRRIGATED NATURAL TURF HAS A SIGNIFICANT EXAPORATIVE COOLING EFFECT) AND ALSO INFECTIONS AS SKIN INJURIES TEND TO BECOME INFECTED MORE OFTEN AS BACTERIA ARE VIABLE FOR A LONGER PERIOD.

SAND - ORGANIC MATTER

ORGANIC MATTER SUCH AS PEAT MOSS IS OFTEN INCORPORATED WITH THE SAND IN NORTH AMERICA AND EUROPE. THIS HELPS INITIAL MOISTURE AND NUTRIENT RETENTION AND ALSO PROVIDES THE REQUIRED MICRO FLORA.

HOWEVER THESE MATERIALS ARE EXPENSIVE IN AUSTRALIA AND THE MIXING PROCESS IS ALSO EXPENSIVE. WHILE OUR OBSERVATIONS HAVE CONFIRMED THE NECESSITY OF INCORPORATING ORGANIC MATTER WHERE TURF IS SEEDED DIRECTLY ONTO SAND WE HAVE FOUND IT TO BE A WASTE OF TIME AND MONEY IF SOD IS USED.

MATURE SOD WILL NOT ONLY ESTABLISH SUCCESSFULLY ON STERILE SAND BUT ALSO THE NEW ROOT GROWTH IS VERY DRAMATIC AND THE REQUIRED ORGANIC MATTER IS PROVIDED BY THE ROOTS. MOISTURE AND NUTRIENT RETENTION QUICKLY IMPROVES AND THE TURF MAT ACTS AS AN INNOCULUM FOR THE REQUIRED MICRO FLORA.

IF SEEDING ON SAND ONE HAS TO DRIP FEED THE NEW BABY PLANTS.

WASHED SOD.

WE HAVE DEVELOPED A SOD WASHING SYSTEM SO THAT THERE IS JUST THE SAND BASE AND THE TURF MAT. THE SYSTEM OF USING WASHED SOD ON A STERILE NON COMPACTIBLE SAND COMBINES THE DRAINAGE ADVANTAGES WITH THE AGRONOMIC ADVANTAGE MATURE TURF PROVIDES.

ROOT DEVELOPMENT FREQUENTLY EXCEEDS 30MM PER WEEK AND NEW SAND SURFACES HAVE BEEN USED FOR HORSE RACING JUST THREE WEEKS AFTER OUR WASHED TURF HAS BEEN LAID.

IT IS IMPORTANT THAT THE TURF MAT HAS THE ABILITY TO RE-GENERATE AFTER DAMAGE - EVEN WHERE ALL THE TOP GROWTH IS REMOVED FROM A PARTICULAR PATCH. THIS IS A PARTICULAR FEATURE OF OUR "BLUEBLEND"PRODUCT.

SUMMARY.

THE TECHNOLOGY NOW EXISTS TO CONSTRUCT NATURAL TURF SPORTSFIELDS WHICH ARE DESIGNED TO COPE WITH A PARTICULAR LOCATIONS RAINFALL INTENSITIES.

MANY OVERSEAS COUNTRIES HAVE REFINED THE DESIGN CRITERIA AND OUR FIRM IS ACCUMULATING THE RELEVANT INFORMATION AND EXPERIENCE.

WE HAVE BEEN INVOLVED WITH SEVERAL PROJECTS IN VICTORIA, TASMANIA AND WESTERN AUSTRALIA AND CAN PROVIDE ASSISTANCE IN PLANNING A PROJECT.

THE RELATIVE COST OF THE SYSTEM IS ENTIRELY DEPENDANT OF THE RELATIVE COST OF SOIL AND SAND IN A PARTICULAR AREA. WE STRONGLY SUGGEST THAT THIS SYSTEM SHOULD BE CONSIDERED FOR ANY NEW SPORTSFIELD.

SOME MODIFICATION TO MAINTENANCE PRACTICES ARE REQUIRED BUT IN GENERAL IT IS MUCH EASIER TO MAINTAIN A DRY FIELD.

THE MAIN FACTOR IS THAT ROOT GROWTH SHOULD BE MONITORED REGULARLY AS THE WATERING AND FERTILISING PRACTICES SHOULD BE SUCH AS TO ENCOURAGE DEEP ROOTING. INSPECTION OF THE ROOTS WILL PROVIDE AN IMMEDIATE INDICATION OF WHAT IS HAPPENING WHEREAS THERE IS A DELAYED EFFECT WITH SURFACE APPEARANCE. THAT FACTOR IS OF COURSE COMMON TO ALL TURF.

THIS PAPER CANNOT COVER THE DETAILED DESIGN CRITERIA FOR THESE SYSTEMS BUT WE WILL BE HAPPY TO PROVIDE FURTHER INFORMATION AS REQUIRED.

SAND SPECIFICATIONS AND NUTRIENT REQUIREMENTS FOR SPORTSFIELDS

by

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Paper presented at the Royal Australian Institute of Parks and Recreation, "Turfgrass Maintenance and Modern Construction" Seminar.

SAND SPECIFICATIONS FOR SPORTSFIELDS

Various soils can be used for growing turf providing they have the following characteristics:

* good infiltration rate
* drain adequately
* adequate moisture / nutrient retention
* resist compaction
* provide a suitable surface for each particular use.

In the main, soils that fit into this category are sands, sandy loams and loams. As the use becomes more intensive sands are the most suitable for construction. Sands resist compaction and maintain a high drainage rate under very heavy wear. Soils with a small percentage of "fines" (e.g. sandy loams and loams) can break down under intensive use leading to compaction and poor drainage.

The "Ideal" Soil

The "ideal" soil, or more specifically sand, for turf culture is a compromise. Soils that are too coarse have a high percentage of large pores (spaces in the soil) and have the following characteristics:

* high infiltration and drainage
* low water holding capacity
* low nutrient holding (easily leached)
* resist compaction
* poor surface traction

On the other hand, soils that have a greater percentage of "fines" (silt and clay) have more small pores and will react as follows:

* good water holding capacity
* low infiltration and drainage
* greater compaction
* hard when dry
* good nutrient retention
* good surface traction

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Table 1 Particle size analysis adopted by the Turf Research Institute, most suited for sand based construction.

TABLE 1. SAND SPECIFICATIONS

DESCRIPTION	SIEVE (mm)	ACCEPTABLE %
Fine Gravel	>2.0	0
Very Coarse Sand	1.0	0-10
Coarse Sand	0.5)	75-95
Medium Sand	0.25)	
Fine Sand	0.125	
Very Fine Sand	0.063	0-10
Silt and Clay	<0.063	<5

An additional consideration in selecting a suitable sand is the proportions of coarse, medium and fine sand. To give the best characteristics it is desirable to have one of these fractions as a dominant percentage. Where there are similar percentages of these fractions, interpacking of particles will occur. Interpacking results in reduced water penetration and drainage.

The most desirable particle size range for best surface traction is 0.1 - 0.6 mm. Particles larger from 0.7 mm provide very little traction. Very fine particles form a slippery surface when wet.

Soil Layers

In large scale construction operations soil quality control is very important. It is essential that soil of uniform quality is supplied. Soils of incompatible particle size (e.g. sand and loam) will form layers. Layers of incompatible soils cause a number of problems that severely affect turf growth. These include:

* poor water penetration
* slow drainage
* waterlogged conditions in winter
* "droughty" turf in summer
* promote shallow root systems
* poor aeration
* reduces turf wearability/repairability

pH and Total Soluble Salts

There are two important chemical characteristics of soils, pH and total soluble salts, that determine their suitability for use.

Many soils used for construction are naturally acid and require agricultural lime to raise the pH to an acceptable level (6.0 - 7.0). Soils with a pH between 4 and 8 are acceptable. Acid soils with a pH less than 4 require too much lime to economically raise the pH. It is also more difficult to maintain the pH at the desired level. Alkaline soils (pH >7) can be amended with sulphur compounds, though this is difficult. If the pH is greater than 8.3 many micro nutrients are in an unavailable form for plant growth. In general, soils of pH 4 to 7 are preferred because the pH can be easily manipulated.

Excessive amounts of salts in soils are harmful to turf growth, particularly to seedlings. Soils with salt levels greater than 600 parts per million are usually not recommended for use.

Soil Modifications

It is not always practical to import soils or to construct a sand-based ground. If heavy clay soils are to be used then gypsum can be applied to improve soil structure. Gypsum can be incorporated into the soil at construction, at the rate of 5 - 15 tonne per hectare.

Sands used in construction require temporary modification until a turf sward is developed. The addition of organic matter, such as fowl manure, improves moisture and nutrient retention, stimulates root growth and starts microbial action in the soil. Organic matter can be incorporated into the top 150mm at the rate of 2 - 3 tonnes per hectare.

Soil Samples and Analysis

The Turf Research Institute provides a soil analysis service. Tests carried out include:

* pH and Salts
* particle size analysis
* hydraulic conductivity
* compaction

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Soil samples submitted for analysis should be representative of the area. For each sportsfield, a number of small samples (30-50) can be bulked together, mixed and submitted for analysis. In general, about 500 grams of soil is sufficient. All samples must be labelled with location and intended use (e.g. construction, topdressing etc.).

FERTILISER PROGRAMS FOR SPORTSFIELDS

Fertiliser programs vary for each sportsfield. A basic program can be advised but this must be modified according to local conditions.

Factors affecting fertiliser requirements are:

* soil type
* use
* climate
* time of year
* irrigation
* type of turf grass
* economics

Sand based sportsfields with rapid drainage rates are easily leached of nutrients compared to heavier soils. On sand grounds, fertiliser should be applied "little and often".

Use is probably the single most important factor in determining fertiliser requirements. The higher the use the greater the wear and turf damage, this requires a higher rate of turf repair. This demands higher nutrient availability.

Climate, particularly rainfall affects the rate of fertiliser application. Under high rainfall conditions where leaching is a problem, less fertiliser applied more often is required.

Time of year affects the demand for fertiliser. Periods of high growth rates such as autumn and spring increases the need for fertiliser. Spring and more so autumn, allows the establishment of a good turf sward before the onset of harsher weather conditions - particularly winter.

Winter applications of fertiliser give minimal growth response because of cold conditions. Summer applications of fertiliser are only considered where irrigation is available.

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The need for fertiliser will vary depending on the type of turf grass. Cool-season grasses (e.g. ryegrass, bluegrass etc.) require fertiliser all year round (if irrigated). The warm season grasses (e.g. kikuyu and couch) are dormant during the winter and there is no requirement for fertiliser.

The following is a general fertiliser program for a moderate to high use sportsfield:

AUTUMN: 300 - 350 kg/ha of an NPK (16:8:10) fertiliser

WINTER: 1 application of Ammonium nitrate at 70 kg/ha

SPRING: 250 - 300 kg/ha of an NPK fertiliser

SUMMER: (if irrigated) 1 - 2 applications of Ammonium nitrate at 70 kg/ha

or

100 -120 kg of NK (20:0:16)

For sand based grounds the autumn applications can be split into two applications to reduce the losses from leaching.

The fertiliser requirements for VFL Park a high use, sand-based sportsground in a high rainfall area, is as follows:

NK (20:0:16) fertiliser every 3 - 4 weeks at 200 - 250 kg/ha

Superphosphate twice per year at 240 kg/ha

The amount of NPK applied in each situation is:

	GENERAL PROGRAM	VFL PARK
N (kg/ha)	130	400
P (kg/ha)	50	43
K (kg/ha)	65	380

The greatest constraint on fertiliser programs is the annual budget. In many areas there is no fertiliser used on sportsgrounds, regardless of the use. Situations such as this are common and will only lead to the rapid deterioration of the turf, providing an inferior playing surface. The general fertiliser program outlined should be a goal to aim for. If money is not available for fertiliser, then the users of the sports facilities should begin to pay the <u>real</u> cost of maintaining the turf.

The soil specifications and fertiliser programs are ideals and not always practical. This does not mean that an effort cannot be made to achieve these ideals.

R.A.I.P.R. PRESENTATION

TURF LAYING AND ESTABLISHMENT - INCLUDING CRICKET WICKETS.

B. Jones.

The purpose of this presentation is to point out that having got the policy planning right, no project need be jeopardised by slip-ups in the practical laying technique.

There are several areas which require thought and care if turf laying is to be successful. The areas which require emphasis however are preparation and watering. Technique in other aspects of the operation are very much a matter of practical commonsense.

Always remember that the cheapest turf laying job is the one that is finished and done right the first time.

PREPARATION.

Although preparation is similar to that for a seeded area a few points are worth mentioning.

We all know that a seeded job will often suffer with protracted problems but a short time spent on preparation can ensure that a sod laying job will be a vigorous grower right from the start.

Firstly, our experience indicates there is often problems with sprinkler systems when they are pushed to their limits. It is good preparation to test them early under maximum flow conditions.

Secondly, if soils of unknown characteristics are being used then a PH test is essential. This suggestion is not intended to duplicate what other speakers are saying but is included as a reminder for the low budget or rush jobs.

PRE WATERING

Pre watering is the cheapest and easiest form of soil consolidation and it provides good soil moisture status which enhances speed of root development.

Good pre-watering will make the job of post laying watering easier as not as much water will have to be pushed through the turf mat to build up the required moisture reserve in the soil.

The area should be allowed to dry enough to traverse and to permit final levelling. Pre watering significantly reduces the intensive care period.

FERTILISER APPLICATION.

Should be done only after fairly good levels are achieved otherwise fertiliser will be raked off the high sports and congregate in the low spots.

On large jobs hand spreading will be inaccurate so some form of mechanical spreading will be desirable.

FINAL RAKING.

At this stage levels would be correct as they would be done as part of the preparation but some removal of footmarks etc. will be required.

Lawn-levellers do an excellent job as they remove bumps without compaction. This operation will lightly mix in the fertiliser.

TURF LAYING.

Strathayr will phone your office late in the afternoon prior to the day of delivery to advise the time of delivery.

On steep slopes lay across the slope, on flat areas lay parallel to the longest straight edge.

The neatest pattern is generally the familiar staggered brickwork type pattern. Boundaries however should have a single full width strip along the edge. This will minimize drying out which occurs more readily if there are narrow strips on the edge.

Rolls should be placed where required, the ends butted up to join, and the turf then unrolled and pushed up to make a neat butt join along the edge. Always push turf into place - don't pull it.

Complete the job as you go so that watering is uniform and simplified and there is not walking over laid turf.

TAMPING DOWN.

If levelling and pre watering are done correctly then there is no requirement for rolling new turf and the undesireable side effects of rolling can be avoided. Unless soil is very wet rolling tends to compact the high spots and leave the low spots. Also there is a tendency to delay watering if rolling is planned.

Tamping, whilst the soil is wet, is more desirable for turf laying as some straightening and bedding in of the ends of the rolls is desirable.

Tamping boards are easily made and on small jobs a normal rake will do.

POST LAYING WATERING.

Here is the real key to a successful job. Keep the sprinklers coming up behind the work so that watering starts immediately after laying and pay a lot of attention to the edges. At this stage concentrate on getting as much water into the soil as possible. Intensive watering for the first three days provides the best and the cheapest job.

Remember you are dealing with a living plant which will quickly dry out until its root growth can provide it with soil moisture.

After the initial period of intensive water the frequency of watering should be progressively reduced in order to encourage deep rooting.

MOWING.

7-10 days after laying the area can be allowed to dry so that mowing can commence. The mower should be at the highest setting with a gradual height reduction over subsequent mowings. Excessive clippings should be removed but it is better to mow at sufficiently frequent intervals to avoid this task.

CRICKET WICKETS.

For a number of years we have trialled various systems with a view to helping overcome the early season wicket problems that beset grounds which are used for both football and cricket.

We are pleased to announce that preferred couch wickets can be prepared rapidly after the the last football game using a sodding method we have developed. During the first summer the turf matures sufficiently to withstand the rigours of the subsequent football season.

Couch wickets are extremely difficult to establish in Melbournes marginal climate by the conventional sprigging method.

By the end of summer wickets prepared this way are just beginning to reach reasonable maturity when they are then subjected to another harsh winter football season.

It takes two Victorian summers to make a good couch wicket. One on our farm and one on the ground.

MOWING AND WATERING PROGRAMS FOR ESTABLISHED TURF*

D E Aldous

Victorian College of Agriculture and Horticulture - Burnley

Two primary cultural practices in turfgrass management are mowing and irrigation and these along with the fertilizer practices are highly interrelated. Changes in mowing practices usually require an adjustment to fertilizer and irrigation regimes. Mowing is the most basic of all turf cultural practices.

Mowing practices are often cited, along with incorrect design or construction and over-use of fields, as contributing to poor turf on athletic fields, school grounds, parks and other recreational areas. In addition to this, overseas figures show that up to to 60% of the grounds superintendent's time may be involved in mowing and that mowing costs viz labour, equipment, replacement and supplies, may contribute to 40% of a total maintenance budget. Therefore to keep costs down, and save time, yet still supply a uniform, dense turf that supports heavy use, a sound knowledge of mowing principles is required.

The main grasses managed by municipal authorities must be capable of withstanding heavy wear. Such grasses include the creeping bents, kentucky bluegrasses, couch grasses, tall fescue and the fine-leaved turf type perennial ryegrasses.

MOWING HEIGHT

Mowing height is defined as the distance above the soil surface at which the turf is mown. No single mowing height is desirable for all turfgrasses. The preferred mowing heights for the commonly used cool and warm season turfgrasses managed in Victoria and given in Table 1. Mowing of the ryegrasses, bluegrasses and fescues over an extended period of time at a height less than 2 cm can lead to a general thinning of established turf. The loss of excess top growth reduces the amount of photosynthetically active tissue with the result that the remaining leaf does not allow for sufficient light capture and conversion to carbohydrate (food reserves will limit root and rhizome production.) Close mowing, outside the turfgrass's inherent mowing tolerance, may reduce the ratio of root to shoot weight. A high root/shoot ratio should always be sought in the management of turfgrass.

Another feature of frequent, severe defoliation is the reduction in rhizome and stolon growth and loss of recouperative potential. Regrowth is also delayed until sufficient photosynthate is again produced from the existing leaf canopy.

Within the mowing tolerance range of the turfgrass, tillering and shoot density are increased at lowered mowing heights. However, severe defoliation can cause a reduction in shoot density and thinning out of the turf stand. Thinning out encourages moss and allows light to reach the soil surface, resulting in weed invasion. Weakened turf is also prone to invasion from disease and insect pests.

If turf is allowed to grow excessively tall, lower leaves may become pale and course in texture, with the grass developing an upright bunch growth habit. Air circulation is restricted and environmental niches are created for disease build-up. It is a poor practise to permit up to 15 cm (6") of growth to develop under the mistaken idea that it protects the surface.

In turfgrass mixtures a shift in mowing height can lead to the competitive advantage of one grass species over another. Hence select the mowing height to favour the predominant or most desirable grass.

Table 1. Cutting heights of turfgrass managed in Victoria

Turfgrass	Cutting Height (cm)
Creeping bentgrass	0.5 - 2.5
Couch grass (Indian doub)	1.2 - 2.5
Tall Fescue	1.5 - 3.0
Kentucky bluegrass	2.5 - 5.0
Perennial ryegrass (turf type)	1.2 - 3.0

FACTORS INFLUENCING MOWING HEIGHT

Along with the physiological condition of the turf mentioned, other factors need to be considered in the selection of a desirable mowing height.

(a) Growth habit. A dense, prostrate growth habit has a competitive advantage over species that display an open upright habit, as a larger portion of green leaves remain after mowing. Thus a higher level of photosynthesis per unit area is maintained with adequate carbohydrate levels for root growth. The erect habit of ryegrass doesn't enable this species to develop sufficient new leaf for metabolism when compared to bluegrass when maintained under a close mowing regime.

Growth habit and location of growing points also dictate tolerance to close mowing. The bentgrasses, for example, have their growing points closer to ground level than the ryegrasses. Differences in cultivar tolerance to the height of cut exist for the bluegrass and some of the improved turf type ryegrasses have also demonstrated better persistance under fairly close mowing.

(b) Purpose of Turf. A different cutting height is required to provide, for example, for resiliency and safety in a sport or recreation situation, as against the desired quality of surface for bowling or putting green.

(c) Age of Turf. Seedling turf is dependent upon the stored food reserves of the seed until sufficient leaf has been produced for photosynthesis. Vigour and plant survival are reduced if low mowing heights are introduced at this early stage. Newly established areas should be mown when the majority of the stand is 50 mm (2") and frequently enough so that only the tips of the leaves are removed.

(d) Seasonal environmental conditions. In areas with characteristically high summer temperatures, the mowing height needs to be raised 10 mm to prevent heat damage. By raising the height of cut more leaf surface is provided to assist in growing and shading lower plant parts. In summer one may be concerned with survival rather than beauty or function.

Turfgrass growth is often reduced under shade conditions as the low light intensities limit the quantity of carbohydrates the turfgrass plant can synthesize. Morphologically, turfgrass plants also respond to shade by reduced tillering. A higher mowing height of 10-20 mm above the preferred mowing height, is recommended for grasses managed under shade. Changes in mowing height may also be considered if turf has been weakened by disease or has excessive seed head formation.

MOWING FREQUENCY

Mowing frequency has been defined as the number of mowings per unit of time. Although closely interrelated with mowing height, frequency is felt to be of lesser importance. As a general rule, no more than one-third of the green leaf area of the grass should be removed at any one time. This means mowing should be done according to height, not according to schedule, eg. established turfgrass maintained at 35 mm (1 1/2") should be mown when it has reached 50 mm (2").

Regular mowing, at the correct height, improves both vigour and quality of the stand. If the mowing height is lowered, frequency must be increased to maintain quality. Shorter and more frequent mowing will place excessive stress on turfgrass, which will ultimately result in both reduced top growth and root/rhizome production. If it is necessary to mow at a lower height, supplemental irrigation, fertilizer and intense management must be provided.

Infrequent mowing removes a high portion of leaf resulting in open turf of poor playing quality. If the grass is permitted to grow taller than the preferred height, it needs to be mown back to its regular height gradually, not at one mowing.

FACTORS INFLUENCING MOWING FREQUENCY

Although mowing height and use are known to effect frequency, any factor that influences shoot growth rate will have the same effect. Vertical shoot growth is closely influenced by genetic and environmental factors, eg ryegrass has a growth rate three times more rapid than bentgrass. Varietal differences within species have also been reported for the bluegrasses.

Increased use of irrigation and nitrogen as well as optimum growing temperatures also stimulate shoot growth and therefore increase mowing frequency. This emphasises the need to mow with the season. The practical aspects associated with poor weather, training sessions, and the rate at water drains away, will also force a change in the frequency of mowing some grounds.

MOWING PATTERN

This has been described as the orientation of back and forth travel while mowing turf. This pattern needs to be regularly changed to distribute wear and

compaction, and to avoid creating "grain": This is often achieved by mowing the field lengthwise one time and crosswise the next, although diagonal mowing should also be considered in a programme. To reduce bruising of the turf on the turns a headland width of 1 and 2 cuts can be left until last, so as turning occurs on the longer grass.

RETURN OR RETAIN CLIPPINGS

Although it is seldom practicable to remove the turfgrass clippings over large areas, problems can arise through irregular mowing practises. If excess clippings are not removed, they can contribute to thatch, smother the grass, enhance the spread of disease and weed seed, as well as providing an objectionable appearance to patrons.

Under a correctly managed programme, clippings are small enough to filter down in the turf and contribute to the organic matter and soil infiltration rate.

SIGNIFICANCE OF WATER

Water is, of course, essential for turfgrass growth and is involved in many plant activities such as germination, cellular development, tissue growth, food manufacture (photosynthesis) and distribution, temperature control and resistance to pressure. Three different needs for watering can be recognised:

1. to replenish soil water reserves - in order to avoid water stress;

2. to lower the surface temperature of the green - in order to avoid heat stress; and

3. to assist in the establishment of seedlings or vegetative material (springs, plugs, sod).

With irrigation our aim should be to apply a similar quantity of water to that lost from the soil through evapotranspiration (the combined water losses of evaporation from the surface and plant uptake or transpiration). As a general guideline lush green bluegrass/perennial ryegrass turf heavily fertilized, cut high and watered daily might loose on a hot windy summer day 16-17 mm. By contrast, a low cut couchgrass, irrigated deeply once every 14 days with moderate fertilizer rates in spring might only loose 6 mm on the same day. It is preferable to keep a rain gauge handy in order to compensate for any rainfall which occurs.

The major factors in using water to best advantage are the following (after Handreck, 1983):

- frequency of irrigation
- depth of root zone
- cutting height
- turfgrass species
- soil/media properties
- amount of fertilizer required
- turfgrass quality

Frequency of Irrigation

Frequency of irrigation will be determined by climatic, soil and plant rooting depth factors. At each irrigation the soil should be wet to the depth of the root zone. Today sophisticated equipment, such as the evaporimeter and tensiometer are available to assist in scheduling irrigation needs. The following table may be used as a guideline for irrigation frequency over summer for various soil types and turf rooting depths.

Soil texture	Rooting depth (cm) (after McAuliffe, 1982)		
	10	20	30
Medium-fine sands	2x/day	daily	daily
Sand loams	daily	3x/week	2x/week
Loams-clays	3x/week	2x/week	weekly

Depth of Root zone

There are major differences in potential rooting depth within and between turfgrass species. For example bentgrass roots rarely penetrate beyond 10 cm, whereas couch roots may go down 2 or more metres. Depth of root system can influence frequency of irrigation. Cutting height is also significant.

When little water is available, keeping cutting height low will mean lower loss of water. Cool season grasses may die if this strategy is adopted. Warm season grasses that have a low compact form of growth perform somewhat differently.

Increasing their height of cut increases their use of water only slightly. Apparently what happens is that the lower leaves are shaded by the upper leaves and so lose less water than might be expected for a measurement of total leaf area (Table 2).

Table 2 WATER CONSUMPTION BY GRASSES CUT AT 6 CM AS A PERCENTAGE OF LOSS FROM GRASS CUT AT 3 CM (After Biran et al, 1981)

SPECIES	% LOSS
Warm season grasses	
Couch	112
Paspalum vaginatum	103
Buffalograss	108
Cool season grasses	
Tall fescue	129
Rye grass	125

So, raising the height of cut of warm season grasses has only a small effect on water consumption.


MARCH
APRIL
AUTUMN

Fertilizer Regime

Starved turfgrasses use water very inefficiently. High levels of fertilizer, particularly nitrogen will increase water consumption through an increase in topgrass and a restruction in root growth (low root: short ratio). Root distribution is also an important factor affecting the rate of water use.

Turfgrass Species

The warm season grasses, such as couchgrass paspalum, buffalo and kikuyu, utilize the water available more effectively and use sunlight more efficiently than do the cool season grasses. They also withstand high temperatures much better (Table 3). For example:

Table 3 WATER USE AND GROWTH OF TWO WELL-WATERED GRASSES (Biran et. al. 1981)

SPECIES	WATER USE (L)	CLIPPINGS (g dry)	TRANSPIRATION RATE (L/g dry)
Couch	34	109	308
Ryegrass	50	74	671

However in southern Victoria, many of these grasses are affected by our winter growing conditions and other alternatives may need to be considered eg overseeding.

Turfgrass Quality Required

The quality of a turf is a function of its utility, appearance, and, in the case of sports turf, its playability during the growing season. The irrigation regime will affect turfgrass quality. The extremely high density of creeping bentgrass for a golf green requires higher quality maintenance than say roadside turf.

Soil properties

The soil for any turfgrass area must provide support for the grass, serve as a storehouse for nutrients, supply oxygen and act as a reservoir for moisture. The texture (size of soil particle), structure (arrangement of soil particles), and porosity (percentages of soil volume not occupied by solid particles) of a soil are the basic physical factors which control the movement of water into the soil (infiltration), through the soil (percolation) and out of the soil (drainage).

Texture, structure and porosity, along with organic matter content, determine the water-holding capacity, control the air-water relationships and drainage characteristics of the soil. All directly affect water requirements of the grass and hence impact directly on water management practices.

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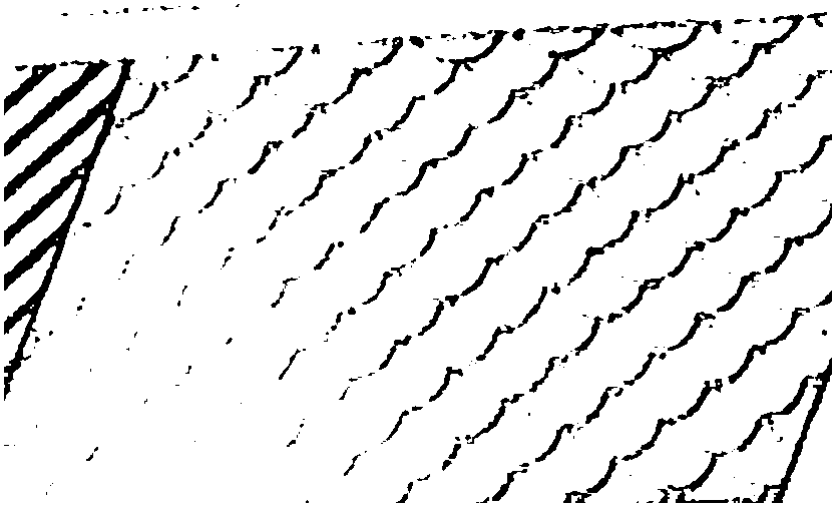

CALIFORNIA TURFGRASS CULTURE
FORMERLY, SOUTHERN CALIFORNIA TURFGRASS CULTURE

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THE SAND FOOTBALL FIELD

*William B. Davis, Delbert S. Farnham, Kenneth D. Gowans**

Maintenance of our highly used football fields has become a major headache since few of the fields can provide a satisfactory playing surface throughout the football season. The heavy traffic thins the turf and when the rains come, the game is often played in the mud. The non-turfed soil in the center of the field becomes densely compacted. Knotweed, *Poa annua* and other weeds invade this bare area and further complicate the problems. These problems have led many turf managers, school officials, and coaches to give up and go the route of artificial turf. While artificial turfgrass offers a partial solution, it is expensive and in many cases does not give a completely satisfactory football field.

Now there is a feasible alternative to both artificial turf and the typically unsatisfactory clay or loam soil football fields. The alternative is a sand field. A primary advantage to sand fields is that they are not muddy when wet because they contain little clay and silt. In addition sands will drain rapidly when compacted, can grow an excellent turf sod with proper nutrition and are easy to repair which is essential for the proper execution of football and soccer.

These qualities have been proven by a number of sand fields, which have now been successfully used and maintained for several years.

Type of Sand Used Key to a Sand Field

Sands vary considerably and, typically, there is a great deal of misunderstanding about the different types. Some sands are droughty; some can compact into hard surfaces; and some may lack good stability. This variation is due to the fact that the sand particles can range in size from 0.1 to 2 millimeters (mm), and any individual sand may consist of particle sizes widely distributed through this range.

Economics has pretty well dictated that the depth of any imported sand, top soil, or special mix must be limited due to cost. The soil physics and drainage characteristics of any shallow soil layer further influence selection. These considerations limit the choice of sands to those that have a narrow range of uniform, relatively fine particles. Many such sands are found in natural deposits along the Pacific Coast, although the deposits are not restricted to this area.

A great deal of research has gone into finding out which of the various types of sands and sand mixes work well for golf and bowling greens. This information is also useful for selecting sands to construct suitable football fields. (See suggested references)

Physical Characteristics Needed in a Sand

Both laboratory tests and field experience have shown that the most satisfactory sands are those in which the particles are fairly uniform in size. Ideally, these sands should also have a relatively small percentage of particles small than 0.1 mm or greater than 1 mm. (See table 1.)

TABLE I. TEXTURAL CLASSIFICATION FOR HIGH TRAFFIC TURFGRASS FIELDS

U.S.D.A. Discipline Name	Particle Size mm	U.S.D.A. Standard Sieve Number		% Range of Suitable Sands
GRAVEL	4.00	5		0-10%
FINE GRAVEL	4.00-2.00	10		
VERY COARSE SAND	2.00-1.00	18		
COARSE SAND	1.00-0.50	35		
MEDIUM SAND	0.50-0.25	60	60%	85-95%
FINE SAND	0.25-0.10	140		
VERY FINE SAND	0.10-0.05	270		
SILT	0.05-0.002	—		2- 8%
CLAY	0.002	—		

An excellent sand for high traffic conditions is one that has 60 percent or more of the particles in the medium size range, with a total of 85 to 95 percent of the particles falling between coarse (0.5 mm to 1.0 mm) and fine (0.25 mm to 0.1 mm). If the coarse fractions predominate or equal the medium fractions, the sand tends to be more droughtly and less stable. A sand that is too high in the fine fractions has slower drainage characteristics, and the addition of a small amount of clay and silt could seal the surface pores, thus restricting water infiltration. When a sand has an equal distribution of coarse, medium, and fine particles, the result is a harder surface with reduced drainage characteristics. This is why the key fraction is a sand that has particles in the medium size range (0.25 mm to 0.5mm).

If the particles vary only slightly in size, sands retain a high percentage of uniform pore spaces. When subjected to compaction, these sands do not greatly change in density or pore size. If the sand particles are relatively small, the individual pores are also small, resulting in a sand that has a fairly good water-holding capacity. Move-

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ment of water into and excess water through these sands can be relatively rapid. Therefore, a sand carefully selected for a football field would settle into a stable compacted state, have good drainage characteristics, yet hold sufficient moisture for plant growth. And these physical characteristics would not change under high traffic. Even at the outer limit of the acceptable range this will still produce a mud free playing surface.

No Need to Crown a Sand Football Field

Fields constructed of clays, loams, or artificial turf depend on surface drainage to remove water that cannot move rapidly into the surface and through the soil profile. This is why football fields usually have 12 to 24 inch crowns. A crown is not required and has only become a standard procedure in football field construction to help remove excess surface water. However, a sand football field, if well constructed and correctly maintained, accepts (infiltration) and moves water through it profile (hydraulic conductivity) faster than any irrigation system or heavy rain can apply it. This is particularly beneficial when the field is also used for other sports, since crowning may then be undesirable. Surface catch basins at the edges of the field can also be eliminated as a sand field does not rely on surface drainage.

Removal of Excess Water

It is not uncommon for a false water table to develop at the interface of the sand layer and the parent soil base. A false water table can occur even if the right sand is used and is correctly placed 12 to 18 inches deep on the parent soil. This is because few parent soils (clays, clay loams, or loams) can accommodate water at a rate greater than 0.25 inch per hour and, when compacted, infiltration rates often drop to 0.01 to 0.1 inch per hour. Therefore, excess water moving through the surface of a sand field accumulates at the interface between the sand and the parent soil.

Some type of tile drainage system is usually necessary to remove this accumulated water. The only exception may be when rainfall or irrigation is not excessive and the parent soil has relatively good drainage characteristics. (Since the parent soil is not subject to surface compaction, its drainage characteristics should not change.) However, a tile drainage system can be expensive and providing the parent soil is not impervious, the omission of a tile system would be less serious than many of the other compromises commonly made.

Spacing of Tile Lines Can Be Critical

A false water table that develops at the interface of the sand layer and the parent soil is close to the surface of the playing field. The importance of rapidly removing excess water created by a false water table governs the distance between tile lines. The maximum spacing between tiles can be as much as 30 feet although this may be too far apart during prolonged rainy weather. Between tiles the water table will rise above the water table at the tiles for a period of time due to the slower movement of water laterally along the interface. However, if the sand depth of the field is 12 to 18 inches, there is no need to space tiles less than 10 feet apart.

Design of a Tile System

There are several approaches to laying out a tile system. Trenches are usually cut in the parent soil to the depth and width needed to accept the tile, which is surrounded by gravel or a sized rock. It is important that no soil cover the tile line and that no trenches be deeper than necessary. Loose soil trenched from ditches should be removed from the site so as to avoid contaminating the tile system. The lines should have a fall of 1 percent and should empty into a storm drain, drainage ditch, or other facility.

In some instances a 4 to 6 inch blanket of gravel and/or coarse sand between the sand and the parent soil has been used. The added expense of these complete gravel blankets are questionable since field experience has not proved that they improve the drainage characteristics of the surface sand. The cost of 200 to 1,000 cubic yards of gravel or sized rock should be well documented before such an expense is added to a football field installation.

Other Approaches to Design of a Tile System

It would be good to consider using a single trench to install both the irrigation system and the tile lines. These systems are often designed and installed separately when it would be more advantageous to combine them. If correctly engineered, closer spacing of the sprinkler system or wider spacing of the tile system could effect a saving in installation cost, with no loss in efficiency.

Still another approach is to grade the parent soil so that three sloping channels run the length of the field. Excess water draining from the sand would then move laterally through the sand at the interface of the parent soil, flowing down a 2 percent slope to gravel encased tile lines. This type of system reduces the amount of trenching necessary for both the tile and the irrigation systems. Since the maximum depth of the sand in the surface layer governs the internal drainage characteristics of the sand, the total volume of sand used does not need to be increased.

Design of the Irrigation System

It is essential to supply adequate moisture to every part of a sand football field. There is minimal lateral movement and no surface spreading out of water when applied to a sand. For this reason, the rule should be 100 percent overlapping of the sprinkler system, with sprinkler heads space 30 to 60 feet apart. Half heads around the outside edge of the field should be clocked separately since they discharge twice as much water as a full circle head. The system should also be designed so that the critical center of the field can be irrigated separately. Many new football fields are also combined with areas for track and field events. If this is the situation, special controls or spacing of sprinkler heads should be used so that water can be applied where and when needed.

There can be no compromise when it comes to an irrigation system for a sand football field. Precipitation rates can be higher for a sand than for a soil field because infiltration rates usually exceed 2 inches per hour and may go as high as 30 inches per hours but coverage is essential.

Amending the Sand

Many of these uniform, relatively fine sands have been tested on golf greens, park sites, and football fields. No organic or inorganic amendments were used in these tests. However, if frequency of light irrigation during the germination period is difficult to manage, a light surface application of organic matter worked into the surface 2 to 3 inches of sand could be used. The type of sands recommended are not drouthy if properly selected, installed and managed. During periods of high evapotranspiration (0.25 to .30 inches per day) every other day irrigation may be necessary. The added expenses of physical amendments plus their mixing problem and cost can therefore be avoided.

Careful Fertilization Is Essential

Turfgrass nutrition studies have been run on sands collected from various sections of California. In these tests nitrogen, phosphorus, and sulfur were always found to be deficient. Most of these sand deposits were found to contain fragments of primary minerals, such as feldspar and mica, which release other nutrients to the plants. Few of our sand sources were pure quartz.

Single superphosphate (0-20-0) can be used to add a relatively large amount of phosphorus and sulfur to the soil. This material is particularly good because it does not leach rapidly from the sand or injure the plants. A rate of 20 pounds per 1,000 square feet or 800 pounds per acre of single superphosphate supplies about 4 pounds of phosphate (P_2O_5) and sulfur (S) per 1,000 square feet to the sand. This is enough to last for several years, particularly if the clipping are returned to the sand.

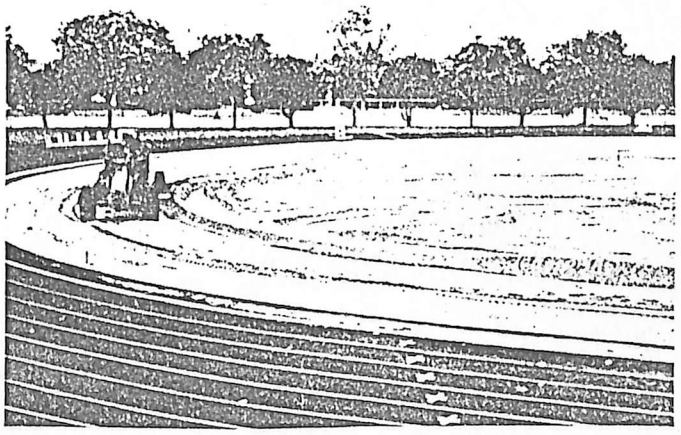
Nitrogen presents a problem because most forms of nitrogen are soluble in water and are soon leached from sands. Water soluble forms of nitrogen include the nitrates, ammoniacals, and ureas, as well as most nitrogen mixes or blends. To be effective, low rates of these types of fertilizers must be applied frequently. It has been found that once the turfgrass is established, an application of ½ pound of nitrogen each month or 1 pound of nitrogen every other month produces a very satisfactory, cool-season turfgrass sod. More frequent or higher rates are required during the summer to maintain the warm-season grasses. While a new turf is becoming established, nitrogen levels must be maintained at a high level to ensure proper growth.

Several sources of slow-release nitrogen are available and have also produced a good, healthy sod. These materials can be applied at much higher rates and will supply nitrogen for several months. Urea formaldehyde, IBDU (isobutylidene diurea), and plastic-coated nitrogen fertilizers are slow-release nitrogen sources. These materials can be applied at rates as high as 9 pounds of actual nitrogen per 1,000 square feet without injury to the grass. Applications of 6 to 9 pounds of nitrogen per 1,000 square feet, using urea formaldehyde or IBDU, have supplied newly seeded grass with adequate nitrogen for at least 4 months. A similar application of plastic coated nitrogen fertilizer provided nitrogen for as long as 11 months.

Potassium should not be overlooked even though many sands did not show a deficiency. Starter application of 5 lbs. of K_2O per 1000 sq. ft. or 200 pounds per acre are recommended. Potassium can be easily leached from some sands so frequent application may be necessary.

Establishment and Management of the Sand Field

Grading the sand football field takes greater care and skill than the typical soil field. If the parent or base soil is firm enough to support loaded trucks, the sand can be partly spread as it is dumped from the truck. If not, the sand can be dumped from the sides and spread with a blade on a small tractor. In either case, considerable work will be required with the blade to move the sand in place and smooth it. Frequent watering will settle the sand and make it more workable. Loaded trucks should not run over unprotected tile and irrigation lines. Most of this traffic can be kept between these lines.

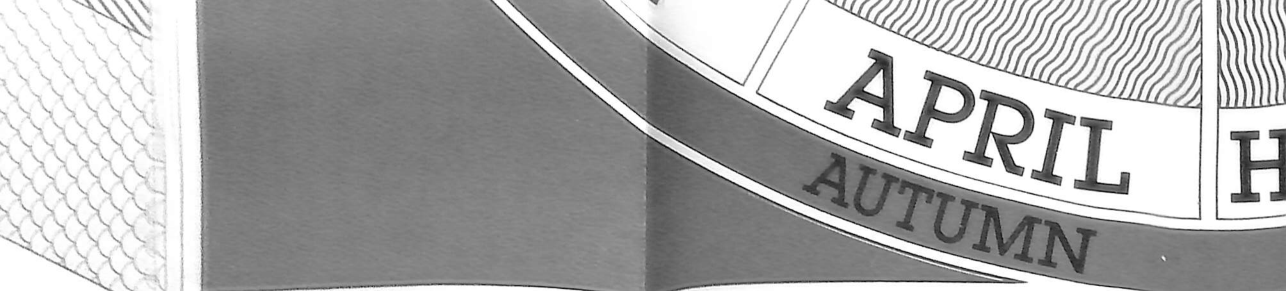


Rough grading of sand completed with road grader. Sand placed 14 inches inside the quarter mile track.

Select seed that grows well in your climatic zone and that can withstand heavy traffic. Spread the seed in two directions to ensure good coverage. Firm the seed into the sand with a ring roller or cultipacker.

The single superphosphate, potassium, and the nitrogen fertilizer can be distributed over the surface of the sand after it has been smoother and settled.

Water frequently enough to keep the surface moist but not saturated. Once the plants germinate, less frequent irrigations are required.


APRIL
AUTUMN
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Water and nitrogen management is the key to a successful establishment. Supply what is needed when it is needed. Don't rely on the irrigation controller clock, the calendar or a cookbook recipe for water and nutrition.

The sand football field answers many of the serious problems encountered on high use football and soccer fields. Overuse of a field still removes turf, but, even in the rain, good footing and playability of the field prevail. Overseeding, fertilization, topdressing, mowing, and other management practices can be done at the convenience of the turf manager. There is no need to wait several days to several weeks for the field to dry out enough to practice a sound management program.

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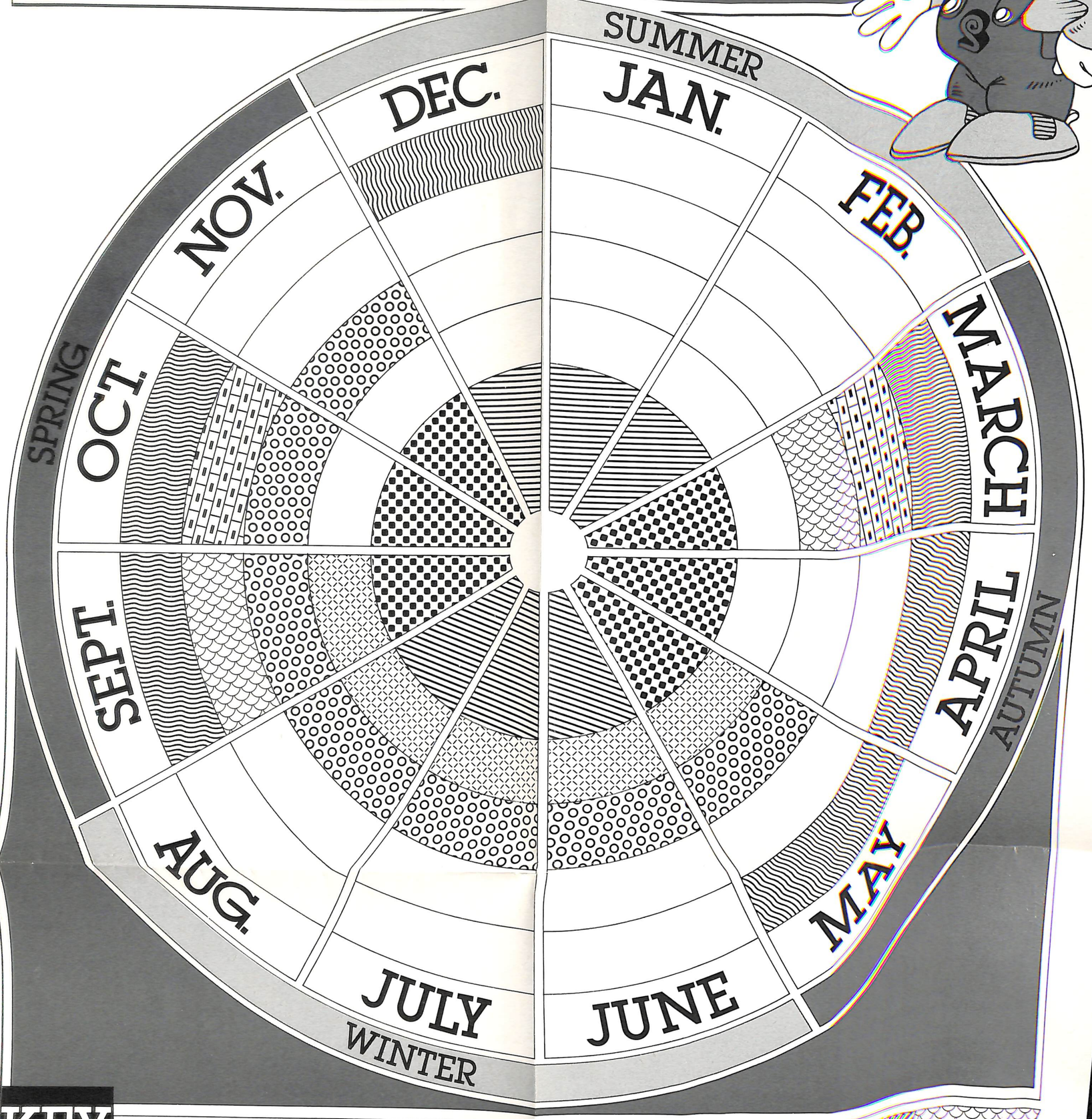
STRATHAYR SAM'S LAWN CALENDAR



KEY

- Fertilise with Complete Lawn Food with High Nitrogen content.
- Time for Dethatch/Coring
- Watch out for Corbie Grubs, if apparent, flood lawn or use appropriate chemical.
- Watch out for Cockchafers, flood lawn as for corbie Grubs, or use appropriate chemical.
- Mow Weekly.
- Mow as Required.
- Watch out for Algae or Moss, they usually indicate poor drainage, poor nutrition or close mowing.

All turf growers claim top quality. Only Strathayr really gives it to you.

Bill Casimaty — 'Strathayr', Richmond

An Aristocrat of the grass world

Life's not easy for lawn in Victoria or Tasmania. The climate is so harsh that the only way traditionally sown lawn can survive is the "shotgun" aproach — using a mixture of grass types in the hope that one will survive. This can result in a "patchwork quilt" effect.

That's why Bill Casimaty came up with Strathayr Instant Lawn, a roll-on turf bred from different strains of the same grass to give an even appearance whatever the application.

One result of this was an aristocrat of the grass world — Strathayr Blueblend. This is the most popular of all the Strathayr range of turf types; it's one you obviously couldn't grow for yourself; and it's one that only Strathayr's broad-acre cultivation methods and specialised techniques can germinate and bring to sufficient maturity for you to use it.

How to: Choose your Strathayr Instant Lawn — it's so easy!

First, you have to consider what kind of use (or abuse!) you intend to give your lawn. We can give you a range of different turf types — and we'll advise you on the right one for you.

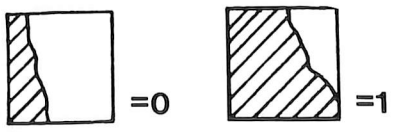
Within three weeks of laying, we have used Strathayr Instant Lawn for horse-racing — and we have different types of turf to suit every use from croquet lawns to racecourses. Here are just some of the places you'll find Strathayr Instant Lawn:

- A.V. Jennings Homes
- Hooker Homes
- Scores of Schools
- Cricket wickets
- Golf courses
- Bowling greens
- Australian Rules Football ovals
- Soccer and hockey pitches
- Croquet lawns
- Horse racing tracks
- Athletic tracks
- Tennis courts

In fact, wherever there's a need for attractive, hard-wearing grass, you'll find a Strathayr blend to suit.

Measure up — it's so easy!

Measure up the total length and total width of the area you're thinking of putting to lawn. Then draw up a grid where each square represents (say) one metre, and work out the shape of your future lawn on it. Then just count the square metres occupied by your lawn. Wherever you have less than a full square metre, count less than half as zero, and more than half as one. That way you'll be right to within half a square metre.



If this all sounds too much for you, give us a ring and we'll do the lot for you: measure, quote, prepare, supply and lay.

Prepare the ground — it's so easy!

Like any aristocrat, Strathayr is particular about its bed. Preparing the ground well is vital.

The first thing you have to consider is your soil. What is its pH — is it acid? If you give us a ring we'll tell you how to get it tested. We may even do it for you. A pH of between 6 and 7 is ideal for the successful establishment of Strathayr Instant Lawn.

Then make sure it's

(a) cultivated and smooth — as nearly bump-free as you can get it.
(b) free of old lawn. Don't worry too much abou seedling weeds. The turf will smother them.
(c) moist (water 2 or 3 days before laying the lawn, then leave it until the surface dries, sc that you can walk about on it).

N.B. You *can* lay Strathayr Instant Lawn over another lawn, but we don't recommend it — especially over an old, thatchy lawn.

Water Strathayr Instant Lawn — it's so easy!

As well as damping the ground before you lay Strathayr Instant Lawn, you must keep it *well* watered for two or three days after it's laid — and in hot weather, *immediately* it's unrolled — so that it grows vigorously into a continuous lawn without joins.

After this first 3 days, progressively cut back your watering until at the 3-week mark you are only watering once a week. This ensures that the roots go down deep, well away from the ravages of sun and wind.

Lay Strathayr Instant Lawn — it's so easy!

Nothing could be easier. Just unroll the strips and lay them — butted right up against each other —like strips of carpet.

Tamp *well* down with a flat board.

Working carefully and neatly right from the start is much better than attempting to correct errors later by rolling etc.

N.B. Keep strips in rolled form covered with sacking until you need them. They "keep" better that way.

Mow Strathayr Instant Lawn — it's so easy!

On the Strathayr property, we use cylinder mowers.

Strathayr Instant Lawn is so easy to cut, you only need a hand mower. For a *real* lawn — as opposed to a cropped paddock full of slashed and bruised grass — nothing beats a cylinder mower. But it has to lift to at least 25mm — because that's the shortest length to which you can safely cut your lawn in our climate. We can sell you a very reputable one.

Conventional mowers are fine — but do avoid drastic reductions in the length of your grass. And remember — let your newly-laid Strathayr lawn grow for at least 10 days before mowing it for the first time.

Fertilise Strathayr Instant Lawn — it's so easy!

Like yourself and your garden, your Strathayr Instant Lawn likes to be fed. Feed it five times a year with a high nitrogen complete lawn food fertiliser. The easiest way is to broadcast it (throw it high in the air) in powder form. Alternatively, to avoid the risk of temporary burning, dissolve it in water and sprinkle it with a watering can.

We can help you with your fertiliser requirements.

Strathayr Saves you: Time

If you were to sow a lawn yourself, you'd have to find the right seed, buy it, prepare the ground, wait for a calm day, sow the seed, spray for weeds and nurture it carefully for 3 to 6 months, protect it from birds, wandering elephants and family — and then live with a possibly unsatisfactory result.

Sowing a lawn for yourself is a tricky business. You *have* to use grass seed which will establish itself quickly — unless you want it to blow away.

What this means is that it will grow *very* rapidly —and you may be chaining yourself to a lawn mower for the rest of your gardening life.

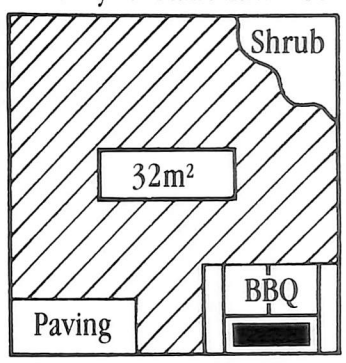
With Strathayr instant lawn you can just make a phone call and everything will be taken care of. And you'll only have to give it 3 days of loving care —not 3 — 6 months!

And once you've correctly laid Strathayr Instant Lawn and watered it through the first three days, you can look forward to weekly watering only.

Money

Strathayr Instant Lawn is consistently the cheapest finished ground surface money can buy.

What Strathayr Instant Lawn Costs



Let's suppose you have an area like this to cover — 30 – 35 square metres. You can do it in a variety of ways. Let's look at some typical costs on a problem-free site:

		Approximate Price*
1.	Strathayr do everything — Remove existing lawn, provide and dress with topsoil, level off and lay lawn.	$260
OR 2.	No existing lawn — Strathayr do all above	$200
OR 3.	You prepare surface, Strathayr lays lawn	$120
OR 4.	You prepare surface and lay lawn	$100

* Site inspection necessary for a firm price.

A variation on doing it yourself — and a particularly useful one if your time, money or water supply is limited — is to lay a little at a time. We quite approve of this method, and it makes no difference to the final highly professional appearance of the lawn, as long as you're equally careful at each stage.

McEnroe. Norman. Cash.
Chappell. The VFL. Kingston Town
All Strathayr users.

Yes, they've all enjoyed the springy turf of Strathayr under their feet.

These are just a few of the sports facilities using Strathayr Instant Lawn

VFL Park
Metropolitan Golf Course Melbourne
Yarra Yarra Golf Course
Moonee Valley
Flemington Racecourse
Caulfield
Cornelian Bay Hockey Grounds, Tas. (used for Australia/England Test Match 5 weeks after laying)
Kooyong Centre Court

Clover-free

One of the things that makes a lawn look green is clover. It's green itself, and it puts nitrogen into the soil. However, clover has drawbacks. It stains clothes, attracts bees, and is not hardwearing.
For these reasons we produce *only* clover-free lawns. You can make sure your Strathayr clover-free lawn always looks its green and perfect best by fertilising as we suggest.
Or if you insist on having clover in your lawn, we'll even give you the seed — free.

Sports Administrators:

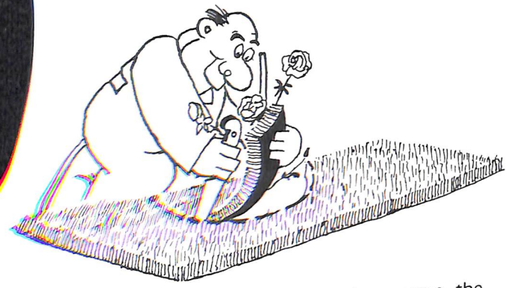
The same team of consultants who designed the Los Angeles Olympic Stadium are available to you — through "Strathayr", Richmond, Tasmania, 7025. Telephone (002) 62 2388.

For more information or to arrange an obligation-free quote.
Ring Barbara Scott on (03) 6024792 or (057) 921182.

Tallarook Park, Seymour, P.O. Box 267, Seymour.

Strathayr Instant Lawn

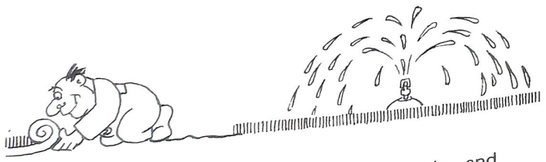
- To shape edges around gardens, drives etc., lay the roll in place and cut to shape with a sharp knife (like a carving knife — do not use a shovel). See diagram 5.



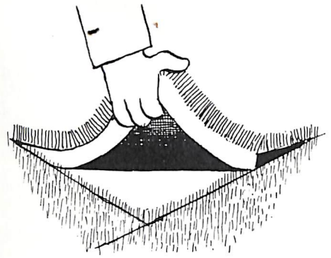
- For sloping areas, lay turf strips across the slope. Lay in a brickwork-type pattern so that the ends of strips are not in line. On extreme slopes temporary wooden pegs should be inserted about every fourth or fifth row to hold turf in position while the roots establish.

WATERING

- As soon as sufficient lawn has been laid, watering should commence while the remainder of the turf is laid. (See diagram 6). Watering should commence within an hour of the commencement of laying (even less in summer). Water sufficiently to saturate the newly-laid turf mat and the underneath soil.

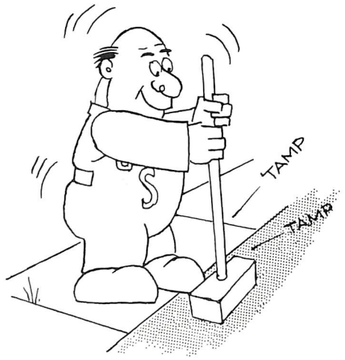


- Next day, saturate the entire lawn again and check that the base soil is wet to a depth of 3–4" (9 cm).
- Since these first two waterings are vital to the well-being of your new lawn, as you water you are advised to check the depth to which water is penetrating. This can be done by carefully picking up corners of several turf strips at intervals across your lawn. (See diagram 7).



TURF—SOIL CONTACT

- The easiest way and quickest way to achieve a good surface is to level and tamp as the turf is laid and before watering. This will also minimise traffic over the newly laid turf. Rolling should not be necessary.



FIRST MOWING

- Your new lawn should be given its first mowing ten to twenty days after laying and should be cut down to a height of 1½ to 2 inches (about 4 cm).
- Subsequently, with frequent mowing, the lawn can be gradually reduced to the desired height.

LAWN MAINTENANCE

You now have a first-class lawn. It will remain weed-free and hard wearing providing it gets reasonable care. Detailed information on good turf care is available in booklet form from both the Victorian and Tasmanian Departments of Agriculture. For your convenience, however, we list some of the important points below.

The following procedure will encourage the growth of the turf species and will keep it strong enough to beat competition, from weeds and disease.

WATERING

- In hot weather, watering will be required twice a week; once a week is sufficient in cooler weather.
- It is best to water in the early morning.
- Where possible, to reduce risk from fungal diseases, avoid night watering and avoid watering in high temperatures.
- Immediately after fertilizing, always water lightly. Heavy watering should be avoided for 48 hours after fertilizer application.
- The best sprinkler types apply water at a slow steady rate.

FERTILIZER

- A top quality lawn will be maintained if one of the following fertilizers is applied at the rate of 6 lbs per 100 sq. yards every six weeks (3.3 kilos per 100 sq. metres):
  Pivot 400
  EZ Orchard 11:3:6
  Hortico No. 4
  If fertilizer is not applied, clover and other weeds will infest the lawn. Weed spraying should never be necessary if the lawn is well-fed.
- In high rainfall areas an early spring application of Nitram will help moss control. In these conditions, turf should not be mown too close in the winter.
- Fertilizer is best applied in liquid form from a watering can or hose attachment.
- Dry fertilizer should not be applied while the grass is wet from dew as burning may result. Also burn marks may result from traffic over the lawn before the dry fertilizer is watered in.

MOWING

- Frequent mowing to a constant height is required to maintain a high quality lawn. Less frequent mowings tend to involve severe reduction in grass length and can cause permanent damage to the lawn. Any change in the closeness of cut should be gradual.
- Grass should be left slightly longer in the hottest part of the year.
- Clippings should be removed, particularly in cool and wet weather.
- With easy-to-mow, fine Strathayr Instant Lawn, for most domestic areas, hand mowers are preferable because of the clean cutting action compared with the bruising of the rotary type. Not only will they give the best finish and maintain plant density, they also save time and risk of accident. Rotary mowers are necessary for the cutting of rye grass which most do-it-yourself lawn preparations include, but are not necessary for Strathayr Instant Lawn fine turf. For larger areas we recommend powered cylinder mowers.

THE FACTS ABOUT

STRATHAYR INSTANT LAWN

THE ADVANTAGES OF INSTANT LAWN

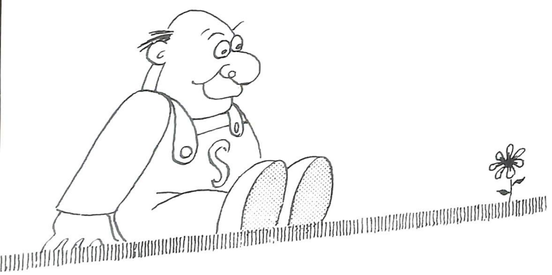
Now you can have the best lawn that it's possible to grow without all the hard work of sowing your own grass seed. No more worries about birds or rain or wind. Strathayr Instant Lawn is grown on broad acres under controlled conditions. It's nutured, fertilized, rolled, watered and when you buy it it's fully matured and only needs watering before you use it.

DELIVERY TO YOUR DOOR

Strathayr Instant Lawn is supplied in rolled strips covering one sq. metre per roll.
2.5 metres x 40 cm. (8' 2" x 16").
Just phone and we will arrange convenient on-site delivery.

QUICK AND EASY TO LAY

As a general rule, inexperienced layers take about an hour to lay 30 sq. yards. Seven to ten days after being laid the instant lawn is ready for use.



SITE PREPARATION

All construction work and site preparation should be completed before the turf arrives. Well planned site preparation will ensure that your instant lawn is laid with speed and ease.

LEVELLING AND SOIL PREPARATION

Strathayr Instant Lawn will provide an instant medium for surface drainage, provided the area is well graded and sufficiently sloped. A minimum slope of 1' in 50' (away from buildings) is recommended.

- No importation of topsoil is necessary where native soil is light and friable.
- Strathayr Instant Lawn will establish successfully on a wide range of soils but so that the lawn is usable in wet weather, with very heavy soils, the incorporation of some sandy soil is desirable.

LIMING AND FERTILIZING

- Soils of pH less than 5.5 will require liming.
- Ground agricultural limestone is recommended as the cheapest and most effective form of lime. Among brands available are:
  Hortico Garden Lime
  David Mitchell Estate Lime
  Hopkins Ground Limestone
- On sandy and clay soils of the Melbourne metropolitan area, as well as those to which mountain soils have been added, use 8 oz. agricultural limestone per sq. yard (271 gms per sq. metre). Strongly acid soils require 12 oz. per sq. yard or more (407 gms per sq. metre).
- Tasmanian requirements are similar, with the general situation being that lighter soils are most likely to be strongly acid.
- Prior to laying an instant lawn, 6–8 lbs. per 100 sq. yards of a lawn starter fertilizer should be used (3.3 – 4.3 kilos per 100 sq. metres). Mixtures available include:
  Pivot Lawn Starter with trace elements
  EZ Orchard 8–4–10
  Hortico Lawn Starter
- Care must be taken to incorporate lime and fertilizer thoroughly in the top 1–2" of soil (2.5–5 cm).

CULTIVATION

1. If the site is a new area, remove all rubbish, stones and other material. Rotary hoe or hand hoe so that the soil is light and friable and then lightly grade to a uniform surface.
2. In some cases, however, imported topsoils may be easier in achieving satisfactory levels and tilth than removing all stones and other material.
3. Where existing lawn is being replaced and if levels permit, the old lawn should simply be cut as short as possible and topped with 1–2" (2.5–5 cm) of soil to ensure an even surface. Apply lawn starter and then follow normal turf laying procedure.
4. Where existing lawn is being replaced and levels do not permit the area simply being topped with soil, either rotary hoe or chip off the old lawn and treat site as new area.

CONSOLIDATION

- Turf must follow the contour of the base upon which it is laid. A prepared surface that is level and sufficiently compacted to avoid subsidence will stop depressions forming later.
- After the preparation of the area has been completed as detailed above, the whole soil bed should be watered for consolidation. (This will also ensure that watering facilities are available as they will be required as soon as laying commences).
- Allow to dry and then give a further raking to ensure an even bed.

ROLL SIZE

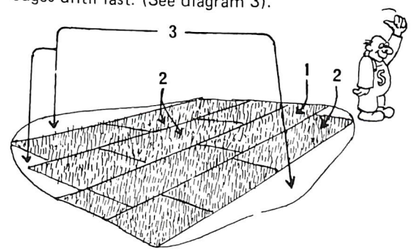
Turf is delivered in rolled strips, 2.5 metres x 40 cm and 2 cm in thickness. Normally soil is filled to the level of kerbing with turf sitting above this level.

TIMING

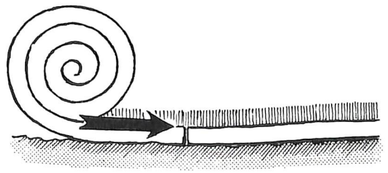
- Ensure preparation is complete before delivery.
- In hot weather, turf should be laid within 36 hours. If delays occur, turf should be unrolled in a cool place and kept watered.
- In cool weather, the turf can be left rolled in a stack for longer periods, but the grass may yellow and take a while to recover.

LAYING YOUR INSTANT LAWN

- Laying procedure should be planned so that traffic over newly-laid turf is avoided.
- The easiest method is to first lay the longest single run, complete the main area and leave edges until last. (See diagram 3).



- Before unrolling, the leading edge of the rolled strips should be firmly butted to the preceeding strip. (See diagram 4). Once unrolled, the strip may be pushed sideways into place. Remember: push, don't pull – the turf should never be stretched.



STRATHAYR INSTANT LAWN

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