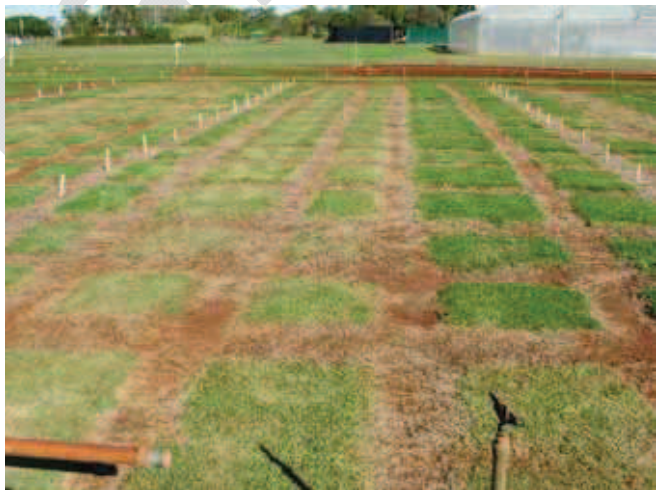
HAL Project TU04013
(Completion date 14 October 2009)

Adaptation and management of Australian buffalo grass cultivars for shade and water conservation.

Final report

Alan Duff, Dr Don Loch and Dr Tim Colmer

Queensland Primary Industries and Fisheries
Department of Employment, Economic Development and Innovation



Hal Project TU04013

Project Leader: Alan Duff
Principal Experimentalist
Dept of Employment, Economic Development and Innovation
Queensland Primary Industries and Fisheries
Redlands Research Station
26-40 Delancey Street
CLEVELAND QLD 4163

Ph: 07 3824 9553
Fax: 07 3286 3094
Email: alan.duff@deedi.qld.gov.au.

Key Research Personnel:

Dr Don Loch (former Project Leader QPIF, Redlands Research Station)
Dr Tim Colmer (University of Western Australia)
Mr Matt Roche (Senior Scientist, QPIF, Redlands Research Station)
Dr Rachel Poulter (Research Scientist, QPIF, Redlands Research Station)
Mr Jon Penberthy (Experimentalist, QPIF, Redlands Research Station)
Ms Lin O'Brien (Lab Technician, QPIF, Redlands Research Station)
Mr Tony Troughton (formerly QPIF, Redlands Research Station)
Mr Russ Durant (formerly QPIF, Redlands Research Station)

This report summarises the experimental work undertaken during the life of this project from July 2004 until May 2009. This included the development of technical information in relation to the adaptation of buffalo grasses to crop morphology, fertilizer x mowing frequency, wear, shade and herbicides undertaken at Redlands Research Station; water use/drought tolerance and performance on alkaline soils at the University of Western Australia and monitoring the adaptation and management of these different buffalo grasses with major private and public developers and users of turf around Australia.

The research team gratefully acknowledges the generous financial support of Horticulture Australia Limited, Buchanan Turf Supplies Pty Ltd, H & T Whiting Turfgrass Development LLC, Turf Growers Association of Western Australia (TGA WA), Turfco, Turf Force, Richmond Turf Supplies, Brisbane City Council, Sod Solutions Inc, Matilda Trading Pty Ltd, Palmetto Group (WA), Delfin Management Services Pty Ltd, Delfin Lend Lease – Springfield Lakes, Sir Walter Group (WA), Betta Turf and the former Queensland Department of Primary Industries. We also acknowledge the vital collaboration of John Lloyd, former landscape Services Manager, Parliament House, Canberra; Phil Ford, Lecturer, North Melbourne Institute of TAFE; Ken Smith, Richmond TAFE, Western Sydney; David Crestani and Marty Holmes, Royal Botanic Gardens, Sydney; David Nickson and Dean Holden, Evergreen Turf; Peter McMaugh, Turf Services, Sydney;

Submitted:

Table 2.2. Morphological and agronomic measurements on 17 genotypes of *Stenotaphrum secundatum* available in Australia. See Table 2.1 for details of the abbreviated codes used to identify the different cultivars or accessions studied.

Attribute	Code	Cultivar/Accession																*LSD*
		AMS	**KPR**	**MAR**	**MAT**	**NKL**	**PAL**	**SAP**	**SHM**	**SJM**	**SWL**	**ST26**	**ST85**	**ST91**	**ST135**	**TF01**	**VEL**	**WA-1**	*(p=0.05)*
Stolon:																			
Internode length (mm)	SIL	50.9	60.7	50.1	55.2	60.7	42.3	52.9	43.7	55.3	64.7	47.1	47.1	31.9	29.1	65.0	32.6	51.6	*4.2*
Internode diameter (mm)	SID	3.04	2.90	2.97	2.77	2.96	2.87	2.87	3.04	2.79	2.82	3.10	2.19	1.91	1.94	2.72	2.43	3.37	*0.20*
Leaf sheath length (mm)	SLSL	17.2	19.6	17.7	17.0	18.7	18.9	17.4	16.2	21.0	21.3	17.0	12.3	10.3	10.3	18.2	15.8	19.9	*1.02*
Leaf blade length (mm)	SLL	13.4	21.4	15.8	19.6	20.0	18.0	14.2	17.0	23.5	23.9	14.5	12.1	10.1	11.0	16.7	14.0	20.8	*1.8*
Leaf blade width (mm)	SLW	5.63	7.01	6.42	6.65	6.61	6.46	5.81	6.30	6.86	7.36	5.76	4.86	3.82	4.00	6.47	5.48	6.56	*0.38*
Leaf blade L:W ratio	SLWR	2.34	3.05	2.48	2.97	2.99	2.78	2.44	2.72	3.42	3.24	2.52	2.49	2.70	2.76	2.58	2.56	3.17	*0.24*
Branches at node 2	B2N	1.32	1.40	1.40	1.83	1.50	1.28	1.10	1.73	1.35	1.12	0.95	1.10	0.88	0.62	1.18	1.17	1.42	*0.34*
Total no. of branches (nodes 2-6)‡	-	10.73	9.90	12.80	12.25	10.68	10.08	10.45	12.43	10.03	9.42	9.78	9.37	10.44	9.90	10.43	10.82	11.85	*0.82*
First node with 2 branches‡	-	2.63	2.55	2.57	2.28	2.78	2.58	2.68	2.40	2.93	2.73	2.87	3.45	2.97	3.05	2.72	2.77	2.52	*0.44*
First node with 3 branches‡	-	5.48	6.07	4.20	3.78	5.72	5.83	5.33	4.47	6.17	6.32	5.77	6.60	4.76	5.40	4.85	5.45	4.15	*0.66*
Flowering culm(tiller):																			
Flag leaf sheath length (mm)	FLSL	53.4	41.1	46.9	50.3	43.2	58.0	48.5	38.3	46.1	42.5	54.2	47.7	34.1	32.0	43.2	42.1	48.5	*5.3*
Flag leaf blade length (mm)	FLL	31.3	24.4	33.8	33.4	27.9	40.5	28.7	25.6	31.4	30.2	32.2	46.3	21.5	21.2	28.2	25.3	30.4	*8.1*
Flag leaf blade width (mm)	FLW	6.49	5.81	6.26	6.67	6.42	6.63	6.14	5.31	6.13	6.68	6.16	6.62	5.04	4.63	6.25	5.63	6.01	*0.74*
Flag leaf blade L:W ratio	FLWR	4.66	4.22	5.46	4.99	4.21	5.88	4.60	4.85	5.11	4.41	5.24	6.83	4.28	4.09	4.43	4.39	4.94	*1.11*
Tiller leaf sheath length (mm)	TLSL	40.1	34.6	31.0	39.9	36.6	36.9	38.5	26.2	31.8	33.0	38.5	35.2	25.2	21.1	36.2	30.7	42.1	*6.2*
Tiller leaf blade length (mm)	TLL	75.0	66.5	65.1	85.6	75.9	58.6	69.5	46.6	72.7	75.0	74.2	78.3	49.1	38.9	80.1	57.9	83.8	*15.3*
Tiller leaf blade width (mm)	TLW	7.82	7.10	6.11	6.61	7.37	6.78	7.39	5.80	6.93	7.19	7.23	7.11	5.61	5.33	6.75	6.54	7.20	*0.89*
Tiller leaf blade L:W ratio	TLW	9.66	9.62	10.94	13.41	10.56	8.83	9.66	8.26	10.61	10.67	10.54	11.20	8.84	7.28	12.08	8.86	11.91	*2.22*

4. Wear

Introduction

Soft leaf buffalo grass cultivars (St Augustinegrass - *Stenotaphrum secundatum*) have been subjected to minimal evaluation of their wear tolerance levels. In Australia, the current knowledge bank in this area is primarily 'anecdotal' and in the majority of cases derived from sources that have a vested interest in the individual cultivars.

Wear tolerance and recovery are important factors for consumers considering the selection of a particular buffalo grass cultivar for their particular situation. There is an expectation that given the particular circumstances, the buffalo grass cultivar selected will have a moderate to high wear tolerance resulting in continual satisfactory 'turf' appearance.

This experiment was designed to evaluate the tolerance of a number of buffalo grass cultivars to wear and their recovery time from the wear imposed. Wear was imposed in a manner that was believed to simulate the wear experienced by lawns in a domestic situation e.g. children playing, pets, general foot traffic, postal deliveries etc. Two simulated wear trials were undertaken in May and August 2008 to assess the performance of 14 buffalo cultivars for wear tolerance and compare them with the wear tolerance of other commercially available turf species.

Materials and Methods

This experiment was conducted at Redlands Research Station (27º32'S lat, 153º15'E long, 25 m above sea level), QLD on a fertile red volcanic ferrosol (Isbell 2002). The experimental area was situated under a shade structure that provided 50% shading. The site was maintained under industry standard practices (fertiliser, irrigation and pest and disease control) and mown regularly (35 mm) to simulate a home garden situation.

The experiment was a completely randomised block design incorporating 14 buffalo grass cultivars (Amerishade, King's Pride, Matilda, "old style" Sydney, Palmetto, Sapphire, Shademaster, Sir James, Sir Walter, ST-26, ST-85, ST-91 and Jabiru), sweet smother (*Dactyloctenium australe*), a green couch grass cultivar (*Cynodon dactylon* (L.) Pers cv. "Wintergreen") and one kikuyu grass cultivar (*Pennisetum clandestinum* cv. RK-19) with 4 replications. Individual plots were 3.0 x 0.75 m.

The planting of the trial site occurred over a period of 5 months from 11 Jan 2007 to 11 May 2007 as a result of the inconsistent availability of cultivars. All cultivars except for the ""old style"" Sydney buffalo were planted as full sod between January and March. The availability of this cultivar was limited and was not planted until 11th May 2009. Due to the slow growth and consequently delayed establishment of this cultivar the trial site was not completely establish until late December 2007.

Due to a lack of knowledge regarding the level of wear that could be safely imposed on buffalo grasses, excessive wear treatments (a single treatment of 15 passes per plot) in the initial stages resulted in severe damage (>60% bare ground and 50-80% leaf loss) to the plots (22nd Feb 2008). This regime was stopped and the plots were allowed to recover to a stage where the wear could be imposed again and Trial 1 commenced. Consequently, a single wear treatment of 6 passes per plot was selected as the wear component for future evaluation. The wear was applied with a modified Brinkman Traffic Simulator (Plate 4.1) as a 1.2 m strip resulting in a 1.2 x 0.75 m wear treatment sub-plot. This treatment was compared to an untreated control providing a non-wear comparison.

Trial 1 consisted of the wear treatment being applied to each plot three times a week (Monday, Wednesday and Friday) commencing the week of 5th May 2009. This continued for a period of four weeks.

The results of Trial 1 in regard to the intensity of the wear imposed led to a rethinking of the wear strategy for Trial 2. Consequently, wear was imposed on Trial 2 twice weekly (Tuesday and Friday) for a period of 9 weeks commencing 5th August 2008. Heavy rain during the week commencing 16th September 2008 (Week 7) resulted in no wear being imposed or visual turf quality assessments being undertaken for that week only.

Visual assessments of turf quality (0-9, 0=worst and 9=best with >=6 being acceptable) were made on a weekly basis by two independent assessors in the worn and control plots for both trials. Visual assessments of the percentage of bare ground in the worn plots were made for Trial 2 only on a weekly basis from week 2.

All data was analysed via the standard Analysis of Variance (ANOVA) using Genstat 11th Ed. (2008). Comparisons of means were made using Fischer's protected Least Significant Difference at a 5% (p=0.05) probability level. Line graphs were constructed using SigmaPlot for Windows Version 5.1.

Plate 4.1. Self-propelled modified Brinkman Traffic Simulator for applying simulated turfgrass wear.

Results

Trial 1 May 2009

Visual turf quality ratings for Trial 1 are presented in Figure 4.1.

For turf quality, after one week of wear treatments the "old style" Sydney buffalo displayed significantly ($p<0.05$) less tolerance than for all other buffalo grass cultivars (Plate 4.2(a)). This cultivar continued to display a tolerance to wear that remained the lowest according to the comparative

measurements taken of all buffalo grass cultivars for the duration of the trial. Similar levels of wear were recorded for the three non-buffalo grasses throughout the trial.

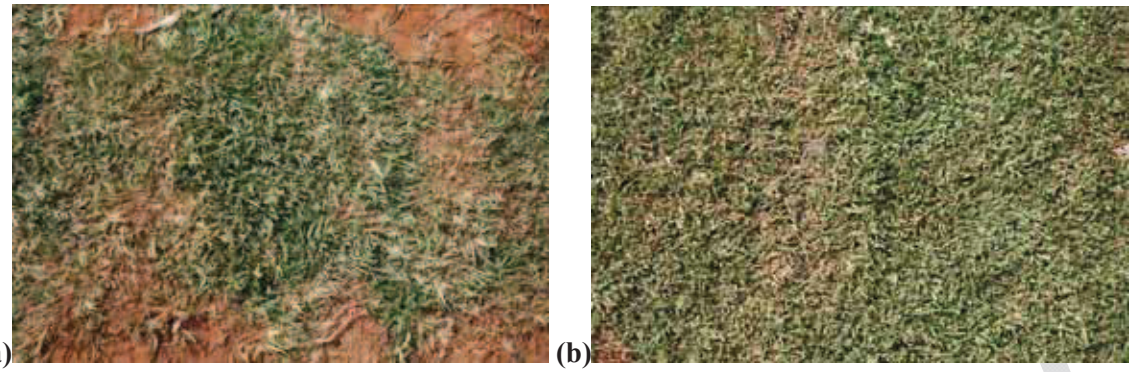


Plate 4.2. Quality of "old style" Sydney buffalo grass (a) and Jabiru (b) after three wear treatments imposed during the week commencing 5th May 2008.

Plate 4.3. Turfgrass quality of eight buffalo grass cultivars after two weeks of wear treatments imposed during May 2008 at Redlands Research Station.

Turf quality for all cultivars was below an acceptable level (< 6.0) until week 6 when Matilda, Sir James and Amerishade and King's Pride recovered to an acceptable level. The cultivars Shademaster, Palmetto, ST-26 and ST-91 had not fully recovered to an acceptable turf quality level until week 12, eight weeks after the wear treatments were finalised. "Old style" Sydney buffalo grass had not fully recovered from the wear treatments until well after the completion of the trial.

Trial 2 August 2009

Visual turf quality ratings for Trial 2 are presented in Figure 4.2.

At each assessment date for Trial 2 there were no significant ($p<0.05$) differences in turf quality among the cultivars Matilda, King's Pride, Shademaster, Sir Walter, Sir James and Jabiru. As was noted in Trial 1, "old style" Sydney buffalo grass was significantly ($p<0.05$) less tolerant of wear than all the other buffalo grass cultivars for the duration of Trial 2.

Matilda, King's Pride, Sir Walter and Shademaster had improved in turf quality to an acceptable level (> 6.0) by week 9. By week 11 the cultivars Sir James, TF01, Amerishade and ST-85 had also improved in quality to an acceptable level. The remainder of the buffalo grass cultivars except "old style" Sydney were of an acceptable quality by week 13, four weeks after the cessation of the wear treatments.

Visual assessment of percentage bare ground is presented in Table 4.1. The percentage of bare ground did not reach 10% or more for any of the buffalo grass cultivars except "old style" Sydney (week 3 – 10%) and the non-buffalo grass cultivars (Kikuyu – Week 2, 11.3%) until week 9. With the exception of "old style" Sydney, the cultivars Sapphire, ST-26 and ST-91 had the greatest reduction in ground cover at weeks 9, 11 and 13. King's Pride and Matilda had the lowest percentage of bare ground exposed as a result of the imposed wear for the duration of the trial.

Table 4.1. Percentages of bare ground determined visually for turfgrass species that have undergone wear treatments in August 2008 at Redlands Research Station.

	Week of Assessment										
Cultivar	2	3	4	5	6	7*	8	9	11	13	14
Palmetto	0.0	1.3	0.0	0.0	1.5		7.5	6.2	7.5	2.5	0.0
Amerishade	0.0	2.5	0.0	0.0	1.3		7.5	8.8	7.5	7.5	0.0
Sir James	2.5	1.3	1.3	1.3	1.5		3.8	3.8	5.7	3.8	0.0
King's Pride	0.0	0.0	0.0	0.0	0.0		3.8	1.2	0.0	0.0	0.0
Matilda	0.0	0.0	0.0	0.0	0.0		1.2	0.0	0.0	0.0	0.0
"old style" Sydney	3.8	10.0	18.8	12.5	20.5		40.0	52.5	51.2	42.5	40.0
Kikuyu	11.3	22.5	21.3	11.3	20.3		42.5	52.5	46.2	26.2	3.8
Sapphire	1.3	1.3	2.5	2.5	3.0		8.8	12.5	12.5	6.2	1.3
Shademaster	0.0	0.0	0.0	0.0	0.0		3.7	2.5	2.5	3.8	0.0
ST-26	1.3	1.3	0.0	1.3	1.5		6.9	10.0	13.7	10.0	0.5
ST-85	0.0	0.0	0.0	0.0	0.0		5.0	6.2	7.5	6.2	0.0
ST-91	2.5	1.3	2.5	5.0	5.0		6.9	10.0	12.5	16.2	4.8
Sweet Smother	5.0	10.0	2.5	10.0	18.3		45.0	42.5	52.5	35.0	4.3
Jabiru	0.0	1.3	1.3	1.3	1.5		3.8	3.8	2.5	2.5	1.3
Sir Walter	0.0	0.0	0.0	0.0	0.0		7.1	2.5	3.7	2.5	0.5
Wintergreen	3.8	10.0	30.0	15.0	20.2		50.0	57.5	63.8	26.2	5.0
LSD (p=0.05)	*5.2*	*9.6*	*8.7*	*5.2*	*8.6*		*13.4*	*12.0*	*12.8*	*12.6*	*5.7*

* No assessments due to wet weather.

AS CAN BE SEEN ABOVE 'MATILDA' WAS ALMOST COMPLETLY UN-EFFECTED BY THE WEAR TREATMENTS

Table 6.2. Total clippings produced (g/m^2) by 12 buffalo grass genotypes irrigated at 80%, 50% or 33% replacement of net evaporation, for 98 days in plots at Shenton Park, Western Australia (Summer of 2007/08). Plots were mown weekly at 25 mm.

Genotype	Clippings produced at 80% replacement (CONTROL) (g dry mass/m^2)	Clippings produced at 50% replacement (% of CONTROL)	Clippings produced at 33% replacement (% of CONTROL)
Common	59 ± 5	93 ± 14	65 ± 3
GP22	202 ± 15	99 ± 5	63 ± 6
Matilda	195 ± 14	104 ± 4	72 ± 6
Palmetto	148 ± 12	82 ± 7	17 ± 3
Sapphire	149 ± 22	82 ± 2	47 ± 3
Shademaster	145 ± 22	104 ± 2	45 ± 7
Sir James	125 ± 2	93 ± 6	52 ± 6
Sir Walter	203 ± 14	91 ± 7	54 ± 5
ST-26	123 ± 16	107 ± 3	65 ± 11
ST-91	30 ± 7	46 ± 6	29 ± 1
Jabiru	188 ± 26	99 ± 10	56 ± 2
Velvet	83 ± 22	33 ± 7	9 ± 1
Mean	138	86%	48%
LSD (p=0.05)	*33.3*	*not applicable*	*not applicable*

AFTER 98 DAYS OF 33% REPLACEMENT OF WATER MATILDA STILL MANAGED TO PRODUCE 72% OF ITS CONTROL GROWTH, GIVING IT THE HIGHEST DROUGH TOLLERANCE IN THIS TEST

Table 6.3. Total clippings produced (g/m^2) by 12 buffalo grass genotypes during 28 days of recovery (irrigated daily at 80% replacement of net evaporation) following 98 days of irrigation at 80%, 50% or 33% replacement of net evaporation, in plots at Shenton Park, Western Australia (summer of 2007/08). Plots were mown weekly at 25 mm.

Genotype	Clippings produced at 80% replacement (CONTROL) (g dry mass/m^2)	Clippings produced following 98 days of 50% replacement (% of CONTROL)	Clippings produced following 98 days of 33% replacement (% of CONTROL)
Common	9.2 ± 1.4	161 ± 34	141 ± 9
GP22	18.3 ± 1.8	134 ± 6	70 ± 15
Matilda	18.9 ± 3.0	110 ± 13	102 ± 22
Palmetto	11.0 ± 2.0	97 ± 13	142 ± 52
Sapphire	17.5 ± 3.2	112 ± 15	49 ± 4
Shademaster	12.3 ± 2.2	88 ± 17	63 ± 11
Sir James	9.1 ± 0.8	95 ± 10	76 ± 11
Sir Walter	23.2 ± 2.6	106 ± 9	39 ± 6
ST-26	10.8 ± 2.0	100 ± 6	94 ± 10
ST-91	4.5 ± 1.3	117 ± 27	80 ± 30
Jabiru	17.6 ± 3.0	101 ± 14	99 ± 14
Velvet	10.2 ± 2.5	122 ± 30	54 ± 18
Mean	13.6	112%	84%
LSD (p=0.05)	*6.4*	*not applicable*	*not applicable*

AFTER THE 98 DAYS OF 33% REPLACEMENT, THE WATER WAS INCREASED TO 80%, 'MATILDA' MAINTAINED A STEADY GROWTH PATTERN REGARDLESS OF THE WATER APPLIED, 'MATILDA' MAINTAINED A RATE AROUND ITS NORMAL GROWTH, ONE OF THE LEAST EFFECTED CULTIVARS BY THE LACK OF WATER.

Thatch (i.e. height of thatch plus shoots immediately after mowing) in the various genotypes was also measured on 4th December 2007, near the end of the experiment. Thatch height of the soft-leaf buffalo grass genotypes ranged from 22 to 30 mm (data not shown), and this was comparable with 26 mm in common old-style buffalo grass and 24 mm in Wintergreen couch grass.

Table 6.8. Comparison of summer vs. winter colour (Hue angle measured using a chromameter) of 15 buffalo grass genotypes and Wintergreen couch grass. Measurements were taken during summer (February 2007) and winter (July 2007) for plots on a soil with pH of 7.5-7.9 at the Wembley Golf Course, Western Australia. Values are means ± standard errors (n = 3).

Genotype	Summer Hue Angle (°)	Winter Hue Angle (°)	Change indicating winter decline (i.e. winter – summer)
Common	116 ± 1.1	108 ± 1.4	- 7.9
GP22	114 ± 1.4	107 ± 1.1	- 5.6
Matilda	117 ± 1.0	109 ± 2.9	- 7.7
MR52	117 ± 0.3	97 ± 2.5	- 19.9
Palmetto	114 ± 1.3	101 ± 4.0	- 13.2
Sapphire	118 ± 1.0	111 ± 3.4	- 7.0
Shademaster	112 ± 1.0	98 ± 3.0	- 14.8
Sir James	119 ± 1.3	109 ± 1.4	- 9.9
Sir Walter	114 ± 1.8	106 ± 4.3	- 8.5
ST-26	117 ± 2.0	105 ± 0.4	- 12.6
ST-85	116 ± 1.7	92 ± 3.3	- 24.2
ST-91	115 ± 1.5	97 ± 0.3	- 17.6
ST-135	115 ± 1.1	98 ± 2.7	- 16.8
Jabiru	117 ± 1.3	111 ± 1.9	- 6.6
Velvet	116 ± 1.5	92 ± 2.4	- 24.0
Wintergreen (couch)	119 ± 0.3	113 ± 2.2	- 5.5
Mean (buffalo grass)	116	103	- 13.3
LSD (p=0.05) (genotype x season)	*5.9*	*5.9*	*8.4*

COMPARED TO 'PAL,ETTO' AND 'SIR WALTER', 'MATILDA' ONLY CHANGED COLOUR BY 7.7% IN THE WINTER MONTHS
PALMETTO DECLINED BY 13.2%
SIR WALTER DECLINED BY 8.5%

Discussion

This research addressed two main research objectives of the Australian Turfgrass Industry, as related to soft-leaf buffalo grass: (i) to determine the rates of water use (i.e. evapotranspiration, ET) and responses to declining irrigation for a range of genotypes, as compared with old-style common buffalo grass; (ii) to evaluate for diversity amongst genotypes of soft-leaf buffalo grass for performance on a soil of moderately high pH. As soft-leaf buffalo grass is a popular amenity turfgrass in many regions of Australia, information on water use and performance on a soil of moderately high pH will benefit the industry by providing the base-line data needed for best practices in irrigation and will also contribute to a better understanding of micronutrient acquisition in a difficult soil type.

In addition to these two main themes, another finding of interest will be the differences amongst genotypes for growth declines during the cooler winter months (Table 6.7), as this characteristic might be of importance during times of limited water availability, if grasses need to recover quickly during cool, winter-wet periods.

Irrigation requirements and turfgrass evapotranspiration (ET)

Restrictions in water availability in many regions of Australia have focused attention on water conservation in all sectors, including turfgrass management. Optimal irrigation scheduling requires

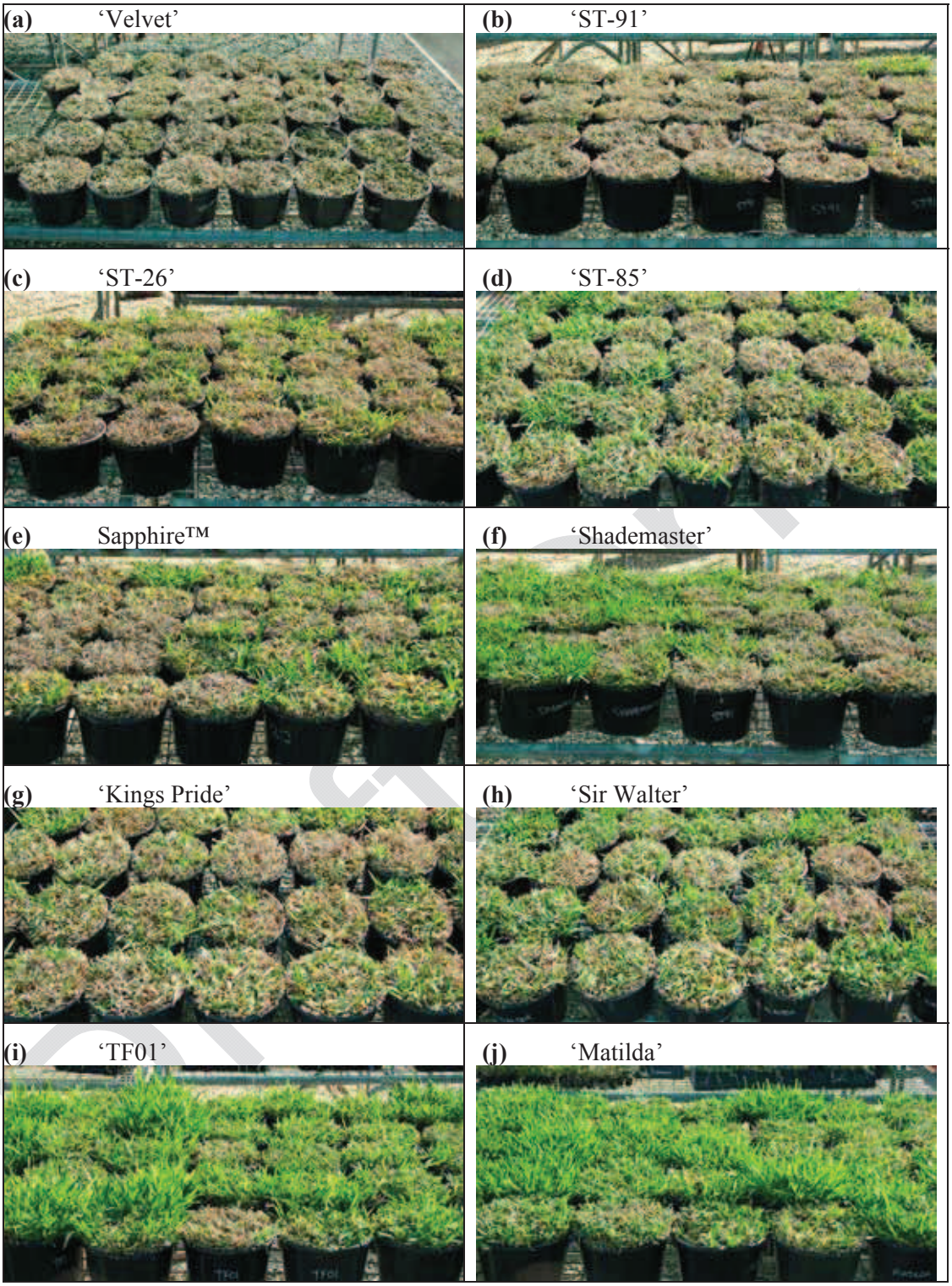


Plate 8.14. Effects of *Gaeumannomyces wongoonoo* on buffalo grass pots to be used for the shade trial at Redlands Research Station, showing apparent cultivar differences in disease tolerance arranged in approximate order of decreasing disease severity from (a) to (j) (May 2007).

MATILDA WAS THE LEAST AFFECTED BY VARIOUS DISEASES THAT WERE APPLIED

BELOW: COPIES OF THE TABLES USED AT VARIOUS SITES TO COMPARE MATILDA, SIR WALTER AND PALMETTO, MATILDA CONSISTENTLY HAD THE HIGHEST AVERAGE QUALITY AND COLOUR SCORES.

Table 8.3. Turf quality ratings for Richmond sun site (0=worst, 9=best).

Cultivar	31-Jan-07	1-May-07	14-Aug-08	20-Nov-07	26-Feb-08	3-Jun-08	avg	
Kings Pride	6.2	7.1	6.8	7.8	6.9	6.9		
Matilda	6.6	7.1	6.8	7.7	7.1	6.4	6.95	1
Palmetto	5.9	6.4	6.3	7.8	7.0	6.7	6.68	3
Sapphire	4.9	6.0	6.0	7.6	6.8	5.8		
Shademaster	6.1	6.7	6.5	7.7	6.9	6.6		
Sir James	5.9	6.9	6.7	7.8	7.1	7.2		
Sir Walter	6.0	6.7	6.3	7.8	6.8	6.8	6.73	2
ST-26	5.8	6.8	6.7	7.5	6.3	6.8		
ST-85	6.3	6.7	6.2	7.8	7.3	6.6		
ST-91	5.5	6.3	6.8	7.8	7.6	7.3		
ST-135	5.4	6.0	6.3	7.9	7.3	7.3		
TF01	6.4	7.2	6.7	7.8	7.0	6.3		
Velvet	6.4	6.6	6.7	7.8	7.1	6.8		
Amerishade	5.7	7.2	6.8	8.0	7.7	6.9		
Wintergreen	5.7	6.8	6.2	6.9	5.3	5.0		
RK-19	4.9	6.3	6.2	7.4	5.1	4.9		
LSD (p=0.05)	*0.7*	*0.6*	*0.6*	*0.4*	*0.5*	*0.9*		

Table 8.23. Turf colour ratings for Springfield Lakes sun site (0=worst, 9=best).

Cultivar	10-May-07	28-Aug-07	7-Dec-07	11-Mar-08	26-Jun-08	24-Sep- 08	9-Dec-08
Kings Pride	5.8	5.4	6.4	5.5	4.7	5.1	6.4
Matilda	5.5	5.4	7.1	5.9	4.3	5.3	5.5
Palmetto	5.0	5.2	7.2	5.8	3.8	4.7	5.0
RK-19	3.7	6.0	7.7	4.3	5.7	5.1	3.3
Sapphire	5.8	5.0	6.8	5.6	4.3	5.1	5.4
Shademaster	5.5	4.6	7.3	6.2	3.9	5.0	6.3
Sir James	5.7	4.7	6.4	5.4	4.7	5.4	5.2
Sir Walter	6.0	4.4	6.1	5.8	4.2	5.1	5.5
ST-26	4.5	4.7	6.6	5.9	4.1	5.4	4.4
ST-85	5.1	4.8	8.0	5.8	4.1	5.8	5.6
ST-91	4.3	4.3	6.7	5.4	4.1	5.4	5.4
ST-135	5.0	3.2	5.6	5.3	3.2	4.9	4.3
TF01	5.5	4.9	6.0	5.3	4.2	4.9	5.5
Velvet	4.7	4.2	7.3	5.9	3.8	5.2	5.0
Amerishade	4.7	4.4	7.2	5.9	3.8	5.3	5.0
Wintergreen	5.3	3.6	7.4	4.9	4.2	4.8	3.3
LSD (p=0.05)	*1.2*	*1.1*	*1.2*	*0.9*	*0.9*	*0.9*	*1.2*

avg
5.57 1
5.24 3
5.30 2

Table 8.24. Turf quality ratings for Springfield Lakes sun site (0=worst, 9=best).

Cultivar	10-May-07	28-Aug-07	7-Dec-07	11-Mar-08	26-Jun-08	24-Sep- 08	9-Dec-08
Kings Pride	5.3	5.3	6.7	6.3	6.3	6.0	5.9
Matilda	5.5	5.6	7.0	6.3	6.1	5.9	5.3
Palmetto	5.0	4.7	7.0	6.5	6.4	5.8	5.1
RK-19	3.5	4.0	6.4	4.0	4.1	2.9	2.2
Sapphire	5.7	5.2	6.8	6.3	5.9	5.8	5.1
Shademaster	5.5	4.9	7.3	6.7	6.5	6.0	6.1
Sir James	5.5	4.9	6.6	6.3	6.5	6.6	5.2
Sir Walter	5.8	5.1	6.3	6.3	6.2	5.7	5.3
ST-26	4.7	4.9	6.6	6.3	5.7	5.8	4.3
ST-85	4.7	4.5	7.7	6.6	6.8	6.5	5.3
ST-91	4.3	3.1	6.0	6.1	6.1	6.4	4.9
ST-135	4.8	3.2	5.3	5.8	5.6	5.1	3.8
TF01	5.7	4.9	6.4	6.1	5.8	5.7	5.1
Velvet	4.8	3.7	6.8	6.0	6.7	6.2	4.8
Amerishade	4.7	4.5	6.6	6.3	5.8	6.1	4.7
Wintergreen	5.3	4.7	7.3	4.8	4.8	3.4	2.7
LSD (p=0.05)	*1.2*	*1.0*	*1.0*	*0.7*	*0.9*	*0.6*	*1.0*

avg
5.96 1
5.78 3
5.81 2

Table 8.30. Turf quality ratings for Redlands sun site (0=worst, 9=best).

Cultivar	30-Apr-07	5-Sep-07	20-Nov-07	20-Mar-08	5-Jun-08	24-Sep-08	20-Dec-08	30-Mar-09
Kings Pride	-	2.1	7.3	7.7	7.6	8.5	6.8	7.0
Matilda	6.7	6.8	6.8	7.9	7.3	8.5	7.2	7.0
Palmetto	6.8	6.7	6.8	7.3	6.9	7.7	6.4	7.7
Sapphire	6.8	7.3	6.9	7.5	7.0	8.3	6.1	7.0
Shademaster	6.3	6.5	7.1	7.3	7.0	7.3	6.3	7.7
Sir James	6.5	7.2	7.0	7.2	6.9	8.5	6.7	8.0
Sir Walter	6.7	7.2	6.7	7.3	7.1	8.0	6.8	7.3
ST-26	7.0	6.6	6.7	7.1	6.5	7.3	6.2	6.8
ST-85	7.0	7.4	7.9	7.6	7.3	8.3	7.2	7.3
ST-91	7.2	7.1	7.7	7.6	7.5	8.3	6.8	7.5
ST-135	6.7	7.3	7.9	7.3	7.2	7.8	6.6	7.5
TF01	6.8	6.8	6.8	7.3	7.1	8.2	6.3	6.7
Amerishade	6.8	7.1	7.8	7.4	7.2	8.2	7.0	7.2
Common	-	2.3	4.5	6.1	6.3	7.7	6.2	6.8
RK-19	5.7	6.6	5.4	6.1	5.4	6.8	4.9	5.8
Wintergreen	6.7	7.2	6.7	6.3	5.6	6.7	5.9	6.0
LSD (p=0.05)	*0.8*	*0.9*	*0.5*	*0.5*	*0.5*	*0.6*	*0.6*	*0.7*

7.28 1
7.04 3
7.14 2