SECTION SIX

Grass Selection

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SECTION 6:
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KEY CONCEPTS

- There is no perfect grass for all situations.
- Each situation must be assessed in terms of climate, soil, budget, maintenance etc.
- Any new grasses must be thoroughly evaluated through both independent trials and on-site trials.
- At least three to five years of evaluation is required.

6.1 INTRODUCTION

Turfgrasses maintained as golfing surfaces represent a very intensive form of horticulture, requiring moderate to high inputs of water, fertiliser, energy (mowing) and plant protection chemicals. However, as the golfing industry becomes more environmentally aware, it is trying to reduce these inputs and find turfgrasses that can survive with lower inputs while still providing good golfing surfaces.

Water is possibly the single biggest issue that will affect golf course management in the future, with increased use of high-salinity water and potential restrictions on water supplies a worldwide trend. There is an urgent need to develop grass species and cultivars that have lower water use, increased drought tolerance and improved salinity tolerance. This will provide significant environmental benefits in reducing the use of high quality potable water and also the potential for run-off.

While new, environmentally acceptable cultivars are being developed, plant-breeding programs are also striving to improve the surface characteristics of turfgrasses to provide better golfing surfaces. While significant advances have been made in the quality of grass varieties for greens, these varieties also appear to require a more intensive maintenance regime.

New South Wales has a range of climates where both cool-season and warm-season grasses can be successfully grown or in many situations a combination of both.

6.2 COUCHGRASS SELECTIONS FOR GOLF GREENS

Tifdwarf (Tifton 419) and *Tifgreen* (Tifton 328) are the predominant grass types used on golf greens. In recent years, golf courses in the USA have been replacing *Tifdwarf* and *Tifgreen* with one of several new ‘dwarf’ couchgrass cultivars. The reasons for the change are:

- contamination with off-types that disrupt the uniformity of the putting surface;
- requirement for increased putting speeds (need for cultivars that tolerate lower cutting heights); and
- significantly improved new cultivars.

Trials in the USA have compared the performance of *Tifgreen* and *Tifdwarf* with that of *Baby, Champion*, *Floradwarf, Miniverde, Mobile, Tifeagle* and other 'TIF' cultivars (White 1999). The results of the trials to date indicate that:

- turf quality is best at about 4.5 kg N/100 m²/yr;
- *Tifdwarf* exhibited the greatest response to increasing nitrogen (up to 6.3 kg N/100 m²/yr);
- *Floradwarf* turf quality was lower than that of *Champion*, *Miniverde*, *Tifeagle* and *Tifdwarf*, mainly due to an adverse response to high sodium and high pH levels;
- many of the new dwarfs accumulate thatch more aggressively than *Tifdwarf*. The thatch accumulation was, on average, five times greater for *Champion, Floradwarf, Miniverde* and *Tifeagle* than for *Tifdwarf* at a nitrogen rate of 2.7 kg N/100 m²/yr; and
- regular verticutting and topdressing are required on the new dwarfs, where severe, infrequent verticutting adversely affects the turf quality.

Texas research (White 1999) posed the question as to whether the new dwarf couchgrasses are superior. The research is not conclusive and, as with most other similar trials (e.g. NTEP 1999), the cultivars need to be evaluated over several years. The greatest attribute of the new grasses is their high density at very low cutting heights when compared to *Tifdwarf*. However, they require frequent mowing at low cutting heights ($\leq$3mm). The golf course must have a budget that allows for:

- regular, low cutting with walk-behind mowers
- regular verticutting, and
- regular topdressing (dusting).

Golf courses that do not have the resources are advised to carefully consider whether to establish the new dwarf couchgrasses in preference to *Tifdwarf* or *Tifgreen*.

In northern New South Wales golf greens, *Tifdwarf* and *Tifgreen* have experienced some problems, particularly with the incidence of diseases during summer stress. While it is attractive to consider the introduction of new 'wonder' grasses, this should be done only after careful local assessment. In the USA, the United States Golf Association (USGA), Golf Course Superintendents Association (GCSAA) and the National Turfgrass Evaluation Program (NTEP) are sponsoring couchgrass trials on golf courses (Anon. 2000). *MSsupreme*, *Tifeagle*, *Miniverde*, *Champion* and *Floradwarf* are being compared to *Tifdwarf* and *Tifgreen* at eight golf courses. This on-site testing program is designed to provide scientific information of a more applied nature about the performance of putting green couchgrass cultivars. The trials are designed to run for five years.

The important requirement is that these new cultivars undergo rigorous assessment in organised, replicated trials and on-course trials before any of them are introduced into New South Wales golf greens. The economic ramifications could be significant. Taking into account the additional mowing, verticutting and topdressing requirements, the increase in maintenance costs is estimated at about $240–350/100 m²/yr.

6.3 BENTGRASS SELECTION FOR GOLF GREENS

Bentgrass has long been considered the premier grass for putting greens with *Seaside* the first of the selected and named varieties released in 1923 (Reese, 2000). The next significant improvement occurred in 1955 with *Penncross* and then *Penneagle* in 1979. Since the mid 1980's there have been many new varieties released, with the current new types having been released to the market about 1995.

The breeding programs have had different objectives in terms of turf characteristics. Bentgrasses are most commonly selected for: greater turf density, reduced spiking, lower cutting height, increased salt and heat tolerance and increased disease resistance. The most obvious changes in characteristics have been in turf density and vigour. While the bentgrasses have become more dense and produce smoother and faster putting surfaces, they require more frequent cutting, dusting and thatch removal.

The Australian Golf Course Superintendents Association (AGCSA) has established a bentgrass variety evaluation trial at Kingston Heath Golf Club (VIC) and Glenelg Golf Club (SA) with a site to be established New South Wales in 2002. The objective of the trials is to assess the growth and performance characteristics of the new bentgrasses under local conditions.

In the absence of Australian data, a review of the data from the United States of America and more specifically, from the National Turfgrass Evaluation Program (NTEP), National Bentgrass Test – 1998 (Putting Green) program (NTEP, 2000) has been done. The NTEP program provides a detailed assessment of many turfgrass varieties, including bentgrass, over numerous sites throughout the USA. The bentgrass trials were established in 1998 and the results that follow are from the 2000 progress report. For convenience, only those varieties that are of interest in Australia are discussed. The full tables are available through the AGCSA or on www.ntep.org (the NTEP web site).

Turf Quality

The mean turfgrass quality of bentgrass cultivars grown at 24 locations in the NTEP trials, provides an average quality over all locations. While this does not provide specific location results, it does provide a good indication of the adaptability of the cultivars. Over the 24 sites, *Penn A4* was the top ranking cultivar with *Penn A1, Penn G1, Penn A2, L-93* and *Penn G6*, marginally below *Penn A4* but were of a similar ranking to each other. *Providence* was ranked significantly below all these varieties with *Penncross* and *Pennlinks* amongst the lowest ranking varieties.

The mean turfgrass quality ratings for each month indicate a similar trend, with the *Penn A* and *G* series and *L-93* being the dominant summer varieties. There were less significant differences between all varieties during the winter months.

At three sites the bentgrasses were maintained without fungicides and these results show that *Penn A1, Penn A2* and *L-93* all rated very highly. *Providence, Crenshaw* and *Penncross* were at the lower end of the ratings.

In trials conducted on 13 golf courses as part of the NTEP program, *Penn A4* was the top ranked variety, with the other *Penn A and G* series bentgrasses and *L-93* also amongst the top rated bentgrasses (Kind, 1999).

Summer Survival

'Summer Survival' has been determined in the NTEP trials by assessing the percentage of living ground cover during the summer months. 'Summer Survival' is of interest both in Australia and the USA as bentgrass is introduced or maintained in many marginal climatic zones where it is under stress from high temperature and humidity.

The results for percent living ground cover over four sites show that *Pennlinks, Providence, Crenshaw, Penncross, Penn G1, Penn A2* and *L-93* were amongst the top ranking cultivars.

Summer density ratings were also recorded with *SR7200* (Velvet Bent), *Penn A1* and *Penn A4* in the top group. *Penn G1, L-93, Penn A2, Crenshaw* and *Penn G6* made up the next grouping with *Penncross* and *Pennlinks* having the lowest summer density.

Thatch

The new bentgrass cultivars have a very high shoot density, an upright growth habit and vigorous growth that can result in rapid thatch accumulation. As improvements have been made in the bentgrass cultivars, such as greater density and more vigorous growth, the downside has been the increased production of thatch. At two sites where thatch depth was measured, the *Penn A and G* series and *SR7200* were in the top group for greatest thatch depth whereas the cultivars *L-93, Crenshaw* and *Penncross* were ranked amongst the lowest thatch producers.

It is very important to note that from a point of sustainability, it is not going to be possible to introduce these improved varieties without implementing a more vigorous program of thatch control. The improved varieties require more regular mowing and frequent topdressing (dusting) and golf courses contemplating their introduction must take this into consideration.

Disease Tolerance

Anecdotal evidence in Australia would suggest that the incidence of diseases such as 'Brown Patch' (*Rhizoctonia sp.*) and *Pythium sp.* increased with the introduction of cultivars such as *SR1020* and *Providence*, when compared to *Penncross*. This has always been attributed to the greater shoot density and less than ideal thatch control techniques which combine to create a microclimate more conducive to the development of disease.

Most new cultivars are selected for improved disease tolerance as a genetic trait. However, the environment will override any in-built advantages if the maintenance practices are less than ideal.

In the NTEP program, Dollar Spot, Brown Patch, Microdochium and Pythum Blight have been reported at some locations. *Penncross* was the cultivar most affected by Microdochium, with *Penn A2, Penn G6* and *Providence* affected more than *L–93. Penncross, Pennlinks, Penn A1, L-93* and *SR7200* were the least affected by Dollar Spot, with Providence and Crenshaw being the most affected. The incidence of Brown Patch was lowest on SR7200, with *L-93, Penncross, Crenshaw* and *Penn G6* being slightly more affected. The cultivar *SR7200* was in a category of its own, exhibiting almost no incidence of Brown Patch.

Pythium Blight was noted at only one site with most varieties exhibiting a very low incidence of Pythium Blight. The variety *Bavaria* (velvet) was significantly more affected than all other cultivars.

At one site in the NTEP trials the incidence of Dollar Spot was recorded where no fungicides were used and the results show that *Crenshaw* was the most affected, with *SR7200* and *Bavaria* being virtually unaffected. *Penn A1, Penncross, Penn A2, Penn G6, Penn A4* and *Penn G1* were amongst the least affected.

Management

The new bentgrass varieties have been in the market place for some time and superintendents are now undertaking their own assessments. Robinson (1998) stated that *Penn A4* required regular low mowing to improve playing quality and health due to high turf density. His program included cutting at 2.5mm and over 12 months double cutting on 169 occasions and single cutting 93 times. In addition, the greens were regularly rolled and dusted (lightly topdressed) on 30-35 occasions. Dusting also presented a challenge in brushing the sand through the dense turf layer, with particles greater that 0.5mm remaining on the surface. Dusting was done almost weekly using a mechanical brush to 'work' the sand in. The program also involved monthly applications of wetting agent to prevent the occurrence of dry patch.This superintendent made cost comparisons with *Penncross* and found that the cost of greens management was $US714 /100m^2 for *Penn A4* compared to $US615/100m^2 for *Penncross*. The main advantage for the *Penn A4* was the consistently high green speeds (> 3.34 metres) and strong competition against *Poa annua* invasion.

A survey of golf clubs that had established new bentgrass cultivars indicated that thatch control was the main concern and that low mowing (2.4 - 3.6mm) was essential with the mowing frequency being from five times per week to daily double cutting at one club (Fraser, 1998). The average stimpmeter reading was 3.05m (10 feet). The report concluded that the new bentgrasses require different management, will perform well in a range of geographic environments and need an aggressive management program (e.g. low mowing).

Salt Tolerance

Marcum (2000) has studied the salt tolerance in the modern bentgrass varieties where he tested 35 bentgrass cultivars, with increasing salinity concentrations from 1 decisiemans/metre/day up to 8 dS/m/metre/day at which time data was collected. The most salt tolerant cultivars were *Mariner, Seaside II, Grand Prix, Seaside, 18th Green* and *Century.* The least tolerant cultivars suffered complete death after ten weeks exposure and they included *Avalon* (velvet bent), *Ambrosia* (colonial bent) as well as *Regent, Putter, Penncross* and *Penn G-6*.

6.4 GRASS SELECTION FOR FAIRWAYS

The National Turfgrass Trials in Australia (Neylan and Robinson, 1997) demonstrated that there was a significant difference in the performance of the couchgrass cultivars used on New South Wales golf courses, with the varieties *Legend, Windsorgreen* and *Santa Ana* having the highest performance index. There are other new couchgrass cultivars available,

such as *Plateau* and *Conquest* that have potential and in particular *Plateau*, which has demonstrated very good shade tolerance. As with all new turfgrass varieties they must be subjected to rigorous evaluation before they are widely adopted.

6.5 TURFGRASS WATER USE

The area of most interest in relation to turfgrasses is in determination of their water use rate and selection of cultivars with a high water use efficiency. Beard and Sifers (1989) have demonstrated that the warm-season grasses have the lowest water use rate, the best drought tolerance and highest recovery, compared to the cool-season species.

Within the warm season species, some differences between cultivars have been observed, but in practical terms these would appear to be very limited. Research in Western Australia (Colmer et.al. 2001) demonstrated that the maximum daily irrigation required to maintain growth and colour ranged from 50–60% net daily evaporation (Epan) for nine warm season turfgrass genotypes to 80–100% for two cool season turfgrass genotypes. For example, ryegrass was almost twice that of *Wintergreen* couchgrass (Table 6.1). The differences in water use rates and irrigation requirements among the warm season grasses were relatively small and not statistically different.

Table 6.1: ET values for various genotypes measured in field lysimeters. Different letters in the same column indicate significant differences at the 5% level.

Turfgrass genotype	ET (days with 5-8 mm of Epan) (% Epan)	ET (days with 8-11 mm of Epan) (% Epan)
Cynodon dactylon 'Wintergreen'	59.8 (± 2.1) [a]	51.9 (± 1.6) [a]
Paspalum vaginatum	63.9 (± 2.4) [a]	53.8 (± 1.5) [a]
Stenotaphrum secundatum	67.8 (± 2.4) [a]	55.4 (± 1.6) [a]
Pennisetum clandestinum	65.8 (± 2.1) [a]	55.4 (± 1.0) [a]
Zoysia spp.'ZT94'	66.5 (± 3.2) [a]	52.3 (± 1.9) [a]
Festuca arundinacea 'Arid'	95.5 (± 4.7) [b]	87.7 (± 3.0) [b]
Lolium perenne 'Accent'	102.1 (± 4.4) [b]	90.0 (± 5.8) [b]

This research would indicate that there is no advantage in changing between warm-season species/cultivars for the purpose of conserving water. However, the conversion from cool-season grasses to a warm-season species has considerable potential in saving water.

6.6 SEASHORE PASPALUM

Seashore paspalum (*Paspalum vaginatum*) has the potential to be one of the most environmentally compatible turfgrasses (Duncan 1996, Duncan and Carrow 1999). It is reported that seashore paspalum will grow with:

- minimal pesticide applications;
- about 20–40% of the annual fertiliser that is applied to hybrid couchgrasses;
- a soil pH of 4–9.8;
- an ability to act as a bioremediant on contaminated sites;
- high-salinity water (on some cultivars up to 14 000 mg/L of sodium chloride);
- drought resistance equivalent to that of couchgrass;
- moderate shade tolerance (up to 35% light reduction); and
- a good tolerance of periodic inundation due to heavy rains or high tides.

Limitations in the use of seashore paspalum relate mainly to its lack of cold hardiness. The earlier selections were killed at –8.0°C, although several ecotypes have survived at –16°C. The other concern with this species is its tolerance of certain insect pests (e.g. mole crickets and army worm) and fungal pathogens (Curvularia, Pythium and Dollar Spot). The research to date has revealed several selections that have exhibited resistance to most of these pests.

Seashore paspalum would appear to have excellent potential on:

- salt-affected soils, and
- areas where only high-salinity water (particularly recycled water) is available for irrigation.

In the short term, the new cultivars of seashore paspalum are not available in Australia; however, when they are introduced they will require intensive assessment to ascertain where they fit into New South Wales golf courses and also what management regimes they will need.

6.7 TURFGRASS PERFORMANCE INDICATORS

Each golf course has its own specific characteristics in terms of soils, climate, microclimates, water quality, maintenance facilities, golfer expectations and budget. In selecting suitable grass types it is often useful to go through a checklist of requirements to assist in making the most appropriate selections. The following table (Table 6.2) can be used as a checklist to identify local conditions, turf requirements and turfgrass suitability.

Table 6.2: Turfgrass performance indicators and selection criteria

1 Turfgrass situation _____
(e.g. green, tee, fairway, rough)

2 What are the five critical requirements for each turfgrass situation?
(i.e. green, tee, fairway or rough)

List in order of priority:

(i) _____

(ii) _____

(iii) _____

(iv) _____

(v) _____

3 What are the site conditions?

- Soils _____
- Water quality

	High	**Moderate**	**Low**
Salinity	☐	☐	☐
Sodium	☐	☐	☐
Bicarbonate	☐	☐	☐

- Water availability ☐ ☐ ☐
- Is shade a factor? ☐ Yes ☐ No
- Is air movement a factor? ☐ Yes ☐ No

• Climatic conditions	**Summer**	**Winter**
Average maximum temperature	_____	_____
Average minimum temperature	_____	_____
Average rainfall (mm)	_____	_____
Average evaporation (mm)	_____	_____

	Summer	**Winter**
Estimated ET (mm)	_____	_____
Average humidity	_____	_____
Average number of daylight hours	_____	_____

- Common pest problems: (List)

_____

_____

_____

4 What resources are available for maintenance?

	High	**Moderate**	**Low**
• Labour	☐	☐	☐
• Equipment			
Mowers	☐	☐	☐
Dethatchers	☐	☐	☐
Sprayers	☐	☐	☐
Renovation equipment	☐	☐	☐
Topdressing machine	☐	☐	☐
• Budget	☐	☐	☐
• Irrigation system	☐	☐	☐

5 Sources of information on grasses

- National Turfgrass Evaluation Program (NTEP) ☐
- Horticultural Research and Development Corporation (HRDC) ☐
- Australian Golf Course Superintendents Association (AGCSA) ☐
- USGA Greens Section
- Golf Course Superintendents Association of America (GCSAA) ☐
- Australian Turf Producers ☐

6 Are the preferred turfgrass varieties available in Australia?

Selection	Yes	No
(i) _____	☐	☐
(ii) _____	☐	☐
(iii) _____	☐	☐
(iv) _____	☐	☐
(v) _____	☐	☐

7 What local evaluations have been undertaken?

_____

_____

8 What have been the results? (Obtain trial data.)

_____

_____

9. For any new grass types, and taking in account all available information, what improvements could be expected in the key requirements (see question 2) compared to the 'conventional' choices. Express as a percentage (%).

_____

_____

REFERENCES

Anon. 2000, *On-site testing of bentgrass and Bermuda cultivars for golf course putting greens*, USGA Greens section News and Update. www.usga.org/green.

Beard, J. B. and Kim, K.S. 1998, *Turfgrass evapotranspiration research at Texas A and M*, *NZ Turf Management Journal*, August 1998.

Beard, J. B. and Sifers, S.I. 1989, *Comparative dehydration avoidance and drought resistance among turfgrass species and cultivars.* Proceedings 6th International Turf Research Conference, Tokyo, Japan,1989.

Colmer, T., Short, D., Pathan S. and Barton, L. 1999, *Optimising water and nutrient management for turf grown on sandy soils*. Queensland Turfgrass Foundation Field Day, 13 November, 2001.

Duncan, R. 1996, *The environmentally sound turfgrass of the future*, Greens Section Record, 1996

Duncan, R. and Carrow, R. 1999, *Salinity tolerance of Paspalum vaginatum and Cynodon spp. genotypes*, Australian Turfgrass Management Magazine, Volume 2.3.

Fraser, M. 1998, *Managing the new cultivars of creeping bentgrasses. Golf Course Management,* August 1998

Marcum, K. 2000, *Salt tolerance varies in modern creeping bentgrass varieties*, *Golf Course Management, May 1999*

Neylan, J. and Robinson, M. 1997, *The Australian National Cynodon Turfgrass Evaluation Trials,* Proceedings 8th International Turf Research Conference, Sydney, Australia, 1997 pp 121-134.

NTEP 2000, *National bentgrass test – 1998 (Putting green).* National Turfgrass Evaluation Program, United States Department of Agriculture, Progress report 2000.

Reese, M. 2000, *Creeping Bentgrass. That was then and this is now,* Australian Turfgrass Management, Volume 2.2

Robinson, C 1998,*A-4, not your parents bentgrass. New management techniques for a new bentgrass variety*, USGA Greens section record, September – October 1998.

White, R. 1999, *Unleash the full potential of new bermudagrass cultivars,* Green Section Record, September/October 1999.