



*Know-how for Horticulture™*

**The collection and  
evaluation of  
bentgrass and  
couchgrass ecotypes  
in old, established  
putting greens**

**John Neylan  
Australian Golf Course  
Superintendents  
Association**

Project Number: TU01001

## **TU01001**

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# THE COLLECTION AND EVALUATION OF BENTGRASS (*Agrostis spp.*) AND COUCHGRASS (*Cynodon dactylon x Cynodon transvaalensis*) ECOTYPES IN OLD PUTTING GREENS

HORTICULTURE AUSTRALIA  
PROJECT TU 1001

FINAL REPORT



Horticulture Australia

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(*Agrostis spp.*) AND COUCHGRASS (*Cynodon dactylon x*  
*Cynodon transvaalensis*) ECOTYPES IN OLD PUTTING  
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**FINAL REPORT**

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**Horticulture Australia**

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**EXECUTIVE SUMMARY**

A key area of turf management and in particular golf course management is the selection and maintenance of the most appropriate turfgrass species and cultivars for the particular site conditions. With the available turfgrass cultivars (both bentgrass and couchgrass) used on golf course putting greens being almost exclusively from the USA, there is a lack of local data to support their management under Australian conditions. There is also a lack of turfgrass cultivars for putting greens that have been selected and bred under Australian conditions.

In Australia there is good anecdotal evidence, supported by very limited trial data, that there are local ecotypes of both bentgrass and couchgrass in putting greens that exhibit very good performance characteristics that are potentially superior to the imported turf cultivars. In the USA, the new generation bentgrasses and to a lesser degree the new couchgrass hybrids, have come from selecting individuals from greens that have exhibited segregation. The selection and development of superior Australian couchgrass cultivars, for use on golf course fairways and sportsfields, has demonstrated the potential for extending this success to turfgrass cultivars for putting greens. These ecotypes need to be collected and evaluated and to assess the potential for developing Australian cultivars adapted to Australian conditions.

Golf courses are facing increasing environmental pressures, with reduced water availability and increasing water salinity being two of the main concerns. The development of new cultivars that have improved heat, drought and salt tolerance, while providing good playing surfaces will be critical in the long term sustainability of the golf course industry.

The objectives of this project were;

- i. To select and evaluate off-types from old bentgrass putting greens that have exhibited segregation, with the long-term aim of developing a bentgrass variety that is suited to growing in Australia.
- ii. To select and evaluate off-types from well-established greens on Queensland golf courses that have exhibited segregation, with the long-term aim of developing a couchgrass variety, that is suited to growing in sub-tropical and tropical Australia.
- iii. To evaluate existing bentgrass and couchgrass cultivars.

Bentgrass and couchgrass plants were collected from old and well established golf greens where there was segregation and individual ecotypes exhibited one or several of the following characteristics;

- Excellent turf quality
- High density
- Tolerance to low mowing
- Putting characteristics

- Minimal spiking
- Disease resistance
- Competition against *Poa annua* invasion
- A dense root system
- Heat tolerance
- Salinity tolerance

There were over 450 bentgrass and 93 couchgrass plants collected and planted into a spaced plant nursery. There was considerably more variation observed amongst the bentgrasses compared to the couchgrasses. Bentgrass is established from seed and all cultivars are multiple parent clones, thereby increasing the opportunity for segregation to occur over time due to climate and management practices. The couchgrasses used on putting greens are sterile hybrids that are vegetatively propagated and any segregation is due to either genetic mutation (a rare event) or contamination.

Of the bentgrasses, 100 were selected and established in a putting green trial where 12 have been identified as having characteristics as good as or better than the industry standards incorporated into the trial. There were 10 couchgrass selections identified as having characteristics that were as good as or better than the industry standards.

Bentgrass cultivar trials were established in four states to assess the qualities of the new bentgrass cultivars and their maintenance requirements. The new bentgrass cultivars and in particular the Penn A and G series bentgrasses are very high density and produce excellent putting surfaces but do not necessarily demonstrate greater green speeds. Their high tiller density and upright growth habit provides a smooth putting surface that exhibits excellent wear tolerance. The main management issue with these new bentgrasses is the rapid development of thatch which necessitates regular sand dustings from early establishment to dilute the accumulated organic matter.

The couchgrass plots provided an excellent opportunity to observe some of the new couchgrass introductions under intensive golf course maintenance conditions. New cultivars such as Tifeagle, Supersport and Tifsport all exhibit very good surface qualities, whereas the seeded couchgrass cultivars were generally inferior to the vegetative cultivars.

An expression of interest was advertised for interested parties to utilize the bentgrass selections. Sydney University provided the most comprehensive plan of how the plant material would be incorporated into their breeding program and an agreement is presently being finalized. Several of the best bentgrass selections produce very few seed heads, which reduces their commercial viability as a seeded cultivar. As a result the viability of vegetative propagation is being pursued as an alternative means of introducing new cultivars.

The best of the couchgrass selections will be incorporated into a couchgrass evaluation trial being undertaken by the Queensland Department of Primary Industry (QDPI) and the intention is for the QDPI (Redlands) to take over the collection for further development into a commercial cultivar(s).

This program has had a strong emphasis on extension with 13 articles in Australian Turfgrass Management magazine, one in Golf Magazine, a peered review paper, conference proceedings for the Australian Turfgrass Conference, 9 field days/workshop and discussion group meetings.

## 1. INTRODUCTION

A key area of turf management and in particular golf course management is the selection and maintenance of the most appropriate turfgrass species and cultivars for the particular site conditions. With the available turfgrass cultivars used on golf courses being almost exclusively from the USA, there is a lack of local data to support their management under Australian conditions. There is also a lack of turfgrass cultivars for putting greens that have been selected and bred under Australian conditions.

In Australia there is good anecdotal evidence, supported by very limited trial data, that there are local ecotypes of both bentgrass and couchgrass in putting greens that exhibit very good performance characteristics that are potentially superior to the imported turf cultivars. The selection and development of superior Australian couchgrass cultivars, for use on golf course fairways and sportsfields has demonstrated the potential for extending this success to turfgrass cultivars for putting greens. These ecotypes need to be collected and evaluated and to assess the potential for developing Australian cultivars adapted to Australian conditions.

Golf courses are facing increasing environmental pressures, with reduced water availability and increasing water salinity being two of the main concerns. The development of new cultivars that have improved heat, drought and salt tolerance, while providing good playing surfaces will be critical in the long term sustainability of the golf course industry.

### 1.1 Bentgrass species (*Agrostis spp.*)

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 with bentgrass 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 with the bentgrasses having become denser and producing smoother and faster putting surfaces.

Over the past 8 -10 years there have been several new bentgrass varieties released and represent a "third generation" of improved bentgrasses for putting greens. The first of the major improvements (first generation) was "Penncross", followed by varieties such as SR1020, Providence and Pennlinks (second generation). The latest generation (third generation) of varieties (notably the Penn A and G series bentgrass cultivars) are noted for their very fine leaf texture, high turf density and reduced susceptibility to spiking. Because of the high turf density, thatch management has been identified as a significant factor in the successful use of these new bentgrasses. These third generation bentgrasses can be cut lower and provide faster putting surfaces than the older varieties while at the same time not damaging the turf (e.g. turf thinning and loss of turf cover).

In Australia, bentgrass putting greens are established with imported varieties that have been bred overseas, often in environments that are completely different to those experienced on Australian golf courses. These new varieties have been

introduced into Australia based on trial data from the USA, however, there has been very little replicated trial work undertaken under Australian climatic conditions and maintenance regimes, with most trials consisting of localised single plot assessments. There are no Australian bred varieties available other than a coarse textured native “Victorian” bentgrass that is a paddock selection and has not undergone any refinement.

In old and well established putting greens there often exist variations in the bentgrass population. This clonal variation can produce several types or strains in the one sward, even though the turf was originally established with a single variety. All seeded turf varieties will contain a natural variation of types even though they are registered as a pure variety. This is a natural occurrence where the population (in this case the seed lot) exhibits a normal distribution of variation for each of its characteristics (e.g. colour, density, disease resistance). Plant breeding programs are designed to minimize this variation and to ensure that the variety is “true-to-type”. This process usually takes several years of crossing like types (the parents), growing out the off-spring (i.e. the seed) and eliminating the off-types. Despite this process there will always be some off-types and under the right conditions will express themselves. There are a range of conditions that may encourage the development of these off-types including; mowing height, climate, pests and maintenance regimes.

The creeping bentgrass (*Agrostis stolonifera*) variety “Penncross” is a classic example of a variety that exhibits strong clonal variation. In fact, many of the most recent bentgrass varieties released from the PennState University bentgrass breeding program have been selected from old “Penncross” putting greens. In the southern hemisphere the most well known variety that was bred using off-types selected from putting greens is the variety “Egmont”, developed by DSIR New Zealand. Some of the parent material of “Egmont” was selected from greens at the Royal Melbourne Golf Club.

The most recent success of such a program of clonal selection and developing a “new variety” has been at the Royal Melbourne Golf Club. Royal Melbourne Golf Club has selected the best types from their original greens (greater than 70 years old) and over several years of selection has now established all the greens on the golf course to their own variety. Royal Melbourne Golf Club is a very good example of old greens that over time exhibited variation or segregation of grass types and is typical of the original “Suttons” seed mix used to establish the greens. The “Suttons” mix was a mixture of stoloniferous, capillaris and canina bentgrass species that through the influence of 70 years of a climate and maintenance activities has resulted in the development of some high quality clones.

The only program of collecting off-types with favourable characteristics was initiated about 10 years ago by the seed company Hodder and Tolley P/L (now Heritage Seeds) and the Victorian Golf Course Superintendents Association. While this project made a collection of bentgrasses and selected the better types it unfortunately did not progress beyond this stage.

## **6.2 Couchgrass (*Cynodon spp.*)**

In Australia, couchgrass putting greens are established with imported varieties that have been bred overseas, principally “Tifgreen” (328) and “Tifdwarf” with no Australian bred varieties available.

In old and well established putting greens there often exist variations in the couchgrass population. This clonal variation can produce several types or strains in

the one sward, even though the turf was originally established with a single variety. "Tifgreen" and "Tifdwarf" are vegetatively propagated (i.e. established from plant material rather than seed) and were originally developed by cross breeding *Cynodon dactylon* and *Cynodon transvaalensis* and then selecting from the resultant hybrid population. The varieties are sterile hybrids and do not set viable seed, however, they are genetically unstable and do not necessarily remain "true-to-type". As a result, off-types are a common characteristic of many older and well established putting greens.

It is uncertain what the trigger mechanism is for these off-types to occur, however, there are a range of conditions that may encourage the development and expansion of these off-types including; mowing height, climate, pests and maintenance regimes. In recent years in Queensland, there have been problems associated with disease, humidity and heat stress that have resulted in deterioration of the surface and is referred to "summer dieback". During these periods of stress, the observation has been made by many Golf Clubs and Golf Course Superintendents, that greens often have patches of these off-types that appear to be unaffected by the conditions.

Because of the natural variation and the apparent successful survival of some of these off-types, there is a large and as yet untapped gene pool that needs investigation. There are several Universities in the USA that have collections of off-types, which have been developed as discrete varieties. In Australia there is a good opportunity to develop an Australian couchgrass suitable for putting greens. The development and success of "Wintergreen", "Windsorgreen" and "Legend" couchgrass for tee tops, fairways and sportsfields is a good example of a selection program that exploited the natural variation that occurs in common couchgrass (*Cynodon dactylon*).

### **1.3 Project objectives**

The objectives of this project were;

- iv. To select and evaluate off-types from old bentgrass putting greens that have exhibited segregation, with the long-term aim of developing a bentgrass variety that is suited to growing in Australia.
- v. To select and evaluate off-types from well-established greens on Queensland golf courses that have exhibited segregation, with the long-term aim of developing a couchgrass variety, that is suited to growing in sub-tropical and tropical Australia.
- vi. To evaluate existing bentgrass and couchgrass cultivars.

## **2. METHODOLOGY**

### **2.1 Bentgrass collection, selection and evaluation**

The bentgrass selection project was undertaken as follows;

#### **2.1.1 Collection of plants**

Bentgrass off-types have been collected throughout the project from October 2000 through to May 2004. The bentgrass off-types were collected as 9mm plugs from putting greens in Victoria, New South Wales, South Australia, Western Australia and SE Queensland. The selection criteria were based on what the individual clubs

considered to be “good” types and plants were collected for the following characteristics:

- High density
- Tolerance to low mowing
- Putting characteristics
- Minimal spiking
- Disease resistance
- Competition against *Poa annua* invasion
- A dense root system
- Heat tolerance
- Salinity tolerance

Following the collection of the plants they were planted into 75 mm pots and grown on until a 50 mm diameter sample was developed and ready for planting into the spaced plant nursery.

### 2.1.2 Spaced plant nursery

A spaced plant nursery was developed at the Kingston Heath Golf Club which is 25 km south-east of Melbourne, Victoria, Australia (table 2). The soil type is a loamy sand with good drainage characteristics. The area was treated with methyl bromide to eliminate all existing *Agrostis spp.*, *Cynodon spp.* and other weeds prior to planting out the bentgrass cores. The individual plants were planted on a 600 x 600 mm spacing.

The spaced plant nursery was weeded as required, irrigated to prevent wilt and there was no pest or disease control. The spaced plant nursery was fertilised when the bentgrass cores were planted with a liquid organic fertiliser with one fertilising in the spring using an NPK (20:2:20) fertiliser at a rate of 1 kg product/100 m<sup>2</sup>. The plants were allowed to grow to their full vertical height but the lateral growth was regularly trimmed to prevent intermingling of the individual plants.

The plants were assessed for the following characteristics;

- **Quality:** Quality was assessed using a 1 to 5 rating with 1 = poor turf quality characteristics and 5 = very high turf quality characteristics. Turf quality represents the overall presentation of the plant in terms of density, growth habit and potential for forming a good quality turf surface.
- **Density:** Density was assessed using a 1 to 5 rating with 1 = very open plant structure and 5 = very dense and compact plant.
- **Height of plant:** Plant height was rated on a 1 to 5 scale with 1 = completely prostrate and 5 = completely erect. Plant height was also measured using a ruler.
- **Stolon number:** Stolon number was rated on a 1 to 5 scale with 1 = no stolons growing from plant core and 5 = numerous stolons growing from plant core.
- **Stolon vigour:** This was a measure of the rate of stolon extension and ground coverage. Stolon vigour was rated on a 1 – 5 scale with 1 = no growth and 5 = strong/vigorous growth.
- **Growth rate:** Growth rate was measured as plant diameter using a ruler. Maximum diameter was determined from the tip of the longest stolon through the center of the plant core.
- **Seed/Flowerheads:** The seed/flowerheads were assessed as the proliferation of seed/flowerheads and were rated as either low,

medium or high. The height of the flowerhead was also determined by rating as low, medium and high. They were also measured using a ruler.

The spaced plant nursery was established in April 2001 with progressive plantings through until November 2003.

### 2.1.3 Putting green trial

A putting green trial was established in May 2003 at the Rosebud campus of the Chisholm TAFE Institute. The putting green is a typical sand based profile over a gravel drainage blanket.

Because of the large number of high quality selections the top 100 plants were selected for planting into the putting green trial. There were two replicates of each selection and the plot size was 0.5 m<sup>2</sup>. The individual plots were established vegetatively using half the plant material from the spaced plant nursery which was cut up into 100 plugs and then planted equally spaced over the plot area.

The putting green was fertilised with an NPK (8:10:10) fertiliser at 4 kg/100 m<sup>2</sup>, agricultural limestone at 10 kg/100 m<sup>2</sup> and processed poultry manure at 50 kg/100 m<sup>2</sup>. An NPK fertiliser (20:0:20) was applied every 2 weeks at 1 kg/100 m<sup>2</sup> during the grow in until a complete turf cover was achieved.

The putting green was irrigated as required to prevent wilt, topdressed on one occasion, fertilised as required (total N:K applied was about 1.5 and 2 kg/100 m<sup>2</sup> respectively), fungicide on two occasions to control the presence of "Take-All Patch" (*Geaumannomyces spp.*) and endothal to control the *Poa annua*. The putting green was mown four times a week at a cutting height of 3.5 – 4.0 mm.

The plots were assessed for;

- % area covered
- Visual turfgrass quality. Turfgrass quality integrates colour, uniformity, density, texture, smoothness and presentation as a putting surface.
- Visual Turfgrass density. The rating scale used for turfgrass quality and density was 9 = best and 1 = poorest.
- Pest tolerance
- Heat and drought tolerance
- *Poa annua* invasion. Rated as % area infested.

## 2.2 Bentgrass cultivar evaluation

The bentgrass cultivar evaluation trials were established at Kingston Heath GC (KHGC), Glenelg GC (GGC), Castle Hill CC (CHCC) and Lake Karryup CC (LKCC) to assess the growth and performance characteristics of the new cultivars under a range of local conditions. The project objective was to evaluate the performance and maintenance requirements of the new strains of bentgrass compared to the established industry standards.

The varieties established at each site are detailed in table 1 and the climatic and soils data is detailed in table 2. At each site there were variations based on local site conditions. For example at GGC, RA1 and RA2 consisted of vegetative material (corings) from two greens at the Royal Adelaide Golf Club as well as an emphasis on salinity tolerance.

The Kingston Heath GC site was established in October 2000, Glenelg GC in March 2001, Castle Hill CC in June 2002 and Lake Karrinyup CC in July 2003.

**Table 1: Bentgrass varieties established at various trial sites**

VARIETY	KHGC	GGC	CHCC	LKCC
Penncross	#	#	#	#
Egmont	#	#		
Suttons			#	
Penn-A1	#	#	#	#
Penn-A4	#	#	#	#
Penn-G2	#	#	#	#
Penn-G6	#			#
Cato	#	#		#
Pennlinks	#	#	#	
L93	#	#	#	#
Dominant	#	#	#	
SR 1019				#
SR 1020				#
Crenshaw				#
Putter				#
SR7200	#			
Mix		#	#	
RA1		#		
RA2		#		
Grand Prix		#	#	
Mariner		#		
T1				#
T2				#

Mix (GGC) = Blend of Dominant, Egmont and SR7200

Mix (CHCC) = Dominant and Pennlinks

Suttons = Royal Melbourne GC selection

RA1 = Vegetative material from Royal Adelaide GC

RA2 = Vegetative material from Royal Adelaide GC

Grand Prix and Mariner = salt tolerant varieties

T1 and T2 = experimental cultivars

**Table 2. Location, soil type and average climate data for each trial site**

Site	Soil Type*	Lat.	Long.	Daily Temp (°C) January		Daily Temp (°C) July		Annual Rainfall (mm)
				Max	Min	Max	Min	
Castle Hill CC	USGA	33.91 S	150.98 E	27.9	18.0	17.7	6.7	917
Glenelg GC	MS	34.95 S	138.52 E	27.9	15.8	15.9	7.6	455
Kingston Heath GC	M-FS	37.97 S	145.10 E	25.8	14.0	14.2	6.6	741
Lake Karrinyup CC	MS	31.93 S	115.97 E	31.6	16.9	17.8	8.1	786

\* USGA – United States Golf Association putting green specification

MS – medium sand

M-FS – medium/fine sand

The trials were a randomised block design with three replicates of each variety with a plot size of 4 m<sup>2</sup>. The bents were seeded at 0.5 kg 100 m<sup>-2</sup>. The vegetative material was planted using corings (9 mm diameter tynes to a depth of 50 mm) with a planting rate of 1.5 m<sup>3</sup> 100 m<sup>-2</sup>.

The maintenance of the trial sites was undertaken by the golf course superintendent at each golf course following a program common to all sites. Fertiliser was applied monthly with a total of 1.5 kg N 100 m<sup>-2</sup>, 2.0 kg 100 m<sup>-2</sup> and phosphorus according to

an annual soil test. The trials were mown 4 – 5 times a week at each site using a combination of walk behind and triplex mowers. The mowing heights were determined as appropriate for each site and typical of the mowing heights for each region. They were as follows; 2.5 – 2.8 mm at Kingston Heath GC, 3.0 - 3.5 mm at Glenelg GC, 3.0 mm at Castle Hill GC and 3 mm at Lake Karrinyup CC. Irrigation was applied as needed to prevent wilt of the turf. Turf cultivation was kept to a minimum so that maximum thatch accumulation could be determined. All sites were hollow tyned with 9 mm tynes once a year and topdressed at a rate of 0.1 m<sup>3</sup> 100 m<sup>2</sup>. Fungicides were only applied when needed to prevent a serious turf loss.

Turf assessments were made regularly at each site for the following parameters;

**Visual turfgrass quality.** Turfgrass quality integrates colour, uniformity, density, texture, smoothness and presentation as a putting surface.

**Visual turfgrass density.** The rating scale used for turfgrass quality and density was 9 = best and 1 = poorest.

**Thatch/mat depth** was measured by extracting a 150 x 20 x 200 mm turf slice and measuring thatch with a metric rule. Thatch/mat was determined as the organic layer immediately below the green portion of the turf to the organic matter/soil interface.

**Green speed** was measured using a modified stimpmeter for small plots (Gaussoin et.al. 1995). The modified stimpmeter has the ball release notch located 0.56 m from the tapered end compared to 0.76 m for the standard stimpmeter.

**Surface hardness** was measured using a Clegg Impact Soil Tester with a 0.5 kg missile and a drop height of 0.3 m. Surface hardness was measured by taking the reading of the third drop at three locations per plot.

**Wear** was applied in mid-summer and mid-winter (high stress periods) at the Victorian site using a wear machine as described by Neylan and Robinson (1997) fitted with soft spikes (Black Widow™). The amount of wear applied at each treatment simulated about 150 rounds of golf. During the August 2004 wear treatment the level of wear was equivalent to over 600 rounds of golf. At the time of this wear treatment the turf was heavily watered prior to applying the wear so as to maximize the potential damage.

Analysis of variance was performed using the Minitab™ program to compare the varieties within each trial site but there were no comparisons between states. A Least Significant Difference (LSD) was calculated at the 5% probability level.

## **2.3 Couchgrass collection, selection and evaluation**

The couchgrass selection project was undertaken as follows;

### **2.3.1 Collection of plants**

Couchgrass off-types have been collected throughout the project from October 2000 through to May 2004. The Couchgrass off-types were collected as 9mm plugs from putting and bowling greens in Queensland, New South Wales and northern Victoria. The selection criteria were based on what the individual clubs considered to be “good” types and plants were collected for the following characteristics:

- High density
- Tolerance to low mowing
- Putting characteristics
- Minimal spiking
- Disease resistance
- A dense root system
- Heat tolerance
- Salinity tolerance

Following the collection of the plants they were planted into 75 mm pots and grown on until a 50 mm diameter sample was developed and ready for planting into the spaced plant nursery.

### 2.3.2 Spaced plant nursery

A spaced plant nursery was developed at the Lakelands Golf Club which is on Queensland's Gold Coast (table 3). The soil type is a medium sand with good drainage characteristics. The area was treated with methyl bromide to eliminate all existing *Cynodon spp.* and other weeds prior to planting out the Couchgrass cores. The individual plants were planted on a 1000 x 1000 mm spacing.

**Table 3. Location, soil type and average climate data for Lakelands GC**

Site	Soil Type*	Lat.	Long.	Daily Temp (°C) January		Daily Temp (°C) July		Annual Rainfall (mm)
				Max	Min	Max	Min	
Lakelands GC	USGA	28.16 S	153.50 E	27.9	20.9	20.3	10.3	1510

\* USGA – United States Golf Association putting green specification

The spaced plant nursery was weeded as required, irrigated to prevent wilt and there was no pest or disease control. The spaced plant nursery was fertilised when the Couchgrass cores were planted with a liquid organic fertiliser with one fertilising in the spring using an NPK (20:2:20) fertiliser at a rate of 1 kg product/100 m<sup>2</sup>. The plants were regularly mown to 4 mm to provide a prepared surface and the perimeters were trimmed to prevent intermingling of the individual plants.

The plants were assessed for the following characteristics;

- **Quality:** Quality was assessed using a 1 to 5 rating with 1 = poor turf quality characteristics and 5 = very high turf quality characteristics. Turf quality represents the overall presentation of the plant in terms of density, growth habit and potential for forming a good quality turf surface.
- **Density:** Density was assessed using a 1 to 5 rating with 1 = very open plant structure and 5 = very dense and compact plant.
- **Height of plant:** Plant height was rated on a 1 to 5 scale with 1 = completely prostrate and 5 = completely erect. Plant height was also measured using a ruler.
- **Stolon number:** Stolon number was rated on a 1 to 5 scale with 1 = no stolons growing from plant core and 5 = numerous stolons growing from plant core.
- **Stolon vigour:** This was a measure of the rate of stolon extension and ground coverage. Stolon vigour was rated on a 1 – 5 scale with 1 = no growth and 5 = strong/vigorous growth.
- **Growth rate:** Growth rate was measured as plant diameter using a ruler. Maximum diameter was determined from the tip of the longest stolon through the center of the plant core.

The spaced plant nursery was established in April 2001 with progressive plantings through until November 2003.

## 2.4 Couchgrass cultivar evaluation

At Lakelands GC, a series of couchgrass cultivars used on Australian and Queensland golf courses were established. The turf species were maintained at either fairway or greens height of cut depending on the application for that particular turf variety. The varieties are listed in table 3.

**Table 4: Warm season turf varieties established at Lakelands GC**

Tifeagle (G)	Riley's Super Sport (F)
Tifdwarf (G)	CT-2 (F)
Tifgreen(328) (G)	Wintergreen (F)
TifSport (F)	Santa Ana (F)
Greenleas Park (F)	Mohawk (F)
Legend (F)	Plateau (F)
Sydney (F)	Princess (F)
Riley's Conquest (F)	

G = greens height of cut (2.5 – 3 mm)

F = fairway height of cut (8 – 10 mm)

The trials were a single plot design with a plot size of 10 m<sup>2</sup>. The couchgrasses were established as washed turf on a USGA sand profile.

The maintenance of the trial site was undertaken by the golf course superintendent. Fertiliser was applied monthly with a total of 1.5 kg N 100 m<sup>-2</sup>, 2.0 kg 100 m<sup>-2</sup> and phosphorus according to an annual soil test. The trials were mown 4 – 5 times a week at each site using a combination of walk behind and triplex mowers. Irrigation was applied as needed to prevent wilt of the turf. Turf cultivation was kept to a minimum so that maximum thatch accumulation could be determined. All plots were shaved down to ground level in December 2002 to remove all the thatch and the rate of recovery assessed. Fungicides were only applied when needed to prevent a serious turf loss.

Turf assessments were made at each site for the following parameters;

**Visual turfgrass quality.** Turfgrass quality integrates colour, uniformity, density, texture, smoothness and presentation as a putting surface.

**Visual Turfgrass density.** The rating scale used for turfgrass quality and density was 9 = best and 1 = poorest.

### 3. RESULTS

#### 3.1 Bentgrass collection

Bentgrass was collected from golf courses in Victoria, New South Wales, SE Queensland, South Australia, Tasmania and Western Australia. Sites were selected for the following reasons;

- a. **Old greens (>25 years old):** That is greens were seeded with old bentgrasses and had segregated over time due to management and environmental influences.
- b. **Greens established to bentgrass varieties no longer available:** Golf courses such as the Royal Adelaide GC have greens that were likely seeded to the old "Suttons German Bentgrass Mix" which is a mix of stoloniferous and capillaris type bents. Greens are old and subjected to 50 plus years of selection pressure.
- c. **Bentgrasses growing under extreme environmental stresses:** These bents were selected from sites of high salinity and no irrigation.

- d. **Bentgrasses with outstanding surface characteristics:** This included bents that exhibit high density, high quality putting surface, tolerant to low cutting heights, from greens renowned for the quality of the surface.
- e. **Bentgrasses surviving amongst other grasses:** Bents were collected from patches in greens that were dominated by other grass species such as *Poa annua*.
- f. **Bentgrasses growing out of the normal growing environment:** Plants were collected from a golf course in SE Queensland and the Sunshine Coast (north of Brisbane).

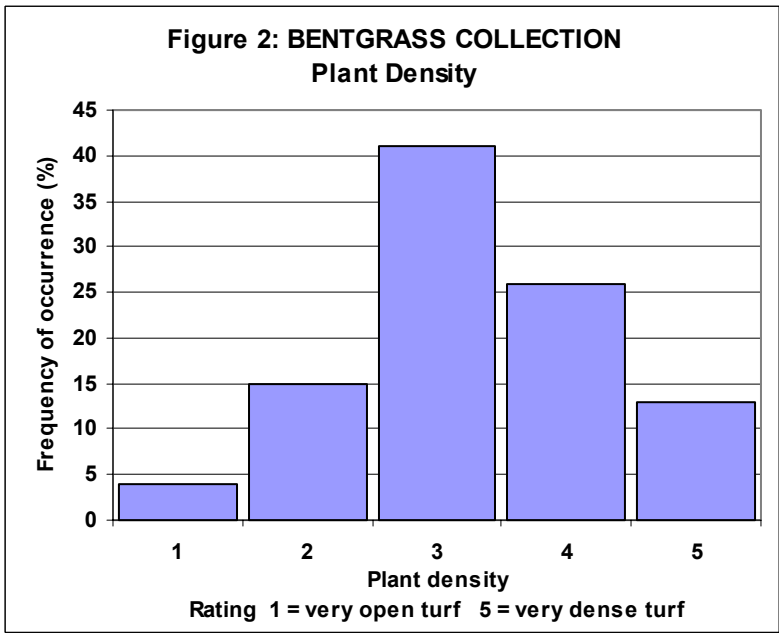
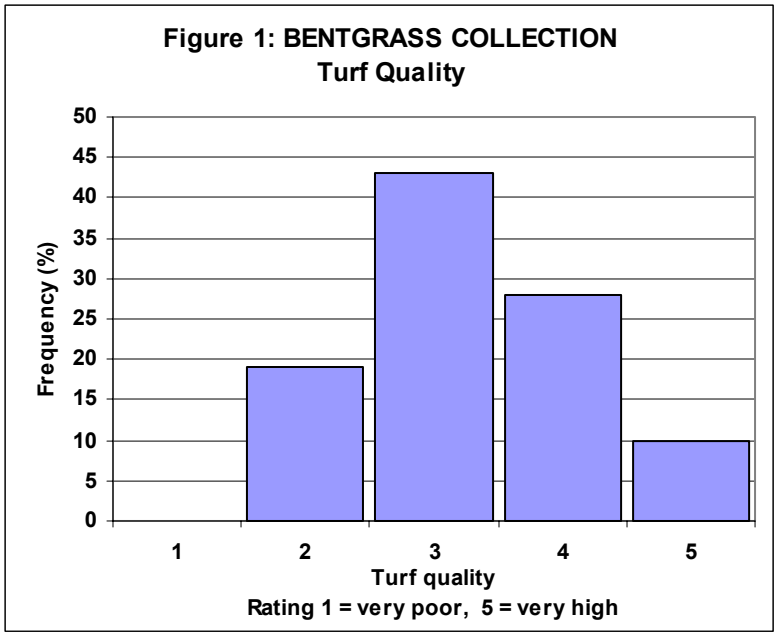
During the 4 years of the project, over 450 individual bentgrass plants were collected, planted out into the space plant nursery and assessed. The list of locations is detailed in table 5.

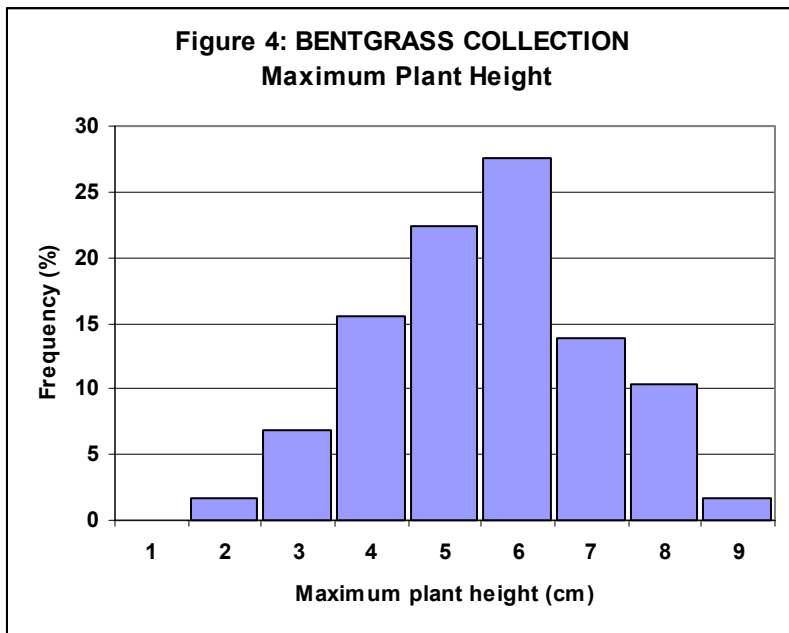
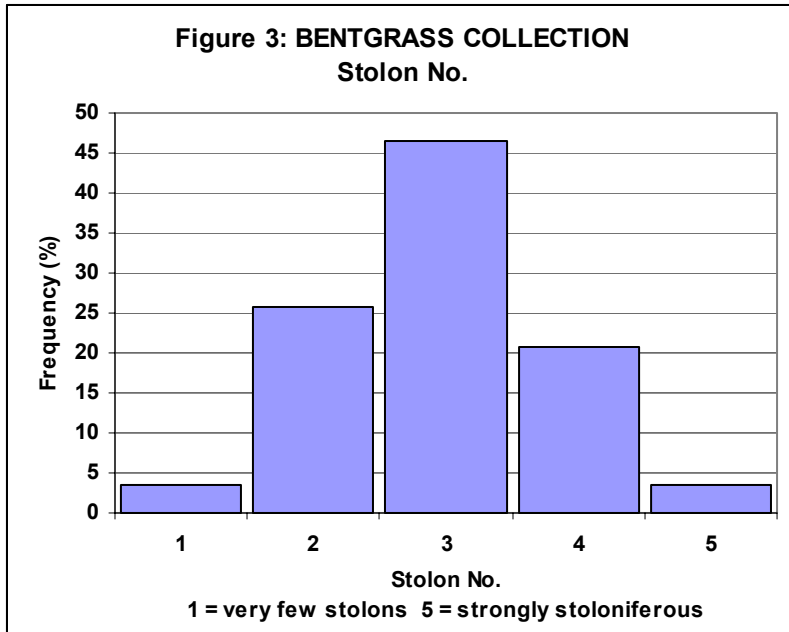
Data was collected on turfgrass quality and density (tables 6, 7 and 9), growth characteristics (table 6 and 8) and flower/seedhead production (table 9). The data collected was variable for each of the parameters, however, it was normally distributed for turf quality (fig. 1), plant density (fig.2), stolon number (fig.3), maximum plant height (fig.4), stolon vigour (fig.5) and maximum plant diameter (fig.6).

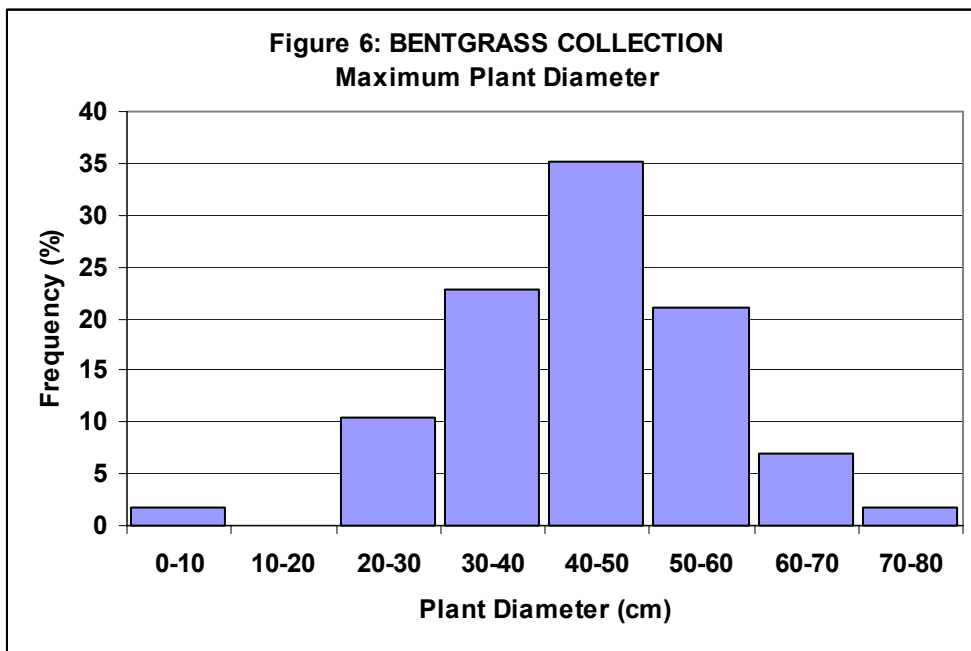
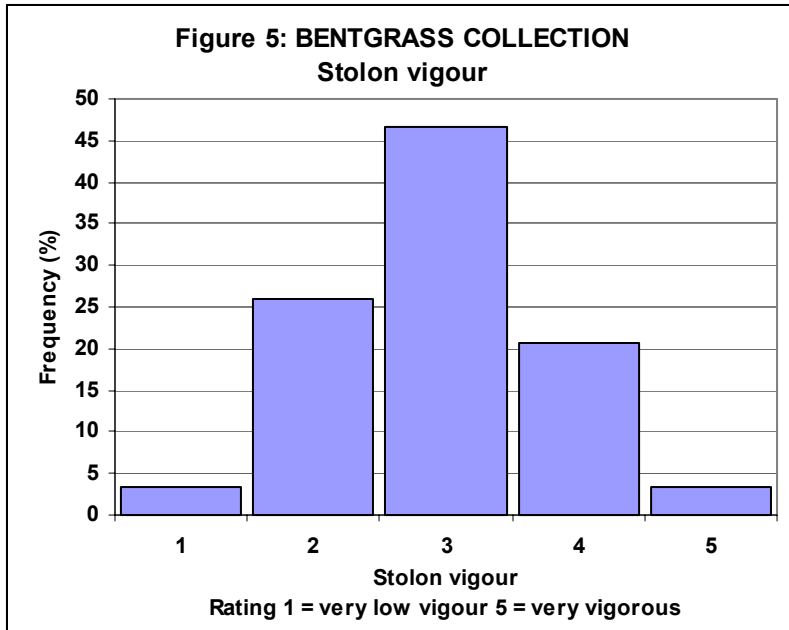
Flower/seedhead production was one of the more interesting characteristics measured. There was a strong negative relationship between turfgrass density and quality and the production of flowerheads in that the greater the density the fewer the flowerheads that were produced. What flowerheads were produced were very short. The more open (less dense) bentgrass plants tended to produce high numbers of flowerheads. Work by Dr. Huff (pers. comm) at PennState University has noted similar characteristics in other turf species and in particular *Poa annua*. This trait appears to be related to an inbuilt survival mechanism in that the more stems that are produced the greater the chance the plant will survive under stress and therefore there is less selection pressure to produce flower/seedheads.

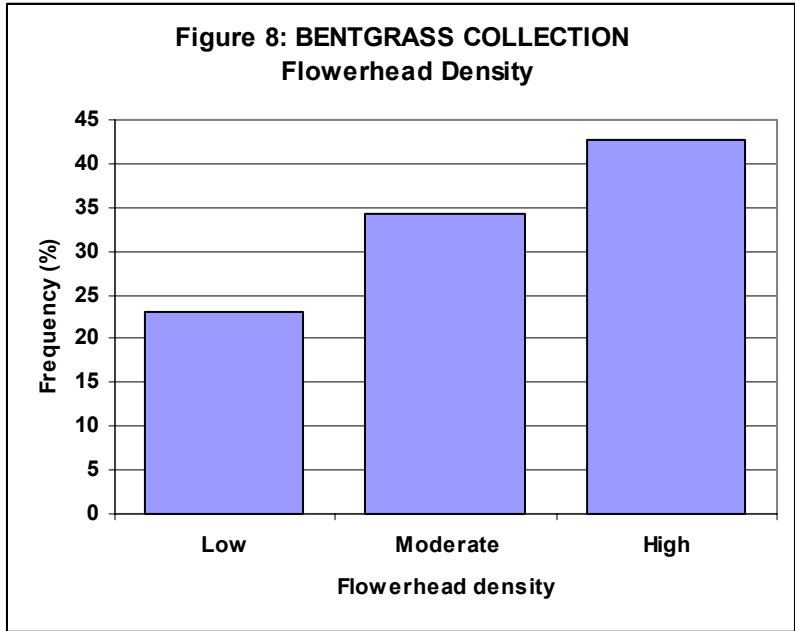
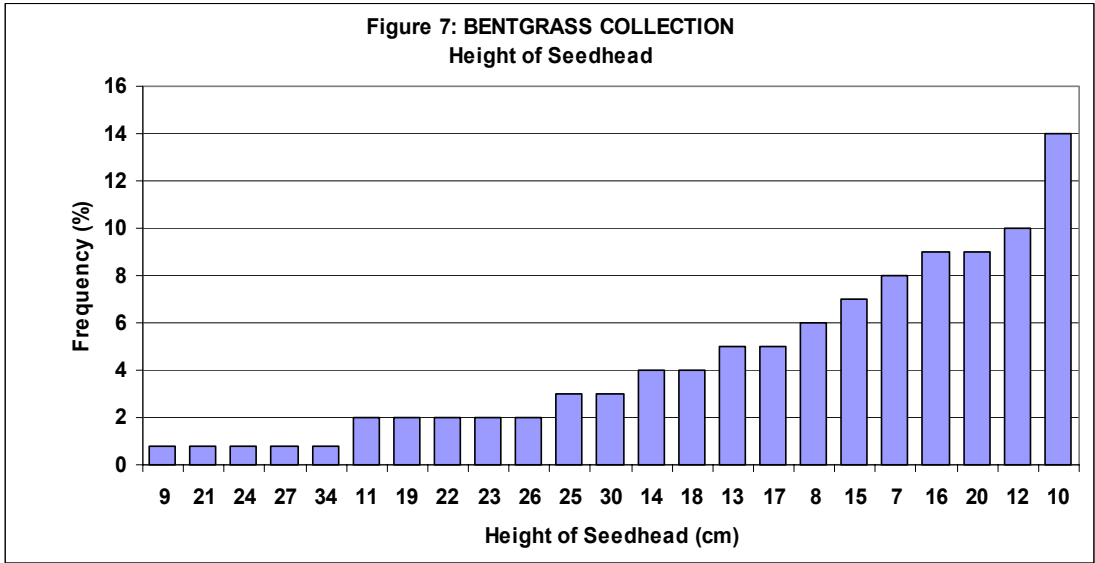
The “best 100” bentgrasses were selected for establishing in the putting green trial (table 10). The selection criteria were based firstly on quality and plant density and then flower/seedhead production. Bentgrasses representing the industry standards were also included in the putting green trial.

The putting green trial provided significant differences in turf quality and density and over the two main assessment dates there were 13 selections that were ranked highest for turf quality on both dates (table 14).

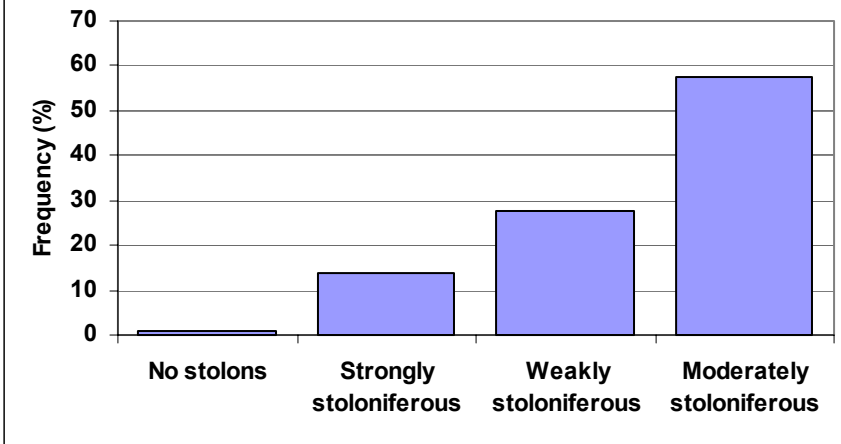




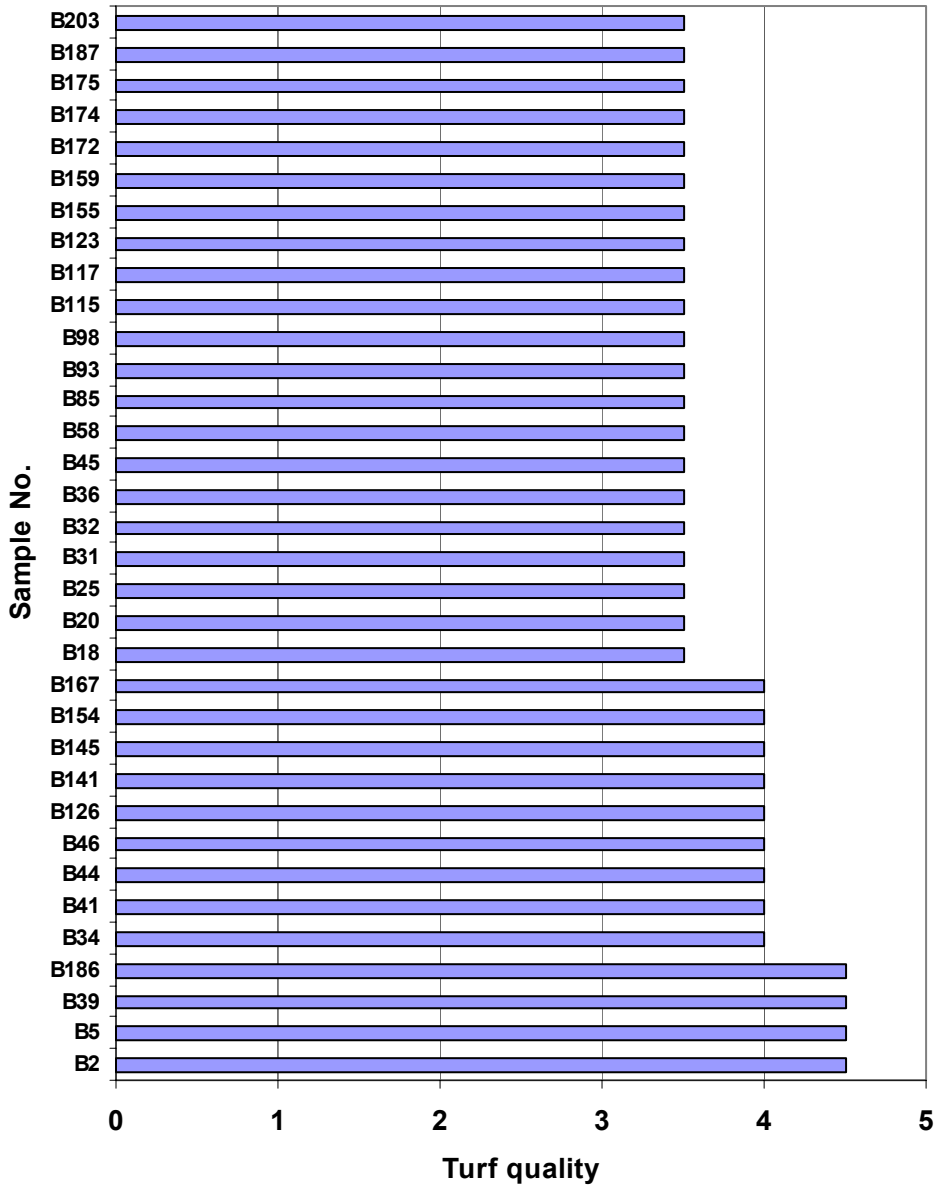




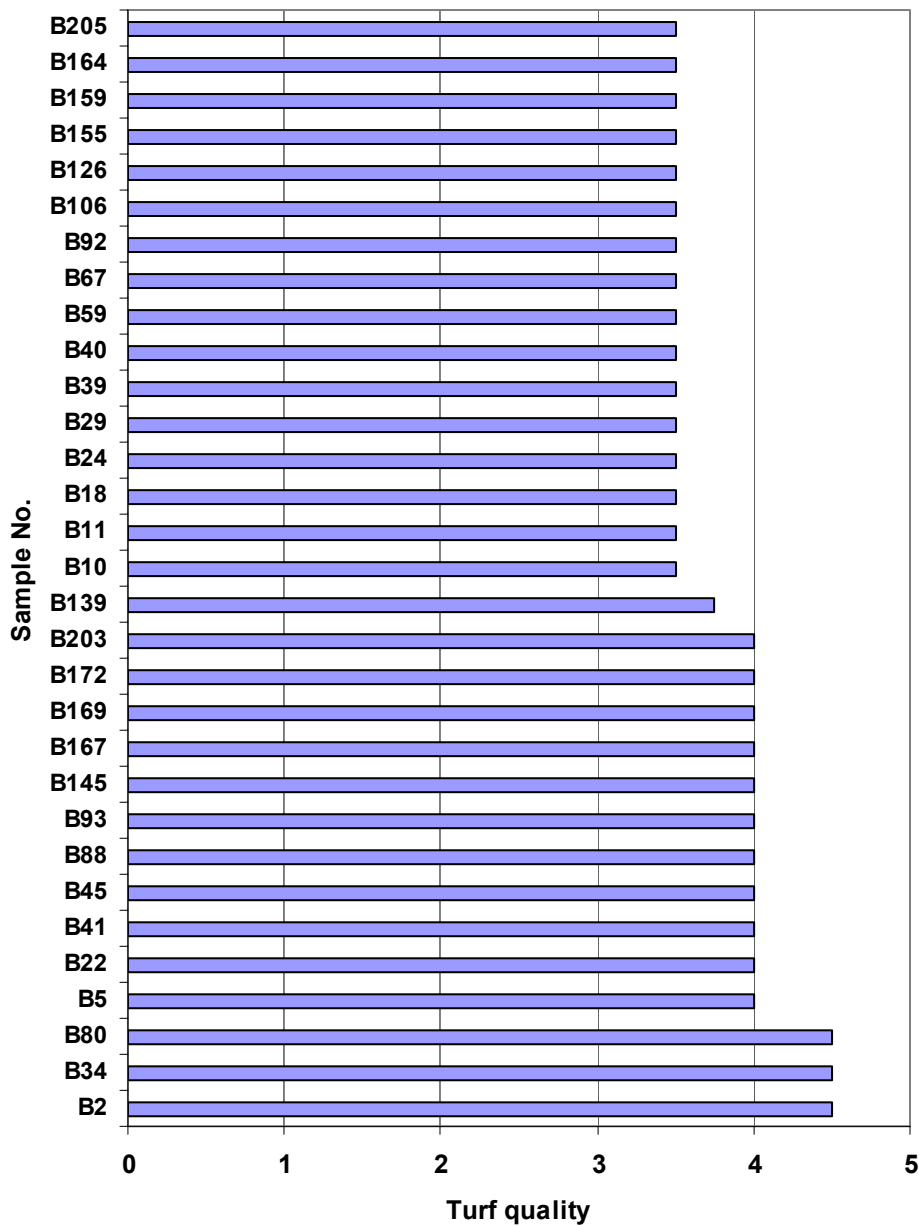
**Figure 9: BENTGRASS COLLECTION**  
**Putting green trial - Chisholm TAFE**  
**Growth characteristics**



**Figure10: BENTGRASS COLLECTION**  
**Putting green trial Chisholm TAFE**  
**Top selections - 23/1/04**



**Figure 11: BENTGRASS COLLECTION**  
**Putting green trial Chisholm TAFE**  
**Top selections - 31/8/04**



**Table 5: Sample number and sites where bentgrasses were collected**

SAMPLE No	SOURCE	SAMPLE No	SOURCE
B1	Thurgoona G/C 12th Green	B240	Frankston Private 1st Green
B2	Thurgoona G/C 12th Green	B241	Frankston Private 1st Green
B3	Thurgoona G/C 3rd Green	B242	Frankston Private 1st Green
B4	Emerald G/C 4th Green	B243	Frankston Private 1st Green
B5	Emerald G/C 4th Green	B244	Frankston Private 1st Green
B6	Thurgoona G/C 18th Green	B245	Frankston Private 1st Green
B7	Emerald G/C 8th Green	B246	Frankston Private 1st Green
B8	Thurgoona G/C 1st Green	B247	Frankston Private 1st Green
B9	Unknown	B248	Frankston Private 1st Green
B10	Royal Adelaide G/C 4th Green	B249	Frankston Private 1st Green
B11	Royal Adelaide G/C 4th Green	B250	Frankston Private 2nd Green
B12	Royal Adelaide G/C 4th Green	B251	Frankston Private 2nd Green
B13	Royal Adelaide G/C 4th Green	B252	Frankston Private 2nd Green
B14	Royal Adelaide G/C 4th Green	B253	Frankston Private 2nd Green
B15	Royal Adelaide G/C 4th Green	B254	Frankston Private 5th Green
B16	Royal Adelaide G/C 4th Green	B255	Frankston Private 5th Green
B17	Royal Adelaide G/C 8th Green	B256	Frankston Private 5th Green
B18	Royal Adelaide G/C 8th Green	B257	Frankston Private 5th Green
B19	Royal Adelaide G/C 10th Green	B258	Frankston Private 5th Green
B20	Royal Adelaide G/C 10th Green	B259	Frankston Private 5th Green
B21	Royal Adelaide G/C 11th Green	B260	Frankston Private 5th Green
B22	Royal Adelaide G/C 11th Green	B261	Frankston Private 6th Green
B23	Royal Adelaide G/C 11th Green	B262	Frankston Private 6th Green
B24	Royal Adelaide G/C 11th Green	B263	Frankston Private 6th Green
B25	Royal Adelaide G/C 11th Green	B264	Frankston Private 6th Green
B26	Royal Adelaide G/C 11th Green	B265	Frankston Private 6th Green
B27	Royal Adelaide G/C 11th Green	B266	Frankston Private 6th Green
B28	Royal Adelaide G/C 18th Green	B267	Frankston Private 6th Green
B29	Royal Adelaide G/C 18th Green	B270	Wagga Wagga CC Old greens
B30	Royal Adelaide G/C 18th Green	B271	Wagga Wagga CC Old greens
B31	Royal Adelaide G/C 18th Green	B272	Wagga Wagga CC Old greens
B32	Royal Adelaide G/C 18th Green	B273	Wagga Wagga CC Old greens
B33	Riverside G/C 1st Green	B274	Wagga Wagga CC Old greens
B34	Riverside G/C 1st Green	B275	Wagga Wagga CC Old greens
B35	Riverside G/C 5th Green	B276	Wagga Wagga CC Old greens
B36	Riverside G/C 17th Green	B277	Wagga Wagga CC Old greens
B37	Grange G/C 4 East	B278	Wagga Wagga CC Old greens
B38	Grange G/C 5 East	B279	Wagga Wagga CC Old greens
B39	Grange G/C 5 East	B280	Wagga Wagga City GC - high salt
B40	Grange G/C 6 East	B281	Monash GC - old Penncross
B41	Grange G/C 6 East	B282	Monash GC - old Penncross
B42	Grange G/C 6 East	B283	Monash GC - old Penncross
B43	Grange G/C 7 East	B284	Monash GC - old Penncross
B44	Grange G/C 11 West	B285	Monash GC - old Penncross
B45	Glenelg G/C 16th	B286	Monash GC - old Penncross
B46	Glenelg G/C 16th	B287	Monash GC - old Penncross
B47	Emerald G/C 17th Green	B288	Monash GC - old Penncross
B48	Home Garden	B289	Monash GC - old Penncross
B49	Home Garden/Lawn	B290	Monash GC - old Penncross
B50	Cheltenham G/C 9th Green	B291	Monash GC - old Penncross

B51	Cheltenham G/C 9th Green	B292	Monash GC - old Penncross
B52	Unknown	B293	Monash GC - old Penncross
B53	Unknown	B294	Monash GC - old Penncross
B54	Joondoolup G/C 5th	B295	Monash GC - old Penncross
B55	Home	B296	Monash GC - old Penncross
B56	RGC	B297	Pymble GC
B57	RGC	B298	Pymble GC
B58	Unknown	B299	Pymble GC
B59	Wodonga G/C 11th Green	B300	Killara GC 8th Green (Pencross)
B60	Terrigal G/C	B301	Killara GC 8th Green (Pencross)
B61	Home	B302	Killara GC 15th Green (Pencross)
B62	Home	B303	Killara GC 13th Green (Pencross)
B63	Royal Hobart	B304	Killara GC 13th Green (Pencross)
B64	Royal Hobart	B305	Castle Hill GC "Suttons"
B65	Unknown	B306	Castle Hill GC "Suttons"
B66	Royal Hobart	B307	Castle Hill GC "Suttons"
B67	Home	B308	Castle Hill GC "Suttons"
B68	Unknown	B309	Castle Hill GC "Suttons"
B69	Wodonga G/C	B310	Castle Hill GC "Suttons"
B70(a)	Riverside G/C 18th	B311	Castle Hill GC "Suttons"
B70(b)	Riverside G/C 18th	B312	Castle Hill GC "Suttons"
B71(a)	RGC	B313	Castle Hill GC "Suttons"
B71(b)	RGC	B314	Castle Hill GC "Suttons"
B72(a)	Swan Hill City G/C	B315	Castle Hill GC "Suttons"
B72(b)	Swan Hill City G/C	B316	Castle Hill GC "Suttons"
B73	Frankston Lawn	B317	Castle Hill GC "Suttons"
B74	RGC	B318	Castle Hill GC "Suttons"
B75	Unknown	B319	Castle Hill GC "Suttons"
B76(a)	Corowa G/C 8th	B320	Manly GC
B76(b)	Corowa G/C 8th	B321	Manly GC
B77	Riverside G/C 17th	B322	Manly GC
B78(a)	Wodonga G/C 5th	B323	Manly GC
B78(b)	Wodonga G/C 5th	B324	Manly GC
B79(a)	Wodonga G/C 15th	B325	Manly GC
B79(b)	Wodonga G/C 15th	B326	Manly GC
B80	Waverley Private G/C 4th	B327	Manly GC
B81	Royal Australian Engineers 5th Green	B328	Mornington G/C 1st Green
B82	Royal Australian Engineers 6th Green	B329	Mornington G/C 1st Green
B83	Royal Australian Engineers near 9th Green	B330	Mornington G/C 1st Green
B84	Royal Australian Engineers near 9th Green	B331	Mornington G/C 1st Green
B85	Royal Australian Engineers 4th Green	B332	Mornington G/C 1st Green
B86	Royal Australian Engineers 2nd Green	B333	Mornington G/C 1st Green
B87	Royal Australian Engineers 3rd Green	B334	Mornington G/C 4th Green
B88	Coolangatta/Tweed G/C Green 5 west	B335	Mornington G/C 4th Green
B89	Coolangatta/Tweed G/C Green 5 west	B336	Mornington G/C 4th Green
B90	Coolangatta/Tweed G/C Green 5 west	B337	Mornington G/C 5th Green (1970's)
B91	Coolangatta/Tweed G/C Green 5 west	B338	Mornington G/C 5th Green (1970's)
B92	Coolangatta/Tweed G/C Green 5 west	B339	Mornington G/C 5th Green (1970's)
B93	Coolangatta/Tweed G/C Green 5 west	B340	Mornington G/C 5th Green (1970's)
B94	Coolangatta/Tweed G/C Green 5 west	B341	Mornington G/C 5th Green (1970's)
B95	Coolangatta/Tweed G/C Green 5 west	B342	Mornington G/C 7th Green (penneagle/penncross)
B96	Coolangatta/Tweed G/C Green 4 west	B343	Mornington G/C 7th Green (penneagle/penncross)

B97	Coolangatta/Tweed G/C Green 4 west	B344	Mornington G/C 7th Green (penneagle/penncross)
B98	Coolangatta/Tweed G/C Green 4 west	B345	Mornington G/C 7th Green (penneagle/penncross)
B99	Coolangatta/Tweed G/C Green 4 west	B346	Mornington G/C 7th Green (penneagle/penncross)
B100	Coolangatta/Tweed G/C Green 4 west	B347	Mornington G/C 11th Green
B101	Coolangatta/Tweed G/C Green 4 west	B348	Mornington G/C 11th Green
B102	Coolangatta/Tweed G/C Green 4 west	B349	Mornington G/C 11th Green
B103	Coolangatta/Tweed G/C Green 1 west	B350	Mornington G/C 11th Green
B104	Coolangatta/Tweed G/C Green 1 west	B351	Mornington G/C 11th Green
B105	Coolangatta/Tweed G/C Green 1 west	B352	Mornington G/C 14th Green
B106	Coolangatta/Tweed G/C Green 1 west	B353	Mornington G/C 14th Green
B107	Coolangatta/Tweed G/C Green 1 west	B354	Mornington G/C 14th Green
B108	Coolangatta/Tweed G/C Green 11 west	B355	Mornington G/C 15th Green (1962/63)
B109	Coolangatta/Tweed G/C Green 11 west	B356	Mornington G/C 15th Green (1962/63)
B110	Coolangatta/Tweed G/C Green 11 west	B357	Mornington G/C 15th Green (1962/63)
B111	Coolangatta/Tweed G/C Green 11 west	B358	Mornington G/C 15th Green (1962/63)
B112	Coolangatta/Tweed G/C Green 11 west	B359	Mornington G/C 15th Green (1962/63)
B113	Coolangatta/Tweed G/C Green 11 west	B360	Mornington G/C 15th Green (1962/63)
B114	Commonwealth G/C- Nursery Surrounds	B361	Mornington G/C 15th Green (1962/63)
B115	Commonwealth G/C- Nursery Surrounds	B362	Mornington G/C 15th Green (1962/63)
B116	Commonwealth G/C- Nursery Surrounds	B363	Mornington G/C 15th Green (1962/63)
B117	The Vines G/C(S.A) Green surrounds	B364	Mornington G/C 15th Green (1962/63)
B118	The Vines G/C(S.A) Green surrounds	B365	Mornington G/C 15th Green (1962/63)
B119	The Vines G/C(S.A) Green surrounds	B366	Mornington G/C 15th Green (1962/63)
B120	Werribee Park G/C 13th Green	B367	Mornington G/C 15th Green (1962/63)
B121	Werribee Park G/C 13th Green	B368	Mornington G/C 15th Green (1962/63)
B122	Werribee Park G/C 13th Green	B369	Mornington G/C 15th Green (1962/63)
B123	Werribee Park G/C 13th Green	B370	Mornington G/C 17th Green
B124	Tewantin-Noosa G/C 2nd Green	B371	Mornington G/C 17th Green
B125	Tewantin-Noosa G/C 9th Green	B372	Mornington G/C 17th Green
B126	Tewantin-Noosa G/C 9th Green	B373	Mornington G/C 17th Green
B127	Tewantin-Noosa G/C 9th Green	B374	Mornington G/C 17th Green
B128	Corowa G/C 8th Green	B375	Mornington G/C 17th Green
B129	Tewantin-Noosa G/C 2nd Green	B376	Mornington G/C Putter (small) and 18th Green
B130	Corowa G/C 1st Green	B377	Mornington G/C Putter (small) and 18th Green
B131	Corowa G/C 1st Green	B378	Mornington G/C Putter (small) and 18th Green
B132	Tewantin-Noosa G/C 2nd Green	B379	Mornington G/C Putter (small) and 18th Green
B133	Corowa G/C 1st Green	B380	Mornington G/C Putter (small) and 18th Green
B134	Glenelg G/C	B381	Mornington G/C Putter (small) and 18th Green
B135	L93	B382	Barwon Heads G/C (bent allowed to grow out of Poa annua)
B136	A1	B383	Barwon Heads G/C (bent allowed to grow out of Poa annua)
B137	Egmont	B384	Barwon Heads G/C (bent allowed to grow out of Poa annua)
B138	SR7200	B385	Barwon Heads G/C (bent allowed to grow out of Poa annua)
B139	Penncross	B386	Vic Creeping bent
B140	Royal Melbourne G/C	B387	Vic Creeping bent
B141	Tewantin-Noosa 9th Green	B388	Vic Creeping bent
B142	Waverley Private G/C Practice Fairway	B389	Castle Hill GC "Suttons"
B143	Waverley Private G/C Practice Fairway	B390	Mornington G/C 1st Green
B144	Waverley Private G/C Practice Fairway	B391	Mornington G/C 4th Green
B145	Waverley Private G/C Practice Fairway	B392	Vic Creeping bent
B146	Waverley Private G/C Practice Fairway	B393	CL

B147	Waverley Private G/C Practice Fairway	B394	CL
B148	Waverley Private G/C Practice Fairway	B395	Sale Croquet
B149	Waverley Private G/C Practice Fairway	B396	CL
B150	Waverley Private G/C Practice Fairway	B397	Seaview G/C (salty water)
B151	Waverley Private G/C Practice Fairway	B398	Launceston G/C 16th
B152	Waverley Private G/C Practice Fairway	B399	Seaview G/C (salty water)
B153	Waverley Private G/C Practice Fairway	B400	Seaview G/C (salty water)
B154	Waverley Private G/C Practice Fairway	B401	Seaview G/C (salty water)
B155	Waverley Private G/C Practice Fairway	B402	Seaview G/C (salty water)
B156	Waverley Private G/C Practice Fairway	B403	Seaview G/C (salty water)
B157	Flinders G/C 4th Green	B404	Launceston G/C 16th
B158	Flinders G/C 4th Green	B405	Royal Hobart 9th
B159	Flinders G/C 4th Green	B406	Port Fairy 14th
B160	Flinders G/C 4th Green	B407	Lorne G/C
B161	Flinders G/C 4th Green	B408	Port Fairy 2nd
B162	Flinders G/C 4th Green	B409	Mowbray 16th
B163	Flinders G/C 4th Green	B410	Launceston G/C 6th
B164	Flinders G/C 4th Green	B411	Royal Hobart 16th
B165	Flinders G/C 4th Green	B412	Apollo Bay
B166	Flinders G/C 4th Green	B413	Lorne G/C 9th
B167	Flinders G/C 4th Green	B414	Launceston 2nd
B168	Flinders G/C 4th Green	B415	Launceston 2nd
B169	Flinders G/C 4th Green	B416	Royal Hobart 9th
B170	Flinders G/C 4th Green	B417	Peterborough 7th
B171	Unknown	B418	Port Fairy 11th
B172	Unknown	B419	Port Fairy 2nd
B173	Unknown	B420	Victoria 9th
B174	Unknown	B421	Victoria 8th
B175	Unknown	B422	Victoria 9th
B176	Unknown	B423	Victoria 18th
B177	Home	B424	Victoria 9th
B178	Mt Gambier G/C	B425	Victoria 18th
B179	Waverley Private G/C Practice Fairway	B426	Victoria 18th
B180	Waverley Private G/C Practice Fairway	B427	Victoria 9th
B181	Waverley Private G/C Practice Fairway	B428	Victoria 9th
B182	Waverley Private G/C Practice Fairway	B429	Victoria 18th
B183	Waverley Private G/C Practice Fairway	B430	Victoria 9th
B184	Waverley Private G/C Practice Fairway	B431	Victoria 9th
B185	Waverley Private G/C Practice Fairway	B432	Launceston
B186	Waverley Private G/C Practice Fairway	B433	Lorne 9th
B187	Waverley Private G/C Practice Fairway	B434	Peterborough 7th
B188	Waverley Private G/C Practice Fairway	B435	Royal Hobart 16th
B189	Waverley Private G/C Practice Fairway	B436	Apollo Bay
B190	Waverley Private G/C Practice Fairway	B437	Launceston 13th
B191	Waverley Private G/C Practice Fairway	B438	Lorne 9th
B192	Waverley Private G/C Practice Fairway	B439	Royal Hobart 11th
B193	Avondale G/C	B440	Launceston 6th
B194	Avondale G/C	B441	Royal Hobart 6th
B195	Avondale G/C	B442	Apollo Bay
B196	Avondale G/C	B443	Victoria 18th
B197	Avondale G/C	B444	Victoria 8th
B198	Avondale G/C	B445	Victoria 8th

B199	Avondale G/C	B446	Victoria 3rd
B200	Avondale G/C	B447	Victoria 11th
B201	Avondale G/C	B448	Victoria 16th
B202	Avondale G/C	B449	Victoria 16th
B203	Avondale G/C	B450	Victoria 18th
B204	Avondale G/C	B451	Victoria 11th
B205	Avondale G/C	B452	Victoria 9th
B206	Avondale G/C	B453	Lorne
B207	Avondale G/C	B454	Port Fairy 14th
B208	Avondale G/C	B455	Port fairy 9th
B209	Avondale G/C	B456	Launceston 6th
B210	Avondale G/C	B457	Apollo Bay
B211	Avondale G/C	B458	Royal Hobart 9th
B212	Avondale G/C	B459	Apollo Bay
B213	Avondale G/C	B460	Royal Hobart 9th
B214	Avondale G/C	B461	Launceston 6th
B215	Avondale G/C	B462	Mowbray 16th
B216	Avondale G/C	B463	Mowbray 16th
B217	Avondale G/C	B464	Royal Hobart 6th
B218	Curlewis G/C 2nd Green	B465	Torquay 10th
B219	Curlewis G/C 2nd Green	B466	Torquay 10th
B220	Curlewis G/C 2nd Green	B467	Gawler Golf Club (Seaside)
B221	Curlewis G/C 2nd Green	B468	Gawler Golf Club (Seaside)
B222	Curlewis G/C 2nd Green	B469	Gawler Golf Club (Seaside)
B223	Curlewis G/C 2nd Green	B470	Gawler Golf Club (Seaside)
B224	Curlewis G/C 2nd Green	B471	Gawler Golf Club (Seaside)
B225	Curlewis G/C 2nd Green	B472	Gawler Golf Club (Seaside)
B226	Curlewis G/C 2nd Green	B473	Gawler Golf Club (Seaside)
B227	Bowral Country Club	B474	Gawler Golf Club (Seaside)
B228	Blackwood G/C	B475	Gawler Golf Club (Seaside)
B229	Blackwood G/C	B476	Gawler Golf Club (Seaside)
B230	Blackwood G/C	B477	Gawler Golf Club (Seaside)
B231	Blackwood G/C	B478	Gawler Golf Club (Seaside)
B232	Blackwood G/C	B479	Gawler Golf Club (Seaside)
B233	Blackwood G/C	B480	Gawler Golf Club (Seaside)
B234	Blackwood G/C	B481	Gawler Golf Club (Seaside)
B235	Blackwood G/C	B482	Gawler Golf Club (Seaside)
B236	Blackwood G/C	B483	Gawler Golf Club (Seaside)
B237	Mt Lofty G/C	B484	Gawler Golf Club (Seaside)
B238	Mt Lofty G/C		

**Table 6: Plant characteristics assessed on 9/10/01**

SAMPLE No.	MAX DIAMETER (cm)	MAX HEIGHT (cm)	MAX HEIGHT (rating)	DENSITY	STOLON No.	VIGOUR
B17	50	4	2	4	3	3
B20	44	6	2	4	3	5
B19	76	3	1	4	2	2
B18	45	6	2	4	3	3
B25	60	6	3	4	3	3
B47	52	7	2	4	3	3
B6	40	6	3	4	3	2
B30	40	6	3	4	3	2
B21	40	7	3	4	2	2
B22	33	5	2	5	2	2
B23	43	6	3	4	3	3
B24	46	7	3	3	3	3
B48	42	8	4	3	2	2
B49	51	4	2	2	4	4
B29	24	3	2	3	2	2
B28	54	4	3	3	4	4
B27	57	4	2	3	4	4
B26	60	5	3	3	5	5
B33	43	6	3	4	4	4
B62	30	5	3	3	3	2
B8	45	6	3	3	3	3
B36	45	4	2	4	3	3
B35	68	5	3	3	4	4
B34	39	8	3	4	2	2
B31	42	8	4	4	3	2
B32	67	7	3	3	4	4
B53	30	6	3	3	2	2
B5	39	5	3	3	3	2
B37	42	4	2	4	3	3
B43	40	5	3	3	3	3
B44	43	5	2	3	3	3
B38	52	6	3	3	3	3
B39	48	5	2	3	4	3
B50	40	8	4	4	3	3
B1	31	7	3	3	3	2
B40	48	3	2	4	4	3
B41	63	5	3	4	4	4
B42	60	6	3	4		4
B10	49	6	3	4	5	3
B11	57	4	2	4	3	4
B51	45	8	4	4	4	3
B61	60	6	3	3	3	3
B12	53	4	2	4	4	3
B13	44	5	3	4	3	3
B14	32	8	4	4	2	3
B15	37	7	3	4	3	3
B16	49	7	3	3	3	4
B57	20	5	3	3	1	1
B9	24	2	2	3	3	3
B55	42	4	2	3	3	3
B52	62	6	3	3	4	4

B58	50	5	3	3	4	3
B3	57	5	3	4	4	4
B2	40	9	4	3	3	3
B60	50	6	3	3	3	3
B56	10	6	3	3	1	1
B59	20	3	2	4	2	2
B54	36	7	3	3	3	2
<b>Average</b>	<b>45</b>	<b>5.6</b>	<b>2.8</b>	<b>3.5</b>	<b>3.1</b>	<b>2.9</b>
<b>Standard deviation</b>	<b>12.6</b>	<b>1.5</b>	<b>0.7</b>	<b>0.6</b>	<b>0.8</b>	<b>0.9</b>

**Table 7: Plant characteristics**

<b>SAMPLE No.</b>	<b>Density (1 – 5) 4/2/03</b>	<b>Quality (1 – 5) 16/4/03</b>	<b>Quality (1 – 5)AP 9/5/03</b>	<b>SAMPLE No.</b>	<b>Density (1 – 5) 4/2/03</b>	<b>Quality (1 – 5) 16/4/03</b>	<b>Quality (1 – 5)AP 9/5/03</b>
B17	4	2	2	B72(b)	3	3	2
B20	4	4	3	B156	3	3	2
B19	3	4	2	B71(b)	2	4	3
B18	4	4	4	B149	1	2	1
B25	4	4	3	B129	5	5	3
B47	4	4	3	B130	4	3	2
B6	4	4	2	B132	3	3	3
B30	4	4	2	B126	3	3	2
B21	4	2	2	B79(b)	4	4	3
B22	5	5	5	B166	3	2	2
B23	5	4	3	B153	5	5	4
B24	4	3	2	B154	2	4	4
B48	3	3	1	B86	1	3	2
B49	3	3	2	B160	4	4	3
B29	3	4	2	B125	4	3	2
B28	4	3	2	B124	3	3	2
B27	4	4	3	B78(b)	3	3	2
B26	5	5	4	B137	3	3	2
B33	4	4	2	B138	2	2	2
B62	2	2	1	B133	3	3	3
B8	4	4	2	B81	2	2	2
B36	4	3	3	B152	3	4	3
B35	4	3	2	B85	3	4	3
B34	5	4	3	B162	3	3	3
B31	4	4	3	B148	3	0	0
B32	4	3	2	B159	2	3	2
B53	3	2	1	B143	2	3	2
B5	4	3	2	B163	3	3	3
B37	3	3	3	B169	3	3	2
B43	4	3	2	B158	3	4	3
B44	5	4	4	B170	3	4	3
B38	3	4	3	B157	3	3	2
B39	4	3	2	B178	4	4	3
B50	3	4	3	B91	3	4	2
B1	3	3	2	B208	5	4	2
B40	5	4	4	B202	5	5	3
B41	4	3	3	B193	5	5	4
B42	4	3	3	B122	5	5	3
B10	4	5	3	B196	5	3	3
B11	3	3	3	B211	5	5	3
B51	3	5	3	B173	2	2	1

B61	2	2	2	B200	4	5	3
B12	3	4	4	B214	3	3	2
B13	3	4	3	B195	3	3	2
B14	5	5	5	B89	3	3	2
B15	4	4	3	B194	4	4	3
B16	3	3	3	B101	4	4	3
B57	2	3	2	B176	2	2	1
B9	3	4	3	B189	2	2	2
B55	2	2	2	B172	3	2	1
B52	3	3	3	B206	5	5	4
B58	2	2	2	B105	5	5	4
B3	4	3	3	B215	3	3	2
B2	4	3	2	B96	4	4	3
B60	4	3	3	B115	4	3	2
B56	2	2	1		5	4	3
B59	3	4	2	B177	2	2	1
B54	5	5	4	B213	4	5	3
B67	4	2	2	B209	3	3	3
B66	3	3	2	B216	2	3	2
B74	3	2	2	B210	4	4	4
B65	2	2	2	B201	3	3	2
B63	2	2	2	B99	4	3	3
B64	3	3	2	B111	5	4	4
B70(a)	2	2	3	B94	3	4	3
B46	2	2	1		5	5	4
B76(a)	4	5	4	B107	3	4	3
B72(a)	3	2	2	B207	2	3	2
B78(a)	3	3	2	B123	4	4	3
B68	2	3	2	B203	3	3	2
B73	1	2	2	B106	5	4	3
B77	3	2	3	B121	5	5	3
B71(a)	2	3	2	B103	4	3	2
B75	3	3	2	B98	3	3	2
B69	3	3	3	B198	4	4	3
B79(a)	3	3	3	B197	3	3	2
B151	1	3	3	B199	4	3	3
B144	1	2	1	B92	3	2	2
B145	2	3	2	B174	3	2	1
B167	3	4	4	B223	3	3	2
B168	3	3	3	B212	3	3	2
B147	2	2	1	B181	3	3	2
B139	3	4	3	B109	5	5	4
B142	1	2	2	B95	4	4	3
B136	3	3	3	B93	4	4	3
B45	1	2	1	B90	5	4	1
B150	1	2	3	B182	3	3	3
B131	3	4	2	B179	3	2	2
B76(b)	3	3	3	B231	3	3	3
B84	3	3	2	B232	3	3	3
B127	3	2	2	B102	4	3	2
B164	3	4	3	B108	3	2	2
B161	4	5	4	B217	3	3	2
B70(b)	3	2	2	B184	3	3	2

B135	3	3	3	B220	5	3	2
B146	2	3	2	B171	2	2	1
B82	3	3	2	B186	2	3	2
B87	3	4	3		4	3	3
B134	4	4	3	B205	3	2	2
B140	2	3	2	B100	5	5	4
B165	2	3	2	B236	4	3	3
B155	3	4	3	B226	3	4	3
B128	4	3	3		3	4	2
<b>Average</b>	-	-	-		<b>3.4</b>	<b>3.4</b>	<b>2.5</b>
<b>Standard deviation</b>	-	-	-		<b>1.0</b>	<b>0.9</b>	<b>0.8</b>

**Table 8: Growth rate of selected bentgrass selections**

Sample No.	MAX DIAMETER (cm) 9/10/01 (1)	MAX DIAMETER (cm) 29/10/01 (2)	MAX DIAMETER (cm) 29/11/01 (3)	MAX DIAMETER (cm) 19/12/01 (4)	MAX DIAMETER (cm) 22/2/02	% Change 1 - 2	% Change 2 - 3	% Change 3 - 4
B17	50	50	52	46	65	0%	4%	-13%
B20	44	44	44	48	42	0%	0%	8%
B19	76	83	73	70	55	8%	-14%	-4%
B18	45	46	40	38	44	2%	-15%	-5%
B25	60	66	71	74	45	9%	7%	4%
B47	52	52	66	70	50	0%	21%	6%
B6	40	50	46	46	46	20%	-9%	0%
B30	40	41	43	38	42	2%	5%	-13%
B21	40	42	45	33	40	5%	7%	-36%
B22	33	43	49	40	42	23%	12%	-23%
B23	43	56	61	56	42	23%	8%	-9%
B24	46	46	43	44	46	0%	-7%	2%
B48	42	61	65	45	52	31%	6%	-44%
B49	51	63	45	42	52	19%	-40%	-7%
B29	24	24	29	28	38	0%	17%	-4%
B28	54	60	61	54	62	10%	2%	-13%
B27	57	72	64	64	53	21%	-13%	0%
B26	60	79	75	78	56	24%	-5%	4%
B33	43	56	64	50	50	23%	13%	-28%
B62	30	52	50	48	54	42%	-4%	-4%
B8	45	49	48	44	45	8%	-2%	-9%
B36	45	45	50	41	50	0%	10%	-22%
B35	68	82	89	66	50	17%	8%	-35%
B34	39	53	40	45	48	26%	-33%	11%
B31	42	44	49	46	46	5%	10%	-7%
B32	67	67	46	48	45	0%	-46%	4%
B53	30	40	44	39	53	25%	9%	-13%
B5	39	39	38	37	38	0%	-3%	-3%
B37	42	42	42	43	44	0%	0%	2%
B43	40	43	51	49	52	7%	16%	-4%
B44	43	46	54	50	54	7%	15%	-8%
B38	52	59	58	58	50	12%	-2%	0%
B39	48	54	48	54	40	11%	-13%	11%
B50	40	41	34	38	33damaged	2%	-21%	11%
B1	31	31	23	26	36	0%	-35%	12%

B40	48	52	59	58	48	8%	12%	-2%
B41	63	63	59	60	53	0%	-7%	2%
B42	60	60	55	63	50	0%	-9%	13%
B10	49	49	47	51	46	0%	-4%	8%
B11	57	69	61	58	52	17%	-13%	-5%
B51	45	45	37	36	40	0%	-22%	-3%
B61	60	60	48	56	47	0%	-25%	14%
B12	53	58	55	60	47	9%	-5%	8%
B13	44	49	44	44	48	10%	-11%	0%
B14	32	49	36	39	38	35%	-36%	8%
B15	37	37	38	39	42	0%	3%	3%
B16	49	49	42	46	47	0%	-17%	9%
B57	20	24	27	34	44	17%	11%	21%
B9	24	24	22	26	38	0%	-9%	15%
B55	42	42	48	46	48	0%	13%	-4%
B52	62	62	58	51	56	0%	-7%	-14%
B58	50	50	35	40	41	0%	-43%	13%
B3	57	62	68	62	40damaged	8%	9%	-10%
B2	40	40	37	36	42	0%	-8%	-3%
B60	50	50	33	42	50	0%	-52%	21%
B56	10	19	24	30	40	47%	21%	20%
B59	20	30	22	26	39	33%	-36%	15%
B54	36	38	34	36	42	5%	-12%	6%
B67		20	22	35	43		9%	37%
B66		17	17	23	34		0%	26%
B74		16	20	26	40		20%	23%
B65		22	23	32	50		4%	28%
B63		26	13	19	36		-100%	32%
B64		15	18	22	40		17%	18%
B70(a)		19	20	29	37		5%	31%
B46		30	42	47	50		29%	11%
B76(a)		14	15	21	24		7%	29%
B72(a)		20	22	27	dead		9%	19%
B78(a)		20	23	26	36		13%	12%
B68		22	22	30	36		0%	27%
B73		14	16	22	42		13%	27%
B77		25	31	36	52		19%	14%
B71(a)		12	16	20	44		25%	20%
B75		25	26	31	46		4%	16%
B69		23	28	26	36damaged		18%	-8%
B79(a)		23	18	23	33damaged		-28%	22%

**Table 9: Seedhead production, turf quality and density**

SAMPLE No.	No. of seedheads 14/10/02	No. of seedheads 14/11/02	No. of seedheads 29/11/02	No. of seedheads 16/12/03	No. of seedheads 9/1/03	Height of seed head	Height of seed head (cm) 9/1/03	Density (1 - 5) 16/4/03	Quality (1 - 5) 16/4/03
B17	low				mod	mod	15	4	2
B20							0	4	4
B19							0	3	4
B18					mod	low	7	4	4
B25					low	mod	12	4	4
B47				high	high	mod	16	4	4
B6					low	mod	15	4	4
B30					low	low	8	4	4
B21					mod	mod	16	4	2
B22					low	low	9	5	5
B23	low						22	5	4
B24					mod	mod	18	4	3
B48			low	low	mod	high	18	3	3
B49					high	mod/high	21	3	3
B29					low	mod	15	3	4
B28	low				low	low	17	4	3
B27					low	low	13	4	4
B26							0	5	5
B33					mod	low	10	4	4
B62		high	high	high	high	high	26	2	2
B8					low	low	7	4	4
B36					high	mod	8	4	3
B35					mod	mod	12	4	3
B34					mod/high	mod	10	5	4
B31					mod/high	mod	10	4	4
B32					mod/high	mod	16	4	3
B53		high	high	high	high	high	30	3	2
B5					low	low	10	4	3
B37							0	3	3
B43					low	mod	7	4	3
B44							0	5	4
B38					low	low	7	3	4
B39					high	low	10	4	3
B50					mod	low/mod	16	3	4
B1				low	mod/high	mod	19	3	3
B40					low	low	8	5	4
B41					mod	low	8	4	3
B42					mod	low	10	4	3
B10	low				mod/high	mod	10	4	5
B11	low				high	mod	13	3	3
B51	low				mod/high	low	7	3	5
B61				mod	high	high	20	2	2
B12			low	mod	high	mod	12	3	4

B13	low				low	low/mod	12	3	4
B14					low	low	7	5	5
B15					low	low	13	4	4
B16				low	high	mod	20	3	3
B57		high	mod	mod	high	mod	17	2	3
B9					mod	low	8	3	4
B55	low		low	low	high	high	20	2	2
B52	low	mod	low	low	mod	mod	10	3	3
B58	low		low	mod	high	high	20	2	2
B3					low	low	8	4	3
B2	low				mod/high	mod	10	4	3
B60	low				low	low	0	4	3
B56			mod	mod	high	mod	18	2	2
B59					mod	mod	15	3	4
B54	low						0	5	5
B67	low	mod		mod/high	high	high	26	4	2
B66	low		mod	mod/high	low	high	17	3	3
B74				mod/high	mod/high	mod/high	15	3	2
B65		high		mod/high	high	mod	7	2	2
B63	low		mod/high	mod/high	low	mod	25	2	2
B64		mod	mod	mod	mod	mod/high	20	3	3
B70(a)				mod	mod	mod	14	2	2
B46		high	high	high	high	high	20	2	2
B76(a)					low	mod	10	4	5
B72(a)				high	high	mod	23	3	2
B78(a)					high	low/mod	17	3	3
B68		high	high	high	high	mod/high	20	2	3
B73	low	high	high	high	high	high	27	1	2
B77	low				mod	mod/high	10	3	2
B71(a)		high	mod	mod	high	mod	13	2	3
B75					high	low	12	3	3
B69	low				high	low	12	3	3
B79(a)	low				high	low	12	3	3
B151							0	1	3
B144	low	high	high	high	high	high	34	1	2
B145				high	high	mod	22	2	3
B167				mod	high	low	10	3	4
B168	low				high	low	13	3	3
B147	low	high	high	high	high	high	25	2	2
B139				mod	mod	mod	20	3	4
B142					mod	high	30	1	2
B136	low	low	low	low	mod	mod	15	3	3
B45	low	high	mod	mod	high	high	30	1	2
B150	low	high	mod	mod/high	high	mod/high	25	1	2
B131					mod	mod	12	3	4
B76(b)			low	low	mod	mod	16	3	3
B84	low			high	mod	mod	24	3	3
B127	low			mod	mod	mod	17	3	2
B164	low			low	mod/high	low	11	3	4
B161					low	low	10	4	5
B70(b)	low			low	high	mod	18	3	2
B135	low			low	high	mod	17	3	3

B146	low				high	mod	18	2	3
B82					mod	mod	16	3	3
B87					mod	low	7	3	4
B134					low/mod	mod	10	4	4
B140		mod	mod	mod	high	mod	20	2	3
B165					mod	low	13	2	3
B155							0	3	4
B128					mod	low	12	4	3
							0	3	3
B72(b)		low	low	mod	high	mod	12	3	3
B156	low				mod	mod	14	2	4
B71(b)	low		mod	mod	mod	low/mod	14	1	2
B149							0	5	5
B129							0	4	3
B130					mod	low	12	3	3
B132				mod	high	mod/high	16	3	3
B126					low	low	12	4	4
B79(b)					mod/high	mod	16	3	2
B166	low						7	5	5
B153	low				mod/high	low	10	2	4
B154	low	high	high	high	high	high	30	1	3
B86	low				low	low	0	4	4
B160					low	low	11	4	3
B125			low	high	high	mod	19	3	3
B124	low				low	mod	0	3	3
B78(b)					high	mod	15	3	3
B137				low	mod	mod	15	2	2
B138				low	high	mod	20	3	3
B133					low/mod	mod	14	2	2
B81	low			low	low	mod	14	3	4
B85	low			low	low	low	0	3	4
B162				high	high	mod	16	3	3
B148							0	3	0
B159					mod	low	16	2	3
B143							0	2	3
B163				mod	high	mod	23	3	3
B169			low	mod	high	mod	20	3	3
B158					mod	low	8	3	4
B170					low	low	10	3	4
B157					mod	mod	16	3	3
B178							0	4	4
B91							0	3	4
B208							0	5	4
B202							0	5	5
B193							0	5	5
B122							0	5	5
B196							0	5	3
B211							0	5	5
B173				mod			0	2	2
B200							0	4	5
B214							0	3	3
B195							0	3	3

B89							0	3	3
B194							0	4	4
B101							0	4	4
B176							0	2	2
B189							0	2	2
B172				mod			0	3	2
B206							0	5	5
B105							0	5	5
B215							0	3	3
B96							0	4	4
B115							0	4	3
							0	5	4
B177							0	2	2
B213							0	4	5
B209							0	3	3
B216							0	2	3
B210							0	4	4
B201							0	3	3
B99							0	4	3
B111							0	5	4
B94							0	3	4
							0	5	5
B107							0	3	4
B207							0	2	3
B123							0	4	4
B203							*	3	3
B106							*	5	4
B121							*	5	5
B103							*	4	3
B98							*	3	3
B198							*	4	4
B197							*	3	3
B199							*	4	3
B92							*	3	2
B174				high			*	3	2
B223							*	3	3
B212							*	3	3
B181							*	3	3
B109							*	5	5
B95							*	4	4
B93							*	4	4
B90							*	5	4
B182							*	3	3
B179							*	3	2
B231							*	3	3
B232				mod			*	3	3
B102							*	4	3
B108							*	3	2
B217							*	3	3
B184							*	3	3
B220							*	5	3
B171				mod			*	2	2

B186						*	2	3		
						*	4	3		
B205						*	3	2		
B100						*	5	5		
B236						*	4	3		
B226						*	3	4		
						*	3	4		
							<b>Average</b>	<b>10.4</b>	<b>3.3</b>	<b>3.3</b>
							<b>St.dev</b>	<b>8.6</b>	<b>1.0</b>	<b>0.9</b>

**Table 10: Top 100 selections planted into putting green trial at Chisholm TAFE – Rosebud Campus**

<b>Selection No.</b>	<b>Origin</b>	<b>Selection No.</b>	<b>Origin</b>
B2	Thurgoona GC 12 <sup>th</sup> Green	B88	Corowa G/C 1st green
B4	RAGC 8th green	B92	Flinders G/C
B5	RAGC 11th green	B93	Flinders G/C 4th green
B6	Emerald G/C 17th green	B95	L93
B10	RAGC 11th green	B98	Royal Aust. Engineers 3rd green
B11	RAGC 11th green	B99	Glenelg G/C
B13	Frankston	B102	Waverley Private G/C practice fwy
B14	Frankston	B106	Waverley Private G/C practice fwy
B17	RAGC 11th green	B108	Waverley Private G/C practice fwy
B18	RAGC 8th green	B112	Tewantin-Noosa G/C 9th green
B20	Frankston	B114	Flinders G/C
B22	Riverside G/C 17th green	B115	Waverley Private G/C practice fwy
B23	Riverside G/C 5th green (in Pennlinks patch)	B117	Royal Aust. Engineers 2nd green
B24	Riverside G/C 1st green	B118	Waverley Private G/C practice fwy
B25	RAGC 18th green	B119	Tewantin-Noosa G/C 9th green
B26	RAGC 18th green	B122	Egmont
B27	Unknown	B123	SR7200
B29	Grange G/C 4th East	B125	Royal Aust. Engineers 5th green
B31	Grange G/C 11th East	B126	Royal Aust. Engineers 4th green
B32	Grange G/C 5th East	B133	Flinders G/C
B34	Cheltenham G/C 9th green	B134	Flinders G/C
B36	Grange G/C 6th East	B136	Mt. Gambier G/C
B37	Grange G/C 6th East	B139	Avondale G/C
B38	Grange G/C 6th East	B140	Avondale G/C
B39	RAGC 4th green	B141	Werribee Park G/C 13th green
B40	RAGC 4th green	B143	Avondale G/C
B41	Cheltenham G/C 9th green	B145	Avondale G/C
B42	Frankston	B148	Coolangatta-Tweed G/C 5th green West
B43	RAGC 4th green	B149	Avondale G/C
B44	RAGC 4th green	B150	Coolangatta-Tweed G/C 4th green West
B45	RAGC 4th green	B154	Avondale G/C
B46	RAGC 4th green	B155	Coolangatta-Tweed G/C 1st green West
B47	RAGC 4th green	B157	Coolangatta-Tweed G/C 4th green West
B48	RMGC 17th green West	B159	Werribee Park G/C 13th green
B49	Unknown	B161	Avondale G/C

B50	Frankston	B164	Avondale G/C
B51	Unknown	B167	Coolangatta-Tweed G/C 1st green West
B52	Unknown	B168	Coolangatta-Tweed G/C 5th green West
B53	Thurgoona G/C 3rd green	B169	Tewantin-Noosa G/C 2nd green
B55	Terrigal G/C	B170	Coolangatta-Tweed G/C 1st green West
B58	Joondoolup G/C Lakes 5th	B172	Werribee Park G/C 13th green
B59	Frankston	B174	Coolangatta-Tweed G/C 1st green West
B60	Royal Hobart G/C	B175	Werribee Park G/C 13th green
B61	RGC	B178	Avondale G/C
B66	Glenelg G/C 16th - drain	B186	Coolangatta-Tweed G/C 1st green West
B67	Corowa 8th green	B187	Coolangatta-Tweed G/C 5th green West
B74	Unknown	B188	Coolangatta-Tweed G/C 5th green West
B80	Flinders G/C	B194	Coolangatta-Tweed G/C 4th green West
B83	Penncross	B203	Coolangatta-Tweed G/C 4th green West
B85	A1	B205	Curlewis G/C 2nd green

**Table 11: % Turf cover 23/10/03 – putting green trial at Chisholm TAFE**

Sample No.	% area cover	Sample No.	% area cover
B112	68	B42	90
B7	70	B43	90
B186	73	B92	90
B188	73	B93	90
B114	75	B95	90
B133	75	B115	90
B148	75	B126	90
B154	75	B136	90
B108	78	B174	90
B170	78	B175	90
B51	80	B187	90
B52	80	B203	90
B61	80	B2	93
B123	80	B40	93
B145	80	B59	93
B194	80	B80	93
B6	83	B88	93
B13	83	B141	93
B29	83	B159	93
B38	83	B167	93
B49	83	B168	93
B98	83	B172	93
B125	83	B17	95
B149	83	B18	95
B178	83	B22	95
B205	83	B34	95
B11	85	B36	95
B14	85	B41	95
B20	85	B74	95
B32	85	B140	95
B50	85	B150	95

B66	85	B25	98
B67	85	B31	98
B102	85	B37	98
B117	85	B39	98
B157	85	B44	98
B164	85	B45	98
B4	88	B47	98
B46	88	B83	98
B48	88	B85	98
B58	88	B99	98
B60	88	B106	98
B118	88	B119	98
B122	88	B155	98
B134	88	B161	98
B139	88	B5	100
B143	88	B26	100
B23	90	B53	100
B24	90	B169	100
B27	90		
<b>LSD (&lt;0.05)</b>	<b>14.25</b>	<b>LSD (&lt;0.05)</b>	<b>14.25</b>

**Table 12: Turf quality and density 21/1/04 – putting green trial at Chisholm TAFE**

Sample No.	Quality (1 – 5)	Density (1 – 5)	Sample No.	Quality (1 – 5)	Density (1 – 5)
B2	4.5	5	B92	2.5	3.5
B4	3	3.5	B93	3.5	4
B5	4.5	4.5	B95	2	2.5
B6	2.5	3	B98	3.5	4
B7	2.5	3	B99	2.5	2.5
B11	3	4	B102	2.5	2.5
B13	2.5	2.5	B106	2	2.5
B14	2	2	B108	2	2.5
B17	3	3.5	B112	1.5	2
B18	3.5	3	B114	2	2.5
B20	3.5	4	B115	3.5	3
B22	2.5	3.5	B117	3.5	4
B23	3	3	B118	2.5	2.5
B24	3	3.5	B119	2.5	3.5
B25	3.5	3.5	B122	1.5	2
B26	3	3	B123	3.5	3.5
B27	1	2	B125	3	3.5
B29	2	2.5	B126	4	4
B31	3.5	3.5	B133	3	3.5
B32	3.5	3.5	B134	2	2.5
B34	4	4.5	B136	2	2.5
B36	3.5	4	B139	4.5	5
B37	3	3	B140	2.5	3
B38	2.5	3.5	B141	4	4
B39	3	4	B143	3	3
B40	3	3.5	B145	4	5
B41	4	4	B148	3	3

B42	2	3	B149	3	3
B43	3	3.5	B150	3	3.5
B44	4	3.5	B154	4	5
B45	3.5	4.5	B155	3.5	4
B46	4	3.5	B157	3	3
B47	2	3	B159	3.5	4
B48	1.5	2	B161	2.5	2.5
B49	3	4	B164	2.5	3.5
B50	1	2.5	B167	4	5
B51	1.5	2.5	B168	2	2
B52	1.5	2	B169	3	4
B53	3	4	B170	2	2
B58	3.5	4	B172	3.5	4
B59	2.5	3.5	B174	3.5	4
B60	1	2.5	B175	3.5	4
B61	1	2	B178	2.5	3.5
B66	2	3	B186	4.5	4.5
B67	3	3.5	B187	3.5	3.5
B74	2	2.5	B188	3	4
B80	3	3.5	B194	2	2.5
B83	2	2	B203	3.5	4
B85	3.5	3.5	B205	2	2.5
B88	3	3.5			
<b>LSD</b> (p<0.05)	<b>1.3</b>	<b>1.2</b>	<b>LSD</b> (p<0.05)	<b>1.3</b>	<b>1.2</b>

**Table 13: Turf quality, density and % *Poa annua* 31/8/04 – Putting green trial at Chisholm TAFE**

SELECTION	Quality (1 – 5)	Density (1 – 5)	%Poa	SELECTION	Quality (1 – 5)	Density (1 – 5)	%Poa
B2	4.5	4.5	3	B92	3.5	4.0	18
B4	3.3	3.3	10	B93	4.0	4.5	5
B5	4.0	4.5	5	B95	2.0	2.0	5
B6	3.0	3.0	10	B98	3.0	3.0	15
B7	3.5	3.5	8	B99	2.0	2.0	68
B11	3.5	4.0	2	B102	2.0	2.0	18
B13	2.5	2.5	25	B106	3.5	3.5	10
B14	2.5	2.5	10	B108	2.8	3.0	8
B17	2.0	2.0	2	B112	2.0	2.0	18
B18	3.5	3.5	1	B114	2.5	2.5	20
B20	2.8	2.5	1	B115	3.0	3.0	2
B22	4.0	4.0	2	B117	3.0	3.0	10
B23	3.0	3.0	4	B118	3.0	3.5	2
S24	3.5	3.5	9	B119	2.5	3.0	18
B25	3.0	3.0	5	B122	2.3	2.3	8
B26	2.0	2.0	9	B123	1.5	2.0	13
B27	1.8	2.0	45	B125	2.8	3.0	13
B29	3.5	3.5	15	B126	3.5	3.5	9
B31	3.0	3.0	3	B133	3.0	3.0	3
B32	3.0	3.0	1	B134	2.0	2.5	23
B34	4.5	4.5	10	B136	2.5	2.5	15
B36	2.8	3.0	6	B139	3.8	5.0	6
B37	2.5	2.5	6	B140	2.5	3.0	1

B38	3.0	3.0	5	B141	2.5	2.5	6
B39	3.5	3.5	2	B143	2.0	2.0	11
B40	3.5	3.5	2	B145	4.0	4.5	1
B41	4.0	4.5	1	B148	3.0	3.0	2
B42	3.0	3.0	2	B149	3.0	4.5	2
B43	1.8	1.8	5	B150	3.3	3.5	3
B44	3.3	3.3	2	B154	2.0	2.5	15
B45	4.0	4.0	3	B155	3.5	3.5	6
B46	2.3	2.3	1	B157	2.0	2.0	21
B47	3.0	3.0	2	B159	3.5	4.0	4
B48	1.8	2.0	28	B161	3.3	3.0	4
B49	3.3	3.5	10	B164	3.5	4.5	2
B50	2.0	2.0	30	B167	4.0	4.0	1
B51	3.0	3.0	13	B168	2.3	2.3	6
B52	2.0	2.0	15	B169	4.0	4.0	13
B53	3.0	3.0	18	B170	2.5	2.5	5
B58	3.3	3.3	10	B172	4.0	4.0	1
B59	3.5	3.5	25	B174	2.8	2.5	1
B60	2.5	2.5	20	B175	3.0	4.0	4
B61	1.5	1.5	18	B178	3.0	3.0	18
B66	3.0	3.5	11	B186	2.8	3.3	1
B67	3.5	3.5	1	B187	2.8	2.8	1
B74	2.0	2.0	2	B188	3.3	4.5	2
B80	4.5	5.0	1	B194	2.5	2.5	3
B83	2.0	2.0	15	B203	4.0	5.0	1
B85	2.5	2.5	13	B205	3.5	3.3	5
B88	4.0	4.0	1				
<b>LSD (p&lt;0.05)</b>	<b>1.0</b>	<b>1.1</b>	<b>8.7</b>	<b>LSD (p&lt;0.05)</b>	<b>1.0</b>	<b>1.1</b>	<b>8.7</b>

**Table 14: Bentgrass selections that ranked highest on both assessment dates**

<b>Selection No.</b>	<b>Origin</b>
B2	Thurgoona GC 12 <sup>th</sup> green
B18	RAGC 8 <sup>th</sup> green
B34	Riverside GC 1 <sup>st</sup> green
B39	Grange GC 5 <sup>th</sup> east
B41	Grange GC 6 <sup>th</sup> east
B93	Coolangatta-Tweed G/C 5th green West
B126	Tewantin-Noosa GC 9 <sup>th</sup> green
B145	Waverley Private GC Practice FW
B155	Waverley Private GC Practice FW
B159	Flinders GC 4 <sup>th</sup> green
B167	Flinders GC 4 <sup>th</sup> green
B172	Unknown
B203	Avondale GC

### 3.2 Couchgrass collection

Couchgrass was collected from golf courses primarily in Queensland with some samples from NSW and northern Victoria. Sites were selected for the following reasons;

- a. **Old greens (>20 years old):** Old greens had segregated over time due to management and environmental influences.
- b. **Couchgrass growing under extreme environmental stresses:** These couchgrasses were selected from sites of high salinity, high humidity (north Queensland) and low light.
- c. **Couchgrasses with outstanding surface characteristics:** This included couchgrasses that exhibit high density, high quality putting surface, tolerant to low cutting heights, from greens renowned for the quality of the surface.
- d. **Couchgrasses that have survived summer die-back:** Summer die-back is a generic term that refers to root diseases such as *Geaumannomyces spp.* and *Rhizoctonia spp.* that affect golf greens in Queensland during high temperatures and high humidity.
- e. **Couchgrasses growing out of the normal growing environment:** Plants were collected from a bowling green in northern Victoria.

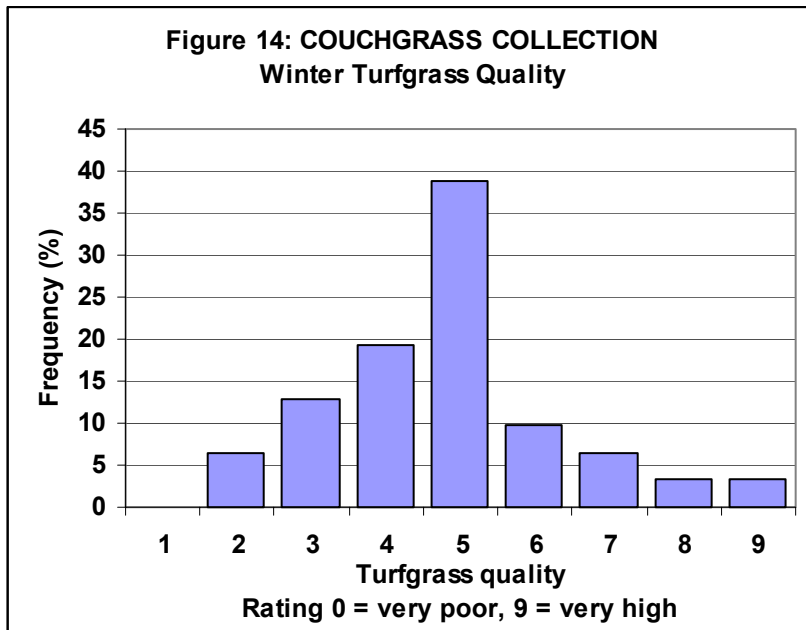
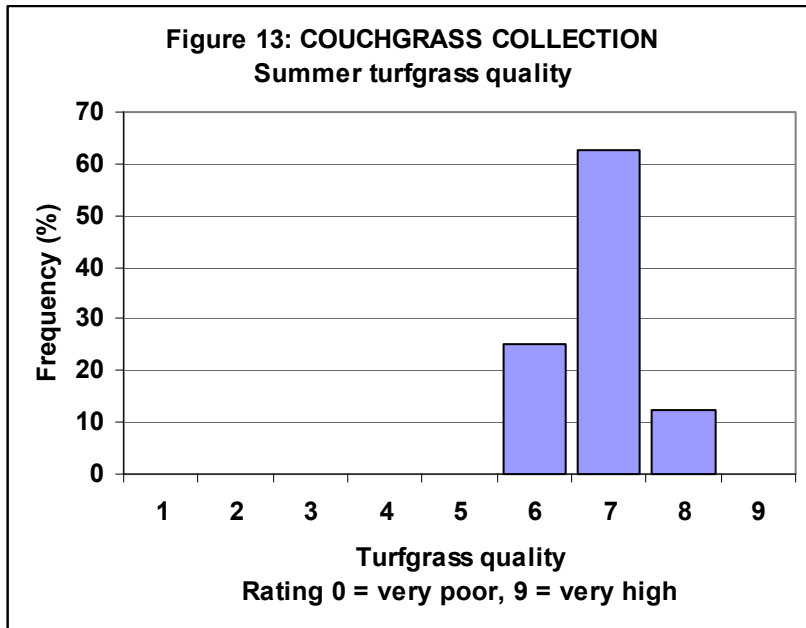
During the 4 years of the project, 93 individual couchgrass plants were collected, of which 74 were planted out into the spaced plant nursery and assessed. Those plants not planted into the spaced plant nursery were received too late for assessment, however, they will be passed onto QDPI Redlands with the better selections for assessment. The list of sample locations is detailed in tables 15, 16 and 17. The number of couchgrass plants collected was considerably less compared to the bentgrasses because the variation in the field was less apparent. This is to be expected given that bentgrass is established by seed. The production of bentgrass seed involves crossing between multiple parents which results in greater genetic diversity and therefore there is greater opportunity for more diverse individuals to appear. The couchgrasses used on golf greens and bowling greens are sterile hybrids that do not produce seed and are propagated and established from vegetative material. Any variation that may occur is due to either contamination or mutation (a rare event).

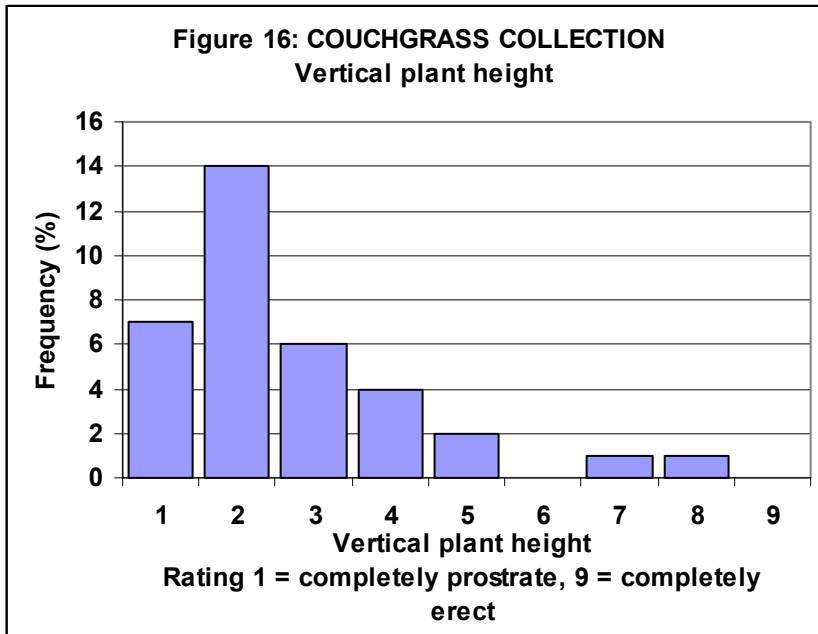
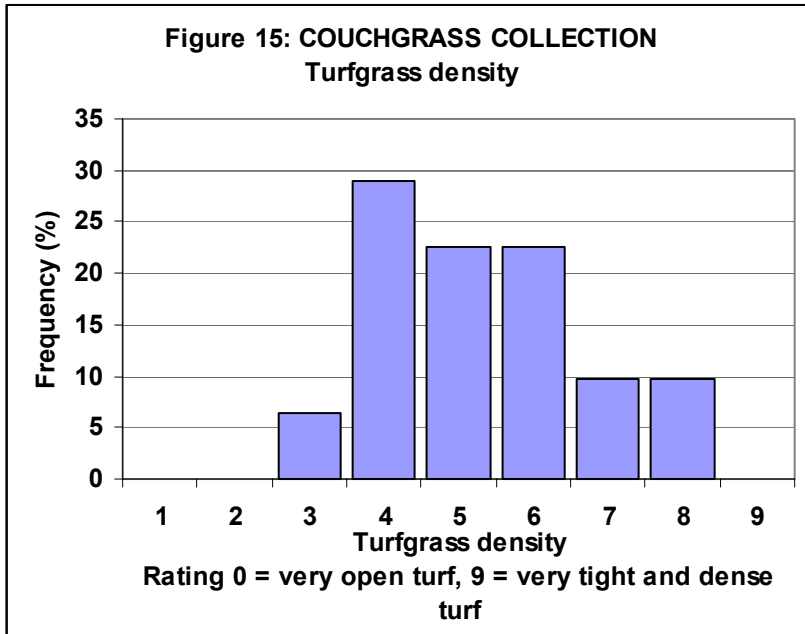
Data was collected on turfgrass quality and density (tables 18 and 20) and growth characteristics (table 19). The data collected was variable for each of the parameters, however, it was normally distributed for turfgrass quality (fig. 13 and 14) and more randomly distributed for plant density (fig.15) and maximum plant diameter (fig.17,18 and 19).

The data for vertical plant height was skewed towards plants that were completely prostrate (fig. 16). This is to be expected as the selection process for high quality couchgrass, for putting greens, is for grasses that can tolerate very low heights of cut. Therefore plants that are prostrate and have low growing points are selected over those that are more upright.

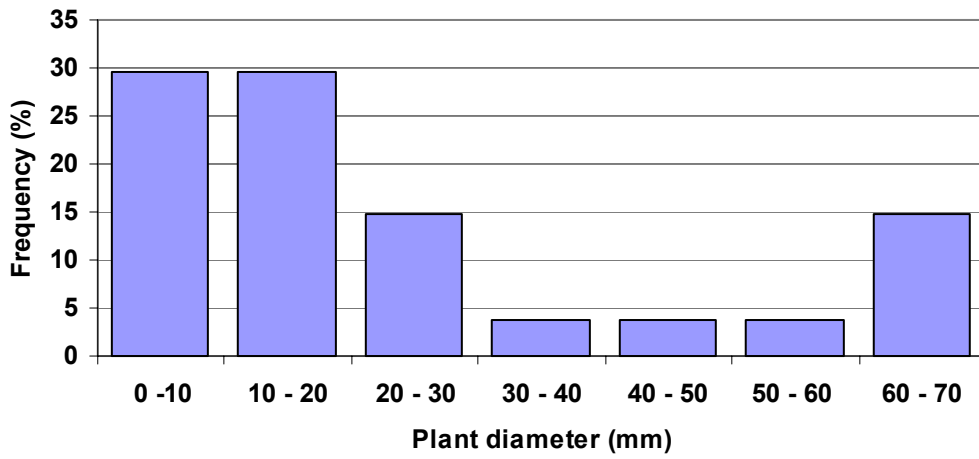
The data collected indicates that there are couchgrass off-types that have the characteristics suitable for high quality putting surfaces. Of the plants assessed there

were 21 selections that ranked highest over all assessment dates of which there were 10 that ranked highly on more than one occasion (table 21).

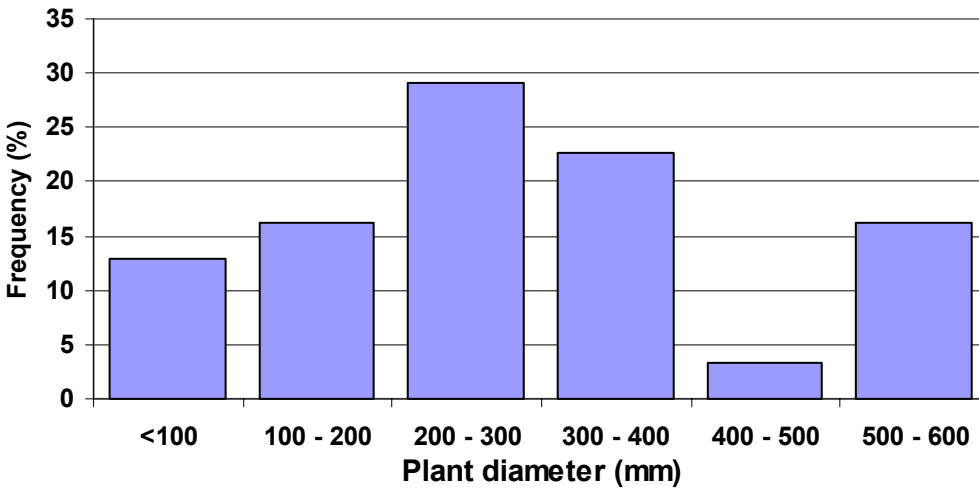


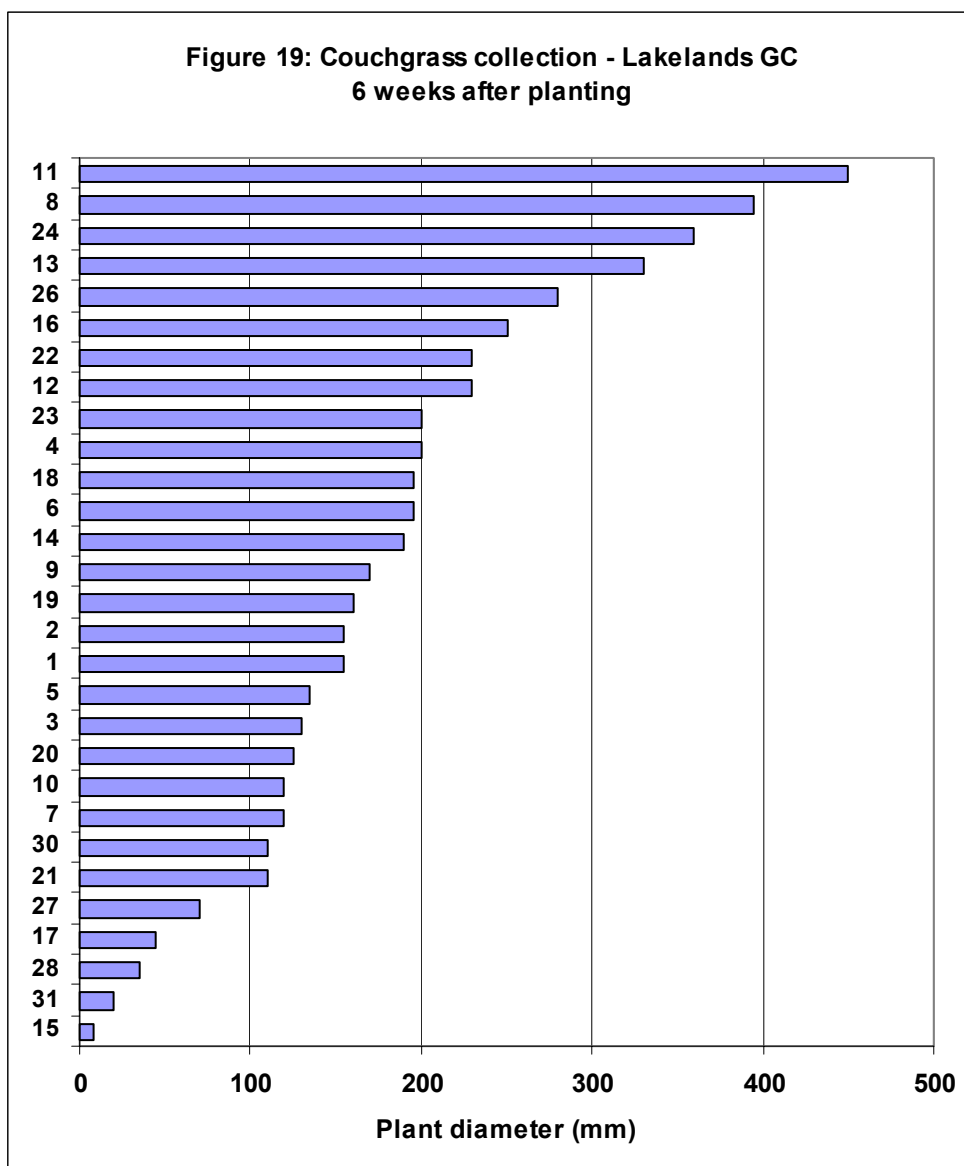


**Figure 17: COUCHGRASS COLLECTION**  
Maximum plant diameter  
2 weeks after planting



**Figure 18: COUCHGRASS COLLECTION**  
Maximum plant diameter  
8 weeks after planting





**Table 15: Plot number and sites where couchgrasses were collected – spaced plant nursery 1**

Plot No.	Origin	Plot No.	Origin
1	Apsley Golf Heights	17	Tewantin Noosa GC 9th
2	Paradise Palms - Prac chipper	18	Tewantin Noosa GC 14th green
3	Royal Queens. 3rd green	19	Coffs Harbour
4	Pacific GC 6th green	20	Teven GC
5	Horton Park GC 8th green	21	Tewantin Noosa 13th green
6	Ocean Shores GC 17th	22	Royal Sth Yarra TC
7	Ocean Shores GC 17th	23	Tifdwarf
8	Gold Coast Burl GC 6th green	24	Tifeagle
9	Gold Coast Burl GC 13th green	25	Tifgreen (328)
10	Mackay GC	26	MS Supreme
11	Swan Hill City	27	Floradwarf
12	Unknown	28	Unknown
13	Cheltenham GC 9th green	29	Unknown

14	Tewantin Noosa GC 3rd green	30	Unknown
15	Gold Coast Burleigh GC 18th	31	Unknown
16	Tewantin Noosa GC		

**Table 16: Plot number and sites where couchgrasses were collected – spaced plant nursery 2**

Plot No.	Origin	Plot No.	Origin
1	Indooroopilly 9W	22	Indooroopilly 5W
2	Royal Queensland 1	23	Gold Coast Burl GC 8th green
3	Royal Queensland 2	24	Surfers GC14
4	Royal Queensland 13	25	Southport 16
5	Royal Queensland 3	26	Southport 16
6	Royal Queensland 2	27	Royal Queensland 3
7	Royal Queensland 13	28	Royal Queensland 2
8	Qu. Coll 34 - Unknown	29	QC 35 - Tifdwarf?
9	Gold Coast Burl GC 8th green	30	QC 28 - Tifdwarf?
10	Gold Coast Burl GC 6th green	31	QC 29 - Stawell BC
11	Gold Coast Burl GC 6th green	32	QC 36 - The Links GC
12	Gold Coast Burl GC 6th green	33	QC 30 - Cairns GC 3
13	Royal Queensland 3	34	Royal Queensland 13
14	Royal Queensland 3	35	Southport GC 13
15	Royal Queensland 2	36	QC 32 - Cairns GC
16	Royal Queensland 13	37	Gold Coast Burl GC 8th green
17	Surfers GC 18	38	QC 31 - Cairns GC
18	Surfers GC 18	39	QC 33 - Unknown
19	Southport GC 3	40	Southport GC 15
20	Southport GC 16	41	Southport GC 3
21	Qu. Coll 41 - Unknown	42	Indooroopilly 9W
		43	Indooroopilly 5W

**Table 17: Selection number and sites where couchgrasses were collected – plants not planted into spaced plant nursery**

Selection No.	Origin	Selection No.	Origin
QC 50	Yamba BC 1	QC 62	Cabarita Beach BC 1
QC 51	Yamba BC 2	QC 63	Cabarita Beach BC 2
QC 52	Yamba BC 3	QC 64	Cabarita Beach BC 3
QC 53	Yamba BC 4	QC 65	Cabarita Beach BC 4
QC 54	Yamba BC 5	QC 66	Cabarita Beach BC 5
QC 55	Yamba BC 6	QC 67	Cabarita Beach BC 6
QC 56	Yamba BC 7	QC 68	Cabarita Beach BC 7
QC 57	Yamba BC 8	QC 69	Cabarita Beach BC 8
QC 58	Yamba BC 9	QC 70	Cabarita Beach BC 9
QC 59	Yamba BC 10	QC 71	Cabarita Beach BC 10
QC 60	Yamba BC 11		
QC 61	Yamba BC 12		

**Table 18: Turfgrass quality, turfgrass density, turfgrass colour, lateral and vertical growth – spaced plant nursery 1**

Plot	Origin	Turfgrass Quality (1 – 9)				Turfgrass Density (1 – 9)		Turfgrass Colour (1 – 9)		Lat. Growth (1 – 9)	Vert. Growth (1 – 9)
		Nov 02	July 03	Aug 03	Dec 04	Sept 02	Oct 04	Oct 04	Sept 02	Sept 02	Sept 02
1	Apsley Golf Heights	7	3	5	5	6	5	6	7	2	3
2	Paradise Palms - Prac chipper	8	4	6.5	5	5	4	7.5	6	1	2
3	Royal Queens. 3rd green	7	6.5	8	6.5	5	6.5	6	6	1.5	2
4	Pacific GC 6th green	7	5	7	7	6.5	8	5.5	6	1	2
5	Horton Park GC 8th green	8	5	5.5	6	5	6	6	7	1	2
6	Ocean Shores GC 17th	7	5	6	5	4	5	5	6.5	1	1
7	Ocean Shores GC 17th	6	5	6.5	4	3	4	5	5	1	1
8	Gold Coast Burl GC 6th green	7	4	5.5	5	6	5	5	6	2.5	2
9	Gold Coast Burl GC 13th green	7	5	5.5	6	7	4	7	7	2	3
10	Mackay GC	6	5	5.5	5	7.5	3	5	7	2.5	4
11	Swan Hill City	6	10	4	6	5	4	5	6.5	7	5
12	Unknown	6	6	5	5	5	3	5	5	1	2
13	Cheltenham GC 9th green	6	2	5.5	6	6	4	7	8	3	8
14	Tewantin Noosa GC 3rd green	6	4	6	5	7	4	6	6.5	2	3
15	Gold Coast Burleigh GC 18th	7	5	6	6	5	4	6	6	2.5	2
16	Tewantin Noosa GC	7	6	6	5	6	5	5	6	1	3
17	Tewantin Noosa GC 9th	7	5	6	6.5	5	6.5	6.5	6.5	1	3
18	Tewantin Noosa GC 14th green	7	4	6	6	5.5	6	6	6.5	2	2
19	Coffs Harbour	7	7	7.5	7	4.5	7	7	5.5	1	2
20	Teven GC	7	6	7	7	6	7	6.5	6	1	2
21	Tewantin Noosa 13th green	8	2	6	7	5	5	6.5	7.5	3	7
22	Royal Sth Yarra TC	7	3	4	4	5	4	6	7	1	3
23	Tifdwarf	7	3	6.5	4	5.5	6	6	6	1	2
24	Tifeagle	7	4	6.5	5	5	5	5	5.5	2	2
25	Tifgreen (328)	7	5	6	7.5	7	8	7	7	1.5	1
26	MS Supreme	7	5	6.5	6.5	7	6.5	7	6	1.5	2
27	Floradwarf	7	5	7	5	4	6	7	6.5	1	1
28	Unknown	7	8	8	6	5	8	7	6.5	1	1
29	Unknown	8	7	6	7	7	7.5	7	7	1	1
30	Unknown	6	3	5	5	2	5	7	6.5	5	5
31	Unknown	6	5	7	4	4	6	7	6	1	1
32	Unknown	7	4	6.5	4	5	4	5	6	4	2
	<b>Average</b>	<b>6.9</b>	<b>4.9</b>	<b>6.1</b>	<b>5.6</b>	<b>5.4</b>	<b>5.4</b>	<b>6.1</b>	<b>6.4</b>	<b>1.9</b>	<b>2.6</b>
	<b>Standard deviation</b>	<b>0.6</b>	<b>1.7</b>	<b>0.9</b>	<b>1.0</b>	<b>1.2</b>	<b>1.5</b>	<b>0.8</b>	<b>0.7</b>	<b>1.4</b>	<b>1.7</b>

**Table 19: Stolon extension and rate of plant establishment – spaced plant nursery 1**

Plot	Origin	Stolon extension rate (mm)			
		Week 2	Week 4	Week 6	Week 8
1	Apsley Golf Heights	14	90	155	355
2	Paradise Palms - Prac chipper	16	50	155	205
3	Royal Queens. 3rd green	10	58	130	202
4	Pacific GC 6th green	28	50	200	280
5	Horton Park GC 8th green	3	70	135	245

6	Ocean Shores GC 17th	23	60	195	345
7	Ocean Shores GC 17th	20	70	120	150
8	Gold Coast Burl GC 6th green	79	140	395	600
9	Gold Coast Burl GC 13th green	12	58	170	395
10	Mackay GC	5	40	120	260
11	Swan Hill City	163	215	450	600
12	Unknown	64	110	230	300
13	Cheltenham GC 9th green	63	130	330	530
14	Tewantin Noosa GC 3rd green	25	80	190	290
15	Gold Coast Burleigh GC 18th	2	8	8	58
16	Tewantin Noosa GC	50	100	250	390
17	Tewantin Noosa GC 9th	5	10	45	105
18	Tewantin Noosa GC 14th green	10	60	195	310
19	Coffs Harbour	7	64	160	190
20	Teven GC	9	30	125	225
21	Tewantin Noosa 13th green	0	25	110	325
22	Royal Sth Yarra TC	0	70	230	500
23	Tifdwarf	33	90	200	250
24	Tifeagle	65	140	360	600
25	Tifgreen (328)	*	*	*	*
26	MS Supreme	12	85	280	335
27	Floradwarf	3	35	70	180
28	Unknown	5	30	35	45
29	Unknown	*	*	*	58
30	Unknown	17	50	110	190
31	Unknown	2	10	20	25
	<b>Average</b>	<b>25.7</b>	<b>69.9</b>	<b>178.4</b>	<b>284.8</b>
	<b>Standard deviation</b>	<b>34.5</b>	<b>45.6</b>	<b>108.2</b>	<b>162.8</b>

**Table 20: Turfgrass quality, turfgrass density and turfgrass colour – spaced plant nursery 2**

Plot	Origin	Quality (1 – 9)	Quality (1 – 9)	Density (1 – 9)	Colour (1 – 9)
		20/04/04	4/10/04	4/10/04	4/10/04
1	Indooroopilly 9W	6	6	6	5
2	Royal Queensland 1	6.5	6.5	6.5	5
3	Royal Queensland 2	6	6	6	6
4	Royal Queensland 13	5.5	7	7	6
5	Royal Queensland 3	8	6.5	7.5	6.5
6	Royal Queensland 2	3	2	2	6
7	Royal Queensland 13	6.5	5	4.5	4.5
8	Qu. Coll 34 - Unknown	6.5	6	6	5
9	Gold Coast Burl GC 8th green	2	6.5	6	6
10	Gold Coast Burl GC 6th green	5.5	7	6	7
11	Gold Coast Burl GC 6th green	7	6	6.5	6
12	Gold Coast Burl GC 6th green	7.5	6	6.5	5
13	Royal Queensland 3	7	6	6.5	5
14	Royal Queensland 3	7	5	5	5
15	Royal Queensland 2	6	6	6	6
16	Royal Queensland 13	6.5	6.5	6.5	6
17	Surfers GC 18	1	1	1	6
18	Surfers GC 18	*	*	*	*
19	Southport GC 3	5.5	5	5	5

20	Southport GC 16	5	5.5	5.5	5
21	Qu. Coll 41 - Unknown	7.5	6	6	6
22	Indooroopilly 5W	6	6	5	6.5
23	Gold Coast Burl GC 8th green	7	7.5	8	7
24	Surfers GC14	*	*	*	*
25	Southport 16	5.5	7	5.5	8
26	Southport 16	7	5	5	5
27	Royal Queensland 3	8	7	8	6
28	Royal Queensland 2	5	6	6.5	6
29	QC 35 - Tifdwarf?	8	7.5	7	6.5
30	QC 28 - Tifdwarf?	7	5	6	7
31	QC 29 - Stawell BC	5.5	6	6	7.5
32	QC 36 - The Links GC	7	6	6	7.5
33	QC 30 - Cairns GC 3	*	*	*	*
34	Royal Queensland 13	2	1	1	5
35	Southport GC 13	1	1	1	5
36	QC 32 - Cairns GC	7.5	6	6	6
37	Gold Coast Burl GC 8th green	6	6.5	6.5	5.5
38	QC 31 - Cairns GC	5.5	6	6	7
39	QC 33 - Unknown	5	6	6	7
40	Southport GC 15	*	6	6.5	6
41	Southport GC 3	5.5	7	7	6
42	Indooroopilly 9W	6	6.5	6.5	7
43	Indooroopilly 5W	*	*	*	*
	<b>Average</b>	<b>5.8</b>	<b>5.7</b>	<b>5.7</b>	<b>6.0</b>
	<b>Standard deviation</b>	<b>1.8</b>	<b>1.6</b>	<b>1.7</b>	<b>0.9</b>

**Table 21: Couchgrass selections that ranked highest**

Selection No.	Origin
2	Paradise Palms
3	Royal Queensland Green 3
4	Pacific GC Green 6
5	Horton Park GC Green 8
11	Swan Hill City
12	Unknown
19	Coffs Harbour
20	Teven GC
21	Tewantin-Noosa Green 13
29	Unknown

### 3.3 Bentgrass variety trials

#### 3.3.1 Germination, seedling emergence and seedling vigour

The time for germination and seedling emergence to occur and seedling vigour were assessed at all sites, however, there was no significant difference between cultivars.

#### 3.3.2 Turfgrass quality

**KHGC:** Significant differences in visual turfgrass quality were observed among *Agrostis spp.* cultivars on most assessment dates. In the summer assessments (table 22) the cultivars Penn A1, Penn A4 Penn G2, Penn G6, Cato and L93 all rated highly. During the winter assessments Penn A1, Penn A4 and L93 consistently rated

highly followed by Penn G2, Penn G6 and Dominant. The cultivar Egmont, which is a brown top bent (*A. capillaris* L.), rated best in the winter assessments and deteriorated in the summer due to heat stress. The cultivar SR7200, a velvet bentgrass (*A. canina* L.), gradually deteriorated in visual turfgrass quality due to summer stress and a failure to recover in the autumn.

**GGC:** Significant differences in visual turfgrass quality were observed among *Agrostis spp.* cultivars on most assessment dates. In the summer assessments (table 33) the cultivars Penn A1, Penn A4 and Penn G2 all rated highly followed by Dominant, RA1 and RA2. During the winter assessments Penn A1 and Penn A4 rated highly followed by RA1 and RA2.

**CHCC:** Significant differences in visual turfgrass quality were observed among *Agrostis spp.* cultivars on all assessment dates. In the 2002/2003 summer assessment (table 40) there was very little difference between the cultivars as most rated highly with Suttons being the exception. In the 2003/2004 summer assessment the cultivars Penn A1, Penn A4 and Grand Prix all rated highly with the Suttons cultivar rating poorly due to heat stress. During the winter assessments Penn A1, Penn A4, Penn G2 and Grand Prix rated highly. Suttons is a site specific selection from a low humidity climate with moderate summers and performs poorly where the summer temperatures and humidity are consistently higher.

**LKCC:** There was variation in quality between cultivars and assessors, however, Penn A1, T1, T2 and Penn G6 rated highly for turfgrass quality (table 43). Penncross rated worst for turfgrass quality.

### 3.3.3 Turfgrass density

**KHGC:** Significant differences in visual turfgrass density were observed among *Agrostis spp.* cultivars on most assessment dates. In the summer assessments (table 23) the cultivars Penn A1, Penn A4 Penn G2 and Penn G6 rated highly followed by L93, Pennlinks and Dominant. SR7200 also ranked highly for visual turfgrass density. During the winter assessments Penn A1, Penn A4 and Penn G2 consistently rated highly followed by L93 and Dominant.

**GGC:** Significant differences in visual turfgrass density were observed among *Agrostis spp.* cultivars on most assessment dates. In the summer assessments (table 34) the cultivars Penn A1 and Penn A4 rated highly followed by Dominant, L93, RA1 and RA2. In the summer of 2002/2003 Penn A4 suffered severe damage and a loss of turfgrass density due to dry patch. During the winter assessments Penn A1, Penn A4 and L93 rated highly followed by RA2.

**CHCC:** Significant differences in visual turfgrass density were observed among *Agrostis spp.* cultivars on three assessment dates. In the summer assessment (table 41) the cultivars Penn A1, Penn A2, Penn G2 and Grand Prix rated highly followed by Pennlinks and L93. In the winter assessment Penn A1, Penn A4 and Penn G2 rated highly followed by L93.

The new bent cultivars are noted for their high tiller number and turf grass density compared to the older cultivars such as Penncross and Pennlinks (Sifers et.al. 2001) and the same observations are made in these trials.

**LKCC:** There were significant differences in turfgrass density with Penn A1, Penn A4, T1 and T2 all rating highly for turfgrass density (table 44). Penncross rated worst for turfgrass density.

### 3.3.4 Wear treatment

#### Kingston Heath GC

**Turfgrass quality:** Significant differences in visual turfgrass quality were observed among *Agrostis spp.* cultivars on all but one assessment date. In the winter assessment (table 24) Penn A1, Penn A4 and Penn G2 rated highly, followed by Penn G6, Dominant, L93, Cato and Egmont. In the summer assessment (table 26), there was little difference between the cultivars with Penncross and Egmont having the lowest rating for visual turfgrass quality. In the August 2004 wear treatment Penncross, Pennlinks, Egmont and SR7200 rated poorly for turfgrass quality compared to all other varieties.

**Turfgrass density:** Significant differences in visual turfgrass density were observed among *Agrostis spp.* cultivars on all assessment dates. In the winter assessment (tables 25 and 28) Penn A1, Penn A4 and Penn G2 rated highly, followed by Penn G6, Dominant, L93, Cato and Egmont. SR7200 also rated highly for visual turfgrass density. In the summer assessment (table 27), Penn A1, Penn A4 and Penn G2 rated highly with Penncross having the lowest rating for visual turfgrass density. In the August 2004 wear treatment Penncross, Pennlinks and Egmont rated poorly for turfgrass density due to the effects of wear compared to all other varieties (table 28).

Winter wear provided the greatest difference in visual turfgrass quality and density with the spikes penetrating the turfgrass surface due to higher surface moisture. As the spikes penetrate there is more tearing of the turf and those cultivars with a greater visual turfgrass density exhibited greater resistance to spike penetration.

#### Glenelg GC

Wear trials were undertaken on one occasion and there was no significant difference between cultivars for scuffing, twisting or treading (table 36).

### 3.3.5 Green speed

**KHGC:** Significant differences in green speed were observed among *Agrostis spp.* cultivars on four of the nine assessment dates (table 29). There was little consistency in the performance of the cultivars other than Egmont provided the slowest green speed on most occasions. There was little evidence that the newer, high density bents were either slower or faster than the older cultivars.

**GGC:** There was no significant difference in green speed on either of the assessment dates (table 35).

### 3.3.6 Thatch depth

**KHGC:** Significant differences in thatch depth were observed among *Agrostis spp.* cultivars on two of the five assessment dates (table 30). In May 2002, thatch depth was 7.3 mm for Penncross which was significantly less than Penn A1, Penn A4, Penn G2 and Cato which were 12.3, 10.0, 10.3 and 10.3 mm respectively. The thatch depth for Penn A1 was significantly greater than all cultivars except Penn A4, Penn G2 and Cato. In January 2004, Penncross had significantly less thatch depth than all other cultivars and there was no significant difference between the remaining cultivars.

In September 2004, there was no significant difference in thatch depth between the cultivars. The data collected indicates that the newer bentgrass cultivars produce a large amount of thatch in the first 12 months, however, over time most of the cultivars appear to produce about the same depth of thatch. These results appear to indicate that thatch depth is somewhat finite but the time it takes to reach that depth varies according to the particular cultivar.

**GGC:** Significant differences in thatch depth were observed among *Agrostis spp.* cultivars on some assessment dates (table 37) where Penn A1 had the greatest thatch depth and Penncross the least. In May 2002, Penn A1 had a significantly greater thatch depth than Penncross, Penn G2, Mix and RA1. In February 2003, Penn A1 had a significantly greater thatch depth than Penncross, Penn A4, Penn G2, Mix and L93. In June 2004, Penn A1 had a significantly greater thatch depth than Penncross, Penn A4, Cato, Mix and RA2. The reduction in thatch depth for Penn A4 was associated with the turf damage and loss of turfgrass density caused by the incidence of severe dry patch.

**CHCC:** Significant differences in thatch depth were observed among *Agrostis spp.* cultivars (table 42) where Penn A1 and L93 had a significant greater thatch depth than Suttons, Dominant, Pennlinks and Mix. Pennlinks had significantly less thatch than all cultivars except Penncross, Suttons, Mix and Dominant. At the August 2004 assessment there was no significant difference between cultivars.

The newer bent cultivars have a reputation for producing considerable amounts of thatch compared to older cultivars such as Penncross which was demonstrated in this study. This is consistent with Sifers et.al. (2001) who demonstrated greater thatch/mat accumulation in Penn A1, Penn G2 and Penn G6.

### **3.3.7 Surface hardness**

Significant differences in surface hardness were observed among *Agrostis spp.* cultivars on two of the three assessment dates (table 31). On the May 2002 assessment, Penn A1 was the softest surface with Penncross and Egmont the firmest. On the February 2003 assessment, Penn A1 was significantly softer than Penn G6, Cato, Pennlinks and Egmont. Surface hardness altered with the increasing maturity of the turf sward and increasing thatch depth where the accumulation of organic matter provides a cushion against the firmness of the soil.

### **3.3.8 Disease**

There was very little disease recorded at any of the trial sites with the occasional occurrence of Rhizoctonia, Dollar Spot, Pythium and Thatch collapse (Basidiomycetes). However, the disease was sporadic in its occurrence and there was little or no significant difference. At Lake Karryup CC there was significant disease with Crenshaw and Penn A1 worst affected (table 46).

**Table 22: Kingston Heath GC - Turf quality 0 = worst 9 = best**

VARIETY	3/1/01	1/2/01	6/3/01	5/4/01	10/5/01	27/6/01	27/7/01	24/8/01	27/9/01	30/10/01	29/11/01	19/12/01	25/2/02	19/3/02	3/4/02	24/5/02	3/7/02	14/8/02	14/10/02	29/11/02
Penncross	6.0	6.2	5.7	6.0	5.8	6.5	6.0	5.8	5.8	5.7	6.0	5.8	6.2	6.0	5.8	6.3	6.0	6.3	6.5	6.0
Egmont	6.0	5.5	5.3	5.5	5.7	6.7	6.5	6.2	5.8	5.5	6.0	6.3	6.0	5.7	5.5	6.3	6.0	7.0	6.8	5.8
PENN A1	6.0	7.2	6.8	7.3	6.8	7.2	6.8	6.8	7.0	7.2	7.3	7.8	8.0	7.3	7.3	7.3	6.8	7.5	8.3	7.0
PENN A4	6.2	6.7	6.3	6.7	6.8	6.7	6.8	6.3	6.7	6.8	6.8	7.0	7.3	6.8	6.8	7.0	7.3	7.8	7.2	6.2
PENN G2	6.2	6.8	6.2	6.7	6.8	6.7	6.7	6.2	6.3	6.7	6.5	6.8	7.3	6.7	7.0	6.8	6.7	7.5	7.5	6.3
PENN G6	6.0	6.5	6.0	6.3	6.0	6.5	5.8	5.8	6.0	6.2	6.2	6.3	6.7	6.5	6.5	6.3	6.2	7.2	6.7	6.3
Cato	6.0	6.3	6.0	6.5	6.2	6.5	6.5	6.3	6.2	6.3	6.3	6.5	6.8	6.8	6.5	6.3	6.3	7.2	7.3	6.3
Pennlinks	6.0	6.2	5.8	6.2	6.2	6.0	6.0	5.7	5.7	5.8	6.0	5.8	6.3	6.0	6.2	6.0	5.8	6.5	6.5	6.0
L93	6.2	6.7	5.8	6.0	6.5	6.3	6.3	6.0	6.0	6.3	6.3	6.5	6.7	6.5	6.7	6.5	6.5	7.2	6.7	6.3
Dominant	5.8	6.7	6.0	6.2	6.2	6.7	6.0	5.8	5.7	5.7	6.2	6.5	7.0	6.7	6.7	6.5	6.3	7.3	7.2	6.3
SR7200	5.8	5.7	5.7	6.2	6.3	7.0	6.8	5.8	6.2	6.7	6.5	6.8	6.3	6.5	5.7	6.2	5.7	5.8	6.3	6.7
LSD (P<0.05)	NS	0.4	0.4	0.4	0.3	NS	NS	0.4	0.3	0.4	0.5	0.6	0.4	0.6	0.5	0.5	0.6	0.9	0.7	0.6

VARIETY	16/12/02	13/01/03	17/01/03	20/01/03	23/1/03	4/2/03	7/2/03	20/3/03	30/4/03	29/6/03	31/07/03bw	31/07/03aw	30/9/03	30/10/03	30/11/03	30/12/03	21/1/04	26/2/04	30/6/04	30/7/04
Penncross	6.2	5.8	5.8	5.8	6.0	5.7	5.8	6.0	6.2	6.5	5.7	5.7	5.7	6.0	6.3	6.0	6.2	6.2	5.5	5.5
Egmont	5.7	6.3	6.3	6.3	5.3	5.5	6.2	5.3	6.2	7.0	6.5	6.5	6.5	6.0	6.7	6.3	5.7	6.3	5.7	5.7
PENN A1	7.5	7.8	7.3	7.3	7.3	7.3	7.2	6.7	7.0	7.0	6.5	6.5	6.7	7.3	7.3	8.1	8.5	7.7	7.0	7.0
PENN A4	6.8	6.8	7.2	7.2	6.3	6.5	6.7	6.5	6.5	6.8	6.7	6.3	6.5	7.0	7.0	7.3	7.7	7.3	6.8	6.8
PENN G2	6.5	7.0	6.8	6.8	6.8	7.0	7.2	6.7	7.0	7.1	6.5	6.5	6.3	7.3	7.3	7.5	7.7	7.3	6.3	6.3
PENN G6	6.8	6.7	6.5	6.5	6.8	6.3	6.7	6.0	6.7	6.8	6.2	6.0	6.0	6.0	6.8	7.0	7.0	7.2	6.3	6.3
Cato	6.8	7.2	6.5	6.5	6.8	6.5	6.5	6.2	7.0	7.0	6.5	6.3	6.2	6.5	7.0	6.7	6.8	6.7	6.2	6.2
Pennlinks	6.0	5.3	5.5	5.5	5.8	5.3	5.5	6.2	6.0	6.3	5.8	5.5	5.7	5.7	6.7	6.5	6.3	6.5	6.0	6.0
L93	6.8	7.0	6.7	6.7	6.7	6.3	6.7	6.7	6.7	7.3	6.3	6.0	6.3	6.7	7.0	7.0	6.8	6.7	6.5	6.5
Dominant	6.5	6.5	6.0	6.0	6.7	6.2	6.5	6.0	6.7	7.0	6.3	6.2	6.0	6.7	7.0	6.7	7.3	6.8	6.7	6.7
SR7200	6.5	7.2	6.8	6.8	6.7	6.8	6.8	4.3	4.8	5.8	5.7	5.2	4.8	5.2	6.5	5.8	5.3	6.0	5.2	5.2
LSD (P<0.05)	0.6	1.0	0.9	0.9	NS	0.5	0.9	1.3	0.9	0.6	0.5	0.6	0.8	0.7	0.6	0.6	0.8	0.7	0.5	0.6

**Table 23: Kingston Heath GC - Turf density 0 = worst 9 = best**

VARIETY	3/1/01	1/2/01	6/3/01	5/4/01	5/10/01	27/6/01	27/7/01	24/8/01	27/9/01	30/10/01	29/11/01	19/12/01	25/2/02	19/3/02	3/04/02	24/5/02	3/07/02	14/08/02	14/10/02	29/11/02
<b>Penncross</b>	7.0	6.3	5.8	6.2	6	6.3	6.2	6.2	6.0	6.3	6.3	6.2	6.5	6.2	6.3	6.3	6.0	6.5	6.5	6.0
<b>Egmont</b>	7.0	6.5	5.8	6.3	6.2	6.8	6.7	6.3	6.7	6.5	6.7	6.8	6.5	6.3	6.5	6.5	6.5	6.8	6.8	6.0
<b>PENN A1</b>	7.3	7.2	7.0	7.7	7.0	7.0	7.2	7.2	7.0	7.7	7.7	7.5	8.5	8.0	7.8	7.5	7.0	8.0	8.8	7.0
<b>PENN A4</b>	7.3	6.7	6.5	6.7	6.8	6.8	6.8	6.5	6.7	7.3	7.0	7.3	7.5	7.0	7.2	7.2	7.7	7.5	7.7	6.5
<b>PENN G2</b>	7.7	6.8	6.3	6.7	6.7	6.8	7.2	6.5	6.5	7.2	6.8	7.0	7.7	6.7	7.2	7.0	7.0	7.3	7.5	6.5
<b>PENN G6</b>	7.0	6.5	6.0	6.5	6.2	6.7	6.3	6.2	6.3	6.5	6.3	6.3	7.0	6.7	6.8	6.5	6.5	7.0	7.0	6.3
<b>Cato</b>	7.3	6.5	6.0	6.5	6.2	6.3	7.0	6.3	6.2	6.8	6.5	6.7	7.0	6.8	6.5	6.5	6.7	7.2	7.5	6.7
<b>Pennlinks</b>	7.3	6.3	5.8	6.2	6.2	6.2	6.5	5.7	6.3	6.3	6.3	6.3	6.5	6.5	6.2	6.3	6.2	6.7	6.7	6.0
<b>L93</b>	7.0	6.7	6.0	6.3	6.2	6.5	6.3	6.3	6.5	6.8	6.5	6.8	6.7	6.5	6.8	6.7	6.5	7.0	7.0	6.3
<b>Dominant</b>	7.3	6.7	6.0	6.3	6.3	6.5	6.5	6.2	6.0	6.0	6.2	6.8	7.3	6.8	6.8	6.7	6.7	7.0	7.2	6.5
<b>SR7200</b>	7.5	6.7	6.8	6.7	6.7	7.0	7.5	6.3	7.0	7.8	7.3	8.0	8.0	7.5	6.8	6.7	6.7	7.7	8.2	7.2
<b>LSD (P&lt;0.05)</b>	<b>NS</b>	<b>NS</b>	<b>0.3</b>	<b>0.4</b>	<b>0.3</b>	<b>NS</b>	<b>0.5</b>	<b>0.4</b>	<b>0.3</b>	<b>0.4</b>	<b>0.6</b>	<b>0.6</b>	<b>0.5</b>	<b>0.5</b>	<b>0.5</b>	<b>0.6</b>	<b>0.4</b>	<b>0.6</b>	<b>0.6</b>	<b>0.5</b>

VARIETY	16/12/02	13/01/03	17/01/03	20/01/03	23/1/03	4/2/03	7/2/03	20/3/03	30/4/03	29/6/03	31/07/03bw	31/07/03aw	30/9/03	30/10/03	30/11/03	30/12/03	21/1/04	26/2/04	31/6/04	31/7/04
<b>Penncross</b>	6.5	6.5	6.2	6.2	6.0	6.2	6.0	6.2	6.5	6.5	5.8	6.2	6.2	6.0	6.3	6.3	6.2	6.5	6.0	6.0
<b>Egmont</b>	6.3	7.0	6.7	6.7	6.5	6.3	6.7	6.3	6.3	7.5	6.7	6.5	6.5	6.5	7.0	6.8	6.5	6.7	6.0	6.0
<b>PENN A1</b>	8.0	8.2	7.7	7.7	7.7	7.5	7.5	7.3	7.7	7.3	7.0	6.7	7.0	7.8	7.7	8.3	9.0	7.8	7.0	7.0
<b>PENN A4</b>	7.3	7.3	7.2	7.2	7.0	6.7	6.8	7.0	7.0	7.0	7.0	6.7	6.8	7.5	7.5	7.7	7.8	7.5	7.0	7.0
<b>PENN G2</b>	6.5	7.5	7.0	7.0	7.0	6.7	7.0	7.2	7.5	7.3	6.7	6.5	6.7	7.5	7.5	7.7	8.0	7.7	6.5	6.5
<b>PENN G6</b>	6.8	7.0	6.5	6.5	6.7	6.7	6.7	6.5	7.0	7	6.3	6.3	6.2	6.5	6.8	7.3	6.8	7.3	6.5	6.5
<b>Cato</b>	7.0	7.3	6.8	6.8	6.8	6.8	7.0	6.8	7.2	7.3	6.7	6.5	6.3	6.7	6.8	7.0	6.8	7.0	6.5	6.5
<b>Pennlinks</b>	6.2	5.8	5.8	5.8	6.0	5.8	5.7	6.7	6.2	6.5	6.2	6.0	5.8	6.2	6.3	6.5	6.5	6.8	6.3	6.3
<b>L93</b>	6.8	7.3	6.8	6.8	6.2	6.3	6.7	7.0	6.7	7.3	6.7	6.5	6.5	7.0	7.0	7.5	6.7	6.8	6.5	6.5
<b>Dominant</b>	6.7	6.8	6.3	6.3	7.0	6.5	6.5	6.8	7.2	7.2	6.7	6.7	6.3	7.0	6.8	7.0	7.3	7.2	6.8	6.8
<b>SR7200</b>	7.8	8.5	8.0	8.0	8.2	8.0	8.0	6.0	5.7	6.8	6.7	6.5	6.3	7.0	8.0	7.5	6.8	7.0	6.0	6.0
<b>LSD (P&lt;0.05)</b>	<b>0.8</b>	<b>0.9</b>	<b>0.7</b>	<b>0.7</b>	<b>0.8</b>	<b>0.9</b>	<b>0.8</b>	<b>NS</b>	<b>0.9</b>	<b>0.5</b>	<b>0.6</b>	<b>0.6</b>	<b>0.5</b>	<b>0.7</b>	<b>0.6</b>	<b>0.7</b>	<b>0.9</b>	<b>0.7</b>	<b>0.3</b>	<b>0.3</b>

**Table 24: Kingston Heath GC – Turf Quality during winter wear 0 = worst 9 = best**

VARIETY	28/05/02	3/07/02	22/07/02	30/07/02	6/08/02	14/08/02	29/08/02
Penncross	6.0	6.0	5.7	6.7	6.5	6.3	6.3
Egmont	6.0	6.0	6.7	7.0	6.8	7.0	7.2
PENN A1	7.3	6.8	7.7	7.8	7.3	7.5	7.7
PENN A4	7.0	7.3	8.0	7.5	7.5	7.8	7.5
PENN G2	6.7	6.7	7.3	7.5	7.2	7.5	7.3
PENN G6	6.3	6.2	7.3	6.8	7.0	7.2	7.2
Cato	6.2	6.3	7.7	7.3	7.0	7.2	7.3
Pennlinks	6.0	5.8	5.7	6.5	6.5	6.5	6.7
L93	6.3	6.5	7.0	7.2	7.0	7.2	7.5
Dominant	6.3	6.3	7.0	7.0	7.2	7.3	7.3
SR7200	5.7	5.7	4.7	6.7	6.2	5.8	6.3
LSD (P<0.05)	0.5	0.6	1.3	1.1	0.71	0.9	0.8

**Table 25: Kingston Heath GC – Turf Density during winter wear 0 = worst 9 = best**

VARIETY	28/05/02	3/07/02	22/07/02	30/07/02	6/08/02	14/08/02	29/08/02
Penncross	6.3	6.0	6.3	6.5	6.5	6.5	6.5
Egmont	6.5	6.5	7.3	7.0	6.8	7.3	7.0
PENN A1	7.8	7.0	8.7	7.2	8.0	8.0	8.0
PENN A4	7.3	7.7	8.0	7.5	7.5	7.8	7.5
PENN G2	7.0	7.0	8.0	7.3	7.3	7.5	7.3
PENN G6	6.5	6.5	7.3	7.2	7.0	7.2	7.2
Cato	6.5	6.7	7.7	7.3	7.2	7.2	7.3
Pennlinks	6.5	6.2	6.3	6.7	6.7	6.5	6.8
L93	6.5	6.5	7.0	7.2	7.0	7.2	7.3
Dominant	6.7	6.7	7.3	7.2	7.0	7.3	7.3
SR7200	6.5	6.7	7.7	6.5	7.7	8.0	8.0
LSD (P<0.05)	0.4	0.4	0.8	0.7	0.6	0.6	0.5

**Table 26: Kingston Heath GC – Turf Quality during summer wear 0 = worst 9 = best**

VARIETY	13/1/03	17/1/03	20/1/03	23/1/03	4/2/03	7/2/03
Penncross	5.8	5.8	5.8	6.0	5.7	5.8
Egmont	6.3	6.3	6.3	5.3	5.5	6.2
PENN A1	7.8	7.3	7.3	7.3	7.3	7.2
PENN A4	6.8	7.2	7.2	6.3	6.5	6.7
PENN G2	7.0	6.8	6.8	6.8	7.0	7.2
PENN G6	6.7	6.5	6.5	6.8	6.3	6.7
Cato	7.2	6.5	6.5	6.8	6.5	6.5
Pennlinks	5.3	5.5	5.5	5.8	5.3	5.5
L93	7.0	6.7	6.7	6.7	6.3	6.7
Dominant	6.5	6.0	6.0	6.7	6.2	6.5
SR7200	7.2	6.8	6.8	6.7	6.8	6.8
LSD (P<0.05)	1.0	0.9	0.9	NS	0.5	0.9

**Table 27: Kingston Heath GC – Turf Density during summer wear 0 = worst 9 = best**

VARIETY	13/1/03	17/1/03	20/1/03	23/1/03	4/2/03	7/2/03
Penncross	6.5	6.2	6.2	6.0	6.2	6.0
Egmont	7.0	6.7	6.7	6.5	6.3	6.7
PENN A1	8.2	7.7	7.7	7.7	7.5	7.5
PENN A4	7.3	7.2	7.2	7.0	6.7	6.8
PENN G2	7.5	7.0	7.0	7.0	6.7	7.0
PENN G6	7.0	6.5	6.5	6.7	6.7	6.7
Cato	7.3	6.8	6.8	6.8	6.8	7.0
Pennlinks	5.8	5.8	5.8	6.0	5.8	5.7
L93	7.3	6.8	6.8	6.2	6.3	6.7
Dominant	6.8	6.3	6.3	7.0	6.5	6.5
SR7200	8.5	8.0	8.0	8.2	8.0	8.0
LSD (P<0.05)	0.9	0.7	0.7	0.8	0.9	0.8

**Table 28: Kingston Heath GC - Turf quality and turf density after intensive wear (August 2004) 0 = worst 9 = best**

VARIETY	Turf quality		Turf density	
	Pre-wear	Post-wear	Pre-wear	Post-wear
Penncross	6.0	5.5	6.2	5.5
Egmont	6.0	6.3	6.8	6.7
PENN A1	7.5	7.0	7.5	7.2
PENN A4	7.2	7.0	7.2	7.0
PENN G2	6.8	6.5	7.0	6.7
PENN G6	6.7	6.3	6.7	6.3
Cato	6.8	6.2	7.0	6.3
Pennlinks	6.0	5.3	6.2	5.3
L93	7.0	6.7	6.8	6.8
Dominant	7.0	6.7	7.2	6.8
SR7200	5.7	5.7	7.5	7.2
LSD (P<0.05)	0.9	0.8	0.8	0.7

**Table 29: Kingston Heath GC - Green speed (metres)**

VARIETY	30/8/01	9/10/02	25/2/02	3/4/02	28/5/02	3/7/02	27/2/03	1/08/03	21/01/04
Penncross	2.02	1.91	2.13	2.41	2.37	2.58	1.93	2.25	2.16
Egmont	1.89	1.65	1.96	2.19	2.07	2.12	1.74	1.9	2.09
PENN A1	1.95	1.92	2.11	2.24	2.28	2.31	2.05	2.09	2.06
PENN A4	1.91	1.89	2.00	2.26	2.17	2.24	1.95	1.99	2.09
PENN G2	2.07	1.88	2.13	2.27	2.20	2.36	1.92	2.18	2.06
PENN G6	2.02	1.86	2.05	2.25	2.24	2.38	1.96	2.16	2.1
Cato	1.96	1.81	1.96	2.19	2.14	2.32	1.86	2.09	2.04
Pennlinks	2.06	1.86	2.16	2.42	2.35	2.41	1.99	2.3	2.15
L93	2.03	1.93	2.12	2.25	2.29	2.36	1.96	2.25	2.03
Dominant	2.08	1.86	1.99	2.14	2.16	2.34	1.97	2.07	2.02
SR7200	2.01	1.81	2.11	2.23	2.20	2.45	1.97	2.12	2.11
LSD (P<0.05)	0.08	0.11	NS	NS	NS	0.2	NS	0.15	NS

**Table 30: Kingston Heath GC - Thatch depth (mm)**

VARIETY	9/10/01	8/05/02	27/2/03	21/01/04	30/9/04
Penncross	12.0	7.3	12.7	12.7	18.7
Egmont	10.0	9.0	11.0	17.3	21.0
PENN A1	12.3	12.3	18.0	18.7	22.0
PENN A4	12.0	10.0	16.0	18.7	22.7
PENN G2	11.3	10.3	16.7	18.0	24.0
PENN G6	13.0	9.0	17.3	17.0	21.7
Cato	11.3	10.3	17.3	19.3	22.3
Pennlinks	12.7	8.7	11.7	19.0	22.3
L93	13.3	8.7	15.3	17.7	21.7
Dominant	11.3	9.0	16.3	17.0	20.7
SR7200	12.3	8.7	18.7	18.0	21.3
LSD (P<0.05)	NS	2.5	NS	3.4	NS

**Table 31: Kingston Heath GC - Surface hardness (gravities)**

VARIETY	8/5/02	27/2/03	21/01/04
Penncross	156.7	92.5	96.7
Egmont	160.0	100.0	101.7
PENN A1	116.7	78.3	75.0
PENN A4	135.0	85.0	88.3
PENN G2	128.3	83.3	81.7
PENN G6	146.7	98.3	86.7
Cato	146.7	98.3	88.3
Pennlinks	131.7	105.0	96.7
L93	143.3	88.3	88.3
Dominant	143.3	90.0	85.0
SR7200	120.0	85.0	85.0
LSD (P<0.05)	26	15	NS

**Table 32: Glenelg GC – Seedling emergence, seedling vigour and seedling disease**

VARIETY	Seedling Emergence	Seedling vigour	Disease
Penncross	11.3	3.3	2.3
Egmont	10.3	3.3	2.3
Penn A1	12.0	4.0	3.0
Penn A4	9.7	4.0	2.7
Mix	9.3	3.0	2.7
Cato	9.3	4.0	2.7
Pennlinks	10.7	3.7	2.7
L93	11.3	4.0	3.0
Dominant	8.3	5.0	2.7
RA1	*	4.0	1.7
RA2	*	4.0	1.7
Mariner	10.0	4.3	2.7
LSD (P<0.05)	NS	NS	NS

\* vegetatively propagated

**Table 33: Glenelg GC - Turf quality 0 = worst 9 = best**

VARIETY	12/06/01	12/07/02	15/8/01	17/9/01	12/10/02	15/11/01	12/12/01	7/01/02	10/02/02	10/03/02	10/4/02	12/05/02	11/06/02	10/7/02	12/08/02	1/09/02
<b>Penncross</b>	5.0	7.3	6.0	6.0	5.0	6.0	6.3	6.0	6.3	6.7	6.3	6.3	6.3	6.0	5.3	5.7
<b>Egmont</b>	5.3	6.7	6.7	6.3	6.0	6.0	5.7	5.0	3.7	3.7	3.7	5.0	2.0	6.0	5.0	6.0
<b>Penn A1</b>	5.0	7.3	7.0	7.0	7.7	7.7	7.7	8.0	8.0	8.0	7.7	8.0	8.0	8.0	8.0	8.0
<b>Penn A4</b>	5.7	7.7	7.7	7.7	7.3	7.0	7.0	6.7	7.7	7.7	7.0	7.3	7.7	7.3	7.3	7.7
<b>Penn G2</b>	1.3	3.0	3.0	3.0	3.0	3.7	4.0	4.0	4.3	4.7	4.7	4.7	4.3	6.0	4.0	6.5
<b>Mix</b>	5.0	7.0	7.0	7.0	6.3	6.0	6.0	6.0	6.0	5.3	5.7	6.3	6.3	6.0	5.3	6.0
<b>Cato</b>	5.3	7.3	6.7	6.7	6.3	6.7	6.7	6.3	7.0	6.7	6.7	7.0	6.7	6.3	6.0	6.3
<b>Pennlinks</b>	5.3	7.0	6.7	6.7	6.0	6.3	6.3	6.7	6.7	6.7	6.7	6.7	7.0	6.3	5.7	5.7
<b>L93</b>	5.0	7.0	6.7	6.7	6.0	6.7	6.7	7.0	7.0	7.0	7.0	7.3	6.7	6.3	6.0	6.0
<b>Dominant</b>	5.3	7.0	6.7	6.7	6.0	6.7	7.0	7.0	7.3	7.3	7.0	7.3	7.0	7.0	6.0	6.3
<b>RA1</b>	4.7	5.7	6.3	6.3	6.7	7.0	7.0	7.0	7.0	6.3	6.0	8.0	5.0	7.5	7.0	7.0
<b>RA2</b>	5.0	5.3	6.0	6.0	5.7	7.0	7.0	7.3	7.3	7.0	6.3	7.0	7.3	7.3	6.7	6.7
<b>Mariner</b>	3.3	4.7	4.0	4.0	4.0	4.3	4.3	6.3	6.3	6.7	6.7	6.7	6.7	6.3	5.3	6.0
<b>LSD (P&lt;0.05)</b>	<b>0.7</b>	<b>1.3</b>	<b>1.3</b>	<b>1.3</b>	<b>1.4</b>	<b>1.6</b>	<b>1.7</b>	<b>1.7</b>	<b>1.5</b>	<b>1.9</b>	<b>NS</b>	<b>1.1</b>	<b>1.3</b>	<b>1.3</b>	<b>1.0</b>	<b>0.8</b>

VARIETY	1/10/02	1/11/02	1/01/03	1/02/03	1/03/03	1/04/03	1/06/03	1/07/03	1/09/03	1/10/03	1/12/03	1/02/04	1/03/04	1/04/04	1/06/04	1/08/04
<b>Penncross</b>	6.0	5.3	5.3	5.7	4.7	5.0	5.3	5.0	6.0	5.0	5.0	5.0	6.0	5.7	5.3	5.0
<b>Egmont</b>	7.0	5.0	7.0	7.0	6.0	6.0	7.0	7.0	8.0	4.0	4.0	8.0	7.0	7.0	4.0	4.0
<b>Penn A1</b>	8.0	8.0	5.3	7.3	8.0	8.0	7.7	8.0	8.0	8.0	8.3	7.7	7.7	8.7	8.0	6.7
<b>Penn A4</b>	7.7	7.3	3.3	5.0	6.0	6.0	6.3	6.3	7.3	6.0	5.7	6.3	7.0	7.3	6.7	5.3
<b>Penn G2</b>	7.0	6.0	5.5	6.0	6.0	6.7	7.0	6.7	7.7	7.7	7.3	6.7	7.0	6.7	6.0	5.7
<b>Mix</b>	6.3	5.3	5.0	6.0	5.7	6.0	6.3	7.0	7.3	5.3	5.3	6.0	7.3	5.7	5.7	4.7
<b>Cato</b>	6.3	6.7	4.7	6.0	6.0	6.0	6.3	6.0	6.7	6.3	6.3	5.7	6.3	6.0	5.3	4.7
<b>Pennlinks</b>	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.3	6.7	6.0	6.0	5.7	7.3	6.3	6.7	5.3
<b>L93</b>	6.7	7.0	5.7	6.3	6.7	6.3	6.7	6.3	7.0	6.7	6.0	5.7	7.0	6.7	7.0	5.3
<b>Dominant</b>	6.7	6.7	6.0	6.3	6.3	6.3	6.3	6.3	7.0	6.7	6.3	6.3	8.0	7.0	6.3	5.7
<b>RA1</b>	7.0	7.5	6.5	7.5	7.0	7.0	6.5	6.5	7.5	7.5	7.0	8.0	8.5	8.0	7.0	5.0
<b>RA2</b>	7.0	7.0	6.0	7.0	7.0	6.7	7.0	7.0	7.0	7.0	7.0	7.3	7.7	8.0	6.7	5.7
<b>Mariner</b>	7.0	5.7	5.7	6.0	6.0	5.7	5.3	5.3	6.7	6.7	6.7	6.3	7.0	6.3	5.7	5.3
<b>LSD (P&lt;0.05)</b>	<b>0.9</b>	<b>1.1</b>	<b>ns</b>	<b>ns</b>	<b>1.4</b>	<b>1.3</b>	<b>1.0</b>	<b>1.1</b>	<b>ns</b>	<b>ns</b>	<b>ns</b>	<b>0.8</b>	<b>ns</b>	<b>0.9</b>	<b>ns</b>	<b>ns</b>

**Table 34: Glenelg GC Turf density 0 = worst 9 = best**

VARIETY	12/06/01	12/07/02	15/8/01	17/9/01	12/10/02	15/11/01	12/12/01	7/01/02	10/02/02	10/03/02	10/4/02	12/05/02	11/06/02	10/7/02	12/08/02	1/09/02
<b>Penncross</b>	6.0	7.3	7.0	7.0	6.3	6.7	7.0	7.0	6.7	6.7	6.3	6.7	6.7	6.0	6.0	6.3
<b>Egmont</b>	5.3	6.0	6.7	6.3	6.3	6.0	6.0	4.0	3.0	3.0	3.0	1.7	2.0	5.0	2.0	6.0
<b>Penn A1</b>	6.0	7.3	7.3	7.3	7.3	8.0	8.0	8.0	8.0	8.7	7.7	8.7	8.3	8.3	8.0	8.0
<b>Penn A4</b>	6.7	7.7	7.3	7.3	7.3	7.0	7.3	6.3	7.3	7.3	7.0	7.7	7.7	7.3	7.3	7.3
<b>Penn G2</b>	1.7	2.7	3.3	3.3	3.3	3.7	4.0	4.0	4.0	4.3	4.3	4.7	4.3	6.0	4.3	6.5
<b>Mix</b>	6.0	7.0	7.3	7.3	6.7	6.0	6.0	5.3	5.3	5.0	5.0	6.0	5.7	5.3	6.3	6.3
<b>Cato</b>	6.0	7.3	7.0	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.3	7.3	6.3	6.3	6.3	6.3
<b>Pennlinks</b>	6.3	7.0	6.7	6.7	6.3	6.3	7.0	7.0	6.7	7.0	7.0	6.7	6.7	6.3	6.3	6.3
<b>L93</b>	5.0	7.0	7.0	7.0	6.7	7.0	7.3	7.3	7.3	7.3	7.0	7.3	6.7	6.3	6.3	6.3
<b>Dominant</b>	6.3	7.3	7.3	7.3	6.7	7.3	7.3	7.3	7.3	7.3	7.3	7.3	6.7	6.3	6.7	6.7
<b>RA1</b>	4.7	6.0	5.7	5.7	6.0	7.0	6.7	6.0	6.0	6.0	6.0	5.3	4.7	7.0	5.0	7.5
<b>RA2</b>	4.3	6.0	4.7	4.7	4.7	6.7	6.3	6.3	6.3	6.7	6.7	7.3	7.3	7.3	7.0	7.0
<b>Mariner</b>	5.7	6.3	6.3	6.3	6.3	6.7	6.7	6.7	6.7	6.7	6.7	7.0	6.3	6.0	5.7	5.7
<b>LSD (P&lt;0.05)</b>	<b>0.9</b>	<b>0.9</b>	<b>0.8</b>	<b>0.8</b>	<b>0.7</b>	<b>0.8</b>	<b>0.5</b>		<b>2.1</b>	<b>2.5</b>	<b>2.4</b>	<b>2.0</b>	<b>1.3</b>	<b>1.2</b>	<b>2.0</b>	<b>ns</b>

VARIETY	1/10/02	1/11/02	1/01/03	1/02/03	1/03/03	1/04/03	1/06/03	1/07/03	1/09/03	1/10/01	1/12/03	1/02/04	1/03/04	1/06/04	1/08/04
<b>Penncross</b>	6.3	5.7	5.7	5.7	5.0	5.3	5.3	5.3	6.0	5.0	5.0	5.0	6.3	5.7	4.3
<b>Egmont</b>	6.0	6.0	6.0	6.0	7.0	7.0	7.0	8.0	8.0	6.0	7.0	7.0	8.0	6.0	4.0
<b>Penn A1</b>	8.0	8.0	7.0	8.0	8.7	8.3	8.0	8.3	8.0	8.3	8.3	7.7	7.7	8.3	7.3
<b>Penn A4</b>	7.3	8.0	4.7	5.0	6.3	6.3	6.7	6.7	7.0	6.0	6.0	6.7	7.0	6.7	5.7
<b>Penn G2</b>	6.5	6.0	6.5	6.5	7.0	7.0	6.7	7.3	7.3	7.3	7.3	7.0	8.0	7.0	6.0
<b>Mix</b>	6.3	5.7	6.0	6.0	6.0	6.0	6.0	6.0	6.3	5.3	5.3	6.0	7.3	5.7	5.0
<b>Cato</b>	6.3	6.7	5.3	6.0	6.3	6.0	6.0	6.0	6.3	6.7	6.7	6.0	6.7	6.0	4.7
<b>Pennlinks</b>	6.7	6.0	6.0	6.0	6.7	6.7	6.0	6.0	6.3	6.3	6.7	6.0	7.3	6.3	5.7
<b>L93</b>	6.3	7.0	6.7	6.7	6.3	6.3	6.7	6.7	6.7	6.3	6.3	5.7	7.3	7.0	5.7
<b>Dominant</b>	6.7	7.0	6.7	6.7	7.3	7.3	6.7	6.7	6.7	6.7	7.0	7.0	8.3	6.7	6.0
<b>RA1</b>	7.5	7.0	8.0	8.0	8.0	7.5	6.5	6.5	7.0	8.0	8.0	8.5	8.5	7.5	6.0
<b>RA2</b>	7.0	7.3	7.0	7.0	7.7	7.3	7.0	7.0	7.7	6.7	7.0	7.3	8.0	7.3	5.7
<b>Mariner</b>	6.3	6.0	6.3	6.3	5.3	5.7	6.0	6.0	6.3	6.3	6.3	6.7	7.7	5.3	5.7
<b>LSD (P&lt;0.05)</b>	<b>ns</b>	<b>1.1</b>	<b>ns</b>	<b>ns</b>	<b>1.7</b>	<b>1.3</b>	<b>ns</b>	<b>ns</b>	<b>ns</b>	<b>ns</b>	<b>ns</b>	<b>ns</b>	<b>ns</b>	<b>ns</b>	<b>ns</b>

**Table 35: Glenelg GC – Green speed (cm)**

VARIETY	Green speed	
	Jan-02	Jun-04
Penncross	188.0	161.7
Egmont	190.7	147.3
Penn A1	184.0	150.7
Penn A4	184.3	142.2
Penn G2	187.0	133.8
Mix	195.3	142.2
Cato	183.3	149.0
Pennlinks	188.7	151.6
L93	184.3	147.3
Dominant	183.7	147.3
RA1	194.3	135.9
RA2	186.0	142.2
Mariner	193.3	143.1
LSD (P<0.05)	NS	NS

**Table 36: Glenelg GC - Wear**

VARIETY	WEAR - Aug 02		
	Scuff	Twist	Tread
Penncross	3.3	3.7	3.0
Egmont	2.0	1.0	1.0
Penn A1	2.3	2.0	1.7
Penn A4	3.0	2.3	1.7
Penn G2	5.0	2.7	1.7
Mix	5.0	2.7	2.3
Cato	3.7	3.3	2.0
Pennlinks	4.0	3.3	3.0
L93	4.3	3.0	2.3
Dominant	4.0	3.0	2.0
RA1	3.0	2.0	1.0
RA2	2.3	2.0	1.7
Mariner	4.0	3.7	2.0
LSD (P<0.05)	NS	NS	NS

**Table 37: Glenelg GC – Thatch depth (mm)**

VARIETY	1/05/02	1/02/03	1/06/04
Penncross	4.7	3.3	4.0
Egmont	6.0	2.0	9.0
Penn A1	11.3	8.0	9.3
Penn A4	9.0	4.3	4.7
Penn G2	6.7	4.7	6.7
Mix	5.3	4.0	4.7
Cato	6.3	5.3	4.3
Pennlinks	7.3	7.0	7.0
L93	9.0	3.3	6.3
Dominant	9.0	5.3	7.3
RA1	10.5	8.5	6.5
RA2	9.3	5.7	6.0
Mariner	7.7	3.3	6.7
LSD (P<0.05)	4.0	3.1	3.0

**Table 38: Glenelg GC – Dry patch and recovery (% area affected)**

VARIETY	1/11/02	1/01/03	1/02/03	1/03/03	1/04/03	1/07/03
Penncross	23.3	21.7	17.3	11.7	8.3	3.3
Egmont	3.3	6.7	0.3	0.0	0.0	0.0
Penn A1	45.3	56.7	50.0	25.0	20.0	12.7
Penn A4	83.3	78.3	78.3	56.7	43.3	25.0
Penn G2	6.7	15.0	7.0	1.7	1.7	1.0
Mix	38.3	35.0	35.0	23.3	20.0	11.7
Cato	31.7	55.0	51.7	35.7	26.7	23.3
Pennlinks	23.3	16.7	8.3	3.3	1.7	0.7
L93	41.7	26.7	23.3	5.0	5.0	2.3
Dominant	46.7	18.3	10.0	1.7	1.7	0.7
RA1	50.0	36.7	36.7	10.0	12.5	3.5
RA2	70.0	36.7	36.7	11.7	11.7	1.3
Mariner	21.7	20.0	10.0	2.3	2.3	0.7
LSD (P<0.05)	38.2	33.0	35.0	29.3	36.3	ns

**Table 39: Castle Hill CC – Germination and seedling vigour**

VARIETY	Germination	Vigour
Penncross	3.0	2.2
Penn A4	3.3	2.7
Penn A1	3.7	2.5
Suttons	3.0	3.0
Grand Prix	3.7	3.0
Dominant	3.0	2.5
Pennlinks	3.3	2.8
Penn G2	3.0	2.5
Blend	3.2	2.2
L93	3.3	2.7
LSD (P<0.05)	NS	NS

**Table 40: Castle Hill CC – Turf quality 0 = worst 9 = best**

VARIETY	28/11/02	20/02/03	15/04/03	27/05/03	13/08/03	23/12/03	16/03/04	26/05/04
Penncross	5.4	8.6	5.4	5.7	5.4	5.4	5.7	6.0
Penn A4	7.8	9.0	8.6	6.9	6.9	7.8	8.1	7.5
Penn A1	8.7	9.0	9.0	6.8	7.2	8.1	7.8	7.7
Suttons	6.3	5.4	6.3	3.9	4.7	2.1	3.9	6.0
Grand Prix	8.1	8.8	8.1	6.3	6.6	6.9	7.2	6.8
Dominant	5.4	8.1	6.3	5.7	6.0	6.0	6.6	6.5
Pennlinks	5.4	8.6	5.9	5.6	5.6	7.2	6.9	6.8
Penn G2	8.1	9.0	8.1	6.3	6.9	6.9	7.5	7.5
Blend	7.2	8.3	6.3	5.7	5.9	6.3	7.2	6.3
L93	6.6	8.1	6.3	6.2	6.2	6.6	7.2	6.7
LSD (p<0.05)	NS	0.2	0.3	NS	NS	1.1	0.9	0.7

**Table 41: Castle Hill CC – Turf density 0 = worst 9 = best**

VARIETY	28/11/02	20/02/03	15/04/03	27/05/03	13/08/03	23/12/03	16/03/04	26/05/04
Penncross	5.4	8.6	6.3	5.7	5.7	5.4	5.7	5.8
Penn A4	7.8	9.0	8.6	6.6	6.9	7.8	8.1	7.3
Penn A1	8.7	9.0	9.0	8.4	6.8	8.1	7.8	7.7
Suttons	6.3	5.4	6.3	2.4	3.9	2.1	3.9	5.7
Grand Prix	8.1	8.8	8.1	7.2	6.3	6.9	7.2	6.7
Dominant	5.4	8.1	7.2	6.3	5.7	6.0	6.6	6.2
Pennlinks	5.4	8.6	7.2	6.0	5.6	7.2	6.9	6.7
Penn G2	8.1	9.0	8.1	7.2	6.3	6.9	7.5	7.3
Blend	7.2	8.3	7.2	6.0	5.7	6.3	7.2	6.3
L93	6.6	8.1	7.2	6.9	6.2	6.6	7.2	6.7
LSD (p<0.05)	NS	0.2	0.3	1.6	0.8	1.1	0.9	0.5

**Table 42: Castle Hill CC – Thatch depth (mm)**

	10/09/03	10/08/04
Penn-A1	4.0	15.3
L93	4.0	12.3
Penn-A4	3.3	13.7
Grand Prix	3.3	13.7
Penn-G2	3.3	15.3
Penncross	2.8	12.3
Dominant	2.7	11.7
Blend	2.7	11.3
Suttons	2.3	12.0
Pennlinks	2.0	13.3
P<0.05	1.2	NS

**Table 43: Lake Karrynup CC - Turf quality**

0 = worst 9 = best

CULTIVAR	A1	A2	A3	A4
Penncross	6.2	5.9	5.0	6.2
Penn A4	6.5	8.2	7.0	8.0
SR 1019	6.7	7.1	6.7	7.3
Penn A1	7.5	9.3	7.3	8.5
Crenshaw	6.3	5.7	6.3	6.8
Penn G2	6.5	6.8	6.3	7.8
Cato	6.2	6.8	6.7	7.0
L93	6.8	7.9	6.7	7.3
Putter	6.8	7.4	6.3	7.0
Penn G6	7.0	7.0	6.3	8.3
SR 1020	6.5	7.0	6.0	6.8
T1	6.3	8.1	8.7	7.0
T2	6.0	8.0	8.3	7.7
LSD p<0.05	NS	1.9	1.8	1.2

A1 ..... A4 = assessor 1 - 4

**Table 44: Lake Karrynup CC - Turf density**

0 = worst 9 = best

CULTIVAR	A1	A2	A3	A4
Penncross	5.7	6.2	5.0	6.3
Penn A4	7.3	6.6	7.7	9.0
SR 1019	6.7	7.8	6.3	7.2
Penn A1	7.5	8.5	8.7	9.2
Crenshaw	6.8	6.3	7.0	6.8
Penn G2	7.0	5.7	6.3	8.0
Cato	7.0	5.3	6.3	7.2
L93	7.2	7.5	6.7	7.7
Putter	6.7	6.7	6.0	7.5
Penn G6	7.8	6.8	7.3	8.3
SR 1020	6.7	7.9	6.3	7.7
T1	7.0	8.1	8.7	7.7
T2	6.8	7.8	8.3	7.5
LSD p<0.05	0.9	NS	1.1	0.9

A1 ..... A4 = assessor 1 - 4

**Table 45: Lake Karrynyup CC - Turf colour**  
**0 = no green colour 9 = very dark green**

CULTIVAR	A1	A2	A3	A4
<b>Penncross</b>	6.3	8.4	8.0	6.3
<b>Penn A4</b>	6.0	8.4	8.0	7.5
<b>SR 1019</b>	6.7	8.7	8.0	7.5
<b>Penn A1</b>	7.0	9.0	8.0	7.7
<b>Crenshaw</b>	6.2	8.1	8.0	7.7
<b>Penn G2</b>	6.2	7.8	8.0	7.7
<b>Cato</b>	6.2	8.0	8.0	7.7
<b>L93</b>	6.3	8.4	8.0	7.7
<b>Putter</b>	6.7	8.2	8.0	7.3
<b>Penn G6</b>	6.2	8.5	8.0	8.0
<b>SR 1020</b>	6.0	8.7	8.0	7.5
<b>T1</b>	6.5	9.2	8.0	8.5
<b>T2</b>	6.7	8.3	8.0	8.5
<b>LSD p&lt;0.05</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>	<b>1.7</b>

A1 ..... A4 = assessor 1 - 4

**Table 46: Lake Karrynyup CC - Disease**  
**10 = no disease 1 = 100% of turf affected by disease**

CULTIVAR	A1	A2	A3	A4
<b>Penncross</b>	7.5	10.0	8.7	7.0
<b>Penn A4</b>	7.0	10.0	7.3	7.5
<b>SR 1019</b>	6.7	8.8	8.3	7.0
<b>Penn A1</b>	7.7	10.0	9.0	8.5
<b>Crenshaw</b>	5.8	6.8	5.7	5.7
<b>Penn G2</b>	6.8	9.8	8.0	7.3
<b>Cato</b>	7.7	9.0	8.3	8.2
<b>L93</b>	6.8	10.0	8.7	8.2
<b>Putter</b>	6.7	10.0	8.7	8.0
<b>Penn G6</b>	7.7	10.0	8.3	7.3
<b>SR 1020</b>	7.3	7.8	7.3	7.0
<b>T1</b>	7.3	10.0	9.0	7.5
<b>T2</b>	7.7	9.0	9.0	7.2
<b>LSD p&lt;0.05</b>	<b>1.1</b>	<b>NS</b>	<b>NS</b>	<b>1.0</b>

### **3.4 Couchgrass variety plots**

The couchgrass demonstration plots, while not replicated provided some useful information in comparing the merits of the various couchgrass cultivars used on both golf greens and on fairways and tees. The plots provided a unique site where these grasses are maintained under intensive golf course management conditions. The plots were rated on various occasions for quality, density and colour (tables 43 - 48).

The inclusion of two of the new creeping bentgrass cultivars, with known tolerance to heat and humidity, provided a good contrast with the more traditional couchgrass cultivars used on golf greens in Queensland and northern NSW. Bentgrass is acknowledged as providing a superior putting surface to the hybrid couchgrasses and over many years golf courses in SE Queensland have attempted to maintain bentgrass as the preferred putting surface. At present there are two golf courses doing this with some success, however, summer management can be very difficult. The Penn A4 and the Penn G2 performed reasonably well, however, they eventually deteriorated to such an extent that they were replaced with couchgrass.

The new hybrid couchgrass cultivar Tifeagle, which is used for putting greens, performed well compared to the more established cultivars, Tifgreen and Tifdwarf.

The couchgrasses maintained under fairway conditions provided few outstanding differences though Supersport, CT-2 and Tifsport all showed promise at various times. The seeded cultivars exhibited the worst performance, with the cultivar Princess being the best of these.

**Table 43: Lakelands GC - Turfgrass quality at a cutting height of 2.6 mm (putting green turf) 0 = worst, 9 = best**

VARIETY	2/10/01	24/7/02	17/9/02	26/11/02	20/4/04	21/9/04	4/10/04
Tifeagle	*	8	8	8	8.5	7	8
Penn A4**	6	6	7	6	*	4	*
Penn G2**	6.5	7	8	6	*	3	*
Tifdwarf	6.5	7	8	7	7.5	7.5	7.5
Conquest	6	6	6	*	6	6.5	5
Super Sport	6	7	7	*	6	7	5.5
Tifgreen	6	7	5	8	6.5	8.5	7.5

\* = no data

\*\* = creeping bentgrass

**Table 44: Lakelands GC - Turfgrass quality at a cutting height of 7 mm (fairway/tee) 0 = worst, 9 = best**

VARIETY	2/10/01	24/7/02	17/9/02	26/11/02	20/4/04	21/9/04	4/10/04
Conquest	6.5	6	8	6.5	6.5	7	5.5
Super Sport	6	6	7	rg	7	7	6
Tifgreen	6.5	8	8	rg	7.5	8.5	7.5
CT-2	6.5	7	7	7	7	7.5	7
Tifsport	*	6	8	7	7	7	7
Greenleas Park	5.5	6	7	rg	6	6.5	5
Wintergreen	6.5	8	7	6	7	6.5	6
Legend	7	7	7	rg	6.5	8	6
Santa Ana	7.5	8	8	rg	6.5	7	6.5
Sydney	5.5	6	4	6	*	*	*
Mowhawk	5.5	6	4	6	*	*	*
Princess	6	6	6	6.5	5.5	6.5	5.5
Plateau	6.5	7	6	rg	7	6	5.5

\* = no data

rg = regrowth following heavy scarifying

**Table 45: Lakelands GC - Turfgrass colour at a cutting height of 2.6 mm (putting green turf) 0 = worst, 9 = best**

	2/10/01	24/7/02	17/9/02	21/9/04	4/10/04
Tifeagle	*	5	7	7	8
Penn A4	7	8	6	*	*
Penn G2	6	8	7	*	*
Tifdwarf	7	6	5	8	7.5
Conquest	6	7	5	6	6
Super Sport	6	6	5	6.5	6.5
Tifgreen	6	6	3	8.5	7

\* = no data

**Table 46: Lakelands GC - Turfgrass colour at a cutting height of 7 mm (fairway/tee)  
0 = worst, 9 = best**

	2/10/01	24/7/02	17/9/02	21/9/04	4/10/04
Conquest	6.5	7	8	7.5	6
Super Sport	6	6	7	7	6.5
Tifgreen	6	6	9	8.5	6
CT-2	6.5	7	8	8	6.5
Tifsport	*	7	8	8	7
Greenleas Park	6	7	7	7	6
Wintergreen	6.5	8	7	7.5	6
Legend	7	7	7	8	6.5
Santa Ana	6.5	8	9	7	6
Sydney	6	7	4	*	*
Mowhawk	6	7	4	*	*
Princess	7	6	5	6	6.5
Plateau	7	7	6	5.5	7

\* = no data

rg = regrowth following heavy scarifying

**Table 47: Lakelands GC - Turfgrass density at a cutting height of 2.6 mm (putting green turf) 0 = worst, 9 = best**

VARIETY	2/10/01	24/7/02	17/9/02	26/11/02	21/9/04	4/10/04
Tifeagle	*	8	8	8	8	8
Penn A4	6.5	7	9	6	*	*
Penn G2	7	8	9	6	*	*
Tifdwarf	7	7	8	7	8	7
Conquest	6	6	6	*	5	5
Super Sport	6	7	7	*	5.5	5.5
Tifgreen	6.5	7	6	8	8	7

**Table 48: Lakelands GC - Turfgrass density at a cutting height of 7 mm (fairway/tee)  
0 = worst, 9 = best**

VARIETY	2/10/01	24/7/02	17/9/02	26/11/02	21/9/04	4/10/04
Conquest	6.5	6	8	6	5.5	5.5
Super Sport	6	6	6	rg	6	6
Tifgreen	7	7	9	rg	8	7
CT-2	7	6	7	7	7.5	7
Tifsport	*	5	7	7	7	7
Greenleas Park	6	5	6	rg	6	5
Wintergreen	7	6	7	6	6.5	6
Legend	7	7	6	rg	7	6
Santa Ana	7.5	7	9	rg	7	6.5
Sydney	5	5	3	6	*	*
Mowhawk	5	5	4	6	*	*
Princess	6	6	6	7	6	5.5
Plateau	7	8	5	rg	5.5	5.5

\* = no data

rg = regrowth following heavy scarifying

### **3.5 Field day/workshop assessments**

During the field days and workshops the attendees were invited to assess the plots and grass collections. This was done to provide confirmation and feed-back from golf course superintendents and other turf managers of the assessment process that we were undertaking. By having the attendees assess the plots, provided greater involvement in the field day and workshop and provided them with a greater understanding of how turfgrass assessment data is collected.

In analysing the data from the attendees, it was interesting to note that they had little difficulty in selecting the best and worst cultivars and therefore there was less variability in the data (tables 48 – 56). However, the less outstanding cultivars or the middle of the range cultivars, provided greater difficulty in assessment and therefore there was greater variation in the data. That is, people found these plots difficult to rate and it then became a matter of personal preference as to the characteristics of that particular cultivar as to how they rated it. In this situation the assessors may be influenced more by colour, grain and texture of the surface. The data from the assessors confirmed our own assessments.

The field days emphasised the importance of turf managers assessing trial data for themselves, inspecting the trial plots and making their own evaluations. They then should select 3 – 5 cultivars that may be suitable and then establish and maintain them under their own site conditions. This will then provide a comprehensive assessment before selecting a new cultivar for the golf course.

**Table 48: Lakelands GC field day workshop assessments (September 2002)**  
**Turfgrass quality at a cutting height of 2.6 mm (putting green turf) 0 = worst, 5 = best**

Cultivar	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18	A19	A20	A21	A22	A23
Tifeagle	4.5	3.0	4.0	4.0	4.0	4.0	3.0	5.0	4.5	4.0	3.0	4.0	4.5	3.0	4.0	5.0	3.0	4.0	4.0	4.0	4.0	5.0	4.0
Penn A4	4.0	2.0	2.0	4.5	4.0	3.5	4.0	3.5	4.5	3.0	2.0	2.0	4.0	3.5	4.0	2.0	3.0	4.0	2.0	3.0	3.0	4.0	3.3
Penn G2	4.5	3.0	4.0	4.5	4.0	4.5	4.5	5.0	5.0	4.0	4.0	5.0	4.5	4.0	5.0	3.0	3.0	4.0	3.0	4.0	4.5	5.0	4.2
Tifdwarf	4.5	2.5	3.0	4.0	3.0	4.0	3.5	3.5	4.5	2.0	3.0	4.0	3.5	2.0	3.0	3.5	4.0	3.0	3.0	4.0	3.0	3.0	3.3
Conquest	3.5	2.5	3.0	3.5	3.5	3.5	2.0	2.5	4.0	3.0	2.0	2.0	2.0	2.0	2.0	2.5	3.0	3.0	4.0	2.0	3.5	2.0	2.8
Super Sport	4.0	2.0	3.0	4.0	3.5	4.0	2.0	3.0	4.0	3.0	2.0	2.0	4.5	2.0	2.5	2.5	3.0	3.0	4.0	4.0	4.0	2.5	3.1
Tifgreen	3.0	2.0	2.0	3.0	4.0	2.5	3.0	1.0	3.5	0.0	3.0	2.0	3.0	2.0	2.0	3.0	2.0	3.0	3.0	2.0	2.5	2.0	2.4
Average	4.0	2.4	3.0	3.9	3.7	3.7	3.1	3.4	4.3	2.7	2.7	3.0	3.7	2.6	3.2	3.1	3.0	3.4	3.3	3.3	3.5	3.4	3.3
St. dev.	0.53	0.42	0.76	0.49	0.36	0.59	0.87	1.30	0.45	1.28	0.70	1.20	0.88	0.79	1.06	0.90	0.53	0.49	0.70	0.88	0.65	1.22	0.57

A1....A23 = Assessors 1 – 23

**Table 49: Lakelands GC field day workshop assessments (September 2002)**  
**Turfgrass quality at a cutting height of 7 mm (fairway/tee) 0 = worst, 5 = best**

Cultivar	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18	A19	A20	A21	A22	A23
Conquest	4.5	3.0	4.0	4.0	4.0	4.5	4.0	3.0	4.0	3.0	4.0	4.0	4.0	3.5	4.0	3.5	3.0	4.0	4.0	3.0	5.0	4.0	3.8
Super Sport	4.0	3.0	4.0	3.5	3.5	3.5	3.0	2.5	4.0	3.0	4.0	1.0	2.5	3.0	2.5	2.0	3.0	4.0	4.0	2.0	4.0	3.5	3.2
Tifgreen	4.5	4.5	5.0	4.0	5.0	5.0	4.5	4.0	3.5	5.0	5.0	5.0	5.0	4.5	4.5	4.0	4.0	5.0	5.0	4.0	5.0	4.5	4.6
CT-2	4.5	3.5	4.0	4.5	5.0	4.0	4.0	5.0	4.0	3.0	3.0	4.0	5.0	3.5	5.0	3.5	3.0	4.0	4.0	3.0	4.0	4.5	4.0
Tif Sport	4.5	3.5	4.5	4.0	4.0	3.5	3.5	3.0	3.5	3.0	2.0	3.0	3.0	3.0	3.0	3.0	3.0	4.0	3.0	3.0	3.5	4.0	3.4
Greenleas Park	4.0	3.0	4.0	4.0	3.0	3.5	3.0	3.0	4.0	3.0	2.0	4.0	4.0	3.0	3.5	2.5	2.0	4.0	3.0	3.0	3.5	4.0	3.3
Wintergreen	4.0	3.0	4.0	4.0	4.0	3.5	3.5	4.0	4.5	3.0	3.0	3.0	4.5	3.5	4.0	3.0	4.0	4.0	4.0	2.0	4.5	4.5	3.7
Legend	4.0	3.0	4.0	4.0	3.0	4.0	3.0	3.0	4.5	5.0	3.0	5.0	4.0	3.0	4.0	3.0	3.0	4.0	3.0	2.0	3.5	4.0	3.6
Santa Ana	4.5	4.0	5.0	4.5	4.5	4.5	4.0	5.0	5.0	4.0	3.0	4.0	5.0	3.5	5.0	3.5	4.0	4.0	4.0	3.0	4.0	5.0	4.2
Sydney	2.0	1.5	2.5	2.0	2.0	2.5	2.0	1.0	2.5	2.0	1.0	1.0	2.0	1.0	1.0	2.0	2.0	3.0	2.0	1.0	2.0	1.0	1.8
Mohawk	2.0	1.0	2.5	2.0	2.0	2.5	2.0	2.0	2.5	2.0	1.0	2.0	3.0	1.0	1.0	2.5	2.0	3.0	2.0	1.0	2.0	1.5	1.9
Princess	3.5	1.5	3.0	3.0	3.5	4.0	2.0	2.0	3.5	2.0	2.0	1.0	3.0	1.0	2.0	2.5	2.0	3.0	3.0	2.0	3.0	4.0	2.6
Plateau	3.5	0.5	2.5	3.5	2.0	3.0	2.0	1.0	3.0	2.0	2.0	1.0	1.0	1.0	1.5	1.0	3.0	2.0	1.0	1.0	1.5	4.0	2.0
Average	3.8	2.7	3.8	3.6	3.5	3.7	3.1	3.0	3.7	3.1	2.7	2.9	3.5	2.7	3.2	2.8	2.9	3.7	3.2	2.3	3.5	3.7	3.2
St. dev.	0.88	1.20	0.88	0.82	1.06	0.75	0.89	1.30	0.75	1.04	1.18	1.55	1.25	1.21	1.43	0.81	0.76	0.75	1.09	0.95	1.12	1.17	0.91

A1....A23 = Assessors 1 – 23

**Table 50: Lakelands GC field day workshop assessments (September 2002)**  
**Turfgrass density at a cutting height of 2.6 mm (putting green turf 0 = worst, 5 = best)**

Cultivar	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18	A19	A20	A21	A22	A23
Tifeagle	4.5	3.0	3.0	4.5	4.0	4.0	3.0	5.0	5.0	4.0	3.0	4.0	4.5	4.0	4.5	4.0	3.0	3.0	3.0	4.0	5.0	5.0	4.0
Penn A4	5.0	3.5	3.0	5.0	4.0	4.0	4.0	4.5	4.5	3.5	2.0	2.0	3.5	3.5	4.0	3.0	3.0	4.0	3.0	3.0	4.0	4.0	3.6
Penn G2	5.0	4.0	4.0	5.0	5.0	5.0	4.5	5.0	5.0	4.0	3.0	5.0	4.5	4.5	5.0	3.0	2.0	4.0	4.0	4.0	5.0	5.0	4.3
Tifdwarf	4.5	2.5	3.0	4.0	4.0	4.0	3.0	2.5	4.5	3.0	3.0	4.0	3.5	3.5	4.0	3.0	4.0	3.0	3.0	4.0	3.5	2.0	3.4
Conquest	3.5	2.0	3.0	3.0	4.0	4.0	2.0	2.0	4.0	4.0	3.0	3.0	3.5	3.5	2.5	3.0	3.0	3.0	3.0	2.0	4.0	2.0	3.0
Super Sport	4.0	1.5	3.0	3.5	4.0	4.0	2.0	2.5	4.0	5.0	4.0	3.0	4.5	3.5	3.0	4.0	3.0	3.0	4.0	3.0	4.5	2.5	3.4
Tifgreen	3.5	2.0	2.0	3.5	3.5	2.5	3.0	1.0	4.0	2.0	3.0	2.0	3.5	2.5	3.0	2.5	2.0	3.0	3.0	2.0	3.0	3.0	2.7
Average	4.3	2.6	3.0	4.1	4.1	3.9	3.1	3.2	4.4	3.6	3.0	3.3	3.9	3.6	3.7	3.2	2.9	3.3	3.3	3.1	4.1	3.4	3.5
St. dev.	0.6	0.9	0.6	0.8	0.4	0.7	0.9	1.6	0.4	0.9	0.6	1.1	0.5	0.6	0.9	0.6	0.7	0.5	0.5	0.9	0.7	1.3	0.5

A1....A23 = Assessors 1 – 23

**Table 51: Lakelands GC field day workshop assessments (September 2002)**  
**Turfgrass density at a cutting height of 7 mm (fairway/tee) 0 = worst, 5 = best**

Cultivar	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18	A19	A20	A21	A22	A23
Conquest	4.5	3.5	3.5	4.0	4.0	4.5	3.5	2.5	4.0	3.0	5.0	4.0	4.5	4.0	3.5	3.0	3.0	3.0	4.0	3.0	5.0	4.0	3.8
Super Sport	3.5	3.0	3.5	4.0	4.0	3.5	3.0	3.5	3.5	4.0	4.0	2.0	3.0	3.0	3.5	2.0	3.0	3.0	4.0	3.0	4.0	3.5	3.3
Tifgreen	5.0	4.5	4.5	4.0	5.0	5.0	4.0	4.0	3.5	5.0	4.0	5.0	4.5	4.0	4.5	3.5	4.0	4.0	5.0	4.0	5.0	4.5	4.4
CT-2	4.5	3.0	4.0	4.0	5.0	4.0	3.5	5.0	4.0	5.0	3.0	4.0	5.0	4.0	5.0	3.0	3.0	4.0	4.0	3.0	4.0	4.5	4.0
Tif Sport	4.0	3.0	4.5	3.5	4.0	4.0	3.5	2.0	3.5	3.0	3.0	4.0	3.0	3.5	3.0	2.5	3.0	4.0	4.0	3.0	3.5	3.5	3.4
Greenleas Park	3.5	2.5	4.0	4.0	3.0	3.5	3.0	3.0	4.0	3.0	3.0	5.0	5.0	3.0	4.0	3.0	2.0	3.0	3.0	3.0	3.5	3.0	3.4
Wintergreen	4.0	3.0	4.0	4.0	4.0	3.5	3.5	4.0	4.5	5.0	4.0	4.0	5.0	4.0	4.0	2.5	4.0	3.0	4.0	3.0	5.0	4.5	3.9
Legend	3.5	2.5	4.0	4.0	3.0	4.0	2.5	2.0	4.5	4.0	4.0	5.0	5.0	2.5	4.0	3.0	2.0	3.0	3.0	2.0	3.5	4.0	3.4
Santa Ana	5.0	4.0	5.0	5.0	4.5	4.5	4.0	5.0	5.0	5.0	5.0	4.0	5.0	3.5	5.0	3.0	4.0	4.0	4.0	4.0	5.0	5.0	4.4
Sydney	1.5	1.0	2.5	1.5	2.0	2.5	2.0	1.0	2.5	3.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	3.0	2.0	1.0	2.0	1.0	1.6
Mohawk	2.0	1.0	2.5	2.0	2.0	2.5	2.0	1.0	2.5	3.0	1.0	2.0	3.0	1.0	1.0	1.5	1.0	3.0	2.0	1.0	2.0	1.5	1.8
Princess	3.5	1.5	3.0	3.5	3.0	3.5	2.0	2.0	4.0	1.0	2.0	1.0	3.0	2.0	2.0	2.0	2.0	3.0	3.0	2.0	3.0	4.5	2.6
Plateau	3.0	1.0	3.0	4.0	2.5	3.0	2.5	2.0	3.0	2.0	3.0	1.0	2.0	2.0	1.5	0.5	2.0	3.0	1.0	1.0	2.0	4.0	2.2
Average	3.7	2.6	3.7	3.7	3.5	3.7	3.0	2.8	3.7	3.5	3.2	3.2	3.8	2.9	3.2	2.3	2.6	3.3	3.3	2.5	3.6	3.7	3.3
St. dev.	1.05	1.15	0.78	0.92	1.03	0.75	0.74	1.36	0.75	1.27	1.30	1.59	1.35	1.10	1.42	0.90	1.04	0.48	1.11	1.05	1.10	1.20	0.93

A1....A23 = Assessors 1 – 23

**Table 52: Lakelands GC field day workshop (September 2002)**  
**Summary of turfgrass colour, density and quality data at a cutting height of 2.6 mm**  
**(putting green turf) 0 = worst, 5 = best**

VARIETY	Turfgrass Colour	Turfgrass Density	Turfgrass Quality
Tifgreen	2.2	2.7	2.4
Conquest	2.9	3.0	2.8
Super Sport	2.8	3.4	3.1
Penn A4	3.7	3.6	3.3
Tifdwarf	2.8	3.4	3.3
Tifeagle	3.7	4.0	4.0
Penn G2	4.2	4.3	4.2
<b>LSD (&lt;0.05)</b>	<b>0.4</b>	<b>0.4</b>	<b>0.4</b>

**Table 53: Lakelands GC field day workshop (September 2002)**  
**Summary of turfgrass colour, density and quality data at a cutting height of 7 mm**  
**(fairway/tee) 0 = worst, 5 = best**

VARIETY	Turfgrass Colour	Turfgrass Density	Turfgrass Quality
Sydney	2.3	1.6	1.8
Mohawk	2.4	1.8	1.9
Plateau	3.0	2.2	2.0
Princess	2.7	2.6	2.6
Super Sport	3.5	3.3	3.2
GLP	3.8	3.4	3.3
Tif Sport	3.9	3.4	3.4
Legend	3.8	3.4	3.6
Wintergreen	3.9	3.9	3.7
Conquest	4.0	3.8	3.8
CT-2	4.5	4.0	4.0
Santa Ana	4.4	4.4	4.2
Tifgreen	4.3	4.4	4.6
<b>LSD (&lt;0.05)</b>	<b>0.4</b>	<b>0.4</b>	<b>0.4</b>

**Table 54: Kingston Heath GC – Workshop September 2002**  
**Turf quality 0 = worst, 5 = best**

VARIETY	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	AVG	CV %
Penncross	2.0	2.0	3.3	1.0	2.3	3.7	2.3	2.7	3.3	2.5	3.0	2.3	1.7	3.5	1.0	2.4	34.7
Egmont	3.0	2.7	3.7	2.3	3.0	4.3	2.7	2.2	3.3	2.7	2.7	3.3	3.0	3.9	3.0	3.1	18.9
Penn A1	4.0	3.7	4.7	3.3	4.0	5.0	4.3	4.0	5.0	4.0	4.0	3.7	5.0	4.2	4.0	4.2	12.3
Penn A4	4.0	4.0	4.5	2.5	4.0	4.0	4.5	3.3	4.5	4.0	4.0	4.0	4.0	4.3	3.5	3.9	13.4
Penn G2	3.7	2.7	4.0	2.0	3.3	4.0	3.3	3.3	4.0	3.5	4.0	3.3	4.0	3.9	2.3	3.4	18.9
Penn G6	2.7	3.0	4.0	2.0	3.0	4.3	3.3	2.7	3.3	2.5	3.0	3.0	3.0	4.3	2.0	3.1	23.1
Cato	3.3	2.7	4.0	2.0	3.3	5.0	2.7	3.2	4.0	3.0	2.7	3.3	4.0	3.9	1.7	3.3	26.1
Pennlinks	2.3	2.3	3.0	1.3	2.3	4.0	2.3	2.7	3.3	2.5	2.3	2.7	2.7	3.5	1.0	2.6	29.2
L93	3.3	2.3	3.7	2.7	2.7	4.7	3.0	2.8	4.0	2.7	3.0	2.7	3.3	4.0	2.0	3.1	23.0
Dominant	3.3	2.3	4.0	2.3	3.3	4.7	3.3	3.3	4.0	3.0	4.0	3.0	3.3	4.1	2.0	3.3	22.4
SR7200	2.0	1.7	3.3	3.3	1.7	3.0	1.7	2.0	2.0	2.7	3.3	2.0	1.7	3.9	2.3	2.4	31.8
<b>LSD (&lt;0.05)</b>	<b>0.7</b>	<b>1.2</b>	<b>0.7</b>	<b>1.4</b>	<b>0.8</b>	<b>1.0</b>	<b>1.3</b>	<b>0.7</b>	<b>0.7</b>	<b>0.7</b>	<b>0.8</b>	<b>0.8</b>	<b>0.9</b>	<b>0.7</b>	<b>1.5</b>	<b>0.4</b>	

**A1...A15 = Assessors 1 – 15**

**Table 55: Kingston Heath GC – Workshop September 2002**  
**Turf density 0 = worst, 5 = best**

VARIETY	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	AVG	CV %
Penncross	2.3	1.7	3.3	0.7	2.0	2.7	2.3	3.0	3.3	2.5	2.3	2.3	2.3	3.0	1.0	2.3	31.7
Egmont	3.0	2.7	4.3	1.0	3.3	4.0	3.3	3.0	3.7	3.0	3.7	2.7	3.3	3.9	3.3	3.2	23.4
Penn A1	3.7	3.7	5.0	2.0	4.0	5.0	3.7	3.8	5.0	3.5	4.0	3.7	4.7	4.1	4.7	4.0	18.8
Penn A4	4.0	4.0	4.5	2.0	4.0	5.0	3.5	3.8	5.0	3.8	4.0	4.0	4.0	4.0	4.0	4.0	16.7
Penn G2	3.7	3.0	4.3	1.7	3.7	4.3	4.0	3.2	4.3	3.0	3.7	4.0	3.7	3.8	2.7	3.5	19.9
Penn G6	3.0	3.0	4.3	1.7	3.0	4.7	3.0	3.0	3.3	2.7	2.7	2.7	3.7	3.9	1.7	3.1	26.2
Cato	3.0	3.0	4.3	1.3	3.0	3.7	3.0	3.3	4.0	3.2	2.3	3.0	4.0	3.6	2.3	3.1	23.4
Pennlinks	2.7	2.7	3.3	1.0	2.0	3.0	2.3	3.0	3.7	2.2	2.3	2.3	3.0	3.6	1.0	2.5	30.5
L93	3.3	2.7	3.7	2.3	2.7	4.3	3.0	3.0	4.3	2.8	3.0	3.3	4.0	3.7	2.3	3.2	19.5
Dominant	3.3	2.7	4.3	1.7	3.3	4.3	3.3	3.5	4.0	3.0	3.7	3.0	3.3	4.1	2.3	3.3	21.3
SR7200	2.3	2.3	4.7	3.3	3.7	4.0	4.3	3.5	4.0	3.0	5.0	2.3	1.7	4.7	3.3	3.5	27.7
LSD (<0.05)	0.8	0.8	0.9	1.3	1.0	1.2	1.1	0.3	0.7	0.6	1.0	1.1	0.8	0.7	1.5	0.4	

**A1...A15 = Assessors 1 – 15**

**Table 56: Glenelg GC Workshop September 2002**  
**Turf quality 0 = worst, 5 = best**

VARIETY	A 1	A 2	A 3	A 4	A 5	A 6	A 7	A 8	A 9	A 10	AVG	STD	CV%
Penncross	2.7	2.8	2.7	3.0	3.0	2.8	3.5	4.0	3.3	2.8	3.1	0.42	13.8
Egmont	3.0	2.5	2.0	1.0	2.8	2.0	1.0	4.0	3.0	1.5	2.3	0.96	42.2
Penn A1	4.3	4.0	4.0	4.3	4.0	4.5	3.7	4.2	3.7	4.2	4.1	0.27	6.7
Penn A4	4.7	3.5	3.7	4.3	3.7	4.0	3.7	3.8	3.7	3.5	3.9	0.38	9.8
Penn G2	3.0	2.7	2.3	3.2	3.0	2.2	2.7	3.3	3.7	2.5	2.9	0.47	16.6
Mix	2.3	2.8	2.0	2.9	2.9	2.7	2.7	3.3	3.0	2.3	2.7	0.39	14.4
Cato	3.0	3.3	2.5	4.0	3.0	3.8	3.8	3.8	3.5	2.8	3.3	0.50	15.1
Pennlinks	3.0	2.8	3.0	3.0	2.9	3.2	3.2	4.0	3.7	2.8	3.2	0.38	12.1
L93	3.0	3.0	3.3	4.0	3.6	3.3	3.0	4.5	3.7	3.2	3.5	0.49	14.2
Dominant	3.3	3.0	3.0	4.3	3.5	3.2	3.5	4.5	3.3	2.8	3.5	0.56	16.1
RA1	3.7	2.5	2.0	2.7	2.0	2.2	2.0	3.0	2.0	2.2	2.4	0.56	23.0
RA2	3.7	3.2	3.0	3.7	3.2	3.7	3.5	4.3	3.3	3.0	3.5	0.40	11.7
Mariner	2.7	2.8	3.3	3.7	3.2	2.7	2.7	4.2	3.0	2.8	3.1	0.50	16.1
LSD (P<0.05)	0.9	0.6	0.7	NS	0.5	0.9	0.5	NS	NS	NS	0.5		

**A1...A10 = Assessors 1 – 10**

## **4. CONCLUSIONS**

### **4.1 Bentgrass collection**

Over 450 bentgrass plants were collected from putting greens around Australia and demonstrate the high level of variability that exists in this species. Of those that have been subjected to detailed evaluation in the spaced plant nursery and the putting green trial, there have been 13 identified with outstanding turfgrass qualities that are equal to or better than several established cultivars. There still remains another 250 selections that require further evaluation, particularly those plants that were selected for their tolerance to salinity, heat and drought.

One of the most notable aspects of the selection and evaluation program was that many of the selections that exhibited excellent turf characteristics demonstrated poor flowerhead/seedhead production. There is a relationship between plant density and the ability to produce seed and this has been confirmed by Dr. David Huff (plant breeder, PennState University) and Mr. Keith Saulsbury (plant breeder, Wrightsons seeds NZ). In producing new cultivars for seed production there is a minimum seed yield required to make it commercially viable to introduce a new cultivar. Consequently, plant breeders are often forced to select plants that have lesser traits in favour of those that are good seed producers. Consequently, there are selections that have superior characteristics which are ignored due to poor seed yields. The outcome of this work indicates there is potential for introducing improved bentgrass cultivars by way of vegetative propagation rather than through seed. This in fact how bentgrass was often established prior to the late 1940's.

### **4.2 Couchgrass collection**

There were 93 plants collected from putting greens and bowling greens that had been originally established to a sterile hybrid couchgrass (*Cynodon dactylon* x *Cynodon transvaalensis*), either Tifton 328 or Tifdwarf. Plants were collected mainly from Queensland with some plants from northern NSW and northern Victoria and there was only a moderate level of variability in this species. Of those that have been subjected to detailed evaluation in the spaced plant nursery there have been 10 identified with outstanding turfgrass qualities that are equal to or better than several established cultivars. There still remains another 19 selections that require further evaluation.

### **4.3 Bentgrass variety trials**

Bentgrass trials were established in Victoria, NSW, SA and WA and represent a wide range of environmental conditions. The trials have demonstrated that there are several new cultivars that have superior turfgrass quality, density and putting characteristics.

The most notable feature of the new cultivars is the very high tiller density. The high tiller density helps to provide a smoother putting surface, however, there is an issue of thatch accumulation and control. The new bentgrass cultivars and in particular the A and G series bentgrasses accumulate thatch very quickly. It is therefore very important that thatch control procedures, such as regular sand dusting, are implemented very early. It is interesting to note that while the newer bentgrasses accumulate thatch quickly, over a period of 24 months or so there is little difference between the cultivars.

### **4.4 Couchgrass plots**

The couchgrass plots provided a very good demonstration area where grasses used for greens, fairways and tees were maintained at the appropriate cutting heights and maintenance regime for presenting high quality playing surfaces.

The observations from these plots were that the new putting green cultivar Tifeagle is a very high quality turfgrass, Tifsport has potential for tees and fairways and the seeded couchgrasses are very poor in comparison to the vegetative cultivars.

#### **4.5 Future development**

##### **4.5.1 Bentgrass**

The project objectives were to identify selections that had outstanding characteristics worthy of introducing into a breeding program to develop new seeded cultivars adapted to Australian conditions. The project has identified 100 plants that are worthy of further development. These individuals are generally low growing, have a high tiller density and produce a very dense, high quality putting surface.

An expression of interest in the collection was called for in October 2003 with five submissions received. The submission from Sydney University was the most detailed in outlining how the plant material would be included into their breeding program. The other submissions expressed interest in developing the grasses at our cost with little or no return to the AGCSA and HAL. The collection is now being propagated in pots for delivery to Sydney University. The final agreement between the interested parties is to be finalised and the AGCSA is waiting on documentation from the University.

The bentgrass collection contains plants that exhibit characteristics yet to be evaluated such as salinity tolerance and heat and drought resistance. The plants need to be assessed for these characters, but at this time there is no funding available to undertake the necessary research. The collection will be maintained in the short term and the plant material made available to Sydney University.

Because of the dilemma of having high quality plants, that are unlikely to produce commercially viable quantities of seed, the AGCSA has been investigating the practicalities of producing new cultivars through vegetative propagation. The advice received from Dr. David Huff and our experience in establishing the putting green trial, indicates that this is a feasible option. The AGCSA is pursuing this possibility with a turfgrass sod producer and limited trials will be undertaken in 2005.

##### **4.5.2 Couchgrass**

There have been 10 selections identified that have outstanding qualities. These selections will be further evaluated as part of a putting green trial being undertaken by the Queensland Department of Primary Industries (QDPI) and the plant material will be given to the QDPI for future development.

#### **5. PROJECT EXTENSION**

The information generated from this project was extended to the turf industry through articles in Australian Turfgrass Management Magazine, Field days and workshops and conference presentations.

##### **Journal Paper**

A paper has been accepted for presentation at the 10<sup>th</sup> International Turfgrass Research Conference in Llandudno, Wales in July 2005. Evaluation of bent (*Agrostis spp.*) cultivars maintained as putting greens at several Australian sites (under review).

##### **Articles**

Articles have been produced as follows;

Australian Turfgrass Management Vol. 3.1  
Australian Turfgrass Management Vol. 3.2  
Australian Turfgrass Management Vol. 3.3  
Australian Turfgrass Management Vol. 3.4  
Australian Turfgrass Management Vol. 3.6  
Australian Turfgrass Management Vol. 4.1  
Australian Turfgrass Management Vol. 4.2  
Australian Turfgrass Management Vol. 4.6  
Australian Turfgrass Management Vol. 5.3  
Australian Turfgrass Management Vol. 5.4  
Australian Turfgrass Management Vol. 5.6  
Australian Turfgrass Management Vol. 6.2  
Australian Turfgrass Management Vol. 6.6  
Proceedings 19<sup>th</sup> Australian Turfgrass Conference, June 2003  
Field day notes  
Golf Magazine December 2001  
Seminar proceedings WA Golf Course Superintendents conference, Margaret River, 2002

### **Field days/workshops**

Field days/workshops have been held at the following sites;

Kingston Heath GC – 1 March 2003  
Kingston Heath GC - 10 September 2003  
Lakelands GC – 17 September 2003  
Glenelg GC – 24 September 2003  
Kingston Heath GC - 10 March 2004  
Chisholm TAFE, Rosebud – 24 March 2004

### **Meetings/discussions**

“PennPals” meeting – Sydney 25 May 2004 and 15 November 2004  
“PennPals” meeting – Melbourne 8 October 2004

### **Conference Presentations**

WA Golf Course Superintendents conference, Margaret River, 2002  
19<sup>th</sup> Australian Turfgrass Conference, June 2003  
Presentations made at all field days and workshops  
Diploma of Turf Management, Chisholm TAFE

### **Other activities**

The trial plots have been inspected by Golf Course Superintendents, Golf Course Architects and Students throughout the period of the project. There has been an “open door” policy for all of the trial sites.

### **ACKNOWLEDGEMENTS**

The Australian Golf Course Superintendents Association is grateful for the funding received from Horticulture Australia.

We are also grateful to the seed and turf companies that have supplied the varieties for this project including; Heritage Seeds, Nuturf, Globe Australia, Turf and Irrigation, Valley Seeds, Advanced Seed, Wrightsons, Simplot, Evergreen Turf, Jimbooma Turf, Twin View Turf, StrathAyr Turf, Peter Brown and Associates and Tropical Lawns..

These projects would not be possible if not for the support of the Golf Course Superintendents and their Clubs at each of the trial sites;

Castle Hill CC – Martyn Black

Glenelg GC – Daryl Sellar

Kingston Heath GC – Martin Greenwood

Lake Karrinyup CC – Trevor Strachan

Lakelands GC – Darren Moore and Stephen Marsden

Chisholm TAFE College, Rosebud Campus – Barry Fraser and Bruce McPhee

Particular thanks to Cassandra and Michael Neylan for their assistance in establishing the plants collected and maintaining the propagating nursery.

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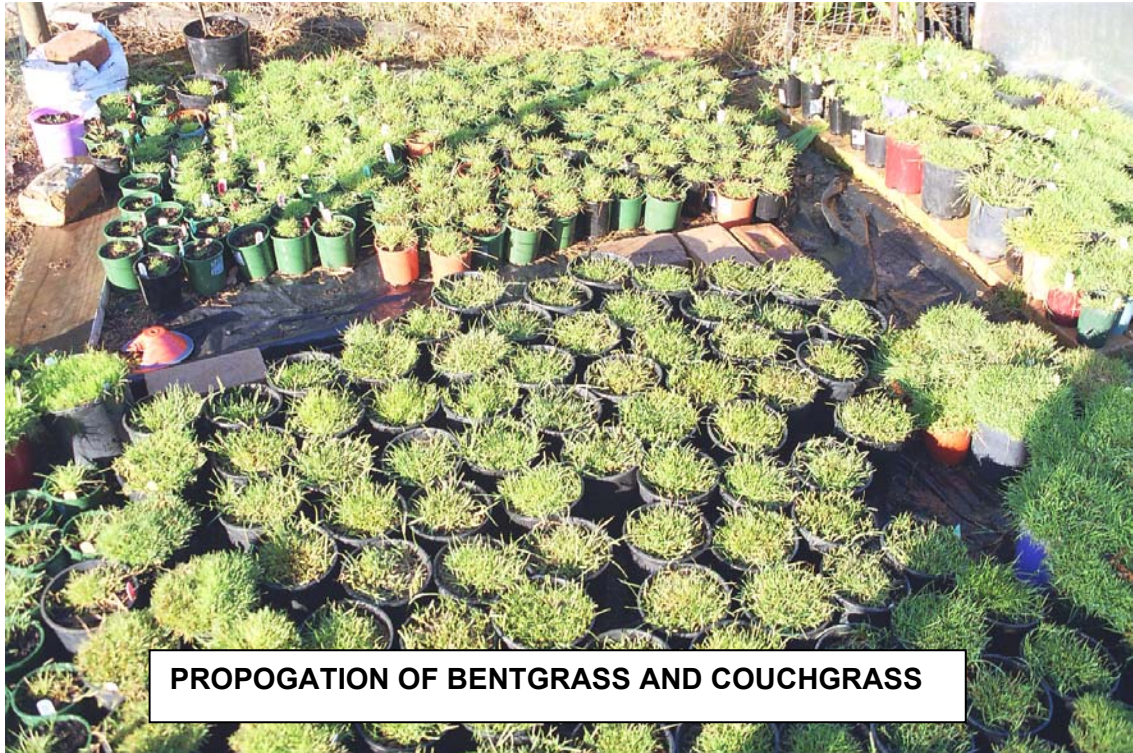
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Sellar, D. 1999. Study into the identification of the bentgrass types at the Royal Adelaide Golf Club. Masters of Agriculture (Turfgrass Management) Thesis. Sydney University, NSW, Australia.

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## PHOTOGRAPHS



**PROPOGATION OF BENTGRASS AND COUCHGRASS**



**BENTGRASS SPACED PLANT NURSERY – JUNE 2001**



**BENTGRASS SPACED PLANT NURSERY  
NOTE DIFFERENT GROWTH FORMS**



**BENTGRASS GROWTH CHARACTERISTICS**





**KINGSTON HEATH GC - INSPECTION OF BENTGRASS SPACED PLANT NURSERY**

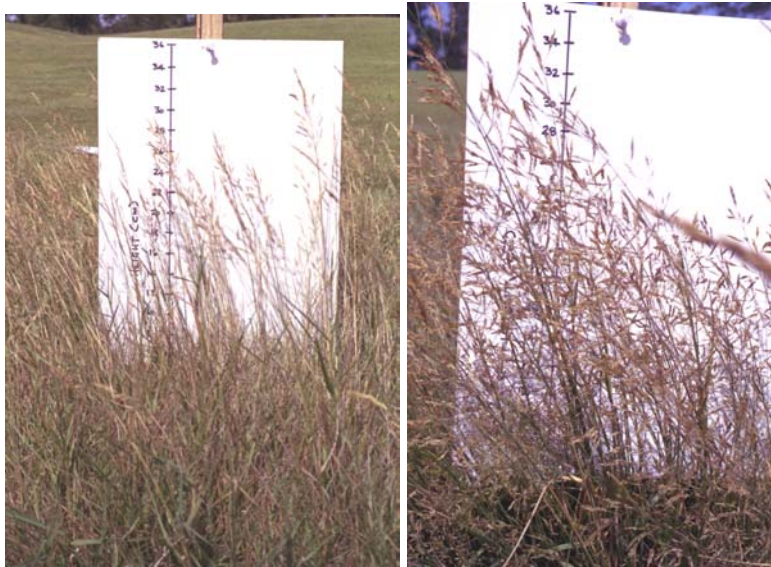


**BENTGRASS GROWTH CHARACTERISTICS**

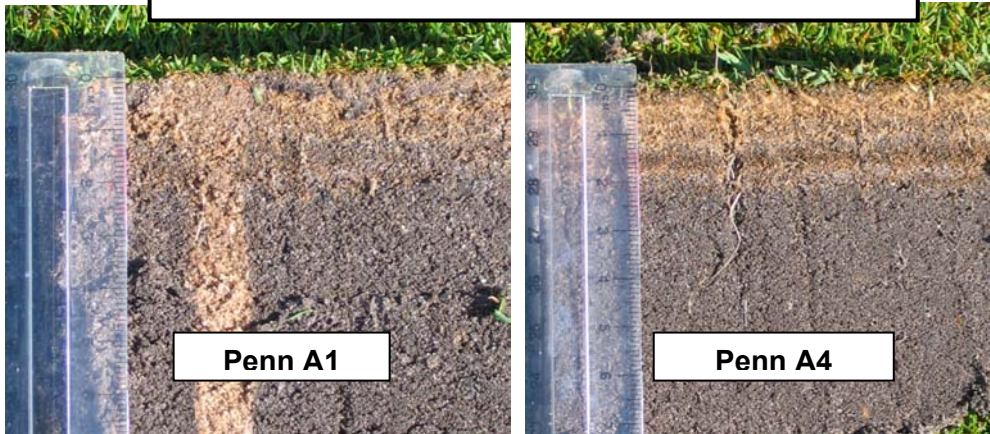




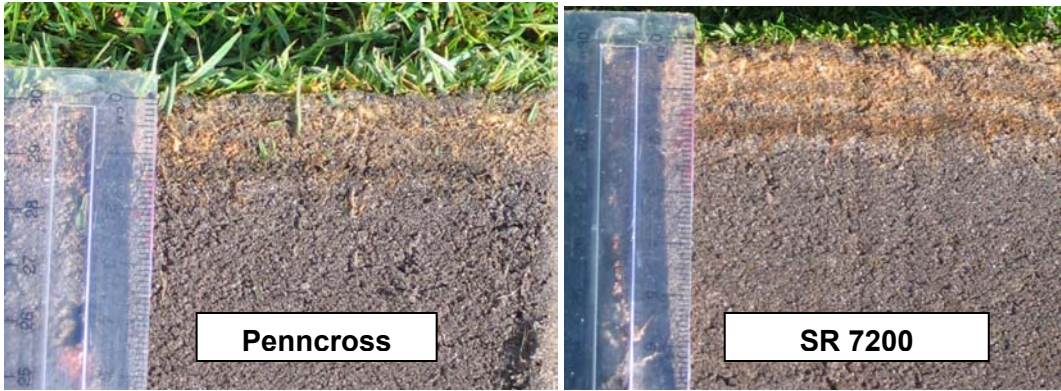
**BENTGRASS FLOWER/SEEDHEADS**



**BENTGRASS – THATCH DEPTH**



**BENTGRASS – THATCH DEPTH**



**LAKE KARRINYUP CC  
- BENTGRASS TRIAL**



**CASTLE HILL CC -  
BENTGRASS TRIAL**



**PUTTING GREEN TRIAL AT  
CHISHOLM TAFE, ROSEBUD  
ESTABLISHMENT OF**



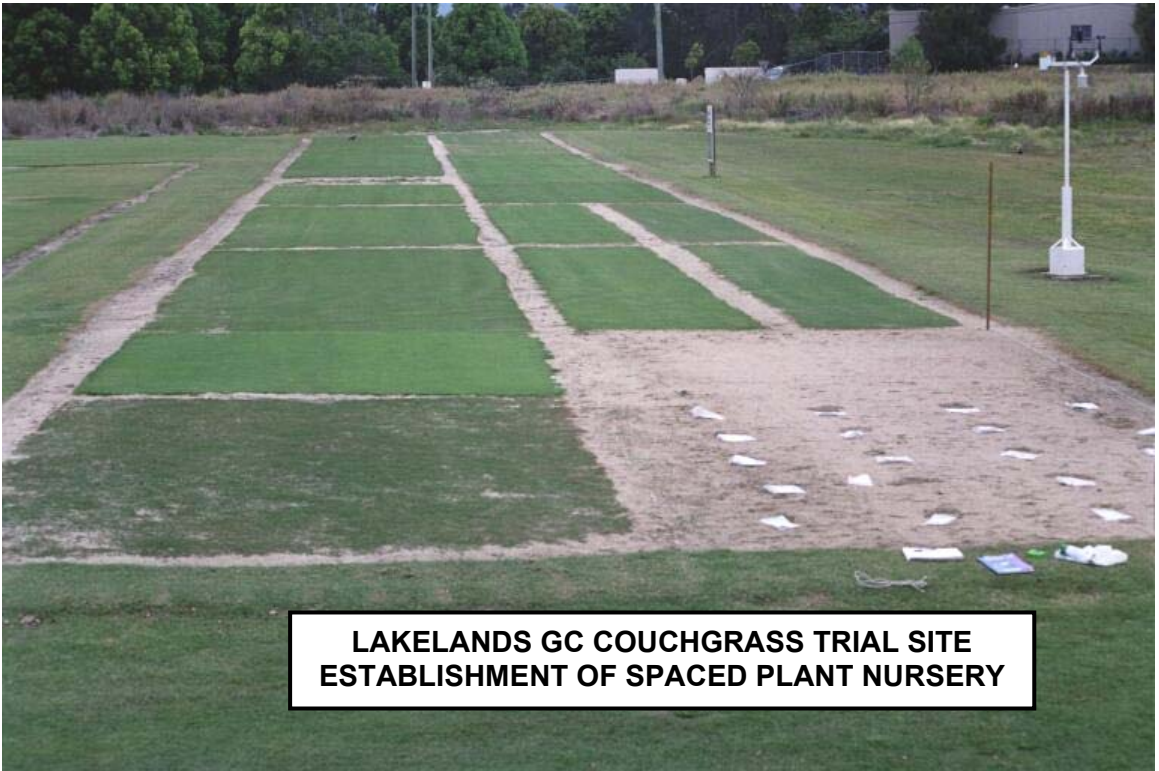
**PUTTING GREEN TRIAL AT  
CHISHOLM TAFE, ROSEBUD  
ESTABLISHMENT OF  
BENTGRASSES**



**PUTTING GREEN TRIAL AT  
CHISHOLM TAFE, ROSEBUD  
TOPDRESSING OF GREEN**



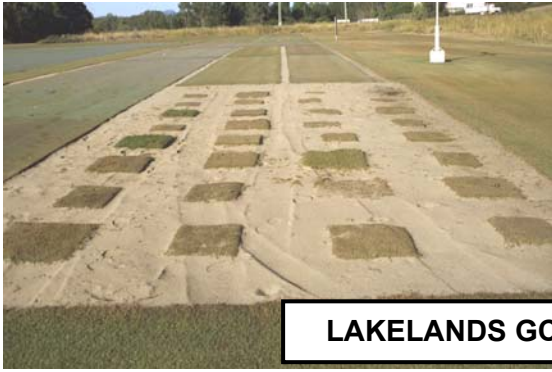
**LAKELANDS GC COUCHGRASS TRIAL SITE**



**LAKELANDS GC COUCHGRASS TRIAL SITE  
ESTABLISHMENT OF SPACED PLANT NURSERY**

**COUCHGRASS COLLECTION**





**LAKELANDS GC – WINTER DORMANCY**



**LAKELANDS GC – FIELD DAY/WORKSHOP**



**GLENELG GC FIELD DAY/WORKSHOP**



**KINGSTON HEATH GC FIELD DAY/WORKSHOP**

## **ARTICLES PRODUCED**