29th Australian Turfgrass Conference

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Australian Golf Course Superintendents Association

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Conference Summary

Feedback received from the delegate survey indicates the 2013 Australian Turfgrass Conference was enjoyed and has been profitable to most of those who attended. The venue of Novotel Twin Waters Resort proved popular as delegates were accommodated on site with only a short work to the conference facilities in the main resort complex.

Keynote speakers Dr Thom Nikolai, Dr Geoff Allen, Dr Paul Barber and Sharon Kaibel certainly got their points across with feedback giving them all a high ranking. Other speakers who ranked highly were Jim Hull, John Neylan, Peter Semos and Terry Muir with the survey again showing that presentations by golf superintendents and sportsturf managers are always enjoyed with Pat Pauli, Ben Tilley, Shane Biddle and Colin Morrison rating highly.

Andrew Peart and Matt Roche both gave presentations on HAL funded research projects. TU11003 - Australian golf course benchmarking study – developing course quality objectives, has been completed. Andrew presented the final results of the study in the Golf Stream. The final report on the four year project TU08018 - Traffic Tolerance of Warm-Season Turfgrasses under Community Sportsfield Conditions was submitted in 2012. Researcher Matt Roche presented the findings in the sportsfield stream and the final report was made available to all by its publication in the conference proceedings.

As in previous years, we used the smaller conference to trial new ideas and concepts. The move of the AGCSA golf championship from an early Monday start to a Sunday afternoon tee off was well supported. This allowed for another full day of education to run on Monday. The choice of two, six hour workshops covering either agronomics or photography on the Monday were successful innovations and well supported by delegates.

Over the course of the four days of education the Australian Turfgrass Conference hosted sessions for not only golf and sportsfield delegates, but also had specialty streams for Golf Course Architects. An optional *'turf tour'* was offered on Friday that visited local clubs and facilities.

Holding a trade show opening on Tuesday night to bring it in line with the larger conference worked well. It gave delegates the opportunity to have quality time with trade companies before the show opened to the general public the following day. This enabled attendees to discuss innovations and new products in an environment where information rather than sales were the priority. The trade survey also showed this as a success with most trade companies agreeing the night was more of a talk/social occasion than any sales being done however they enjoyed the intimacy of the evening.

The three social events were of varying success. The welcome and dinner as usual were enjoyed by all with only a few complaints regarding the catering. The Hawkers market was enjoyed by those who attended however with such a busy programme many preferred to have a free night.

Over the course of the four days of education the Australian Turfgrass Conference hosted sessions for not only golf and sportsfield delegates, but also had specialty streams for Turf Technicians, Golf Course Architects and Town Planners and Facility General Managers. Another important component to the conference is the opportunity it gives for national groups to conduct meetings. During breaks in the conference schedule the AGCSA was able to host and facilitate the following meetings:

- National Turf Education Working Group
- National Executive of the Sports Turf Association (STA)
- State Superintendents National Meeting
- Society of Australian Golf Course Architects (SAGCA) AGM.
- AGCSA Annual General Meeting

Outcomes

DELEGATE LIST

Of the 317 delegates in attendance;

Golf course superintendents and staff	210	or 66.2%
Sports field grounds managers	79	or 25.0%
AGIC/Architects	28	or 8.8%

Full delegates list is attached.

KEY OUTCOMES

Lessons Learnt and Observations

1. Must give delegates at least one free evening to relax and do their own thing.

2. Resort location was very popular. It kept everyone together and sessions were all well attended as no transport was necessary.

3. Large transitioning of older more experienced workers leaving the manual work and working as consultants or sales reps.

4. Delegates are looking for lighter, healthier meals.

Forward Planning

1. Given a new wave of younger people taking over management roles, some of the purely agronomic talks and content need to be reintroduced given the new audience.

2. Hands on, practical training gives a balance to sitting for long periods listening to speakers

Other

Conference Programme
See attached

Conference Proceedings
Hard Copy enclosed, electronic pdf attached to report submission.

Session Recordings
All sessions can be viewed at
http://www.bizviz.co.nz/Mediasite/Catalog/catalogs/turfgrass2013

Evaluation – Survey Results

The online survey tool has continued to be a success. Of the 251 delegates that supplied their email address 70.5% (177) responded. Below is a sample of the survey feedback and results.

Please add your comment on any of the speakers and/or topics covered at this conference.
Dr Thom Nikolai adds some interesting humor to the conference, excellent speaker (10)
Geoff Allen - Health aspects are really important. Saron Kaibel - Continually puts her points across in a practical and fun way. John Neylan, Tom Nikolai and Andrew Peart are always full of good content and relavent information.
good speakers topics on WH&S were good but probably too much emphasis on it. good topic on grinding
Good to see quite a bit of relevance to warm season grass
Jim Hull was the best and most interesting topic
Pat Pauli Horton Park update.
Really liked both john neylan on cover your arse tom nikolai a fantastic effort to keep me interested over 6 hours on the Monday
The diversity of topics and quality of speakers was great. Sharon Kaibel was a standout.
the tree veg talks were a bit long. Col Morrison talk was a stand out on how it can be done.

Please suggest any speakers you would like to see present at future conferences.
A forum of educaters from across the country which would allow empolyers a chance to understand what it apprentices are being taught, and allow for future study ie Dipolma.
a public relations person who can teach supers to respond to situations; not to react and get themselves into more trouble.
Any New Zealand or English Superintendent or Tournament Director, maybe even a golfer to give a perspective of what the profesionals expect/love or hate
Dr Micah Woods Bill Brown, CEO of Turf Republic, Founder of iTurf Apps @iturfapps. John Kaminski, Ph.D. Agsafe APVMA EPA
Frank Rossi
Jim Hull giving more scientific review of the many turf products we are bombarded with every year.
Keep up the diversity
Sports field construction and drainage specialists. Soil/profile specialists.
Sportsfield section needs more speakers in charge of major sport facilities and maybe a guest speaking well know in the sports field area world wide.
while at the confrence i spoke and got told about many supers and there time in the industry.Maybe a veteran eg peter lonergan?? whos career spands over some great courses in different states would be a good topic. a topic like my life in the industry

Do you have any further comments or suggestions?
Small workshops/talks on the trade show floor that only go for around 15mins with seating for only 20 people, like they do in the US (3)
Over all i thought the conference was good, good speakers, good topics, well catered for with good food, and a good attendance.. Well Done.(5)
live demos of machinery (3)
The venue and organisation was excellent for it being a smaller conference
If individuals are agreeable to have contact details available to enable networking oppurtunities.

1. Which area of the conference were you registered for?

	Response Percent	Response Count
Golf Stream	**76.3%**	**135**
Sportsfield Stream	23.7%	42

2. How would you rate the overall relevance of the conference topics to the challenges you face daily in your workplace?

	Response Percent	Response Count
Very relevant	36.7%	65
Relevant	**61.6%**	**109**
Irrelevant	1.7%	3

3. Were you satisfied with the calibre and topics of the speakers?

	Response Percent	Response Count
Very Satisfied	35.0%	62
Satisfied	**60.5%**	**107**
Dissatisfied	4.5%	8

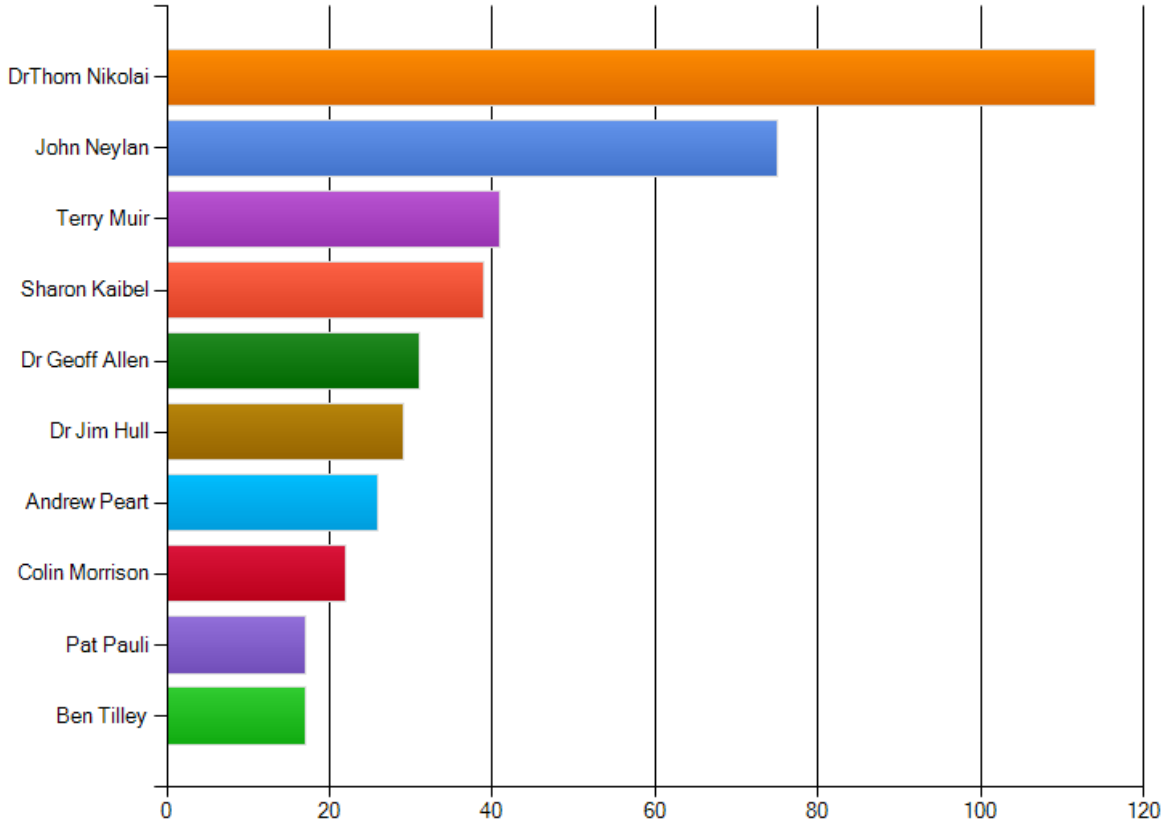
4. Please give your overall rating of the 29th Australian Turfgrass Conference

	Response Percent	Response Count
Adequate	5.6%	10
Good	32.2%	57
Excellent	**54.2%**	**96**
Outstanding	7.9%	14

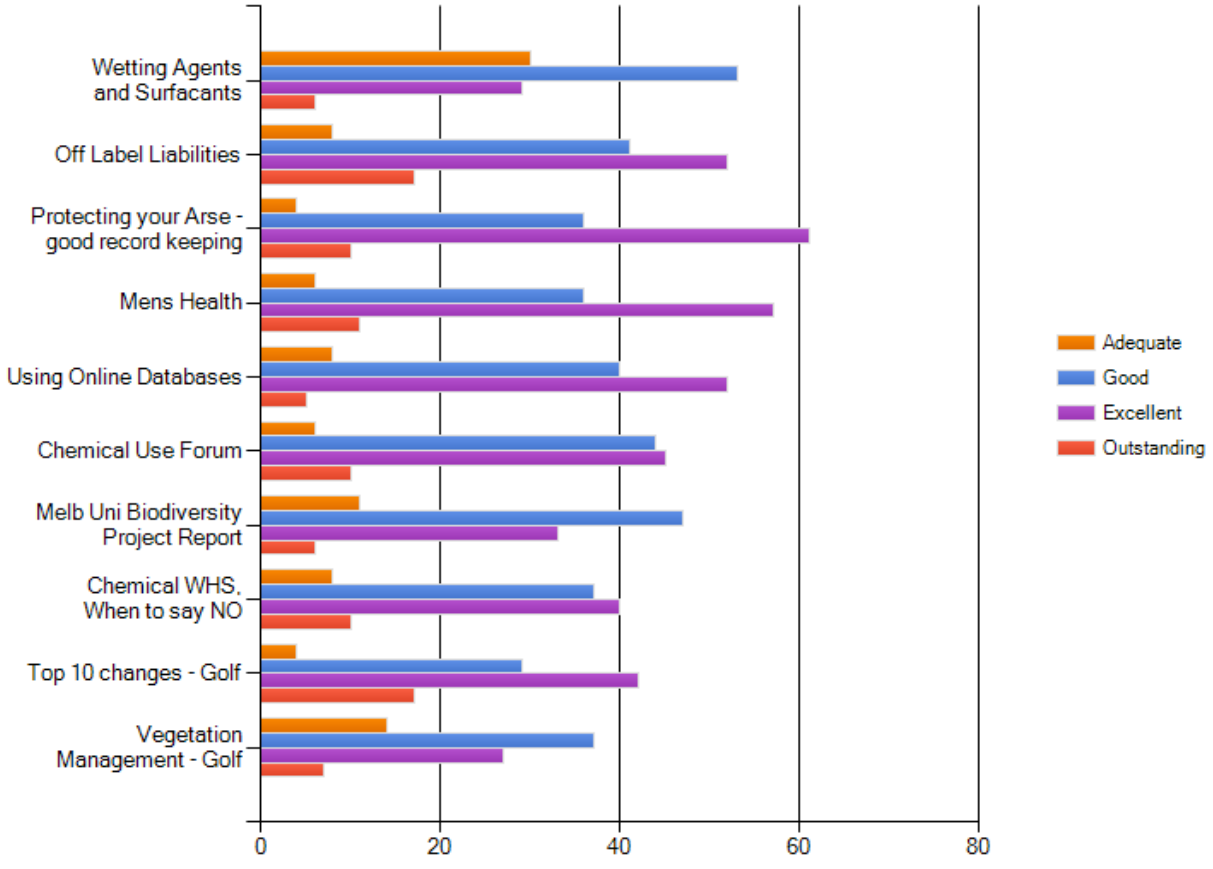
5. Please rate the quality of speakers and content at the 29th Australian Turfgrass Conference.

	Adequate	Good	Excellent	Outstanding	Rating Average	Rating Count
Speakers	5.4% (9)	36.3% (61)	**53.0% (89)**	5.4% (9)	2.58	168
Topics	10.0% (16)	**43.1% (69)**	41.9% (67)	5.0% (8)	2.42	160
Content	8.3% (13)	**47.8% (75)**	39.5% (62)	4.5% (7)	2.40	157

Top 10 Conference Speakers



Top 10 Conference Topics



Programme

SUN	SUNDAY 23rd June		
Registration Foyer 2.00-4.00pm			
	12.00 - 4.30	4.30 - 5.30	5.30 - 8.00
	AGCSA Golf C'ships	Pre Dinner Drink and Canapes	Toro Golf Dinner

MON	MONDAY 24th June			
AGCSA Jacobsen Workshops	All Day 11.00 - 4.30 (Lunch @ 12.30)	12.30 - 1.30	All Day 9.30 - 4.00 (Lunch @ 12.30)	7:30 - 10:00
	Gary Lisbon		Dr Thom Nikolai	
	How to photograph your golf course.	Lunch	" Balancing Budgets, Turfgrass Health and Customer Satisfaction"	Welcome Reception

TUESDAY	TUESDAY 25th June										
Plenary	8.30 - 9.10	9.10 - 9.50	9.50 - 10.30	10.30 - 11.00	11.00 - 12.30	12.30 - 1.00	1.00 - 2.00	2.00 - 2.40	2.40 - 4.00	4.00- 5.00	7:00 - 9.00
Mudjimba Rooms	Dr Geoff Allen	John Illingworth	John Neylan		Dr S Livesley and Dr Caragh Threlfall	Education and Awards		Terry Muir	Tilley, Prosser & Bernhard		
	Men's Health	Wetting Agents and surfactants	Using online databases to research turf problems	Morning Tea	Melbourne University Golf Course and Parkland biodiversity project report	Short Talk on TAFE Education and Training by Bruce Davies followed by Award Announcements by Peter Lonergan	Lunch	Off Label Liabilities	Chemical Use Forum	Trade Opening	Hawker Beach Market Night

WEDNESDAY	WEDNESDAY 26th June											
Golf	8.30 - 9.10	9.10 - 9.50	9.50 - 10.30	10.30-11.00	11.00 - 12.30			12.30 - 2.00	2.00 - 3.00	3.00 - 5.30	3.15 - 4.15	6.00 - 9.00
Mudjimba Rooms	GA and PGA	Andrew Peart	Pat Pauli		Vegetation Management Workshop — Paul Barber, Darren Wilson and Adam Robertson				Dr Thom Nikolai			
	Stephen Pitt and Brian Thorburn discuss the State of golf in Australia	AGCSA Benchmarking Outcomes	The Horton Park Saga	Morning Tea	Environmental and Arborcultural contsultant Paul Barber will look at ways to manage and audit vegetation on your course. Darren and Adam will give case studies on the management methods they use.			Lunch Trade Show	The Top 10 Changes in Golf Course Maintenance in the past 25 years	Trade Show	A.G.C.S.A. A.G.M	Toro Pub
Sportsfield	8.30- 9.15	9.15 - 10.00		10.00 - 10.30	10.30 - 11.10	11.10 - 11.50	11.50 - 12.30	12.30 - 2.00	2.00 - 3.30	3.30 - 5.30	4.00 - 5.00	
Maroochy Room	Dr Thom Nikolai	Terry Muir			Matt Roche	John Neylan	Stephen Bernhard		Peter Semos			
	Environmental Stewardship in the Green Industry	Chemical WHS and Environmental Risk Management - When to say NO		Morning Tea	Traffic Tolerance of Warm-Season Turfgrass under Community Sportsfield Conditions	Protecting your ass! - The importance of good record keeping.	Healthier turf at a reduced cost	Lunch Trade Show	The Top 10 Changes in Sports Ground Management in the past 25 years	Trade Show	Prospsosed STA National Function	
AGIC/SAGCA	8.30 -				10.00 - 1.00			12.00 - 2.00	2.00 - 3.30 / 4.00 - 5.30			
Ninderry Room	AGIC and SAGCA members welcome to attend lectures and / or trade exhibition.				Australian Golf Industry Council (AGIC) executive meeting			SAGCA BBQ Lunch	SAGCA AGM / Afternoon Tea followed by Melbourne Uni. Briefing.			

THURSDAY	THURSDAY 27th June									
Golf Tasman	8.30 - 9.10	9.10 - 9.50	9.50 - 10.30	10.30 - 11.30	11.30 - 1.00			1.00 - 2.00	2.00 - 4.00	7.00-12.00
Mudjimba Rooms	Colin Morrison	John Neylan	Dr Jim Hull		Golf Course Management in Queensland				Human Resource Management	
					Ben Tilley	Dr Brett Morris	Robin Doodson		Sharon Kaibel	
	Working at Deere Run during John Deere Classic	Protecting your ass! - The importance of good record keeping.	Interpreting soil tests - How accurate are they?	Morning Tea	Warm Season Grasses	Management in the Tropicsl	Reconstruction	Lunch Trade Show	:Roles, Position Description & Staff Reviews. :Team discipline, morale & conflict resolution. :The importance of policies and procedures.	Presidents Dinner
Sportsfield	8.30 - 10.00		10-.00-10.30	10.30 - 11.30	11.30 - 1.00			1.00 - 2.00		
Maroochy Room	Sportsfield Management in QLD — Paul Sanson & Brendan Ott		Scott Roberts		Vegetation Management Workshop — Paul Barber, Nathan Tovey and Shane Biddle					
	Management techniques at Tony Ireland Stadium - Townsville, Toowoomba Grammar School		Touring the Sportsfields of N.Z.	Morning Tea	Environmental and Arborcultural contsultant Paul Barber will look at ways to manage and audit vegetation. Nathan and Shane will give case studies on the management methods they use.			Lunch Trade Show		

FRIDAY	FRIDAY 28th June		
	9.00 - 3.00		8.00 - 2.00
	Turf Tour		Education Meeting
	Venues still to be determined. Possible sites include Turf Farm, Racecourse, Pelican Waters Golf Club, Sockland Stadium, new Horton Park Site.		National Turf Education Working Group meeting including the presenting and endorsement of draft Cert IV delivery and assessment guides.

29th Australian Turfgrass Conference
Delegates List

Given Name	Surname	Organisation	State
Brad	Van Dam	ACT Cricket Association	ACT
John	Neylan	AGCSA / Neyturf	VIC
Kyle	Murray	Agro Invest Overseas Ltd	NSW
John	Quinn	Agro Invest Overseas Ltd	NSW
Shani	Waugh	ALPG	QLD
Alan	Chappell	AML Turf	NSW
Brett	Balloch	Anglesea Golf Club	VIC
John	McLachlan	Anglesea Golf Club Inc	VIC
Graeme	Logan	ANZ Stadium	NSW
Roopnarainsing	Gunness	Aquinas College	WA
Shaun	Williams	Aquinas College	WA
Brett	Woodward	Armidale Golf Club	NSW
Stuart	Hall	Asquith Golf Club	NSW
Peter	Blain	Australian Golf Club	NSW
Dave	Smith	Australian Golf Club	NSW
Troy	Richards	Australian Sports Commission	ACT
Matt	Roche	Australian Sports Turf Consultants	QLD
Gareth	Hammond	Avondale Golf Club	NSW
David	Warwick	Avondale Golf Club	NSW
Linc	Urquhart	Bagara GC	QLD
Jeff	Powell	Ballarat Golf Club	VIC
Phil	Hill	Barnbougle Dunes Golf Links	TAS
Stephen	Chapman	Barossa Valley Golf Club	SA
Michael	McMahon	Beerwah Golf Club	QLD
Dave	Ramage	Belconnen Magpies Golf Club	ACT
David	Buchanan	Belmont Golf Club	NSW
David	Thomson	Bermagui Country Club	NSW
Chris	Neal	Bonville Golf Resort	NSW
Mitch	Adair	Bribie Island Golf Club	QLD
John	Hagan	Brisbane North Institute of TAFE	QLD
Sean	Stuchbery	Bundaberg Golf Course	QLD
Doug	Rowe	Busselton Golf Club	WA
Steven	Kazurinsky	Cabramatta Golf Club	NSW
Wayne	Anderson	Caloundra Golf Club	QLD
Bruce	Davies	Canberra Institute of Technology	ACT
Garry	Dawson	Canberra Institute of Technology	ACT
Steven	Jacobsen	Carnarvon Golf Club	NSW
Martyn	Black	Castle Hill Country Club	NSW
John	Forrest	Challenger TAFE	WA
Matthew	Fealy	Charlestown Golf Club	NSW
Heath	Crawford	City of Boroondara	VIC
Danny	Edmunds	City Of Casey	VIC
Nigel	Fernando	City of Darebin	VIC
Jon	Halsall	City of Greater Geelong	VIC
Paul	Mofflin	City of Kalgoorlie-Boulder	WA
Hugh	Gardner	City of Swan	WA
Scott	Adams	Citywide Service Solutions	VIC
Troy	Muir	Club Pelican Golf	QLD
Justin	Sheehan	Coffs Harbour Golf Club	NSW

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Given Name	Surname	Organisation	State
Anthony	Toogood	Commercial Club	NSW
Thomas	Bickerdike	Commonwealth Golf Club	VIC
Steven	Bolt	Commonwealth Golf Club	VIC
Mark	Prosser	Commonwealth Golf Club	VIC
Lyne	Morrison	Consulting Golf	ACT
Peter	Lonergan	Coolangatta-Tweed Heads Golf Club	NSW
Kirsty	Herring	Cooroy Golf Club	QLD
Todd	McNamee	Coral Cove Golf Club	QLD
Darren	Harvey	Corowa Golf Club	NSW
Paul	Mogford	Crafter & Mogford Golf Strategies	VIC
Neil	Crafter	Crafter + Mogford Golf Strategies	SA
Greg	Marshall	Cronulla Golf Club	NSW
Merve	Hayward	Cypress Lakes Resort	NSW
Ben	Davey	Davey Shearer Golf Design	VIC
Brenten	Coulthard	Densal -Growling Frog Golf Course	VIC
Oliver	Norton	DLF Seeds	AUCKLAND
Martin	Formosa	Dunheved Golf Club	NSW
Charles	Dunlop	Duntryleague Golf Club	NSW
Ted	Parslow	E & G Parslow & Associates	KUALA LUMPUR
Jason	Winter	E&G Parslow and Associates	
Rodney	Waite	Easts Leisure and Golf	NSW
Travis	Scott	Eastwood Golf Club	VIC
Mark	Perham	Eden Park	NZ
Grant	Greenway	Endeavour Turf Products	VIC
Daniel	Sacco	Endeavour Turf Products	VIC
Jamie	Dawson	Enviro Links Design Pty Ltd	ACT
Chris	Haynes	Everglades Country Club	NSW
Gary	Day	Flagstaff Hill Golf & Country Club	SA
Colin	Morrison	Flinders Golf Club	VIC
Troy	Jordan	Forsyth Barr Stadium	OTAGO
Greg	Stevenson	Garangula Polo Club	NSW
Matthew	Hanrahan	Geelong Grammar School	VIC
Chad	Gilmour	Gladstone Golf Club	QLD
Daryl	Sellar	Glenelg Golf Club	SA
Roland	Curley	Glenorchy City Council	TAS
Peter	Semos	Global Turf Solutions Pty Ltd	QLD
Brett	Chivers	Globe Australia P/L	VIC
Graham	Papworth	GNP Golf Design Pty Limited	NSW
Scott	Harris	Gold Creek Country Club	ACT
Stephen	Pitt	Golf Australia	VIC
Gary	Lisbon	Golf Select	VIC
Craig	Coster	Graham Marsh Golf Design	QLD
David	Ireland	Graham Marsh Golf Design	QLD
David	Ireland	Graham Marsh Golf Design	QLD
Shaun	Gerring	Green Acres Golf Club	VIC
Mathew	Poultney	Green Acres Golf Club	VIC
David	Cole	GreenMakers Pty Ltd	VIC
Jesse	Bartlett	Guildford Leages Club	NSW
Ian	Elphick	Gunnedah Golf Club	NSW

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Given Name	Surname	Organisation	State
Harley	Kruse	Harrison & Kruse Golf Design	NSW
Damien	Murrell	Hawks Nest Golf Club	NSW
Brad	Beetson	Headland Golf Club	QLD
Mick	McCombe	Headland Golf Club	QLD
Ben	Tilley	Headland Golf Club	QLD
Jeremy	Mamet	Heritage Golf Club	MAURITIUS
Peter	Fraser	Hervey Bay Golf & Country Club	QLD
Nathan	Humphreys	HG Sports Turf	NSW
Jim	Porter	Holmesglen Institute of TAFE	VIC
Eric	Eller	Horticultural Training Pty Ltd	QLD
Pat	Pauli	Horton Park Golf Club	QLD
Paul	Irvine	Howlong Country Golf Club	NSW
Rodney	Ferry	Huntingdale Golf Club	VIC
Michael	Freeman	Huntingdale Golf Club	VIC
James	Hull	Independent Turfgrass Consulting	NSW
Duncan	Alexander	Indooroopilly Golf Club	QLD
Barbara	Conway	Indooroopilly Golf Club	QLD
Charlie	Giffard	Indooroopilly Golf Club	QLD
Joel	Leth	Indooroopilly Golf Club	QLD
James	Melville	Indooroopilly Golf Club	QLD
Luke	Nowlan	Indooroopilly Golf Club	QLD
Dane	Robertson	Indooroopilly Golf Club	QLD
Gerry	Charlton	IPOS Consulting	SA
Martyn	Hedley	John Paul College	QLD
Andy	Wood	Kauri Cliffs Golf Course	NORTHLAND
Jarryd	Graham	Kew Golf Club	VIC
Ryan	Fury	Killara Golf Club	NSW
Hayden	Mead	Kingston Heath Golf Club	VIC
Adam	Fry	Kooyonga Golf Club	SA
Ryan	Tracey	Landscape Solutions	QLD
Mark	Weitz	LAUCALA ISLAND RESORT	FIJI ISLANDS
Tony	Smith	Launceston Golf Club	TAS
Joshua	Straub	Lismore Workers Golf Club	NSW
Tony	Fogarty	Living Turf	NSW
Wayne	Ryder	Living Turf	NSW
David	Worrad	Living Turf	NSW
Simon	Brown	Long Reef Golf Club	NSW
Ben	Norton-Smith	Longyard Golf Club	NSW
Martin	O'Malley	Lynwood Country Club	NSW
Brian	McAtee	Maccas Sport Turf	QLD
Ryan	Markwell	Magenta Shores / Turnpoint	VIC
Grant	Vormister	Magnetic Island Golf Club	QLD
Michael	Bradbery	Manly Golf Club	NSW
Jason	Martin	Manly Golf Club	NSW
Mark	Scholes	Maribyrnong Council	VIC
John-Paul	Stewart	Marist College Ashgrove	QLD
Jon	Tait	Marist College Canberra	ACT
Jeremy	Cutajar	Maroondah City Council	VIC
Rob	Christie	Marysville Community Golf & Bowls Club	VIC

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Jacob	Freeman	McLeod Country Golf Club	QLD
Steve	Livesley	Melbourne University - Burnley	VIC
Caragh	Threlfall	Melbourne University - Burnley	VIC
Thomas	Nikolai	Michigan University	USA
Matthew	Clissold	Monash Country Club	NSW
Kyle	Wilson	Moonah Links	VIC
Andrew	Ryan	Mooroopna Golf Club	VIC
Nathan	Reynolds	Morisset Country Club	NSW
Kevin	Toebelman	Mornington Golf Club	VIC
Brent	Hull	Moruya Golf Club	NSW
Andrew	Schindler	Mowbray Golf Club	TAS
Rob	Kerr	Mt Coolum Golf Club	QLD
Craig	Gillin	Mt Gambier Golf Club	SA
Barry	Bryant	Mt Osmond Golf Club	SA
Jason	Seis	Mudgee Golf Club	NSW
Paul	Barber	Murdoch University	WA
Nick	Launer	Murray Downs Golf and Country Club	VIC
Brett	Mogg	Nelson & Haworth	QLD
Craig	Hitchcock	New Plymouth District Council	TARANAKI
Bill	Read	New Plymouth District Council	TARANAKI
David	Burton	New South Wales Golf Club	NSW
Gary	Dempsey	New South Wales Golf Club	NSW
Matthew	Goodbun	Newcastle Golf Club	NSW
John	Shannon	NMIT	VIC
Wayde	Leech	Noosa Springs	QLD
Malcolm	Harris	Northbridge Golf Club	NSW
Andy	Lowen	Nudgee College	QLD
Matthew	Steven	Oasis Turf	VIC
Shane	Heaney	Ocean Shores Country Club	QLD
Michael	Clayton	Ogilvy Clayton Pty Ltd	VIC
Michael	Cocking	Ogilvy Clayton Pty Ltd	VIC
Ashley	Mead	Ogilvy Clayton Pty Ltd	VIC
Paul	Reeves	Pacific Coast Design	VIC
Phil	Ryan	Pacific Coast Design	VIC
Andrew	Perrett	Pacific Dunes Golf Club	NSW
Zak	Darlington	Pacific Golf Club	QLD
Shaun	O'Leary	Pacific Golf Club	QLD
Kelvin	Nicholson	Pacific Harbour Golf & Country Club	QLD
Dean	Henderson	Palmer Coolum Resort	QLD
Graeme	Norvill	Parklands Turf Ltd	WAIKATO
David	Johnson	Patterson River Country Club	VIC
Angus	McPhedran	Pegasus Golf and Sports Club	N.Z.
Craig	Geeve	Pennant Hills Golf Club	NSW
Warren	Green	Peregian Springs Golf Club	QLD
Blake	Matthews	Peregian Springs Golf Club	QLD
Scott	Wilson	Peregian Springs Golf Club	QLD
Gavin	Kirkman	PGA Australia	VIC
Brian	Thorburn	PGA Australia	VIC
Steve	Brennan	Port Macquarie Golf Club	NSW

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Given Name	Surname	Organisation	State
Steven	Burchett	Portarlington Golf Club	VIC
Matee	Suntisawasdi	Procrop T & O Co., Ltd.	BANGKOK
Scott	Fogg	Queanbeyan Golf Club	ACT
Mathew	Hose	RACV Cape Schanck Resort	VIC
lincoln	Coombes	RACV Royal Pines Resort	QLD
John	Coulsell	RACV Torquay Golf Club	VIC
Peter	James	Redcliffe Golf Club	QLD
Max	Laverty	Redland Bay GC	QLD
Andrew	Johnson	Rich River Golf Club	VIC
Richard	Chamberlain	Richard Chambelain Golf Design	QLD
Dave	Mason	Riversdale Golf Club	VIC
Tim	Smart	Riversdale Golf Club	VIC
Richard	Moore	Riverside Golf Club	VIC
Dean	Bailey	Rosanna Golf Club	VIC
Mark	O'Sullivan	ROSEVILLE GOLF CLUB	NSW
Jason	Bushell	Rowes Bay Golf Club	QLD
Steven	King	Royal Agricultural Society of NSW	NSW
Terry	O'Keeffe	Royal Agricultural Society of NSW	NSW
Jody	Walker	Royal Auckland Golf Club	MANUKAU
Stephen	Eppelstun	Royal Canberra Golf Club	ACT
Luke	Jorgensen	Royal Canberra Golf Club	ACT
Andrew	Boyle	Royal Melbourne Golf Club	VIC
John	Mann	Royal Melbourne Golf Club	VIC
Michael	Dennis	Royal Perth Golf Club	WA
Luke	Bonner	Royal Queensland Golf Club	QLD
Adam	Mills	Royal Queensland Golf Club	QLD
Alistair	Dunn	Royal Sydney Golf Club	NSW
Chris	Hamer	Royal Sydney Golf Club	NSW
Adam	Marchant	Royal Sydney Golf Club	NSW
Steve	Marsden	Royal Sydney Golf Club	NSW
Damon	Quigley	Safety Beach Country Club	VIC
Robin	Doodson	Sanctuary Cove Golf and Country Club	QLD
Glenn	Gibson-Smith	Sanctuary Cove Golf and Country Club	QLD
Trevor	Ridge	Sawtell Golf Club.	NSW
Scott	Roberts	Sebastopol Bowling Club	VIC
Jon	McCarthy	SGS	QUEENSLAND
Dave	Cockshott	Shire of Broome	WA
Clint	Hankinson	Shire of Broome	WA
Adam	Fortier	Shoalhaven Ex Servicemens Club	NSW
Tony	Webster	Shoalhaven Ex Servicemens Club	NSW
Craig	Molloy	Shortland Waters Golf Club	NSW
Kenton	Boyd	Shotmakers	NSW
Jennifer	Cromarty	Socom	
Shane	Greenhill	Sorrento Golf Club	VIC
Justin	Groves	South Australian Cricket Association Inc.	SA
David	Hobday	South West Rocks Country Club	NSW
John	Illingworth	SST Australia	VIC
Paul	Chalmers	St Aloysius' College (NSW)	NSW
Terry	McPartland	St Andrews Anglican Colleges	QLD

29th Australian Turfgrass Conference
Delegates List

Given Name	Surname	Organisation	State
Wesley	Saunders	St. Michael's Golf Club	NSW
Mark	Barrett	Stadium Turf Management	NSW
Peter	Wall	Stadium Turf Management	ACT
Jon	Bonner	Stadiums QLD	QLD
Peter	Cronin	Stadiums QLD	QLD
Malcom	Caddies	Suncorp Stadium	QLD
Michael	Rudduck	Sunshine Coast Council	QLD
Duncan	Lamont	Surfers Paradise Golf Club	QLD
Daniel	Ryan	Sydney Cricket & Sports Ground Trust	NSW
Mark	Mitchell	TAFE NSW - Ryde	NSW
Ryan	Mulder	Tewantin Noosa Golf Club	QLD
Adam	Lamb	The Barwon Heads Golf Club	VIC
Brett	Morris	The Brisbane Golf Club	QLD
John	Halter	The City Golf Club Inc.	QLD
Simon	Muller	The Dunes Golf Links	VIC
Ben	Baumann	The Glades Golf Club	QLD
Rodney	Cook	The Grange Golf Club	QLD
Rowan	Daymond	The Grange Golf Club	SA
Aaron	Kelly	The Grange Golf Club	SA
Brendan	Allen	The Hills Golf Club	NZ
Adam	Robertson	The Kew Golf Club	VIC
Anthony	Mills	The Lakes Golf Club	NSW
Idris	Evans	The Western Australian Golf Club	WA
Thomas	Foster	Thomas Foster Turf	VIC
Warren	Duncan	Thomson & Perrett	VIC
Ross	Perrett	Thomson & Perrett	VIC
Tim	Hicks	Thurgoona Country Club	NSW
Matt	McLeod	Tocumwal Golf Club	NSW
Paul	Sanson	Tony Ireland Stadium	QLD
Danny	Beresford	Toowoomba Golf Club	QLD
Nathan	Tovey	Trinity Grammar School	VIC
Dean	Izzard	Turf Bio-solutions Australia	NSW
Christopher	Deppeler	Turf Management Solutions	VIC
Travis	Cumming	Turfcare and Hire	VIC
Amy	Foyster	Turfmate	VIC
Justin	Trott	Turnpoint	VIC
Rob	Weiks	Twin Doves Golf Club	Vietnam
John	Shaw	Twin View Turf	QLD
Garry	McClymont	Twin Waters Golf Club	QLD
Jeff	Reeves	Twin Waters Golf Club	QLD
Dave	Simpson	Twin Waters Golf Club	QLD
Gary	Topp	Twin Waters Golf Club	QLD
Shane	Biddle	University of Queensland	QLD
Clyde	Wooderson	Villanova College	QLD
Lewis	Dienelt	WACA	WA
Matthew	Lane	WACA	WA
Cameron	Sutherland	WACA	WA
Brian	Cattel	Wagga Wagga City Council	NSW
Chris	Smith	Wagga Wagga City Council	NSW

29th Australian Turfgrass Conference
Delegates List

Given Name	Surname	Organisation	State
Brenton	Morey	Wagga Wagga Country Club	NSW
David	Warnaar	Warrnambool Golf Club	VIC
Darren	Wilson	Wembley Golf Complex	WA
Robert	Savedra	Wesley College	VIC
Graham	Sullivan	Wesley College	VIC
Matthew	Gates	West Lakes Golf Club	SA
Shane	Harvey	Westgate Research Pty Ltd	NSW
Brett	Sipthorpe	Westpac Stadium	NZ
Dave	Morrison	Windaroo Lakes Golf Course	QLD
Michael	Dove	Wodonga Institute of TAFE	VIC
Greg	Holihan	Wollongbar Institute of TAFE	NSW
Rod	Tatt	Woodlands Golf Club	VIC
Keith	Ollier	Wyong Shire Council	NSW
Andrew	Spicer	Wyong Shire Council	NSW
Steve	Trigg	Wyong Shire Council	NSW
Rodney	Bloss	Xavier College	VIC
Heath	Pohl	Xavier College	VIC
Andrew	Smith	Yamba Golf and Country Club	NSW
Nick	Murphy	Yarra Ranges Council	VIC
Chris	Burgess	Yarrawonga Mulwala Golf Club	NSW
Trevor	Elliott	Yarrawonga Mulwala Golf Club	VIC
Cynthia	Carson		QLD
John	Geary		VIC

29th Australian Turfgrass Conference

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JOHN DEERE
GOLF

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PROCEEDINGS

REGISTRATION DESK

Throughout the conference the registration desk can assist delegates and guests with any conference requirements.

Sunday 23rd June	2:00pm-4:00pm
Monday 44th June	9:00am-4:00pm
Tuesday 25th June	8:00am-4:00pm
Wednesday 26th June	8:00am-3:00pm
Thursday 27th June	8:00am-2:30pm

TRADE SHOW HOURS

Tuesday 25th June	4:00pm-5:30pm
Wednesday 26th June	9:00am-5:00pm
Thursday 27th June	9.00am-2:00pm

If you have any Conference queries during the event please call Simone Staples on 0415 322 213 or if your enquiry is related to the Trade Exhibition call Peter Frewin 0418 593 072.

CATERING

Meals are provided as part of your booth entitlement and provided on both Wednesday and Thursday during the trade exhibition (two passes per booth). Meal passes will allow for morning tea and lunch to be served in the Wandiny Room. To gain access to catering, all delegates will need to produce a valid delegate name badge as provided at registration.

NAME BADGES

It is a requirement that all delegates wear their allocated name badges to all conference sessions and social functions to gain access.

BAYER ENVIRONMENTAL SCIENCE WELCOME RECEPTION

Where: Eucalypt Clearing, Novotel Twin Waters Resort
When: Monday 24th June 7:30pm-10:00pm
Theme: Aussie Bush **Dress:** Aussie Bush Garb/Neat Casual

The AGCSA Board and staff invite you to attend the Bayer Welcome Reception. The reception will have an "All things Aussie" theme. Canapés and refreshments will be served throughout the evening. A great way to relax and enjoy catching up with friends and colleagues.

HAWKERS BEACH MARKET - lanyards ***must be warn***

When: Lorikeet Beach, Novotel Twin Waters Resort
When: Tuesday 25th June 7:00pm-9:00pm
Dress: Casual outdoor event, please dress warmly

A social event designed for delegates to relax and enjoy a casual evening together.

SYNGENTA PRESIDENT'S DINNER

When: Wandiny Room, Novotel Twin Waters Resort
When: Thursday 27th June 7:30pm-12:00am
Dress: Semi formal – smart pants and collared shirt **Cost:** $110 per head

The President's Dinner is the last opportunity for those who have attended the conference to get together socially. Incorporating the 2012 AGCSA Award presentations this night is a fitting finale to the week.

FRIDAY OPTIONS

Post Conference Turf Tour: The 2013 turf tour will visit some of the sights listed: Pelican Waters Golf Club, Corbould Park Racetrack, Twin View Turf, Quad Park (Stockland Park), Horton Park Golf Course Redevelopment. The tour will include morning tea and lunch and will return to Novotel Twin Waters at approximately 3pm. More details on the venues will be published in "The Cut" and on the AGCSA website.

HOW TO PHOTOGRAPH YOUR GOLF COURSE

Gary Lisbon
GOLFSelect

How to take the perfect photo
Whilst I have entitled this section "how to take the perfect photo" there is no such thing as a perfect photo. Beauty is in the eyes of the beholder and different photos mean different things to different people. It may be a memory from a hole in one on a particular hole, a spectacular shot, the overall memory of playing a course or something different.

There are however a number of key elements I have learnt over the years that go into making a photo better than it might otherwise be. Use the list below as a guide.

11 key elements

1. Composition and Perspective
2. Height – a photographer's best friend
3. Use of filters – enhance the shot without being artificial
4. Time of the day – what a difference a few hours makes
5. Different seasons – your course changes during the year
6. Keep shooting - take lots of shots – digital is wonderful
7. Learn to love storms – better than a totally blue sky
8. Why I hate overcast days – no shadows
9. People or no people – they really do get in the way
10. Location does help
11. Always have your camera with you – you never know what might happen

Composition and Perspective
Two of the single most important ingredients to a perfect golf course photograph are composition and perspective. How the photo looks, does it draw the viewer's eye into the heart of the photo and so on.

Composition can best be described as where you put the elements of the scene into the photograph. From a golf course point of view there are a number of possible elements that can go into a photograph. These would include:

- Golf green and flagstick (shows the ultimate prize)
- Tee boxes (give a sense of how the hole is played)
- Bunkers (adds colour and shape to a shot)
- Water hazards (adds colour, shape, danger)
- Rough grasses (help to show the hole, frame a fairway and provide foreground perspective)
- Clubhouse (if attractive can add interest to the shot)
- Trees (can be used to frame a shot)
- Dips and hollows (add shape and interest to the scene and also a 3 dimensional feel)
- Elevation change (adds a 3 dimensional feel to the shot) – fairway on the 5th at NSW is an example
- Distinctive pathways (leading viewers into the shot)
- Other interesting features (historical building off course, halfway huts)

Using all of these elements in the correct way will help to enhance your photographs and create a real "wow" factor. To use these elements you should consider the following points:

Focus the viewer's attention

- The main subject matter should be the primary focus in a shot. There is no point in having a photo with a bunch of trees as the main focus when the inviting, sun soaked fairway leading to the green is left off to the side.

Arrange the elements/ Simplicity is often the key

- It is rare that a photo will have all of the elements listed above but those elements you do have should be used to best effect.
- Think carefully about where elements should be placed in a shot.
- Don't try and overcrowd the shot with too many competing elements.
- Simplicity is often the key (I have a shot of the 15th at Cape Kidnappers which I love for its simplicity). The shot can look clean, uncluttered and have a warm feel about it.

Change your perspective

- Perspective is how the photographer views the elements of the photo by the placement of the camera.
- Most people take photos at their eye level (generally around 5 to 6 feet off the ground).
- By varying this perspective you change the horizon line placement and consequently how the viewers see the shot.
- Try different techniques. Lie on the ground and shoot upwards, kneel down, take a shot close to a distinguished bush, use height (refer next section).

Don't be afraid of vertical

- In my first 6 years of taking photos I rarely turned the camera sideways to capture a vertical shot.
- Now I do it quite a bit. Adding a vertical element to your shots allows you to incorporate features that can be lost otherwise.
- Tall trees have character and frame very well when captured vertically. They tend to give off a sense of size especially when placed near another object (such as a golf flagstick).
- Some holes lend themselves better to capture vertically. A hole playing downhill and flanked by trees can sometimes be lost if captured horizontally. When you turn your camera the other way the shot really leads the viewer into the hole.
- Vertical shots are also shots that magazine editors crave! Front cover shots need to be vertical to fit the dimensions of golf magazines, club newsletter, "Australian Turfgrass Management Magazine" and more.

Use contrast

- It is generally not good practice to shoot directly into the sun or directly with the sun at your back.
- Images shot this way can be harsh and unflattering.
- However there are times where you may like to use contrast in this way – to expose the outline of a flagstick in a silhouette form atop a green is one example.

Frame within the frame

- This is a very powerful technique that is not hard to master.
- Look for natural frames within the shot itself. On a golf course this is often a tree that overhangs a shot. Including the tree in the image adds an additional level of interest to

the shot (no longer is the shot framed by 4 straight lines but uses the shape of the tree to lead the viewer into the shot).

Pay attention to the little things

- On a golf course there are many elements competing for attention (I have listed many of them above). Not all of these elements are attractive.
- When you compose your shot be aware of elements that are ugly or don't add interest to the shot. These might include powerlines, mobile phone towers, rubbish bins, cars, tyre marks, recently laid turf, golfers).
- If you find yourself with these element creeping into the viewfinder then often a step to the left or right will remove one or more of these (powerlines and mobile phone towers can often be obscured by trees if you move one or two steps sideways).

Photograph the hole the way it is played

- This is a concept I sometimes struggle with. From an architectural point of view it is nice to be able to see the hole as it is laid out from tee to green.
- Try and incorporate the tee into the foreground of a shot.
- Include the green and flagstick where possible in the shot.
- Depending on sun position however this does not always work out and you need to be guided by the conditions around you.
- I often take photos to the side of greens incorporating bunkers or from the back of the green looking back down the hole as the light is better. There is no firm rule.
- It is something to keep in mind but don't be bound by it.

The rule of thirds

- Common photograph/painting technique that breaks the viewfinder into 3 vertical lines and 3 horizontal lines.
- The 4 intersecting points are the key points and studies have shown that the human eye goes to those points first when looking at a photograph.
- In composing your photo therefore you should look to place key elements (flagstick, tee box, tree) at one of those four points.
- This rule works well for golf course photographs and you should practice capturing shots this way.
- As always rules are meant to be broken and this is one of the rules which can be broken and still result in good photos.

Height

A camera takes images in two dimensional form. A camera also tends to flatten out and lessen changes in elevation.

To help negate this effect height can be a photographer's best friend. Where possible, use a ladder to take shots or a place that gives you height beyond your normal height.

Some examples of "height generators" that I have used in the past include:

- 6 foot or higher ladder attached to the back of a motorized cart.
- Standing on the roof of a motorised cart (don't let the pro see you…).
- Tournament TV towers are wonderful ways of gaining height quickly.
- Cherry pickers which may be used for trimming work also present good vantage points.
- Clubhouse roofs.
- A helicopter, whilst being expensive, is the ultimate "height generator" .

Remember to always keep safe….

Use of filters
Filters are a camera accessory that fit across the front of a lens for a specific purpose.

- UV Filter – generally used to protect the front of the lens.
- Polarising filter – enhances blues in the sky and other colours. Works best when at 90 degrees to the sun angle. If you have a completely blue sky can result in banding and great dips in the colour spread.
- Neutral density filter – helps to balance the large exposure range between skies and fairways.
- Coloured filters – help to add elements of orange, magenta and other colours to the shot. Should be used sparingly to avoid creating artificial images.

Filters are ideally used to help recreate the shot that was seen at point of capture rather than creating anything artificial. Filters can help to enhance a shot but if not used carefully can ruin the shot and make it completely unnatural.

Time of the day – what a difference a few hours makes
Arguably the single biggest factor in taking good golf course photographs is the time of the day. The sun rises in the East and sets in the West. During the day it generally moves up and over from one side of the horizon to the other.

The best time for taking golf course photos is first thing in the morning and last thing prior to sunset. I typically (not absolutely) use the guide of:

- **Morning shoot** – sunrise to sunrise + 1.5 hours
    - Example: if the sun rises at 6am then optimal time for a morning shoot is 6:00am to 7:30am
- **Evening shoot** – sunset – 1.5 hours to sunset
    - Example: if the sun sets at 8:00pm then optimal evening shooting is 6:30pm to 8:00pm

It is during the above “golden time” that the sun casts the longest shadows, has the richest depth of colour and is warm without being too harsh. As the sun rises in the sky the contrast increases and the landscape becomes more harsh. The photos do not have the same level of warmth.

Some golf courses, due to their terrain provide challenges as a result to their topography and may require different shooting times. **Courses that feature heavy, tree lined fairways** are most challenging because fairways are often in shadow and when the sun does get above the shadow line it is too high in the sky to get any warmth in the image. Moving around and looking for different angles and seeing where the sun is hitting the course is key here. Brookwater in Queensland is an example– a heavily wooded course with fairways carved through the trees and often in shadow provides less of a window to capture the course.

Almost as much of a challenge are those **flatter, links style courses** that look plain and boring during the majority of the day but come alive just prior to sunset and just after sunrise. The Old Course at St Andrews is one such example – the window of opportunity to capture quality photos is a lot less than on a course that has more prominent features.

The above are guidelines and **localised conditions** or where your course is may change this. To give you an idea in winter heading down to Tasmania and shooting Barnbougle Dunes/Lost Farm is an interesting exercise. At this time of the year the sun generally does not go up and

over the top of you but rather sits on the horizon for much of the day before setting. I love these times because it means I can shoot when in other places it would not be worth shooting.

I have managed to capture some great images of Lost Farm at 11:00am (based on a sunrise of 7:00am) which in other locations would be useless. As with everything however there are exceptions.

It is possible to still capture a good photograph outside these times and I would encourage you to keep shooting but your eye soon gets trained as to what will work and what will not work.

One other consideration is the **warmth of the sun**. I mentioned above the ideal time being just after sunrise and just prior to sunset however the sun still needs to "warm up" before a quality shot can be taken. As a guide use your shadow to see how "warm" the sun is. If you only see a pale outline of yourself then it is not quite worth taking a photo. Once this outline darkens and you see it more clearly you are in a better position to take a photo of the course.

Different seasons – your course changes during the year

Courses look different during the year. And that in itself is quite exciting. In your role you are on the course all year round, in all conditions, all types of weather and this gives you an amazing opportunity to capture wonderful photographs of your course.

In saying this there are some times of the year when it is just not worth taking your camera with you. **Winter** is generally not the best time to show off your golf course (or photograph it). The most noticeable difference in courses during winter are those with couch fairways. When couch goes dormant it loses colour and to be frank is UGLY! Photos taken during this time are awful and not worth taking.

A number of courses however feature grasses which do not lose colour. In these cases the courses are fine to photograph all year round depending on other conditions (ie. Dry ground v mud)

The predominant colours on golf courses are green, white and brown. Combined with blue skies the range of colours is fairly limited.

So when you have an opportunity to introduce more colours into a shot then you should take advantage of this. **Explosive colours** from blooming flowers, gorse, rhododendrons – all of these combine to add interest to a shot. Look at some of the courses below renowned for their different colours

- Augusta National – Azaleas, Dogwoods (introduces pink, red, purple, orange)
- Royal Dornoch/Walton Heath – Gorse, Heather (explosive yellow)
- Swinley Forest – Rhododendron (pink, purple)
- Royal Canberra – Azaleas and other colourful flowers (pink, purple)
- Royal Melbourne/Kingston Heath – flowering tea tree (green, white, yellow)

Another big change in your course during the year (you may not realise) is the **sun position** as it does rise and set in different positions. True it is still rising in the East and setting in the West however there can be 20 or 30 degrees difference in the angle.

What this means is that holes which at a certain time of the year are looking directly into the sun (not an ideal shot) will, at other times, be perfectly set up for a shot to be taken. I have found particularly at a place like Barnbougle that the sun moves around a lot and I capture completely different pictures according to the time of the year I am there.

Keep shooting - take lots of shots – digital is wonderful
Digital is wonderful in that you can take as many shots as you like and then throw away the ones you don't like. There is no additional $ cost in taking 50 images compared to 200 so why not take as many as you can!

Most digital camera offer an immediate ability to preview a shot just taken and so in doing so you can see what worked and what did not. In this way you are learning immediately after taking a shot rather than having to wait for film to be developed and then trying to remember what elements were involved in that shot.

So I encourage you to take lots of shots.

NB. In a later section I talk about editing and archiving images and whilst you can take as many as you like there is a "time cost" in doing so when it comes to reviewing, editing and archiving these shots.

Learn to love storms – better than a totally blue sky
You might not think that taking photos when it is raining would result in good photos. Generally this is the case.

However when the storms stops and the skies start to clear there is a great opportunity to capture dramatic and exciting photographs. If the wind is blowing then this gives you more comfort as the wind helps to break up the clouds and expose patches of blue.

Storms and rain also bring with them the possibility of **rainbows** – another element which can dramatically alter the look and feel of a shot. To get a rainbow you need rain and sun and they can be quite spectacular when incorporated into a shot.

Totally blue skies, whilst working well for a "Queensland – beautiful one day, perfect the next" advertisement can make a golf scene look boring. If you compare images with clouds to those without you will see the dramatic nature of the shots with clouds in them. Having said that blue skies are still an important element of a good golf photograph and I would gladly take a blue sky over the next section we are going to talk about – heavy cloud cover.

Why I hate overcast days – no shadows
Heavy cloud cover is the sure fire killer of a photo shoot. Many times I have been frustrated by a blanket of clouds which covers the sky and provides an "off white" look to the sky.

The problem with heavy cloud cover is that the sun is somewhere above the cloud and it is shining however when the sun hits the blanket of cloud and projects to the earth the light is diffused (spread out) completely. Great for wedding photos but not for landscape photography!

I generally try and avoid shooting when the cloud is completely across the sky. If there is a heavy wind blowing there may be the possibility of the cloud breaking up but don't hold your breath.

Sometimes it is better to just be inside reading a good book!

People or no people – they really do get in the way
Landscape photography is, as its name implies, a photo of the landscape – whether that is a golf course, a mountain range or anything else. Personally I find the inclusion of people in my golf course shots as something of a distraction.

I try and avoid capturing people in my shots and if they manage to creep in I tend to edit them out in the post capture editing process.

Location does help
The location of the golf course and land it is built on has a big bearing on the types of images you can capture. Each golf course is different both in terms of design as well as location and conditioning. Elements which make capturing good photos easier are listed below.

- **Ocean backdrop** (ie. NSW Golf Club, Barnbougle, Kauri Cliffs, Cape Kidnappers, The Cut, Narooma, The National, The Coast, Flinders) can really frame a shot well.
- **Mountain backdrop** (showing scale) – Arrowtown, Millbrook, Jacks Point, Banff, Royal County Down.
- **Clear definition between fairway and rough** (non watered rough areas help golfers to see the hole laid out – The National, The Dunes).
- **Changes in elevation** (hitting down to a green from an elevated position).
- **Holes cut through forests** with tall trees lining fairways (Bonville, Brookwater).
- **Interesting backdrops** – historical buildings – moreso in UK/Ireland – St. Andrews, Muirfield, Royal Dornoch, Sunningdale.
- **Distinctive bunkering** – bunkers with interesting shapes, generally unkept (Barnbougle, Doonbeg, National Moonah, Lake Karrinyup, Cypress Point).

Generally speaking no one golf course will have all of these elements (Cypress Point gets close…). You need to make the best of what you have and be creative in capturing the shots that are before you.

Always have your camera with you – "be prepared"
As the boy scouts motto states "Be prepared". It does pay to always have your camera with you – you never know what will happen to the weather or what kind of shot might present itself.

Over recent years I have spoken to a number of ground staff at golf courses I have been photographing who show me photos they have managed to capture on a "special morning" on their smart phones. The shots look nice but to be perfectly honest are limited in what you can do with them. Phones are generally for making telephone calls (although you would not know it these days) and whilst most phones will take photos the quality is certainly not at the same level as a dedicated digital camera.

Always have your camera with you – it does not mean you will be using it but if the most amazing morning presents itself you will be able to capture it.

As people who work on golf courses on a daily basis you have a major advantage over someone like. You are there every day – rain, hail, shine and get to see and feel the golf course. As a photographer I tend to come in for a shoot within defined timeframes and with the weather being as fickle as it can be don't always get the right shot. You cannot use that as an excuse!

Technical Elements

Camera settings
Digital cameras these days have so many different settings. Which settings are best? Your camera will generally have a landscape shooting mode and for all intents and purposes this setting is fine to use.

File size
I learnt this the hard way…in my early days I did not capture photos at the highest resolution available to me. The end result was that I had some very nice photos of various courses but could not do much with them as the image resolution was not sufficient.

You can also reduce the size and quality of the image from a large file but you cannot go the other way.

Always shoot at the highest resolution quality available to you.

RAW v JPG
Most of the higher end cameras offer the ability to show in RAW format. This is an uncompressed format that keeps all file information and results in fairly large files which need to be manipulated using dedicated software.

JPG files are compressed files that retain the same information however are defined as a lossy compression technique meaning that over time with repeated opening and closing of the file image quality is lost (generally in the sky areas).

I used to shoot in RAW and JPG but found that I was not using the RAW files in any way and all it was doing was taking up disk space. I found when working with JPG files (shot at the highest resolution) that I could achieve all I wanted to in terms of image quality, reproduction to large wall size prints, magazine images and even books. Accordingly this is my preferred method of shooting and whilst some other professionals might shake their head it has worked well for me.

Camera/Lens Options – Canon/Nikon/Olympus/Sony
In the digital camera marketplace there are so many brands and so many options! How do you make up your mind? Prices range from $300 to over $20,000

So how do you make up your mind? A few guidelines to consider:

- Choose a reputable brand (ie. Canon, Nikon, Sony, Olympus, Fuji)
- Decide between SLR, Interchangeable Lens Cameras, Compact
- Lens quality beats anything else – invest money in good lenses
- Need lenses to capture a range of focal lengths (17mm to 200mm is good range)

Post capture editing
It would be nice to think that when you capture an image it is perfect and does not need any touching up. The reality however is different.

Areas to be edited
Common areas of post capture editing include:

- Removing bunker rakes
- Removing people and other non golf course items (motorised carts)
- Removing ground staff buggy tyre tracks (annoying!!)
- Adjusting for incorrect exposure (ie. sky too light, course too dark)

The primary objective with editing is to recreate the scene without these “unwanted distractions” however at the same time not creating anything artificial.

Editing time
I mentioned earlier about the ability to take as many images as you like using digital. Whilst this is good in one sense it can provide a time impost at the editing stage. I have found over the years that, as a guide, you need to allow 5 minutes of time per photo to get your images into a finished state.

So if you do the sums take 20 photos then there is 100 min of work. If however, you take 100 photos (not an unusual situation) then this will mean roughly 8.5 hours of post editing work. When you put it in these terms the time can add up.

The editing work typically includes:

- Transfer of files
- Renaming of files
- Reviewing images
- Editing images
- Saving as new files
- Backup of files

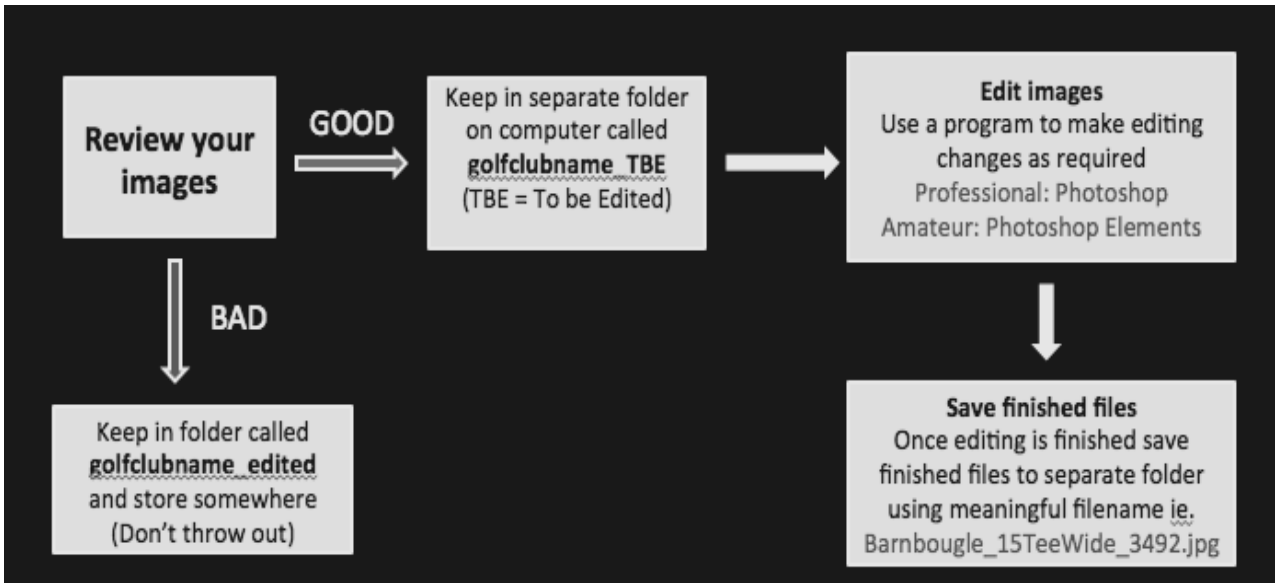
Keep all images
Digital photography is wonderful in that you can take as many images as you like, review them and discard those that are not up to scratch.

Whilst the thought of unlimited shots is exciting it also creates a whole new time overhead in sorting through those images and finding the images you feel you would like to keep. I identified this above.

One thing I have learnt over time is that no matter how bad you feel an image is keep it in its original form. Thoughts and opinions change over time and the image you hated last year may now appeal to you.

Equally as important is that images provide a snapshot of a course at a point in time – something you can't go back to a year or so down the track.

Post Capture Editing workflow
It is important to establish a post capture editing workflow to ensure efficiencies in editing and not losing any valuable files in the process. Below is a summary of how I undertake this task.



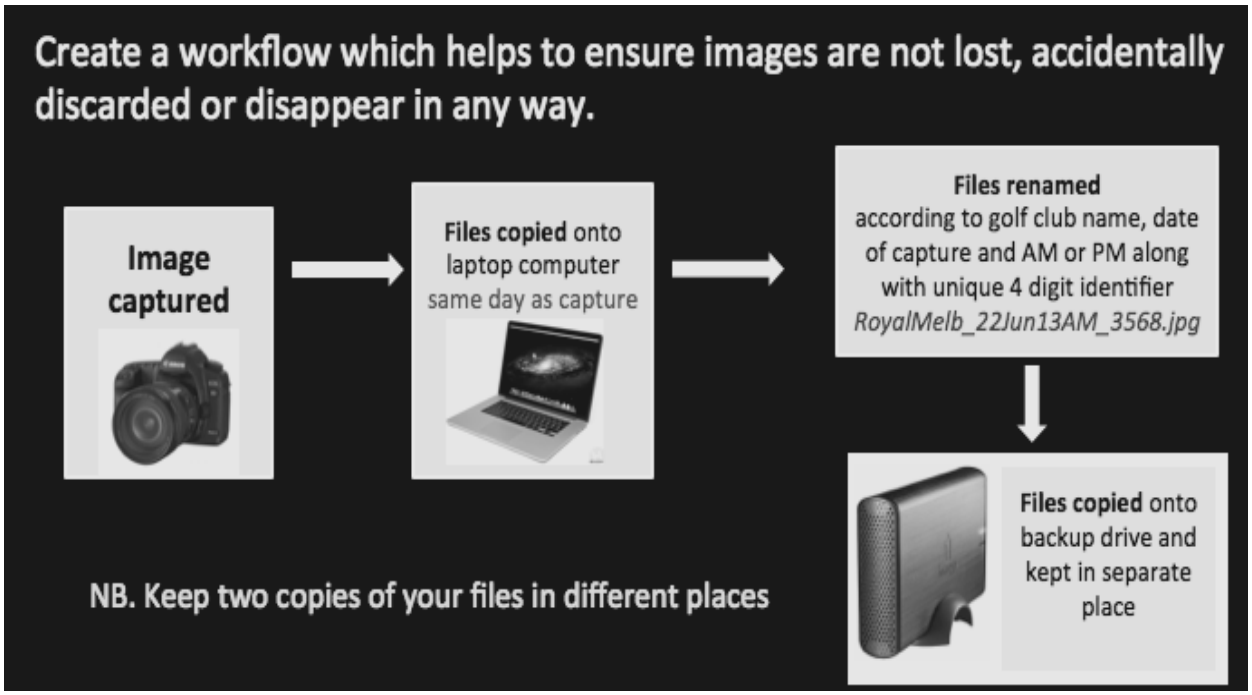
Archiving and preserving images– backup is critical
In this day and age most photographs are taken with digital cameras. This creates a computer file of the image.

As with anything where computers are involved things can go wrong. Files can be corrupted, computers can be stolen, hard drives can stop working, offices can be flooded/set on fire.

Backing up your images is critical if you are to keep your peace of mind.

Backup drives are available for as little as $60 and provide you with a peace of mind in the event of a disaster.

I use the following workflow as a guide to ensure all images I take are preserved for as long as I want them



Conclusion

You have before you a blank canvas and a subject that changes every day you look at it. It is a subject that can be captured in many different lights over the many seasons of the year. Enjoy taking lots of photos and honing your technique.

I hope the tips I have provided in this document are beneficial for you and look forward to seeing some of your photos as you capture them.

Please feel free to contact me if you have any further questions or tips about what I have outlined. I am happy to have a chat and I may even see you in my travels to your golf course.

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SURFACTANTS AND WETTING AGENTS FOR TURF

John Illingworth
SST Australia Pty Ltd

Introduction

The problem of water repellence has been known to turf superintendents for a long time. The problem has become more significant and more frequent with the move towards sand based greens and playing surfaces. Essentially, sands have replaced soils as the preferred growing medium and topdressing treatment.

Sands have a larger particle size than soils, so therefore provide a much lower surface area per unit volume upon which to absorb degrading organic matter in the profile. This leads to a build up of hydrophobicity and can cause problems such as poor nutrient and water availability to the turf and in many cases leads to dry patch.

Development of wetting agents for intensive turf management

In the early 1950's researchers started investigation into the use of wetting agents to improve water infiltration and turf health. Now, one of the most successful approaches used to overcome the problem of water repellency in turf is by the application of surfactants.

Conventional practice in Australia is to apply wetting agents at least 2 - 3 times per year over the spring and summer seasons. More highly maintained golf courses have found that more frequent application leads to more uniform and consistent playing surface quality, with some superintendents applying wetting agents monthly, and others adding wetting agents to most irrigation schedules.

Inevitably discussion focuses on 'which is the best wetting agent'? In truth the question cannot be answered in simple terms; partly because different situations require different solutions, and partly because the term 'wetting agent' is inappropriately used as a general description of the various surfactant options available to manage water infiltration into turf surfaces.

In order to determine which product is likely to assist water infiltration in any specific situation we need to define what performance characteristics are required.

For example:

- spread
- penetration and infiltration
- relatively dry firm surface
- relatively moist soft surface
- quickly draining
- slow draining
- importance of security from phytotoxicity
- water volume required for application
- method of application

There are many different types of 'wetting agents' offered for use in Australia. Outlined below is a summary of the most common types of surfactants that are promoted for this purpose and the general characteristics that they demonstrate.

Anionic surfactants

- Ammonium Lauryl Ether Sulphates

- Sodium Lignosulphonates
- Sodium alkyl sulphosuccinates

Features

- Introduced for use in turf in the early 1950's
- Conventional general purpose surfactants found in agricultural and industrial applications
- Generally very good at reducing surface tension of water
- Usually improve initial water penetration
- Tend to degrade fairly quickly (not long lasting)
- Can be phytotoxic at the application levels required to meet industry standards
- Best applied in higher water volume and watered in after application
- Usually recommended application rates tend to be far too low to achieve premium protection from water repellency
- The electrostatic charge of anionics aids adsorption onto soil particles. This characteristic is beneficial for use as an agglomeration aid for fine compacted soils.
- Most commonly used in conjunction with a polymeric surfactant to improve initial penetration.

Nonionic surfactants

- Nonyl Phenol Ethoxylates
- Alcohol Ethoxylates

Features

- Nonyl Phenol Ethoxylates introduced for use in turf in the mid – late 1950's
- Widely used to assist the spray application of pesticides in the agricultural industry
- Quite efficient at reducing surface tension
- Can provide short-term assistance for water penetration into turf
- Small - low molecular weight molecules and therefore tend to have poor adsorption and retention properties in soil. As a result they are washed through easily and only provide a short term effect.
- Can be highly phytotoxic to grasses. Nevertheless, some higher molecular weight Nonyl Phenol Ethoxylates which exhibit lower phytotoxic potential have been usefully employed in non severe situations for many years under a frequent application program
- Best applied in higher water volume and watered in after application

Polymeric nonionic surfactants (block co-polymers)

- Polyoxyethylene Polyoxyproplene glycol block copolymers and random polymers

In the early 1980's in Australia a new class of surfactant was identified that produced an order of magnitude improvement in the efficiency of aiding penetration of water into water repellent soils and in the maintenance of high quality turf surfaces.

Features

- Many different types available
- High molecular weight molecules. The polymeric structure adsorbs strongly onto soil particles.
- Complex structure is slow to degrade, therefore long lasting

- Good rewetting performance and long lasting effect. Adequate surface tension reduction also enables reasonable penetration efficiency.
- Widely used in Australia and provide the longest term performance, usually requiring only 2 – 3 applications per year.
- Significantly less phytotoxic than anionic and conventional non-ionic surfactants
- Best watered in after application
- Some recent developments have improved the penetration and wetting ability. This enables improved lateral movement of water through the soil profile and better penetration of built up hydrophobic regions under the turf surface.

Reverse block co-polymers

- Polyoxypropylene Polyoxyethylene glycol block copolymers

Features

- Introduced for use in turf in the mid 1990's
- Moderately high molecular weight
- Fair retention to soil and moderate penetration ability
- Poorer draining effect allows better moisture retention
- Applied at low application rates which ensures very low phytotoxicity and are therefore very safe to use
- Not usually required to be watered in immediately
- Must be applied frequently under a strictly observed management program
- Well suited to large well resourced golf clubs
- In severely water repellent situations the penetration ability of this group of polymerics is often not sufficient to achieve adequate restoration performance.

Ultra-penetrants – organosilicone ethoxylates

- Polyether Modified Polysiloxanes

Ultra-penetrants are not widely used in the Australian Turf Industry, however they are successfully used in many countries around the world. This class of surfactant is radically different to all other classes mentioned above. They are nonionic in nature, yet exhibit outstanding water penetration ability.

Features

- Introduced for use in turf in the early 1990's
- Applied at rates as low as one tenth of conventional wetting agents
- Can penetrate most hydrophobic turf areas, and quickly restore good water infiltration
- Have medium soil adsorption characteristics so they must be applied at regular intervals to maintain effect
- Ideally suited to application by direct injection irrigation methods
- Boom spray application is also possible, best watered in after application
- Ideal for treatment of problem areas.
- Excellent performance as dew retardants on playing surfaces

Eco-friendly biodegradable wetting agents

- Alkyl Polyglucosides / Alkyl Polysaccharides
- Alkyl Sulphosuccinates

Some European countries have adopted the use of eco-friendly wetting agents for maintenance of turf surfaces and they are beginning to appear in Australia.

Features

- Tend to be based on low molecular weight biodegradable surfactants
- Excellent surface tension reduction and provide very good initial water penetration
- Biodegradable, therefore don't last long and rapidly degrade in the environment
- May provide acceptable efficacy under less demanding European conditions, however their suitability for the Australian environment will depend on severity of the situation
- They usually require frequent application to meet the performance standards expected in Australia.
- Preferably applied in moderate water volume and watered in after application
- Are commonly used in combination with polymeric non-ionic surfactants to provide enhanced initial penetration and infiltration.
- Blends with polymerics have been marketed in Australia since the mid 1990's yet have been patented in the USA since early 2000's

End capped polymeric nonionic surfactants

- Polyoxyethylene Polyoxyproplene glycol block copolymers Methyl endcapped

Features

- Introduced for use in turf around 2005
- Relatively low phytotoxic potential
- Preferably applied in moderate water volume and watered in after application
- Suited to regular application at intermediate application rates
- Slightly less draining than conventional polymeric non-ionics, therefore maintain higher moisture levels in the turf

Organic acid removal treatments

Features

- Introduced around 2004
- Non-phytotoxic
- Regular application required (monthly)
- Provides drier playing surface

Multibranched polymeric surfactants

- Introduced in late 2000's
- Very high molecular weights
- Can last longer than conventional polymerics

Water retainers

- Introduced in late 2000's
- Very low phytotoxic potential
- Suitable for application with low water rates
- Watering in immediately after application not required
- Hold water in the profile – restrict drainage

- Best suited for areas that suffer infrequent or poor irrigation, drought affected areas or on sands that have poor water holding capacity
- Demonstrate excellent rewetting performance

Conclusion

The large range of wetting agent products available to turf superintendents is no doubt very confusing. This is exacerbated by the fact that some suppliers make inaccurate and unsubstantiated claims about their product. If the supplier cannot identify which category the product fits into and what are its distinctive performance attributes then the turf superintendent has no basis on which to judge its suitability to the particular environment under consideration. The turf superintendent must clearly consider several factors before choosing an appropriate wetting agent:

- Severity of water repellency (low, medium, high)
- Proposed frequency of application (weekly, fortnightly, monthly, twice per season)
- Application dilution strength (0.1%, 1%, 2% 5%, 10%)
- Application water volumes (400, 1000, 2500, 5000 L/Ha)
- Phytotoxicity potential (low, medium, high)
- Watering in (immediate, within 1-2-3 hours, evening or next day, next rain)
- Other treatments applied (fertilizer, pesticides)
- Cost / quality (low, medium, high)
- Degradability (high, medium, low)

Once these questions are answered, the choice of product becomes relatively simple.

The best quality products usually deliver the best performance and can be viewed as offering the best value for money. However, as conditions vary greatly around Australia no product consistently achieves ideal performance in every situation. The poorer functional products can provide a benefit in situations where there is very little water repellency, however, only premium products will work well in highly water repellent situations.

USING ONLINE DATABASES TO RESEARCH TURF PROBLEMS

John Neylan

Abstract
The internet has opened up a world of information and many turf managers use it as a source of knowledge. The question and challenge is – is the information accurate, well researched and not just a load of sales spin? If you are serious about researching information and data that will truly assist you in making good management decisions then you need to use independent sources.

The best source of on-line information on turf is the Turfgrass Information File (TGIF) which holds most of the world's research papers and other writings on turf. In addition there numerous other sites associated with universities and independent organisations that can also be an excellent source of information.

Introduction
Since the mid-1990s, the Internet has had a revolutionary impact on culture and commerce, including the rise of near-instant communication by electronic mail, instant messaging, Voice over Internet Protocol (VoIP) "phone calls", two-way interactive video calls, and the World Wide Web with its discussion forums, blogs, social networking, and online shopping sites.

The Internet's takeover of the global communication landscape was almost instant in historical terms: it only communicated 1% of the information flowing through two-way telecommunications networks in the year 1993, already 51% by 2000, and more than 97% of the telecommunicated information by 2007 (Hilbert and López, 2011). Today the Internet continues to grow, driven by ever greater amounts of online information, commerce, entertainment, and social networking.

The internet has opened up a world of information and many turf managers use it as a source of knowledge. By entering the term "*Turf Research Australia*" into the search engine it returns about 6.8 million hits. As you sift through the list there are some useful sites, lots of commercial sites and random junk. The question and challenge is – is the information accurate, well researched and not just a load of sales spin? If you are serious about researching information and data that will truly assist you in making good management decisions then you need to obtain it through independent sources.

The importance of well conducted research
In agriculture research a scientist identifies solutions to problems through experimentation. Research can be broadly defined as a systematic inquiry into a subject to discover new facts or principles. Whether it is the development of a new pesticide, fertiliser, grass variety or other innovation there is an expectation that it will have undergone rigorous testing and trialling against established industry standards as a means of testing its efficacy or performance.

The turf industry is a high end business with numerous products available to the turf manager. The constant question is, or should be, is it supported by well conducted research. For some products such as pesticides, the law demands that the product is supported by a strong research program. At the other end of the scale there is a myriad of "big claim" products that have very little or no well conducted research but rely on anecdotal evidence to support their claims. It is interesting to examine a few of the areas affecting the turf industry to see what research supports the products.

Pesticides represent the most rigorously researched products in the turf industry because of the health and environmental impacts of pesticide use. By law (APVMA, http://www.apvma.gov.au/) any new pesticide has to be thoroughly researched and evaluated through multiple replicated trials across a range of locations so that any claims that are made can be substantiated. The

label that is associated with the registered product is a legal document and can only be based on the data collected from these research trials. So as a general rule we can be confident that any new pesticide will work within the parameters of the label. However, recent experiences would indicate that even in this rigorously tested environment turf managers should undertake their own local trials to see whether there are any differences due to localised aspects.

Plant Breeders Rights is a universally accepted means of registering a new cultivar and protecting the associated intellectual property. For a new turfgrass cultivar to achieve Plant Breeders Rights and to be accepted as a new and distinctly different cultivar, it needs to have undergone replicated trials against industry standards for its anatomical characteristics (e.g. internode length, rate of spread, leaf length etc.). However, this information has little relevance as a turf sward or playing surface. New varieties must be assessed in replicated plots where it is maintained as a turf sward. These trials must take place at multiple sites. Under these conditions it can be compared as a playing surface against the industry standards for a broader range of attributes (e.g. putting quality, disease resistance, thatch accumulation, winter dormancy etc.). Because it is a newly registered cultivar it does not necessarily imply any superior characteristics as a turf. Again, the specific nature of each site requires the turf manager to select the best of these and to assess them under his/her maintenance regime and climate.

In recent years there has been a trend towards being “green and organic” and improving “soil health”, with a plethora of organic based products, soil conditioners and other growth stimulants available to the turf manager. The challenge is being able to source creditable data that can support the claims and allow turf managers to make informed decisions on how such products may fit into their management program. When comments are made regarding factors such as soil health and root growth it requires painstaking research to substantiate such impacts. This is the information that the product supplier should be able to provide to support the claims.

Research can be undertaken by anyone with some knowledge of science and scientific method. However, the question must be asked as to how creditable is the person undertaking the research and the institution that they represent. These are further factors that need to be explored before we adopt a new product or program.

All turf managers need to make their own enquiries into the effectiveness of various products and this is best done by examining the available research. Well conducted research involves:

- A well defined problem e.g. controlling *Poa annua* in bentgrass putting greens.
- Stating the objectives e.g. to determine whether product X is better than the industry standard in the control of *Poa annua*.
- Selection of appropriate treatments, experimental material and experimental design e.g. the treatments could include; product X compared to the industry standards endothal and bispyribac-sodium. There would be 4 replicates and the data collected would include numbers of plants affected by the pesticide and the percentage change in the *Poa annua* population.
- Variability is a characteristic of biological material. Hence we need to decide whether differences between experimental units result from unaccounted variability or real treatment effects. That is, did product X kill the Poa annua plant or did it die due to other causes. Statistical science helps overcome this difficulty by requiring the collection of data in a way so as to provide unbiased estimates of treatment effects and the valuation of treatment differences by tests of significance based on measuring variability. The more replicates there are the greater the chance that the differences are due to treatment effects rather than chance variations.
- Consideration of data to be collected. Is the data that has been collected reflect the problem to be solved or the claims of the product, grass etc. under investigation. For

example; if a product stimulates root growth the data collected must include factors such as dry weight of roots over several seasons.
- Outlining statistical analysis needed. Research data has no relevance unless it has been statistically analysed. Statistical analysis provides the means by which differences can be determined if they are due to treatments and not random events.
- Conducting the experiment. The institution undertaking the research (e.g. individual, university, company etc.), the researchers and the site where it is undertaken must all be considered when considering the credibility of the research.
- Analysing data and interpreting the results, and reporting research findings.

It is important not to confuse observation trials with well conducted replicated trials. However, predicting benefits in your specific location can be difficult or even impossible (e.g. trials have been done in Sydney and you are in the west of Melbourne). Observation trials may be undertaken based on the original research and is a legitimate way of looking at a product in your specific environment. It is important that you test the product yourself, but test it properly. Any field test must have a comparison with an established alternative and be replicated. The next thing to consider is your reference treatment or control, so that you can interpret the research findings. Ideally it should be something you do currently, and not a 'nothing applied' treatment as you are generally trying to prove the treatment is as good as, or better than, what you are currently doing (or cheaper). Finally, give the product a thorough test in different seasons.

Where can we go to find reliable information?

From a scientific viewpoint the most reliable source of research information is from peer reviewed journals. For research to be published in these journals the research protocol will have firstly gone through a detailed and rigorous internal review before the trials are commenced. The researcher(s) will have undertaken a literature review to determine the state of knowledge on the subject, determined the most appropriate methodology and examined aspects that have not worked in other researchers research. Once the work is completed and written up and submitted to a journal, there is a process of rigorous review by well-respected researchers familiar with the particular field of work. During this process all aspects of the research including; methodology, data collection, statistical analysis and conclusions are scrutinised. Research papers that have any aspects that are doubtful or poorly explained are returned to the authors for clarification. In some cases if the research cannot stand up to such scrutiny it is rejected. In the turf industry some of the key journals are; Agronomy Journal, Crop Science and the International Turfgrass Society Research Journal.

Turfgrass Information File (TGIF)

The turfgrass industry is fortunate that there is an extensive library of publications held within the Turfgrass Information File (TGIF) database. Between 1983 and 1992, the USGA Turfgrass and Environmental Research Program provided funding to develop a searchable archive of turfgrass information. The result was the Turfgrass Information File (TGIF), housed within the Turfgrass Information Center (TIC) at Michigan State University Libraries. As of 2012, the library of information on the care of turfgrass holds more than 200,000 records that reside in the Turfgrass Information File (TGIF) database. Each year, another 15,000 records are entered into the TGIF database.

Publications indexed in the TGIF database include articles from peer reviewed publications, technical reports and conference proceedings, trade and professional publications, local professional newsletters, and popular magazines as well as monographs, theses and dissertations, fact sheets and brochures, software, and web documents. TGIF indexes materials from government, college/university, professional organisation, and private publishers.

In June 2012 it was announced that 50 percent of all TGIF records were linked to full-text versions. TGIF currently has a total of approximately 204,000 records, and more than 102,000

records are full-text accessible (Carson, 2012). The ability to access full-text turf research and other pertinent turf materials is especially important for turf professionals who may not be located near a research library. Full-text access can be provided when those who hold the copyright to materials allow TGIF to digitize and make a back file of their publications (http://tic.msu.edu/pubjrnlbrowse.htm) or when others load their own material on the Web.

While not all material is in the full text version the database provides a very good abstract of the research or the article which gives enough detail to allow the researcher to decide whether the complete article is worth pursuing. The TGIF database provides a link to either the full text version or the site where it can be downloaded. It should be noted that some of the peer reviewed journals charge a relatively small fee to access their journals for 24 hours or more.

The TGIF database is available to all AGCSA members through the members section of the website (www.agcsa.com.au) and is strongly recommended to anyone that is looking to research a problem.

Turfgrass Environmental Research Online (TERO)

TERO is an online service that provides the results of research projects funded through the USGA Turfgrass and Environmental Research Program. This free resource is located at http://usgatero.msu.edu. (Kenna, 2005).To browse TERO, first click on Browse TERO Articles and the list of articles will appear. The articles are sorted by their publication date, but you can also sort articles by research area, workgroups, or specific area of interest. Once an article is selected a PDF version of the article will appear on your screen. All articles have a literature-cited section that, in most cases, is linked to a record in the Turfgrass Information File (TGIF) at Michigan State University.

USGA Green Section Record

The Green Section record is published by the USGA Green Section and the first periodical was published in 1921. Published under various titles, the Green Section Record magazine debuted in May 1963 and since that time has offered the latest information on golf course management, turfgrass culture, environmental issues, research, and economic sustainability. The Green section Record would be familiar to most golf course superintendents and contains relatively short, easy to tread articles on practical turf management issues through to a summary of key research projects. It is all written by researchers that have been funded thorough the USGA research programs or by the very experienced USGA Green section agronomists. It is a very high quality extension journal that takes the recent research and places it in a practical context.

In July 2010, the print publication changed to a weekly digital magazine that lands in your inbox every week or so and is free to subscribers at http://www.usga.org/Course-Care/Green-Section-Record/Green-Section-Record/. Importantly, the USGA has digitised all of the past issues and these are freely accessible on-line and at no cost. Articles can also be searched by keyword, however, it is not the best searchable database. Just browsing through the issues is a very pleasant stroll through the years as you sift through the index for each issue. As a side note, it is interesting how little the basics have changed over the decades.

University and other websites

All universities and most professional organisations have websites with many of these organisations undertaking turf research and providing information for members. There is a large amount of useful information contained within these sites either as; extension notes, research papers, power point presentations and knowledge bases. While some of the terminology from overseas organisations can be a bit tricky to negotiate and the local climates have to be taken into account, there is a large amount of information that can head you in the right direction. The challenge with much of this information is the ability to place it into the right context. Unfortunately there are many “amateur agronomists” in golf clubs that like nothing better than to Google™ up a particular topic – this is when a little knowledge becomes very dangerous.

Table 1 lists several websites that provides a variety of useful information for turf managers.

TABLE 1: List of useful websites

UNIVERSITY	WEB ADDRESS	SPECIFIC INFORMATION
PennState University	http://plantscience.psu.edu/research/centers/turf/extension/professional-turf	General
Ohio State University (Buckeye Turf)	http://buckeyeturf.osu.edu/	Video tutorials Photo gallery Fact sheets
Rutgers University Center for Turfgrass Science	http://turf.rutgers.edu/	Research reports Fact sheets
University of Florida	http://turf.ufl.edu/research_mechanism.shtml	Research reports
University of Florida IFAS Extension	http://edis.ifas.ufl.edu/	Insects
Washington State University	http://turf.wsu.edu/research.htm	Research papers on pesticide trials
Michigan State University	http://www.msuturfdiseases.net http://www.turf.msu.edu/golf-courses http://www.msuturfweeds.net/	Disease i.d. and management Weeds Various
University of California Agriculture & Natural Resources	http://www.ipm.ucdavis.edu/PMG	Weeds Pest Management IPM
Asian Turfgrass Center	http://www.asianturfgrass.com	Management of turf in Asia Photos
Queensland Department of Agriculture, Fisheries and Forestry archive of scientific and research publications	http://www2.dpi.qld.gov.au/extra/era/index.html http://era.deedi.qld.gov.au/cgi/search/simple?q=turf&_order=bytitle&abstract%2Fkeywords%2Ftitle_srchtype=ALL&_satisfyall=ALL&_action_search=Search	Turf research papers
Horticulture Australia (HAL)	http://www.horticulture.com.au/	Turf research papers (fee has to be paid)
Turf Australia	http://www.turfaustralia.com.au/professionals/vc-funded-turf-projects	The Turf Australia website contains most of the HAL funded research project reports
Environmental Institute for Golf	http://www.eifg.org/	Reports on research funded through the Golf Course Superintendents Association of America (GCSAA)
Australian Golf Course Superintendents Association (AGCSA)	http://www.agcsa.au	Reports on research funded through the AGCSA and articles in Australian Turfgrass Management Journal

National Turfgrass Evaluation Program (NTEP)

The National Turfgrass Evaluation Program (NTEP) is one of the most widely-known turfgrass research programs in the world. From its early beginnings, NTEP has expanded to the evaluation of seventeen turfgrass species in as many as forty U.S. states and six provinces in Canada (www.ntep.org). It is a cooperative effort between the non-profit National Turfgrass Evaluation Program, Inc., and the United States Department of Agriculture (USDA). NTEP is headquartered at the Beltsville Agricultural Research Center (BARC) in Beltsville, Maryland USA.

Information such as turfgrass quality, colour, density, resistance to diseases and insects, tolerance to heat, cold, drought and traffic is collected and summarised by NTEP annually. The data collected is from a range of sites across the USA and is undertaken by universities that run turfgrass research programs. The NTEP program is funded via the seed companies that pay to enter grasses into the program, however, the assessments and reporting are undertaken independent of the seed companies.

The NTEP information is used by individuals and companies in thirty countries. Plant breeders, turfgrass researchers and extension personnel use NTEP data to identify improved environmentally-sound turfgrasses. It is a very useful site for Australian turf managers to determine the relative rankings of new grasses despite the climate differences. As with all turfgrass trials, once selecting a group of grasses that may be useful, it is essential that local trials are undertaken.

All of the past and present turfgrass trials have been digitized and are available through the NTEP website, http://www.ntep.org.

References

Hilbert, M. and López, P. 2011."The World's Technological Capacity to Store, Communicate, and Compute Information. Science (journal), 332(6025), 60-65; free access to the article through here: martinhilbert.net/WorldInfoCapacity.html

Carson, T. 2012. Golf Course Management. Golf Course Superintendents Association of America.

Kenna, M. 2005. Using Turfgrass and Environmental Research on the Internet. Accessing research results is just a click away. USGA Green Section Record, May-June 2005.

LINKING BIODIVERSITY BENEFITS WITH CARBON BENEFITS ON YOUR GOLF COURSE

Dr Stephen Livesley & Caragh Threlfall
The University of Melbourne

Introduction

Golf course systems provide a really good opportunity to investigate ecosystem services and ecological processes that occur in all urban green spaces. Because of the way they are managed, golf courses contain the full spectrum of green space types: from the most intensively managed turfgrass areas (greens and tees), to less intensively managed grass fairways to low-managed or even 'passively' managed grassy rough and wooded rough 'out-of-play' areas. Almost all suburbs have at least one golf course that was established at about the same time as the suburb was. A key difference between golf courses and the smaller residential green spaces or urban parks that surround them is that golf course land management is relatively consistent and well recorded, whereas residential garden and urban park management is extremely variable and poorly recorded.

The ecosystem services of supporting biodiversity and providing carbon sequestration are at the forefront of many land managers minds. To this end, the AGCSA, in conjunction with the University of Melbourne, has embarked on a joint research project with the objective of improving the understanding of ecosystem services provided by urban green spaces and in particular golf courses. Jointly funded by the Australian Research Council (ARC), the Australian Research Centre for Urban Ecology (ARCUE) and the AGCSA, the three-year project is now well underway making use of a network of golf courses in Melbourne's south-east suburbs.

The golf courses included in the study are:

- Brighton Golf Course
- Victoria Golf Course
- Woodlands Golf Course
- Rossdale Golf Course
- Spring Valley Golf Course
- Kingswood Golf Course
- Peninsula Golf Course
- Frankston Golf Course
- Centenary Park Golf Course
- Sandhurst Golf Course
- Ranfurlie Golf Course
- Settlers Run Golf Course
- Amstel Golf Course

Project Objectives

This project has established a network of 13 Golf courses and 6 remnant vegetation reserves all located on the sandy soils of South-east Melbourne. Using this network of sites we are able to investigate:

1) Vegetation characteristics (out-of-play areas)
The plant species composition and the structural complexity of wooded and unwooded areas of rough and nearby nature reserves are measured to quantify not only biomass and therefore carbon, but also to better understand the relationship between vegetation characteristics, soil properties and the soil biodiversity that it supports.

2) Soil biodiversity (out-of-play areas)

The PhD student Alessandro Ossola will be assessing the diversity of soil macro and mesofauna in simple and complex golf course vegetation as compared to remnant vegetation reserves. He will be considering those biodiversity elements that are active in C and nutrient cycling processes, such as slaters, millipedes, ants, beetles and worms. Differences in soil biodiversity will then be related to differences in soil properties such as soil C content, soil aggregation, soil bulk density, soil water holding capacity and infiltration.

3) Carbon stocks (whole of golf course)
In 2013, soil will be sampled in the 13 golf courses to determine soil C content and other properties in 1) managed turf grass fairways, 2) extensively managed rough (simple and complex) and 3) remnant nature reserves. Soil samples will be collected to a depth of 0.3 m. In combination with the vegetation characteristics measured previously it will be possible for the project to investigate:

- Golf course management intensity (high, medium and low) and the impacts upon soil and vegetation carbon.
- Golf course management duration (decades) and the impacts upon soil and vegetation carbon.

It is expected that vegetation carbon will increase as a golf course ages, but only up to a certain age, beyond which vegetation biomass/carbon will be relatively constant. However, it is unknown how soil carbon will respond to long-term golf course management, and how different soil carbon will be in areas that are intensively or extensively (passively) managed.

This project will have real relevance to how we think about soil health in our urban green spaces and the influence of management practice and management intensity. For example, linking soil (and surface litter) biodiversity to soil carbon status may provide some real indicators as to the value of the diverse and complex vegetation structures within our golf courses, or in fact any large urban green space.

Project Methodology
Golf courses were sorted according to the complexity of vegetation they contain, and time since they were established. We included courses that are over 100 years old, in addition to those recently developed (<10 years old). We also included courses that contain patches of complex remnant vegetation, as well as those that are more open and park like. After a golf course is landscaped, it takes several decades for the vegetation to establish and surface litter to accumulate, providing a more natural ecosystem for faunal biodiversity to find refuge. As such, we expect there may well be a greater biodiversity benefit in older, more established golf courses, and in courses that contain more complex vegetation.

The biodiversity value of each golf course was assessed during Spring and Summer throughout 2012-13. The components of fauna biodiversity studied include insect communities, birds and insect-eating bats. Various methods were employed to measure the number of species occurring within each golf course, and the relative of abundance of key species. Key species under investigation include native bees, predatory bugs, beetles, and less common species of birds and bats. These key species were selected because of the functions they provide within the ecosystem or because of their sensitivity to environmental change.

Analysis of preliminary data suggests that both golf course characteristics such as vegetation structure and the health and age of trees present, in addition to the location of courses in the wider urban landscape contribute to the fauna biodiversity values of a golf course. The existing vegetation in urban golf courses provides habitat for a wide diversity of fauna types, and we found urban golf courses supported a diverse invertebrate and vertebrate community, including a variety of threatened bird species. Older courses are providing suitable habitat for an array of animals, however younger courses that have been landscaped to specifically include fauna

habitat can attract some, but not all, groups of fauna. Our data suggests that the diversity of species occurring in golf courses is likely to improve over time, especially if key habitat types are provided such as landscaped water bodies and patches of unmanaged long grass and understorey. Our data suggests that urban golf courses can provide excellent amenity/recreational use and high value biodiversity conservation areas.

Overall, our study will provide the golfing industry with a detailed and predictive understanding of the biodiversity value of the urban green spaces they manage. Recognition of the biodiversity supported and the habitat elements required by urban golf courses will enhance urban green space management, biodiversity conservation efforts and the liveability of Australia's cities.

OFF LABEL LIABILITIES

Terry Muir
Environmental Business Solutions

Introduction

What makes your actions right or wrong, legal or illegal under current pesticide laws? If we could extrapolate lessons learned from recent events there would be two that standout. The first is that the industry's view of the law cannot be "shades of grey." We cannot have a mix of those acting within the intent of the law and those seeking loopholes and innovative interpretations of the law to justify their questionable actions. The second is that the profession will undermine its own legitimacy if it is unable to answer the following questions - What are sports turfs' ideals when it comes to pesticide use? What is in the best interest of golf? and What are the professional and moral expectations of our Superintendents and turf curators? There is a complex role of individual ethics, social norms and self interest in pesticide use behaviour and the turf industry needs to test its legal and moral barometer and move away from the view that if you do something long enough it must be right.

Pesticide Management is Dead – The turf industry must now proceed to revive it

Warren G Bennis said that if we cannot invent and reinvent ourselves we must be content with borrowed postures, second hand ideas and fitting in instead of standing out. This paper examines an opportunity for the sports industry to combine innovations in law, technology, design and decision making to create a new and better pesticide use strategy - a reinvention of the way the industry manages and uses pesticides.

Faced with the evidence, many in the industry have started to admit that pesticide misuse is real, but many still argue that their actions have little or nothing to do with it. Others see the value of change and others will simply disconnect. What we must do is reinvent the right things.

Many practitioners in the state of Victoria operate under provisions unlike any other state with respect to off-label pesticide use. This will most likely change with national pesticide laws proposed to come into effect. The fear of many in the industry is that much of what is being promoted as the future of pesticide law will actually come to pass. We should welcome this proposed uniform approach as part of reviving sportsturf pesticide management.

It is not that the people involved in all of this aren't smart. Indeed, these are some very smart, very dedicated people, but they don't see the law for what it is. It evolves and the industry and every member must evolve with it. No change means no growth.

The following is an exert from Jonathan Wells', Is It Time to Reinvent Yourself? "If every Superintendent was to look back on their life they would discover that they have been reinventing themselves from the beginning. When they were a child they most likely saw a vision of the future based on their limited knowledge and experience. You may have said that you wanted to be a fireman or professional golfer or a newsreader when you grew up, or maybe you saw yourself going for a social worker degree so you could help others in your community. How many of you became your childhood vision?

Chances are, not many grow to fulfill their childhood vision of themselves. Why not? Probably because by the time you were a teenager, you had completely reinvented yourself. You had acquired new knowledge and had new experiences. Your whole perception of the world and your place in it had changed. Instead of seeing life from a child's point of view, you were beginning to see things as a young adult. You were no longer the same person.

Wouldn't it have seemed ridiculous not to change at that point? Of course it would, because growth requires change. What happened next?

By your mid-twenties you had probably reinvented yourself again. Why? Same reasons as before - more knowledge and experience. In other words, you grew into a new and different version of yourself. Now, let me ask you this, at what stage do you imagine that this process stops? When does the need to reinvent ourselves cease to exist? If you have followed my reasoning so far, you will see that there is only one answer to this question. The need to reinvent ourselves only stops when our personal growth and development stop.

When you take in new knowledge and implement it, it changes you. When you have new experiences and learn from them, it changes you. Whenever you act on what you learn it's called growing. So as long as we continue to grow, we will need to reinvent ourselves periodically. When we resist this process it can have a very negative effect on our sense of joy and our enthusiasm for life. If we know that we need to make a change and yet refuse to do so, it creates internal conflict. That means that our resistance has put us at cross purposes with our inner self.

When we reinvent ourselves it's like multiplying our knowledge base and perspective. It allows us to consider things from several different angles. We don't give up our former self, we simply add another dimension. Every time we add a new dimension to our lives we gain knowledge, insight, and experience. Over the course of a lifetime that becomes a deep well to draw from. There is a richness of wisdom that can only come through experience. That's a richness we can never know unless we learn to embrace change."

From careless consumers to recalcitrant turf managers; from unaddressed risk to the moments of Oh! And Whoa! my presentation will examine what have we learnt from the last 12 months. It will examine the real meaning of compliance and best practice and discuss if many feel they are holding a wolf by its ears - both holding on and letting go seem equally undesirable.

It is time to let go and do things differently. Kodak and Instagram are the same thing: shared personal snapshots. But technology, design, delivery and management made Instagram a success and left Kodak a dinosaur. Every problem is also an opportunity and it is up to the industry to restore the profession's tarnished reputation.

The emerging reality is that the sports turf industry is not entitled to proceed with business as its sees fit, unable or unwilling to innovate or think strategically or critically about its direction. The last thing the industry needs is a perception that it is more intent on having its way rather than getting things right.

AUSTRALIAN GOLF COURSE BENCHMARKING STUDY – DEVELOPING COURSE QUALITY OBJECTIVES

Andrew Peart
AGCSATech

Introduction

Golf courses and the associated playing surfaces are constantly under scrutiny by golfers and there are always comparisons made between golf courses and the apparent playing conditions. Almost all of these judgements are based on opinions with little or no knowledge of why a particular playing surface performs the way it does on any particular day.

This study involved monthly monitoring of the performance of selected golf greens and fairways over a 12 month period. There were nine golf courses monitored in Melbourne which represented three different categories of golf course (i.e. elite, mid-high level private and public access), as well as a one off assessment of three golf courses in Sydney and Brisbane representing the same categories.

Golf greens were assessed for; surface hardness, moisture retention, organic matter, thatch depth, rooting characteristics, smoothness and overall surface quality. Specific instruments such as the Clegg hammer, stimpmeter, Fieldscout TDR300 moisture probe, Trufirm® and the TORO Precision Sense™ platform were evaluated as methods of providing accurate, quantitative and repeatable data.

Results

The results for surface hardness, volumetric water and greens speed are discussed below.

Surface Hardness

Surface hardness is a variable that is often measured; however, it can be undertaken with two different instruments, the Clegg hammer and the Trufirm®. Both instruments were used in the trial, with over 6000 Clegg hammer readings taken with both the dome and flat head and nearly 3000 Trufirm® readings recorded. A strong correlation between the instruments has been developed, which can be seen below (Figures 1 &2).

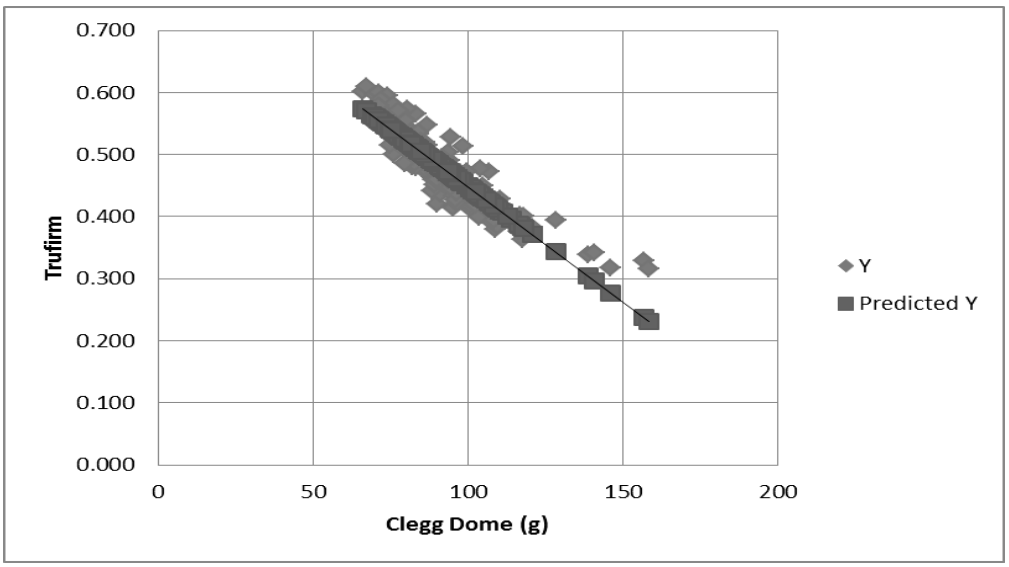

FIGURE 1 Regression analysis of surface hardness for the Trufirm verses Clegg (Dome Head)

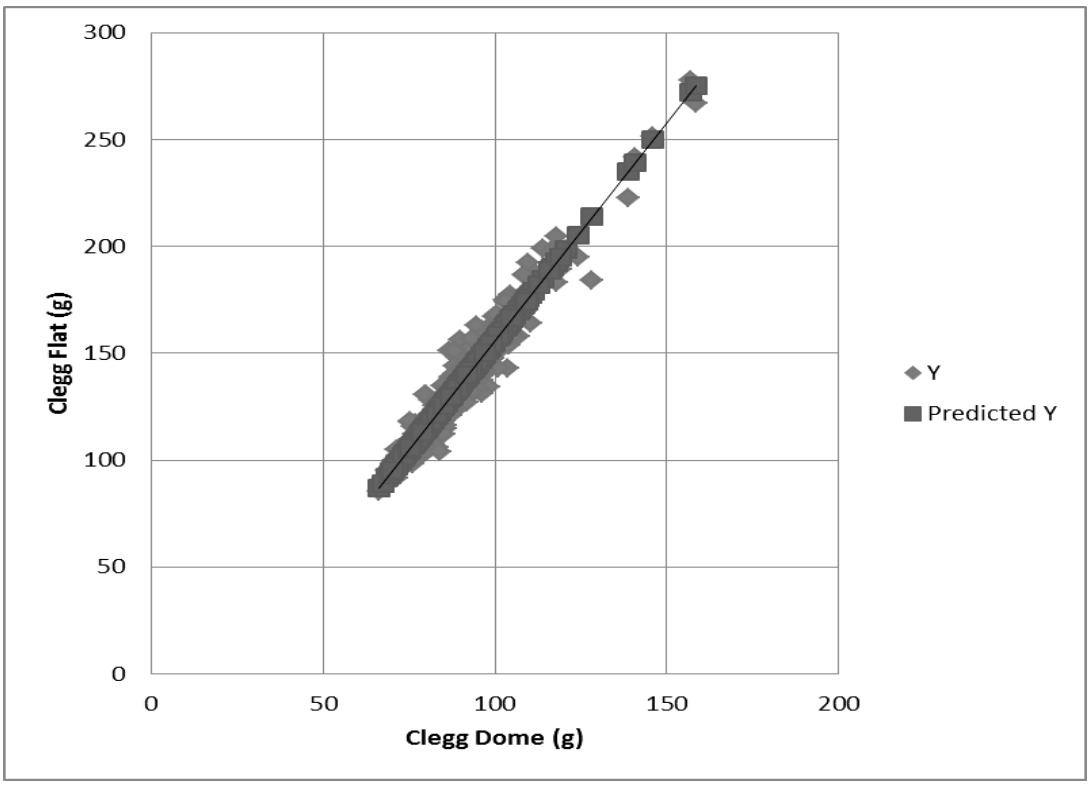

FIGURE 2 Regression analysis of surface hardness for the Clegg (Flat Head) verses Clegg (Dome Head)

The figure below (Figure 3) shows the results for surface hardness, measured using the dome head on the Clegg hammer, for each category of club during the assessment period. The trend showed that on nearly all occasions that the elite clubs provided the firmest surfaces while the public courses had the least firm surfaces.

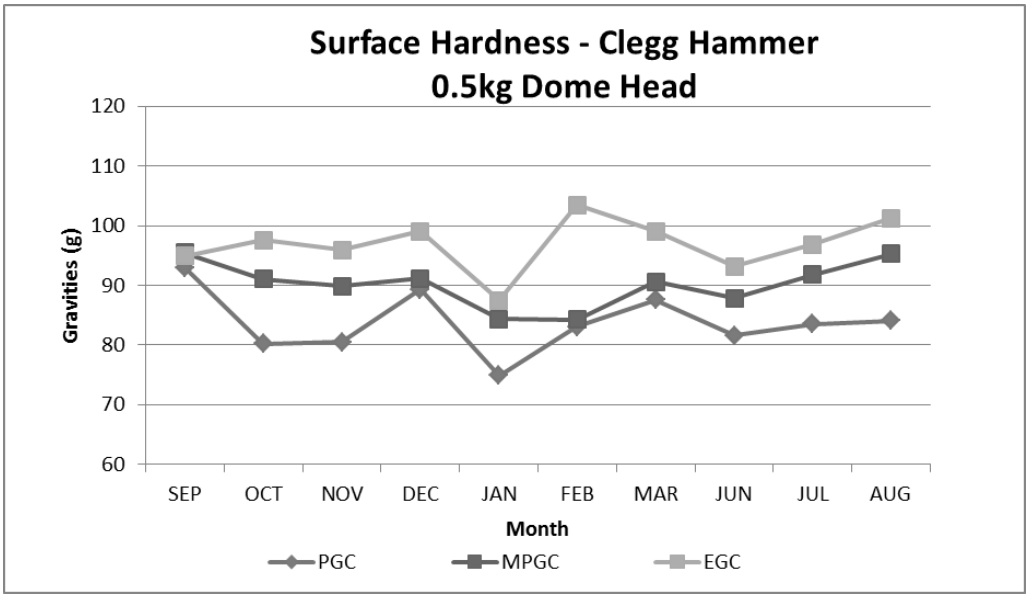

FIGURE 3 Surface Hardness as measured with the Clegg hammer – dome head.

Volumetric Water

The results for volumetric water content measured using the 120mm length probes indicated that the public courses had a higher soil moisture content within the profile than those of the

mid-high private and elite courses. This was particularly evident over the late autumn and winter months.

Soil moisture content was also measured using the 38mm length probes from March until August. The results showed that the public courses generally had a higher soil moisture content, with the exception of the March result when the mid-high private clubs had the higher moisture content, due to one of the mid-private clubs having an excessive wet upper profile on that assessment date.

A correlation coefficient was calculated for moisture at 3.8 and 12cm using the combined data across all sites. The correlation coefficient was 0.82 and illustrates a very strong relationship between the two depths of soil moisture content.

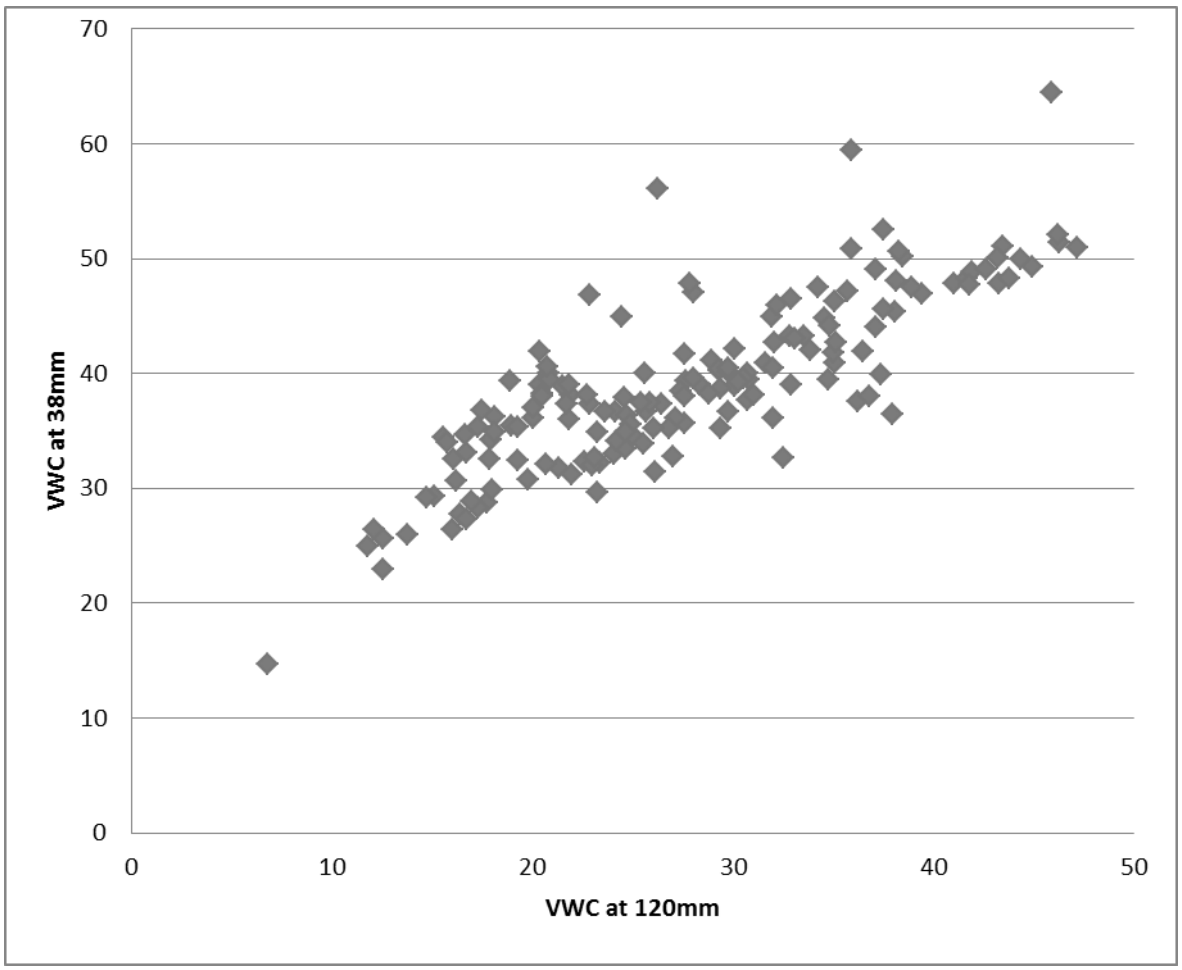

FIGURE 4 Scatter chart of moisture retention between volumetric water at 3.8cm and 12cm**.**

Green Speed

The trend for green speed across all golf course categories generally increased throughout the assessment period. The mid-high private clubs and the elite clubs had similar paced greens, although in the month of February the green speed at the elite clubs was much higher. This was primarily due to one of the elite clubs lowering their height of cut and increasing their rolling during February.

The green speed on the public courses was on average less than the other two categories for the majority of the period. This is due to a combination of a higher height of cut, no rolling, less frequent cutting, more deviation in ball roll and higher levels of surface moisture. Unfortunately, this was not substantiated with the correlation data for those individual variables. It may

however be as a result of the combination of those variables which will affect green speed.

Correlation Coefficients

Correlation coefficients were calculated to determine the relationship between all of the variables used to measure the performance of the greens. The different categories of clubs exhibited differing relationships, however, the most apparent was that green speed is influenced by surface smoothness and overall surface quality opposed to any other factors, particularly at the mid to high level private clubs and elite clubs.

There was a secondary relationship observed showing that surface smoothness was most influenced by surface hardness and mowing height, however, this result was not generally reflected at the public courses.

HORTON PARK GOLF CLUB SAGA

Pat Pauli
Horton Park Golf Club

The Horton Park Golf Club used to be on the outskirts of the Maroochydore Business District on flood prone land but over time the city centre has moved towards us and has now basically surrounded us.

I commenced work at Horton Park Golf Club in January 1982. When I arrived the club had just voted against moving to a new site that a developer had proposed. I was told the Golf Course Architect at the time was none other than Peter Thompson.

1985 the club purchased an adjoining 40ha block of low lying flood prone land $275,000 which according to the committee of the time would secure our water and future at our current site. The council changed the rules and would only allow development of a golf course as long as we put a road through the centre of it. 1988 the Club sold a portion of the land $400,000 and in return the developer provided 14 Ha for 2 holes around a lake which was part the clubs irrigation storage.

This deal provided the funds and the extra land to redevelop the existing course, build a driving range and put to bed any thoughts of future relocation.

During the late 80's and early 90's the course was redeveloped.

Around 2002 the board of the time were looking at ways to find funds to rebuild the Clubhouse. The sale of the airspace above the clubhouse car park was considered but the developer was more interested in a portion of land on the Driving Range. The Club ended up selling 1/3 of a Ha for nearly $7m. The smart ones within the club and on the Board were trying to work out what the club maybe worth considering $7m for 1/3 Ha and the club was situated on 53ha.

The President of the Club was elected as a councillor on to the Maroochy Shire Council and whilst there became privy to the proposed development of The Maroochydore Business Centre. This proposed plan had a road going straight through the centre of the golf course.

The Board of the time thought it best to leave under our conditions rather than council's and proceeded to look for interested parties to whom we may be able to sell and rebuild elsewhere.

In December 2006 the club has a new President and a partnership with Babcock and Brown a merchant bank like Macquarie Bank has been formed to facilitate the relocation. Part of this deal involved B&B paying all existing members annual fees up to time of relocation and a further 5 years. There was never going to be a fight even though most members were quite happy to stay on the current site.

Some of the unit owners in the new 6 story building on the driving range were very unhappy and would end up being a thorn in the side of the Board in the future.

Graham Marsh Golf Design was selected as the Golf Course Architect and the club was going to construct 36 holes with all the bells and whistles on old cane land west of our existing site. Around the time of the Global Financial Crises (GFC) 2007-08 rumours were rife that B&B were in trouble and the contract with 3 cane farmers for the land had lapsed. This soon proved to be correct.

The whole process started again, trying to find anyone interested in being involved. The Board interviewed 6 parties and in the end selected Lend Lease who own and operate The Sunshine

Plaza Shopping centre in the city centre located a stones through from our existing course. Lend Lease initially had 3 months to do due diligence according to the club directors but ended up controlling our site for nearly 2 years.

In 2008 the Qld Government under the Premiership of Peter Beatie amalgamates local councils and Maroochy Shire Council joins with Caloundra and Noosa to form the Sunshine Coast Regional Council (SCRC).

During this period Lend Lease didn't appear to be doing anything and kept blaming council for the time delay, but all the time controlling our site. At the same time some SCRC Councillors and the President of the Maroochydore Chamber of Commerce were constantly in the press and on TV that we needed to move on or be resumed. Lend Lease wanted to redevelop Sunshine Plaza and find a site for David Jones, but David Jones did not want to be located on the current golf course site. My opinion Lend Lease was tying up our site to stop any opposition from moving in.

During all this the members elected a new President who had different thoughts to most of the directors who were currently on the Board. This proved very interesting as well.

Rumours were rife amongst the members that we were buying Twin Waters Golf Club, a 20 minute drive from our current site but on the other side of the Maroochy River. Twin Waters Golf Club was and still is owned by a Japanese doctor who was initially reluctant to sell from all reports. In the end he agreed to sell for the betterment of Maroochydore and its people.

March 2011 HPGC Board members meet with staff and informed them that next day a public announcement would be made that the Board had signed a contract brokered by Lend Lease to buy Twin Waters Golf Club subject to member's approval. The reason given is the SCRC will announce the next day that the SCRC will purchase HPGC for $38m.The SCRC wants the site for its new Principle Activity Centre (PAC) and that it required a road to be built through the middle of the golf course to service the PAC and it needed to be built by August 2011. According to the SCRC and the HPGC board this was a win win situation for both the members and the SCRC. This process was conducted under the threat of certain resumption which would happen by 31st August 2011.

The deal was, SCRC would pay HPGC $38m and the club would purchase Twin Waters Golf Club for $28m as long as we were gone by the 31st August 2011. The additional money would be used to upgrade The Twin Waters Clubhouse and motorised cart sheds to accommodate the increase in members. This deal was a long way from the original deal which was struck by Babcock and Brown, but then a lot had happened to the world economy since then.

Three special General Meetings were held and all three meetings failed by a maximum of 5 votes to gain a 66.66% member support to purchase Twin Waters Golf Club. It was a very stressful period for both members and staff, and at this point there would be no golf club after 31st August 2011. Some of the members who were against going to Twin Waters used some of their own monies to employ legal people to fight the cause and in one case prevented a SGM from going ahead.

Members who had been friends for years could not agree and to the point would not even play golf together. There was even a loud argument on the 10th green one member's day where two of the four walked off never to return. The interesting part in this whole process was the President stood alone amongst the Board in not wanting to go to Twin Waters, but was in favour of buying land and building a new course. It was very sad to see the club disintegrating and very quickly.
Members were voicing their opinions in the press, on TV and taking to email, it was very ugly a far cry from the club that I first started work with in 1982. During this period the members and

staff of Twin Waters Golf Club were dealing with similar issues. Some of their members thought it was a good idea because their fees may become cheaper and others did not want a bar of it. The staff had no idea where they stood except to say 2 lots of staff would not go into one.

With no options left and time fast running out The Board put in place consultants to find land close to our existing site that may be suitable for a new course.

An extension of time until 30th October was granted by SCRC which allowed the AGM to take place in September. A number of Board Directors did not stand for election and the new Board met with the SCRC to broker a new deal.

The President and New Board members were able to arrange with the SCRC an extension of time and an extra $4m for the current site. Two years from the 30th June 2012 was granted which meant the club had less than 3 years to get all the design and development approvals done for clubhouse, maintenance facility and 27 hole golf course as well as construct the course.

The block of land selected had been used for growing cane and is situated some 10minutes drive from our current site and close to the Maroochy River. One of the major hurdles has been to meet the entire flood monitoring approvals that is required on the Maroochy River Flood plain. This is made much more difficult when certain areas have to meet 1 in 100year flood criteria. It does very much limit the design of the course but that is all another story for some other time.

SUSTAINABILITY, RESPONSIBILITY, CAPABILITY – AN ALTERNATIVE APPROACH TO VEGETATION MANAGEMENT

Dr Paul Barber
ArborCarbon Pty Ltd

Introduction

Over the years, we have conducted surveys, carried out monitoring, diagnosed health disorders, and treated a wide range of vegetation species throughout golf courses, parks, gardens and reserves in Australia and south-east Asia. Although vegetation within these growing environments can face similar challenges in both regions, there are many differences, including the vegetation species, pests and pathogens, climate, soil type, application of chemicals, type of management. The focus of this paper will be mainly on managing trees in Australia.

The Australian population is rapidly expanding, hitting 23 million about 6 hours prior to me writing this paper. The majority of the population is focused around the urban centres, with some of the Australian cities amongst the fastest growing in the world. With expansion comes removal of existing vegetation and open space, resulting in serious consequences for the dependent biodiversity. The sustainable management of vegetation within existing and newly created parks, gardens, reserves and golf courses has never been so important. This vegetation provides numerous benefits to the reliant biodiversity, but arguably more important, the people who live within communities nearby and visit these areas.

Unfortunately many people view trees, and particularly large, old trees, as a real risk to life and property. Such views threaten the retention and sustainable management of this vegetation. But realistically, how many serious injuries or deaths of people occur within Australia each year from trees that fail? I could probably count them on one or two hands. The majority of these injuries and deaths would be within the tree-management industries (i.e. forestry, arboriculture, tree surgery) and not the general public who occupy the public open spaces. We accept risk every day when we drive our car, cross the road, play sport, swim in the ocean, eat fatty foods etc. The risks associated with these activities are far higher than those from tree failure. What is the point I am trying to make? Over-pruning and premature removal of vegetation, mostly due to the perceived risk of the vegetation to life and property, is not sustainable. It is often based on fear, and the idea that old or sick trees are high risk. If we make the correct choice about the vegetation we plant, adopt suitable methods for establishment, carry out precise monitoring, conduct early and correct diagnosis of health disorders, and correctly manage these health disorders, we can sustainably manage and conserve this valuable vegetation, and in doing so, greatly reduce the costs and energy output associated with vegetation management. Rather than view vegetation as a risk, we should consider that such vegetation could greatly reduce the risks associated with extreme weather events. The climate has now changed and we are experiencing a greater incidence of extreme weather events. Healthy vegetation can greatly increase the resilience of the surrounding infrastructure and assets to extreme climatic events like frost and flooding. For example, the extensive root systems of large trees have a great capacity to minimise erosion and removal of top-soil, uptake of excess water, and removal of pollutants that are commonly associated with freak flooding events.

At present, for many reasons, the majority of stakeholders are not adopting a sustainable approach to vegetation management, and in doing so, are greatly contributing to having a negative impact upon the environment, and wasting valuable dollars and resources that could be better spent on other, more sustainable activities. We have the capability to make changes, and the obligation to act responsibly and ensure our vegetation is managed sustainably for the enjoyment of future generations. Let's now discuss this in more detail.

Mapping and Monitoring

How many of you know what portion of your asset is occupied by vegetation? What amount of vegetation has been lost/gained annually over the past decade? How has the health of your vegetation changed each year? If there has been a decline in the health of your vegetation, what is the spatial and temporal pattern of this decline? How has your vegetation responded to treatment? How is your management of turf impacting upon tree health? These are all questions that can be answered using a combination of remotely-sensed and *in-situ* techniques. Over recent years we have been acquiring and analysing high-resolution (0.01m to 0.5m) imagery using specialised sensors fixed to airborne platforms (i.e. fixed wing, UAV). These sensors are very sensitive to subtle changes in vegetation growth and condition, and allow us to answer many of the questions that are listed above. By combining this precise vegetation monitoring technology with our knowledge on the ground, we can adopt a pro-active approach to the development of sustainable vegetation management strategies. The image below shows the results of different types of analysis of airborne multi-spectral imagery over urban locations throughout Perth, WA. Figure 1 quantifies the amount of woody vegetation (coloured in khaki) as 18.4% canopy cover, and the image on the right shows how the vegetation health over a golf course has changed over a one year period, with red showing loss, white stable, and blue gain. The year was one of the driest on record and caused widespread decline in health of vegetation throughout Perth.

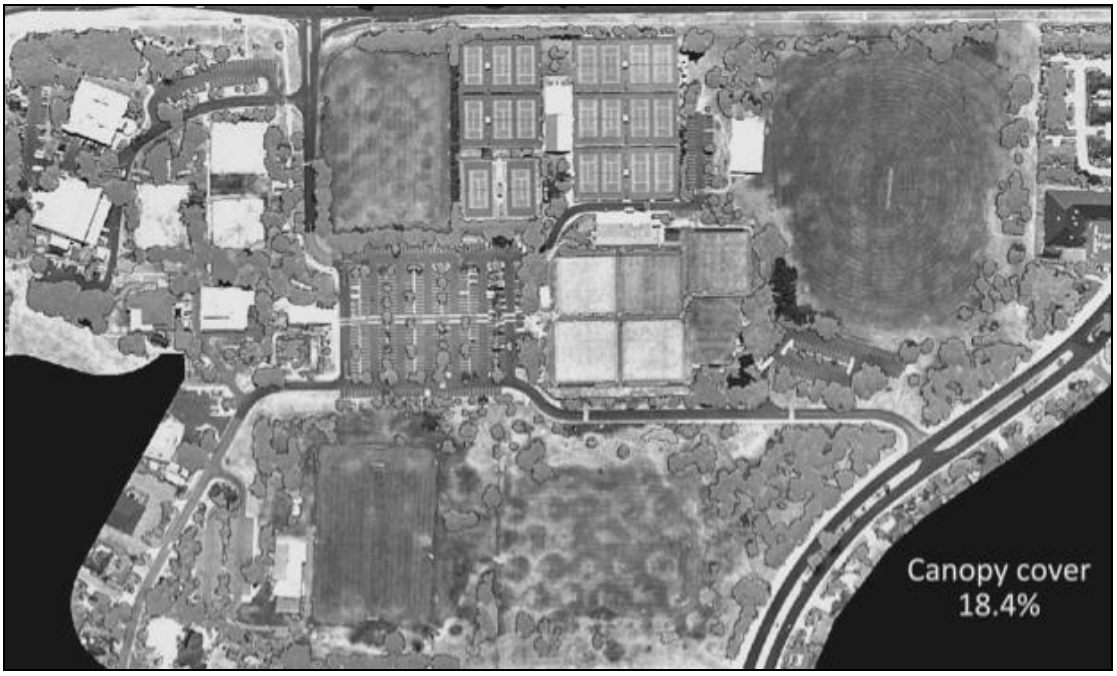

FIGURE 1. Canopy cover quantified from analysis of airborne multi-spectral imagery (0.5m resolution).

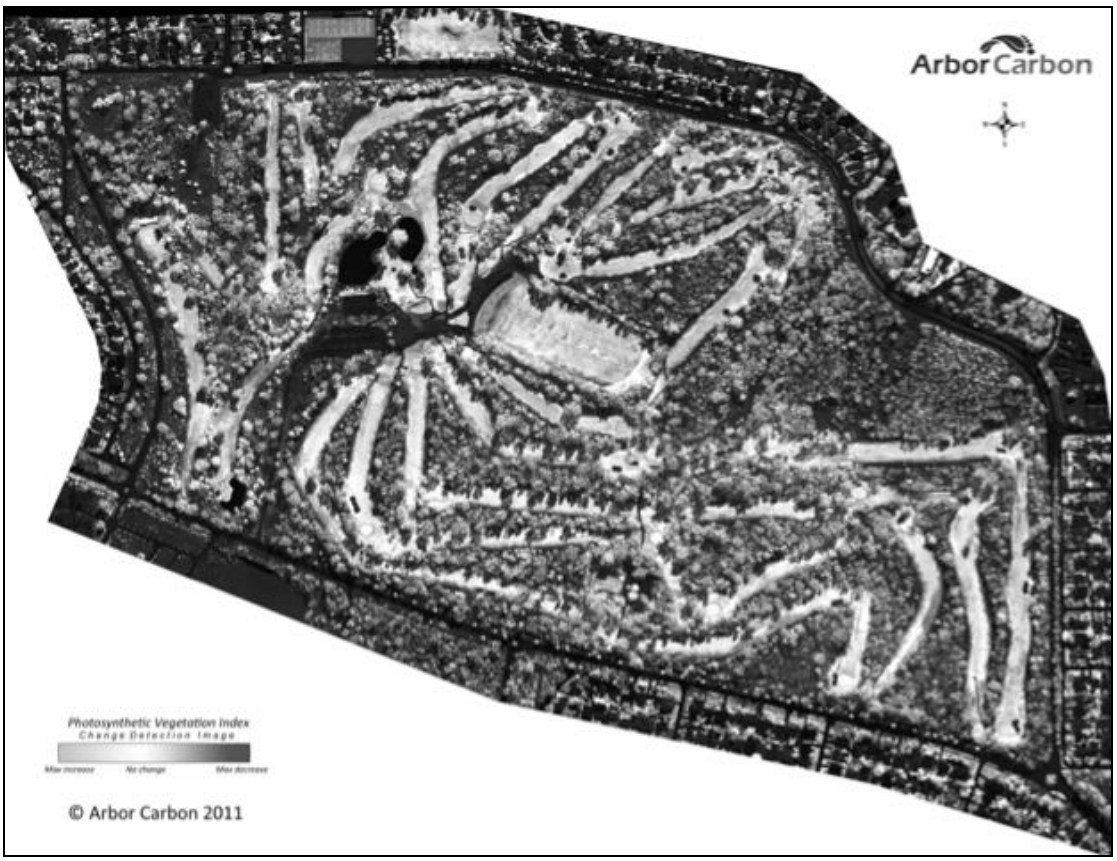

FIGURE 2. Change in vegetation health over a one-year period. Red indicates loss, white stable, and blue gain.

Causes of Native Tree Decline

Factors causing the premature decline in health of trees can be categorised as predisposing, inciting or contributing. Trees growing in turfed, urban environments, and particularly native Australian trees, are already predisposed to premature decline in health, due to sub-optimal soil conditions, a lack of beneficial soil microbes, radiant heat from impervious surfaces, a lack of space for roots etc. Many other factors in these environments can incite or trigger the premature decline in health of vegetation, including mechanical damage, over-pruning, extreme climatic events (i.e. drought, frost, hail, flooding, cyclone), groundwater drawdown, pesticides, pathogens, pests etc. As trees begin to decline in health, their susceptibility to other contributing factors increases and these factors can exacerbate the decline to the point of death. Such factors include pathogens, pests, over-pruning, excess irrigation or fertiliser. We very commonly observe vegetation managers increasing application of water or fertiliser, and excess removal of the canopy following observation of decline symptoms. If inciting factors like root pathogens, pests, or decay fungi are present, these actions can favour these factors by improving conditions for infection and development of disease, or increasing stress thereby reducing the ability to resist further attack. Over the past two years during surveys of declining trees in many parks, gardens, reserves and golf courses throughout the Perth urban area, we discovered nine different species of the root pathogen *Phytophthora* associated with disease symptoms. *Phytophthora* is considered to be one of the most important genera of pathogens of trees worldwide. These species have been identified using a combination of traditional and DNA-based techniques. Figure 3 shows a phylogenetic tree of the species we isolated, with three new to science and one a new record for Australia. Interestingly, some of these species have only previously been found in nurseries, raising questions about how they were introduced into the parks we surveyed. We have now adopted a program to manage these potential pathogens.

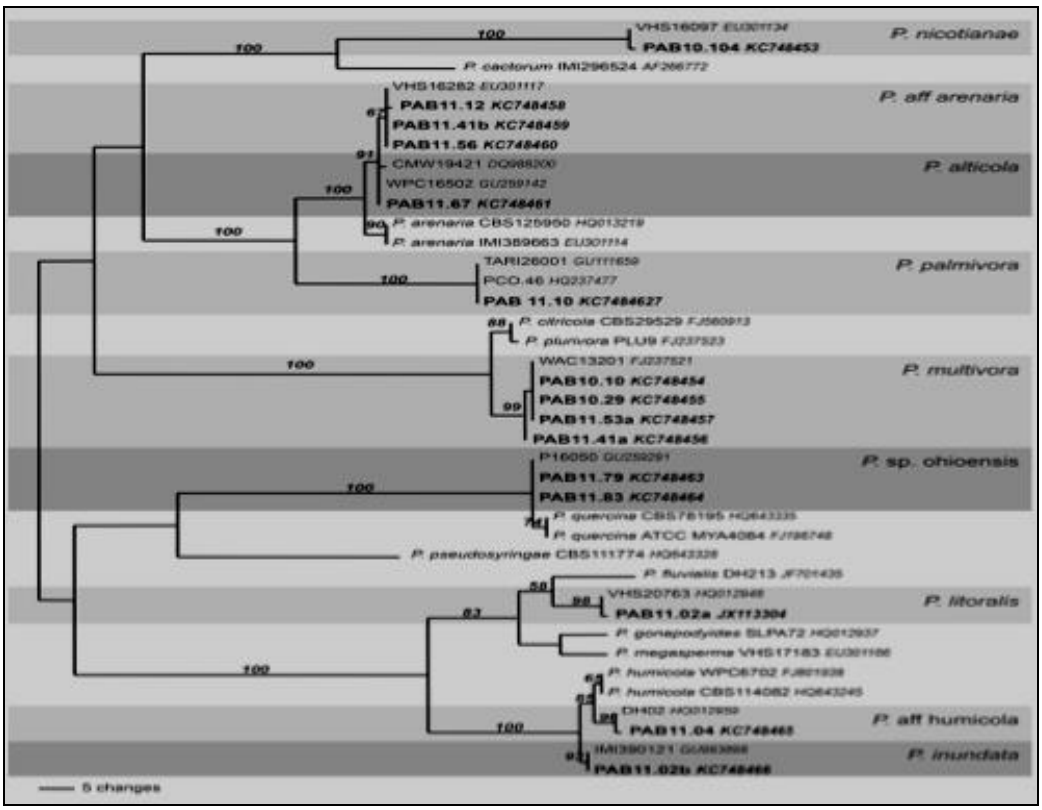

FIGURE 3. Phylogenetic tree of *Phytophthora* species isolated from declining native trees.

Diagnosis of Vegetation Health Disorders

Accurate diagnosis of the causes of decline in vegetation health, particularly in the urban environment, is challenging. Almost every situation is different, and as a result, so too can be the causal factors. It is first important to gain an understanding of the history of a site and what predisposing factors are present, and what factors may have incited or triggered a decline event. This knowledge can be sourced from the site manager or previous site managers, and also from historical environmental data (i.e. airborne imagery, climate records etc.). It is then important to know the biology of the host and pest/pathogen, consider the limitations of the environment within which they occur, and identify the signs and symptoms associated with the decline. Collection of physiological measurements may be required, and soil, foliage and/or root samples. This is where experience can be important, and this can reduce the number/range of samples collected and therefore reduce costs for analysis. Laboratory analysis is undertaken and data analysis to identify anomalies. The puzzle can then be pieced together to form an accurate diagnosis.

Sustainable Vegetation Management

Sustainable management of vegetation health disorders can only be successfully achieved if the cause(s) of the disorder are accurately diagnosed. Inaccurate diagnosis can result in incorrect management and this can be costly with unfortunate outcomes. Pruning is often a last resort as it may cause the re-allocation of valuable plant resources to respond to the wounding, at expense of defence against the causal factor(s). Sometimes we are unable to treat the predisposing or inciting factor (i.e. flooding, frost, hail etc.), so we are required to manage the inciting or contributing factor(s). Trees are incredibly resilient and can often respond favourably and rapidly to such treatments. Over the past few years we have treated a wide range of disorders of vegetation using a combination of cultural, soil and systemic (i.e. implanting, injection) treatments with very good results (Fig. 4). This form of management has many positive outcomes, including the conservation of the tree, enhanced aesthetics and biodiversity values, increased benefits to people (i.e. increased shade, reduced air pollution), and finally, reduced costs and energy output for pruning, removal and replacement.

FIGURE 4 Results of treatment of a tuart (*Eucalyptus gomphocephala*) suffering from severe insect attack.

Conclusion

The alternative approach to vegetation management discussed within this paper does not require the allocation of large funds, or radical change to the way that we conduct our day to day activities. It does however require superintendents and environmental/parks coordinators to think more holistically about vegetation health, identify and understand the importance of this vegetation, and be open to new ideas and methods that are not widely used within the industry. The benefits of such an approach far outweigh the costs if we consider this holistically, and we must strive to always improve our approach to vegetation management, so that we stay one step ahead of the new and emerging factors impacting upon vegetation health. We have the capability, and have an obligation to act responsibly and manage our vegetation sustainably.

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TREE AUDIT AND MANAGEMENT WEMBLEY GOLF COURSE

Darren Wilson
Wembley Golf Course

The Wembley Golf Course is situated within 6 kilometres of the Perth CBD in the Western Suburbs only one kilometre from the beach. The course was built around the existing natural bushland with an emphasis to use the large Tuarts, Banksias, Jarrah and WA Peppermints as a major feature.

The very first task was a tree audit to identify all major trees as well as a risk assessment on all holes especially where the golfers stop such as around tees and greens. Priorities were as such:

- Identify trees which have the potential to be a hazard.
- Assess the current condition and future longevity.
- Recommended remedial work to be carried out on individual trees which pose a threat to patron's safety.
- Provide priority ranking of remedial works as per risk analysis.
- Site assessment for *Phytophthora cinnamomi.*
- Provide report on findings from samples.

Findings:

- Much of the native flora is indigenous to the area, particularly the large Tuarts (*Eucalyptus gomphocephala)*
- These trees range from a relatively young age to over 180 years old.
- There are also many Jarrah, (*Eucalyptus marginata)* Marri (*Eucalyptus calophylla*) Flooded Gums (*Eucalyptus rudis*), Sheoaks (*Allocasaurina spp*) and *Banksia spp*.

The criteria used to calculate the remaining safe life expectancy of the existing large Tuarts is based on a number of factors. The key information required for long term planning is how long each tree can be expected to remain on site with an acceptable degree of safety. Assessment for each tree is based on potential of the species in the locality and the final assessment made gives particular consideration to the following:

- Obvious past influences
- Health and vitality – present and future potential for the species on the site
- Estimate age in relation to expected life expectancy for the species
- Remedial work which may be necessary to allow retention in the existing situation

Therefore taking into consideration the extent of decline and levels of possible root decay, also most importantly the rise or fall of the water table levels over the next ten years could possibly see the life expectancy of these large Tuart trees be retainable within an acceptable level of risk for approximately five to fifteen years.

Tree Evaluation Hazard Rating
Probability of Target Impact: **1-3 points**

1. **Occasional Use:**
   Low use roadways (i.e. turnabouts, dead end road etc.) low-use recreation trails; woods and open spaces with low foot traffic.

2. **Intermittent Use:**
   Roadways intersections in high use areas; parking lots adjacent to moderate-low use areas; dispersed picnic areas; collector streets and minor arterial roadways

3. **Frequent Use:**
   High use park and play areas; all buildings and residences; schoolyards; specially marked handicap-access areas; and parking lots; adjacent to high use areas; principal arterial roadways, freeways and expressways.

Size of Defective Part(s): **1-4 points**

1. Parts **less than 50mm** in diameter
2. Parts from **50mm to 250mm** in diameter
3. Parts from **250mm to 500mm** in diameter
4. Parts **greater than 500mm** in diameter

Probability of Failure: **1-3 points**

1. **Low**: some minor defects present - minor branch dieback; minor defects or wounds
2. **Moderate**: one to several moderate defects present - Stem decay or cavity within safe shell decay; hardwood stem with single crack and some decay; weak union with enrolled bark, defect(s) affecting <1/2 tree's circumference; leaning tree (away from target area; <45 degree angle), without recent root lifting or soil mounding.
3. **High**: multiple or significant defects present such as stem decay or cavity at shell safety limits; multiple cracks or a single crack which goes completely through the stem, weak union with crack or decay; defect(s) affecting >1/2 trees circumference, with decay present, leaning tree (towards target area; <45 degree angle) with recent root lifting or soil mounding; recent construction, dead or lodged branches; dead trees.

Species Rating: **0-2 points**

0. **Durable Species** – Not prone to Failure (eg. Red Oak, Sugar Maple, etc.)
1. **Average Species** – Moderate Strength
2. **Weak Species/Dead Trees** – Prone to Failure (eg. Poplar, Willow, White Pine, some Eucalyptus spp., Wattles etc.)

Tree No.	Species	Location Info.	Probability of Target Impact	Size of Defective Part(s)	Probability of Failure	Species Rating	Hazard Rating	Action Recommended						Action Completed	
			1-3 points	1-4 points	1-3 points	0-2 points	Sum of the four columns	CO	CT	CR	CL	CR N	?	Date	Initial
Second Nine Old Course, Golf Hole No 17															
		Tee to Green Left Side													
13	*Eucalyptus gomphocephala*	Tuart Tree	2	3	2	1	8	*			*				
5	*Eucalyptus marginata*	Jarrah Tree	2	3	2	1	8	*			*				
2	*Eucalyptus calophylla*	Marri Tree	2	3	2	1	8	*			*				
1	*Eucalyptus gomphocephala*	Tuart Tree	2	4	3	1	10						R		
1	*Eucalyptus gomphocephala*	Tuart Tree	2	3	3	1	9	*		*	*				
		Tee to Green Right Side													
13	*Eucalyptus gomphocephala*	Tuart Tree	2	3	2	1	8	*			*				
5	*Eucalyptus marginata*	Jarrah Tree	2	3	2	1	8	*			*				
10	*Eucalyptus calophylla*	Marri Tree	2	3	2	1	8	*			*				
2	*Eucalyptus gomphocephala*	Tuart Tree	2	4	3	1	10						R		
1	*Eucalyptus marginata*	Jarrah Tree	2	4	3	1	10						R		
1	*Eucalyptus calophylla*	Marri Tree	2	4	3	1	10						R		

CO – Cleaning Out.....CT – Crown Thining CR – Crown Reduction CL – Crown Lifting CRN – Crown Renewal ? - Other
R- Removal G – Group of Trees

Typical Report from Audit

The findings of the first report are as follows

- Over $250,000 immediate work required impacting on patronage safety.
- Replanting program of native species required annually.
- Another report required on why there was a rapid decline in Tuarts occurring.

The second report findings on the rapid decline were as follows:

- *Phytophthora cinnamomi, (Dieback)*
- *Armillaria luteobubalina (Honey Fungus)*
- Scale Insect *Maskiella globosa*
- 527 trees directly under stress from the above

Next was to label, collect a GPS co-ordinate, measure the dbh, (Diameter at Breast Height) and crown height and photograph each tree. Treat all trees with a range of systemic treatments being trialled to improve the health of tress and prepare a report to list the trees identified, their attributes, images, and the treatments applied to each, for the purpose of ongoing monitoring.

MANAGING AND AUDITING VEGETATION ON YOUR GOLF COURSE

Adam Robertson
Kew Golf Club

Location
The Kew Golf Course site is approximately 53 hectares situated on river flats meandering along the Yarra River. It forms part of what the Victorian State Government refers to as "Melbourne's green wedge". Within this area there are many other golf courses and open space parkland forming an important ecological corridor along the Yarra River.

The course at a normal Yarra River water level is six meters above sea level with predominantly most of our course land sitting at an elevation of between 10 and 11 meters. The site is a retarding basin for when the Yarra River comes into flood.

Our golf course site has been listed as one of the most significant zoological site within Boroondara. Primarily for the rare fauna of its wetlands (and particularly for the breeding colonies of waterbirds) and significant for the presence of rare plants.

History
In 1894 The Kew Golf course was founded on a layout about 2kms from the present site. In 1922 the course relocated to the present site on the corner of Belford and Kilby Road, East Kew. The members then formed a plantation committee to plant trees and shrubs to define the fairways. Apart from the rivergum's, the site was almost treeless. A report was commissioned from a then, well-known expert nominating tree species for planting. The club purchased and planted the recommended trees. Members also selected and planted their own species. That said 800 trees were assessed of an estimated 2234 trees within the boundary of the course, approximately 40% of these being naturally occurring indigenous trees with 60% being planted specimens. This figure clearly demonstrates the effect of the member's plantings over the years.

Process over time
With our ageing and diverse range of trees I felt the need to better understand the makeup of our site. I originally approached the club in September 1998 with a proposal to conduct an audit to better understand our diversity of trees on the course. I viewed the trees as our biggest asset as members would proudly tell guests that playing at Kew was like taking a walk through the Botanical Gardens. The proposal didn't get the committee's support at the time. Again, in August 2005, I approached the club with another proposal to conduct a vegetation audit as several notable golf clubs around Melbourne had started implementing assessments to form part of proposed course upgrades which in turn were part of a course master plan. Again, it wasn't high on our clubs agenda so didn't get support. This was a time when council really didn't interfere and we didn't have any plans for future course works. The club was comfortable at that point in time. Yet, the problems associated with the makeup and maturity of our vegetation was creating significant problems for players and overall course maintenance and playability. Other issues were:

- Encroachment of tree canopy over the holes affecting play;
- Root damage to assets (drainage and irrigation) compromised playing surfaces;
- Shading of playing surfaces;
- Unsafe playing environment;
- Competition for soil moisture and nutrient causing root decline;
- Tree litter;
- Compromised character and integrity of course design.

Over the next seven years, tree maintenance started to become more of a significant component in our course maintenance. Our local council started paying more attention to tree preservation and conservation within the overall municipality and the drought was also starting to have an effect on the trees.

A new direction

In 2010, the club reviewed its current grass policy (two grass system) and found weaknesses in continuing. The inconsistency in our common couch cover and the natural transition process between seasons was making establishing a consistent, uniform surface difficult. So the club set out to investigate the suitability of a single grass strategy. The committee invited several independent consultants to undertake a grass study to look and advise the club on the best grass moving forward. AGCSATech and Graeme Grant Golf Design undertook the study with both indicating that Santa Ana will give the best overall performance for The Kew Golf Course year round. As part of both reports, it was highlighted the need to improve ground and growing conditions. This well and truly put our tree stands in the spot light. In September 2011, it was recommended to the members the new direction forward. In recommending the change the committee was conscious of not fore going the courses unique feel and character. This bought up the concern of how many trees we were going to have to remove?

Not everyone likes change

The question that was consistently being asked by the members was what effect will this have on our trees? How many will be cut down? The emotional attachment with the trees started to weigh heavy into the discussions with members about moving forward. Certainly there were some other concerns that members held but on the whole, the question of trees was unanswered. A petition was put forward with the required numbers signatures to hold off starting the work and take it to a vote by the members. Prior to a member's information night I again had obtained a fee proposal from a Melbourne base company, Treelogic for an assessment and survey for the golf course. Hastily the members were informed that the club had obtained a fee proposal to conduct a tree audit. This was to help identify the effect on trees and manage the trees moving forward. This helped to waylay some of the fears people had. The vote at an EGM in October 2011 was 59% to 41% in favour of the committee implementing their proposed new course works triggered by implementation of the new grass policy.

In early 2012, Treelogic was commissioned to start their assessment and survey work with a Landscape Consultant, Philip Liston engaged to assist in developing a Vegetation Management Plan (VMP) using the findings from the Treelogic report.

The arboriculture assessment

The assessment process observed trees from ground level looking at their growing environment and surrounding area. GIS surveying was used to plot individual trees onto aerial imagery with each tree being given a number. Observations were made of each assessed trees to determine species, origin, age category and condition. Measurements of crown height and width and trunk dimension at chest height were also taken. Each of the assessed trees had calculated and allocated a tree protection zone (TPZ) figure for reference for future course redevelopment work. All this information was then complied to formulate the overall report. The report also gave priorities and recommendations of possible work to be carried out on a trees where required.
That said, from the preliminary assessment, over 800 were reported on of the estimated 2234 trees within the boundary of the course. Approximately 40% of these being naturally occurring indigenous trees with 60% being planted specimens. 116 different species were identified. An example of the collected data is shown on the next page.

Tree No	No of Trees	Botanic name	Common Name	Origin	Age class	DBH (cm)	Height	Width	Health	Structure	Arb Rating	TPZ (m radius)	Comments	Recom'd works	Priority	Shading	ADJDBH
1	1	*Eucalyptus sideroxylon*	Red Ironbark	Victorian native	Maturing	60	15	8	Dead	Very poor	None	7.2	Remove	Remove	1		60
2	1	*Eucalyptus botryoides*	Southern Mahogany	Victorian native	Semi-mature	58	16	18	Fair	Fair to poor	Moderate	7	Crossing rubbing branches				58
3	1	*Ulmus glabra* 'Lutescens'	Golden Wych Elm	Exotic deciduous	Semi-mature	72	11	17	Fair	Fair	Moderate	8.6	Low spreading habit. Uplift	Formative prune	3		72
4	1	*Quercus palustris*	Pin Oak	Exotic deciduous	Maturing	64	17	16	Fair	Fair	Moderate	7.7					64
5	1	*Quercus palustris*	Pin Oak	Exotic deciduous	Semi-mature	38	10	13	Fair	Fair	Moderate	4.6					38
6	1	*Nyssa sylvatica*	Tupelo	Exotic deciduous	Semi-mature	14	5	7	Fair	Fair	Moderate	2					14
7	1	*Nyssa sylvatica*	Tupelo	Exotic deciduous	Semi-mature	13	4	6	Fair	Fair	Moderate	2					13
8	1	*Cupressus macrocarpa*	Monterey Cypress	Exotic conifer	Maturing	13	14	17	Fair	Fair to poor	Low	2	Shading. Included bark forks. Consider removal	Consider removal	4	Shading	13
9	1	*Eucalyptus botryoides*	Southern Mahogany	Victorian native	Maturing	93	17	18	Fair	Poor	Low	11.2	Trunk & limb decay. Consider removal	Consider removal	3		93
10	1	*Eucalyptus sideroxylon*	Red Ironbark	Victorian native	Maturing	50	18	15	Fair	Fair	Moderate	6					50
12	1	*Eucalyptus scoparia*	Wallangarra White	Australian native	Semi-mature	30	11	7	Fair	Fair	Moderate	3.6					30
13	1	*Corymbia maculata*	Spotted Gum	Victorian native	Maturing	88	25	23	Fair	Fair	Moderate	10.6	Supported hanger-Crown maintenance	Crown maintenance	2		88
14	1	*Corymbia maculata*	Spotted Gum	Victorian native	Maturing	87	18	14	Fair	Poor	Low	10.4	Included bark fork - Cable bracing req'd	Cable bracing	1		87
15	1	*Eucalyptus botryoides*	Southern Mahogany	Victorian native	Maturing	83	16	13	Fair	Poor	Low	10	Trunk & limb decay. Shading			Shading	83
16	1	*Quercus palustris*	Pin Oak	Exotic deciduous	Semi-mature	39	12	11	Fair	Fair to poor	Moderate	4.7	Shading. Included bark fork			Shading	39
17	1	*Eucalyptus botryoides*	Southern Mahogany	Victorian native	Over-mature	93	14	12	Fair to poor	Poor	None	11.2	Trunk decay. Previously lopped. Consider	Consider removal	2		93

The Vegetation Management Plan (VMP)

The formation gathered in the arboriculture assessment was then used to assist in the formulation of the VMP. The document provides the framework for establishment, maintenance and sustainability of the courses vegetation moving forward. The aim being:

- Conserve and enhance the existing landscape and character of the golf course;
- Provide a co-ordinated approach to tree retention, removal and replacement;
- Ensures future tree management and landscape development compliments visual character and strategic qualities of the course;
- Ensure future tree management activities and actions are consistent with turf management and general course design/management imperatives;
- Give direction for future committees and management.

Other documents that were reviewed to help formulate the considerations within the VMP were;

- Kew Golf Club - Site Characteristics, Tree Sub Committee.
- Kew Golf Club – Grass Study Report Sept 2010 AGCSA Tech
- Kew Golf Club – Grass Study Report Aug 2010 Graeme Grant Golf Design
- Kew Golf Club – Individual Hole Report March 2011 Graeme Grant Golf Design
- Inventory and Assessment of Indigenous Flora and Fauna In Boroondara – Extract, Site 7. The Kew Golf Club.

From all this information the Landscape Consultant then compiled a hole by hole plan outlining observations and recommendations. This formed part of a high level landscape concept plan to guide future planting initiatives.

Dealing with council

Our site falls under the City of Boroondara Planning Scheme and is zoned Special Use – Golf Course. We have three planning overlays governing the course. Environmental Significance Overlay (ESO), Significant Landscape Overlay (SLO) and Land Subject to Inundation (LSI). The main overlay that has significant control is the ESO. The purpose of the Environmental Significance Overlay (ESO) is to identify the significance of the Yarra River corridor as an important open space, recreational, aesthetic, conservation and tourist asset. It seeks to ensure that development is compatible with the Yarra River corridor's landscape character and environmental values. I have found the tree audit document very helpful in dealing with council. Trying to wade through the governance issues in removal of a tree can be extremely difficult. Both documents have been shared with our local council to help smooth the governance process of tree removal with council indicating which trees from our clubs nominated trees removal list require a permit.

No of Trees	*Botanic name*	Common Name	Origin	Reason for Recom'd Remov	Health	Recom'd works	TL Priority	Local Law Perm	ESO	SLO	52.17 permit req'd	KGC Priority	Removal Approved by C'tee
1	*Cedrus atlantica*	Atlas Cedar	Exotic conifer	1	Very poor	Remove	2	No	Yes	No	No	1	30-Aug-12
1	*Cpressus macrocarpa*	Monterey Cypress	Exotic conifer	1	Fair to poor	Consider removal	4	No	No	No	No	0	30-Aug-12
1	*Eucalyptus botryoides*	Southern Mahogany	Victorian native		Fair			No	No	No	Yes	0	30-Aug-12
1	*Eucalyptus botryoides*	Southern Mahogany	Victorian native	1	Fair	Monitor	4	No	No	No	Yes	1	30-Aug-12
1	*Eucalyptus maidenii*	Maiden's Gum	Victorian native					No	Yes	Yes	Yes		
1	*Cedrus atlantica*	Atlas Cedar	Exotic conifer		Fair to poor			No	Yes	No	No	1	30-Aug-12
1	*Acer negundo*	Box Elder	Exotic deciduous	1,2,3	Fair	Weed sp.		No	No	No	No	1	30-Aug-12
2	*Pinus radiata*	Monterey Pine	Exotic conifer	1,2	Fair	Weed sp.		No	No	No	No	1	30-Aug-12
1	*Eucalyptus bicostata*	Victorian Blue Gum	Victorian native	1	Fair	Consider removal	2	No	Yes	Yes	Yes	1	30-Aug-12
1	*Eucalyptus bicostata*	Victorian Blue Gum	Victorian native	1	Fair to poor	Remove	1	No	Yes	Yes	Yes	1	30-Aug-12
1	*Eucalyptus bicostata*	Victorian Blue Gum	Victorian native	1	Fair	Consider removal	2	No	Yes	Yes	Yes	1	30-Aug-12
1	*Melaleuca armillaris*	Bracelet Honey-myrtle	Victorian native	1	Fair to poor	Consider removal	2	No	Yes	Yes	Yes	1	30-Aug-12

Future implementation

The actions from the VMP provide for a long term management approach (10 years and beyond). Some recommendations have already been implemented and some probably never will. It will be used as a reference document to form part of the decision making and planning process for future course works.

The information in both documents has been used to formulate new working documents for use in obtaining council permits. A Tree Management Plan for the new practice fairway development and assistance in formulating an Ecology Report for a Flora and Fauna Assessment and Net Gain Analysis of trees for removal.

Plant and tree selections for various revegetation projects around the course as part of our golf course redevelopment.

The Kew Golf Club held an information night recently to discuss the contents of both reports with the members. Only approximately 30 members turn up. Not bad out of just under 1600 members. What it showed me was that we had won over the confidence and support of the members in relation to management of the courses vegetation.

Bibliography

Callander, B (2012) Arboricultural Assessment Kew Golf Club. Treelogic.
Liston, P (2012) Vegetation Management Plan. Phillip Liston Landscape Consultants.
Johnson, J (1994) Birdies and Billabongs. A History of The Kew Golf Club 1894-1994.

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THE TOP 10 (OK 12) CHANGES THAT HAVE IMPACTED GOLF COURSE MANAGEMENT OVER THE PAST 25 YEARS

Dr Thomas A. Nikolai
"The Doctor of Green Speed"
Michigan State University

In December of 2011 the Michigan Golf Course Superintendents Association (MiGCSA) sent out a survey to members asking, "What are the top three things that have changed the way you manage (or operate) your facility?" The results of that survey were the first step in determining *The Top 10 Changes that have Impacted Golf Course Management in the Past 25 Years*. The second step was to ask 22-year USGA Agronomist Bob Vaverek to develop a top 10 list of his own. The third step was to show the results of both surveys at the Michigan Turfgrass Foundation Conference on January 11, 2012 in Grand Rapids, MI and ask for additional input from the audience. As a result of those three undertakings 25 possible selections were identified as having the greatest impact on golf course maintenance over the past 25 years. The fourth and final step was to post those 25 possible selections on the MiGCSA website and ask the members to, "Please rank the top 10 changes that have occurred over the past 25 years that have most impacted golf course management at your golf course".

The results from that survey were published in the MiGCSA quarterly magazine *Course Conditions* which resulted in a similar survey being performed with the Golf Course Superintendents Association of America (GCSAA). In August of 2012 the GCSAA sent out an electronic survey to their members asking them to "Please rank the top 10 changes that have improved golf at your facility(s) within the past 25-years". Participants had 30 categories to choose from and were asked to rank the categories in order of importance. Though not in the same order both surveys (MiGCSA and GCSAA) resulted in a Top 10 list with 8 identical components. This leads me to writing this article for the Australian Golf Course Superintendents Association (AGCSA) which is the Top 12 changes that have taken place in golf course management over the past 25 years.

Top 10 lists (or Top 12) are fun because of the conversation and controversy they create. The reason behind my requesting superintendent input in the making of this list was to determine how many of these changes had anything to do with turfgrass research performed at Michigan State University (MSU) or any other research facility around the world. So below is *The Top 12 Changes that have Impacted Golf Course Management over the Past 25 Years* as chosen by the MiGCSA and the GCSAA. The list is in descending order followed by comments from me.

12. Poa annua management: Most every article that mentioned *Poa annua* written prior to the 1970's states, "*Poa annua* is a fine dense turfgrass suitable for the putting surface but unfortunately it cannot survive the summer heat". The biggest problem with that statement is it was not true. Yes, *Poa annua* often died during the summer but not because it was hot, but because conditions are favourable for anthracnose and summer patch. Dr. Joe Vargas with assistance from Ron Detweiler of MSU were the first to rebuke the folklore and to initiate scientifically valid management programs to keep the desirable putting surface thriving during the summer months. To this day their research continues to have an impact on the proper maintenance of *Poa annua*. Additionally, although it remains elusive turfgrass researchers are attempting to identify a management method to increase *Poa annu'sa* cold hardiness. Finally, for those that want to manage *Poa annua* by eradicating it Dr. Ron Calhoun was good enough to discover a chemical that eradicates the species in bentgrass stands "Velocity" with other products, e.g. Poa Cure, creating a new buzz.

11. Alternative spikes (non-metal bottoms): If you have only been involved in the golf industry the past 15 years you might not even know what a metal golf spike looks like. Back in the Mid-90's, when metal spikes made-up nearly 100% of the market, I requested $100.00 from

Michigan Turfgrass Foundation President Jon Maddern so I could purchase three pair of golf shoes from Meijer Thrifty Acres to perform an alternative spike study. What followed has been years of alternative cleat research where most every member of the MSU turfgrass team was happy to give ideas and lend a helping hand. Our approach was unique in that our team would traffic three 3-foot plots with each cleat design included in the study (28 different designs one year) and afterward golfers and/or golf course superintendents would rate the damage to the putting surface. While we examined the impact alternative and metal spikes had on numerous putting surfaces we didn't stop there. MSU also gathered data on the impact each cleat design caused to infrastructure and the impact they had on traction while swinging a golf club and while walking on wet slopes and pavement. These interactive studies became popular and by demand MSU performed spike studies at multiple sites in Michigan, Germany, Austria, Ohio, Tennessee, and Florida. Additionally, MSU turfgrass researchers were invited by The PGA Tour to traffic plots at the Buick Open at Warwick Hills C.C. so the professional golfers could evaluate the impact different cleat designs had on the putting surface. Our scientific methodology is so well respected that MSU continues to test cleat designs for various companies to make certain new prototypes provide acceptable traction and result in minimal disturbance on the putting surface. Undoubtedly, that $100.00 investment from the MTF has saved golf courses thousands of dollars on infrastructure repairs (bridges, decks, stairs, carpeting, golf carts, etc.) and has also led to smoother putting surfaces.

10. Plant breeding and new cultivars: Plant breeding and new turfgrass cultivars has been driven by research, promoted by industry and adopted by superintendents to increase turfgrass performance, maximize playability and promote sustainability. Many of the new cultivars have a niche for geographic regions depending upon climatic conditions and/or water quality. While there are numerous new bentgrasses the newer ultra-dwarfs have significantly increased putting green performance in warm season turfgrass regions and *Pasplum* has made a major impact for sites with saline water conditions.

9. Instant communication technology (Internet/mobile phones)*:* This has nothing to do with turfgrass research. One question, is this a good thing or a bad thing? Ok, I know there are a lot of pluses, but sometimes I wish I only had a phone in my office.

8. Improvement of wetting agents: While working on a golf course in the 1980's I was instructed to stir a generous amount of dishwashing liquid into a bucket of water and to pour the solution on dry spots on a putting green. The hope was it would alleviate the localized dry spots and while it didn't work the superintendent was certain it worked as good as any product on the market. He may have been correct. I say that because in the 1990's I worked for Dr. Paul Rieke and while we performed wetting agent studies most every year I don't recall any of them doing an outstanding job reducing localised dry spot. However, over the past decade research has clearly shown that repeated use with certain formulations greatly reduces or eliminates localised dry spot. From our findings it is clear that initial annual application must be preventative. Today some superintendents are concerned that wetting agents work to good, that is, they make the green hold too much water. Current research is addressing the validity of this concern.

7. Greens mower improvements: An extensive literature review on the Turfgrass Information File (TGIF) reveals that from the late 1920's until the early 1970's the lowest height of cut possible with a commercial green mower was 0.187-inches. Given that titbit of information it should come as little surprise that the average green speed over that time period remained unchanged at a stellar 27-inches (as recorded by Edward Stimpson with his original wooden Stimpmeter). In the 1970's bed knifes were made thinner, the Stimpmeter was refined and mass produced, and green speeds increased. Due to the demand for faster green speeds and the release of newer cultivars it became necessary for greens mowers to be a more precise instrument to follow contours and maintaining adjustment to minimise scalping. Over the past 25 years improvements in green mower technology include the release of ultra-thin bed knifes, walk-behind floating heads, easier adjustment, counter rotating brushes, more reels, and

adjustments for frequency of clip. While turfgrass researchers have no claim on being involved in these technological advancements MSU has performed more putting green mower research than any other turfgrass research facility. Green mower research performed at MSU includes the impact that HOC, bed knife maintenance, bed knife thickness, multiple mowing (double and triple cutting), and mowing/rolling frequency has on turfgrass quality, wear tolerance, and green speed. In 2012 green mower research at MSU included investigations into brushing (forward and reverse) and the importance of frequency of clip at multiple mowing heights.

6. Green speed management: Green speed management advancement was primarily driven as a pact between research and the golf course superintendents by amassing data over a 25 year period. The release of the book, *The Superintendents Guide to Controlling Putting Green Speed* shifted the green speed conversation by presenting green speed as a sound management tool. Due to that publication the once ignorant mantra, "Speed Kills" is almost dead as more superintends have embraced Al Radko's Stimpmeter and Mike Morris's ideal green speed methodology to increase customer satisfaction while monitoring maintenance inputs.

5. Sand topdressing equipment and knowledge of rates and timing: If you have been in the golf course business for 30 years or more chances are you have applied topdressing on a green with a spade, but thankfully you probably didn't have to do it more than twice a year. Today topdressing is applied at least every three weeks on most golf courses and there are numerous methods to apply the material. The original topdressing material and frequency study was initiated by Dr. Paul Rieke a little over 30 years ago. That study clearly demonstrated the importance of proper rates and frequency to minimise the negative effects of layering. More recently topdressing studies have focused on incorporation of the material into the canopy with minimal disruption to the game and how these methods can impact organic matter content. Additionally, Dr. Joe Vargas has been examining the effectiveness of applying fungicides incorporated in the topdressing material.

4. Aerification improvements: Aerification improvements were driven by competition among manufactures at the demand of superintendents. Today, needle tine aeration can be done in mid-season because it minimises turf stress during the summer high temperatures. It also improves surface drainage, infiltration and percolation and many feel it is a must in their regions to keep the turf healthy. The old Ryan aerifiers were great for their time, but many in our survey singled out the superiority of the Pro Core 64 which currently owns more than 80% of the world market. Those numbers will only create more competition possibly resulting in greater advancements with aerifcation tools.

3. Lightweight green rolling*:* It wasn't that long ago that some superintendents were poking their finger in my chest while saying, "I don't care what your research says there is no way I am ever going to let one of those machines on my greens". Fact: if it were not for research performed at MSU almost no golf course in the world would roll their greens except for tournament preparation. In 1993 MSU was the first institution to research how different rolling frequencies and mowing heights interacted on green speed and turfgrass quality. From 1995-2000 MSU performed a lightweight rolling study on 3 putting green root zones where it was discovered rolling decreases dollar spot, localised dry spot, bird pecking (decreased cutworms?), broadleaf weeds, and moss. Prior to those findings rollers were only used to increase green speed but most everyone was afraid rolling would be detrimental to the grass or root zone if used too often. In 2002 MSU was the first (and remains the only) research institution to perform a comparative study among different lightweight rollers. In 2004 MSU initiated the first rolling/mowing frequency studies and found rolling could take the place of mowing while retaining green speed and increasing traffic tolerance.

2. Improvement in knowledge and use of PGR's: The first turfgrass research I ever performed was a PGR putting green speed study under the guidance of Dr. John Rogers III and

Dr. Bruce Branham. The year was 1990 and Primo was not included because it had not yet been released. Imagine a world without Primo, I wonder if you can. At first glance it is easy to state that turfgrass researchers has had nothing to do with the formulations of PGR's, wetting agents, or any pesticides. However, that is an oversimplification. The fact of the matter is that industry contacts various research facilities across the United States for product testing during development to determine if their product works, if it's toxic to certain turfgrass species, what frequency should the product be applied at, and what rates are safe.

***1. Irrigation technology*:** In the 2002 edition of *Turfgrass Management for Golf Courses* Dr. James B. Beard states, "Proper turf irrigation is the most difficult day-to-day agronomic decision the golf course superintendent makes". While that statement may still be true it is certain that in the past decade a lot of the guess work has been taken out of irrigation replenishment due to advancements and the ease of use of TDR's. TDR's (hand held models and those permanently placed in the root zone) measure the volumetric moisture content in the soil which reduce the guesswork for irrigation replenishment which can reduce water use while improving playing conditions. Since TDR readings are based on volumetric soil content (as opposed to plant available water) there is a learning curve unique to each golf course. In 1990 TDR turfgrass research was initiated at MSU on *Poa annua* and bentgrass greens by Dr. Rieke's graduate student Mike Saffell. Years passed and many an MTF Conference attendant was tired of hearing Dr. Rieke or his graduate students give presentations on TDR research. The point: **groundbreaking technology takes years to develop, money, and patience** but there is no doubt that the TDR research of the early 90's performed at research facilities has had a major impact on how greens are currently irrigated today.

Conclusion

By my count turfgrass research has had a direct impact on 9 items on our Top 12 list (all italics, bold). The point of this article isn't to brag, well maybe it is a little, but to point out the significance of your financial commitment to turfgrass research by being a member of the AGCSA.

Top 10 (or 12) lists are fun because they stimulate conversations about the order of importance or what's missing. To me this list demonstrates the importance of the relationship among superintendents, research, and the industry. In short, golf course superintendents depend upon useful research results, research depends on funds generated from local chapters and industry, and the industry depends upon patronage from the superintendent. If you belong to a local chapter be proud of the advancements you have helped to create and when possible consider the industry that subsidises your local chapter seminars golf outings. All three of us, the superintendent, industry, and research are linked by a delicate web that advances us all. We have come a long way in 25-years.

ENVIRONMENTAL STEWARDSHIP IN THE GREEN INDUSTRY

Dr Thomas A. Nikolai
Michigan State University

In the late 1980's and early 1990's the turfgrass industry came under intensified environmental scrutiny in the USA and Canada. As a result research efforts began to focus on pesticide and nutrient fate as numerous environmental laws and regulations were placed on the books.

As a result the Michigan Turfgrass Environmental Stewardship Program (MTESP) was created in the early 1990's at the demand of golf course superintendents in the state of Michigan. The state of Michigan is surrounded by the Great Lakes which holds 20% of the fresh surface water on our planet. The golf course superintendents in the state wanted to know the best methods to protect the natural resources in the state as well as needed a good partner to make certain they were kept abreast of increasing legislation at the local, state, and federal level. They partnered with the Michigan Turfgrass Foundation and created new positions at Michigan State University to spearhead the Program.

Dr. Frank Rossi was the original Turfgrass Educational Specialist in charge of the program. His predecessor was Greg Lyman who found so much success with the MTESP that he was hired away by the Golf Course Superintendents Association of America to originate the Environmental Institute of Golf. The Mission statement of the MTESP remains:

- to advance the environmental stewardship of Michigan's golf industry by increasing awareness and understanding of Michigan's environmental resources, the potential impacts of golf turf management, and to elevate the level of pollution protection;
- to enhance wildlife habitat, indigenous vegetation, and protect water;
- to clearly identify environmental laws and regulations and advance the compliance of the golf course industry;
- to engage the golf industry, regulatory agencies, MSU, and environmental advocacy groups in productive communication; and
- to recognise, promote, and award environmental stewardship achievements.

The purpose of the MTESP is to assist property managers in describing and evaluating potential sources of contamination from their operation through a series of self-assessment exercises. Through these exercises property owners and managers are able to gauge their level of pollution protection, clearly indicate their level of compliance with laws and regulations that affect turf operations and establish a plan to further protect and enhance their environmental surrounds.

The majority of environmental hazards on the grounds of turfgrass facilities were identified as being in or near the vicinity of the maintenance building. To minimise environmental risk the MTESP focused on wellhead protection, fuel storage, pesticide handling, pesticide and fertiliser storage, equipment wash pads, spill prevention control, and buffer strips to reduce pesticide, fertiliser, and sediment movement into surface water.

As the MTESP grew in popularity golf courses, grounds, universities, and some lawn care companies took part to become compliant with the laws and regulations and earn MTESP Certification.

At the same time several studies were taking place across the USA and Canada to monitor the fate of pesticides after application. One of my favourite studies took place at the University of Guelph in Ontario, Canada by Harris. In that study Harris used human volunteers and measured their level of exposure to 2,4-D after they were allowed to walk and sit in treated areas. 2,4-D was used because it is quickly excreted in urine.

After 2,4-D was applied at the labelled rate ten volunteers entered the hour after area 1-treatment and ten other volunteers entered the area 24-hours after treatment. In each group 5 individuals wore long pants, short sleeve shirts, shoes and socks while 5 others wore shorts, short sleeve shirts, and were barefoot. Both groups (1-hour after treatment and 24 hours after treatment) remained in treatment area for 1 hour walking, sitting, lying down in five minute intervals.

Urine was collected from all subjects for four consecutive days. The results indicated that none of the individuals that entered the area 24 hours after treatment had any detectable 2,4-D residue in their urine. Of the 10 individuals that entered the site 1-hour after only 3 had detectable residue in their urine and all of them were subjects that were barefoot. The person with the most residue had 0.426 milligrams of 2,4-D in their system which is well below the World Health Organisations acceptable daily intake of 2,4-D which is 24 milligrams. This study help result in pesticide applicators posting treated sites for 24 hours after treatment and pesticide containers stating, “Do not enter the site until the pesticide is dry”.

In 1989 Dr. Bruce Branham and his graduate student Eric Miltner initiated a long term nitrogen fate study. They started by placing 1.14 m diameter x 1.20 m deep monolith lysimeters into an intact Marlette find sandy loam soil. At the base of each lysimeter was an outlet for infiltrated water which was collected and analysed for nitrate content.

Treatments consisted of two different rates of nitrogen applied as urea onto the *Poa pratensis* turfgrass that was laid upon the surface of the lysimeters. The low rate of nitrogen was 98 kg N ha^{-1} per year and the high rate was 244 kg N ha^{-1} per year.

Nitrate rates above 10 mg/L (10 ppm) can lead to blue baby syndrome. This implies that nitrogen fertility program resulting in leachate values greater than 10 ppm nitrate is particularly dangerous for infants and the elderly.

From 1989 to 1999 neither the high rate nor low rate of the applied urea ever resulted in nitrate leaching values great than 10 ppm. However, in 2000, 2001, and 2002, the high rate of urea resulted in nitrate values of 14.7, 18.9, and 25.3 ppm respectively. As a result of this alarming trend Dr, Kevin Frank decided to reduce the high rate of nitrogen from 244 kg N ha^{-1} per year to 196 kg N ha^{-1} per year. IN 2003 the nitrate collected in the leachate was 29.7 ppm, however, in 2004 that number dropped to 8.8 ppm nitrate in the leachate. In 2005 and 2006 the ppm nitrate went above the threshold at 11.6 and 12.5 respectively. However, from 2007 – 2012 nitrate levels have never gone above 10 ppm.

Examining the literature it became obvious that turfgrass stands 10-years or older do not require as much nitrogen as establishing stands.

Most of the environmental turfgrass research that came out of the early 1990’s laid the foundation for current day green industry managers to be environmental stewards. Best Management Practices (BMP’s) continue to evolve with phosphorous rates and pesticide risk classifications becoming reduced which increases the need for well trained turfgrass practitioners that deserve adequate compensation for their knowledge.

CHEMICAL USE IN THE WORKPLACE – ETHICAL DECISION MAKING AND WHEN TO SAY NO

Terry Muir
Environmental Business Solutions

Introduction

Pesticide laws in Australia have a moral or ethical purpose and that is to either make people's lives better and safer or to protect some important right. Whilst current practices to some extent recognise the obligations in the law, the evidence suggests some practitioners are failing in their obligations to the law. All of us at some time experience a temptation to bend our moral system and in those circumstances we are often blind to the full picture. Our own position takes on increased importance and it is easy to overlook how our actions will affect ourselves and others. Chemical use and safety is about making the right decisions for all the right reasons. Don't find yourself looking back and wishing you had chosen differently in a decision. You don't have to change your whole personality; you just have to get better at the art of saying no

The word NO is perhaps the most important and certainly the most powerful word in language. As William Ury said, "Every day we find ourselves in situations where we need to say No - to people at work, at home, and in our communities - because No is the word we must use to protect ourselves and to stand up for everything and everyone that matters to us."

It is now 12 months since the EPA investigation commenced amid allegations of widespread pesticide misuse by chemical suppliers and turf management practitioners. Amid accusations of unethical practices the profession of the sports turf manager was exposed to an unprecedented image crisis and an industry sullied by what's been done by those who have acted questionably. Did they say no? Did they have the power to say no? Were they the powerful powerless within their organisation? Whatever the situation, it is critical for every business to ensure pesticide use decision making authority exists and is present.

Refusing impossible and unreasonable requests is relatively easy. But saying 'no' when you can say 'yes' may be harder. The current industry issue suggests many people didn't allow themselves to say no. Perhaps many found it too difficult to say no to the boss or the supplier or to themselves. Whatever the reasoning behind any decision to misuse pesticides the impacts can be far reaching.

Dianne J Chandler in her article, The Perfect Storm of Leaders' Unethical Behaviour, put it succinctly when she said, "Unethical behaviour of leaders has consequences for leaders themselves, followers, and their respective organisations. Unethical behaviour of leaders occurs when a conflux of factors interact between leaders, followers, and the situational context catalysed by a critical incident or trigger event that pulls everything into its centre. Unethical leadership behaviour damages all involved including leaders, followers, and organisations."

Based on this analysis, ethical leadership behaviour is defined as the organisational process of leaders acting in a manner consistent with agreed upon standards of character, decency, and integrity, which upholds clear, measurable, and legal standards, fostering the common good over personal self-interest. Unethical leadership behaviour is, therefore, defined as the organisational process of leaders acting in a manner inconsistent with agreed upon standards of character, decency, and integrity, which blurs or violates clear, measurable, and legal standards, fostering constituent distrust because of personal self-interest.

Being susceptible to unethical leadership behaviour is possible for every leader. As Ciulla (2001) said, "all leaders are imperfect and carved out from the warped wood of humanity." The sports turf industry would do well to closely guard itself by putting effective accountability

structures in place, yielding to the checks and balances instituted for the well-being of all stakeholders, and taking responsibility for poor actions.

We generally know if something feels right. If unsure we could ask ourselves key questions to consider when facing a personal ethical dilemma:-

- Am I making an informed decision?
- Is there a risk?
- What is the risk of taking the risk?
- Would I feel comfortable about my professional peers, family and friends knowing about the situation?
- Is it legal?
- How would I feel if I saw this in a newspaper?

Pesticide use involves risk and pesticide use decision making is about making informed ethical decisions based on that risk. It should include risk reduction, risk sharing, risk avoidance, and then risk acceptance.

But when it comes to organisational risk there are four types of risk that worry an organisation. Strategic risk is concerned with the inability to achieve high-level goals. Operations risk concentrates on factors associated with the efficient use of resources. Compliance risk affects the ability to comply with legal and regulatory requirements. The fourth risk, organisational risk is based on the organisation's structure.

A review of personal and organisational risk will identify the probability and impact of an undesired outcome. This concept of risk assessment will be explored further during my presentation along with an examination of the road forward. The challenge for the industry is to learn from the past because it holds the building blocks of a better future.

Too much of the good work of turf managers is being lost amid a sea of negativity and the industry must now be ready to discuss ways to project a better image of its pesticide users. An opportunity for the industry to consider implementing its own accreditation protocol at a national and state level as a means of determining, formally recognising and promoting the pesticide management competence of turf managers exists.

The industry would determine what industry best practice is and then set the appropriate criteria individuals must satisfy. It would include skill levels and qualifications, compliance systems and procedures, and risk management and ethics with the goal of prompting a greater sense of collective responsibility and accountability.

Pesticide misuse exposes individuals and their organisations to criminal and financial sanctions. It should be a non-sharable burden with responsibility for misuse resting solely with the individual who was unable to say NO when the circumstances warranted it.

WEAR TOLERANCE AND COMMUNITY SPORTSFIELDS

Matt Roche
Australian Sports Turf Consultants

Introduction

Since 2006, former turf research staff at the Queensland Department of Agriculture, Fisheries and Forestry Queensland (DAFFQ) Redlands Research Facility (RRF), undertook wear tolerance studies on a range of turfgrasses suited for home/recreational use (e.g. *Stenotaphrum secundatum* – buffalograss) under both elite and community sportsfield conditions. The work has been undertaken using Redlands Wear Traffic Simulator, which is based on the design of the University of Georgia's GA-SCW Simulator (Carrow *et al.*, 2001). The ride-on self-propelled machine enables traffic (wear and compaction) treatments to be applied rapidly and uniformly across a trial.

DAFFQ studies undertaken between 2006 and 2008 of 8 *Cynodon* spp. cultivars trialled for elite conditions showed that wear tolerance was associated with high shoot density, a dense stolon mat strongly rooted to the ground surface, high cell wall strength as indicated by high total cell wall content, and high levels of lignin and neutral detergent fibre (NDF) (Roche *et al.*, 2009); not shoot moisture content as suggested by Trenholm *et al.* (1999, 2000) and Brosnan *et al.* (2005) for other species. Wear tolerance was also affected by turf age, planting sod quality, and wet weather.

Within the earlier DAFFQ wear studies little focus was given to assess soil compaction and relief, particularly within the Redlands simulated wear facility. Australian studies (e.g. Aldous *et al.*, 2001 and Henderson *et al.*, 2007) concluded that effectiveness of decompaction work was only short lived. If any (long-term) benefit was to be made by conducing amelioration activities, regular physical treatment was required, not annual works which is seen by a number of councils and community sportsfields. Research by Henderson *et al.*, (2007) also identified that having 15-30 % percent soil moisture was ideal to reduce surface hardness and maintain a Gmax ("tens of gravities) reading between 70-80 Gmax of community sportsfields.

In the present study, 4 simulated wear trials were run at RRF between 2009 and 2012 to asses traffic stress (wear and compaction) across 8 warm-season turf varieties containing green couch (*Cynodon dactylon*), *Cynodon* hybrid (*C. dactylon* x *C. transvaalensis*), blue couch (*Digitaria didactyla*) and kikuyu (*Pennisetum clandestinum*). The aim was to document the effects of (simulated) traffic stress to identify which varieties would provide more suitable in meeting user requirements, and how effective a periodic decompaction program was compared with more regular scheduling.

The information collected is to assist turf managers care for their sportsfield whether it is at an elite, regional, premier or community sports level. But with this information, turf managers need also be provided with appropriate levels of training and resources to provide safe and playable sportsfield for everyone to enjoy.

Material and Methods

Redlands Research Facility Wear Trial

The experimental site was located at Redlands Research Facility (RRF) (27º32'S lat, 153º15'E long, 50 masl), Cleveland, Queensland, Australia on a 15-cm deep sand (fine bedding sane from River Sands) profile with pop-up irrigation and internal drainage to remove excess water. The experimental area was situated on a level area receiving full sunlight throughout the day.

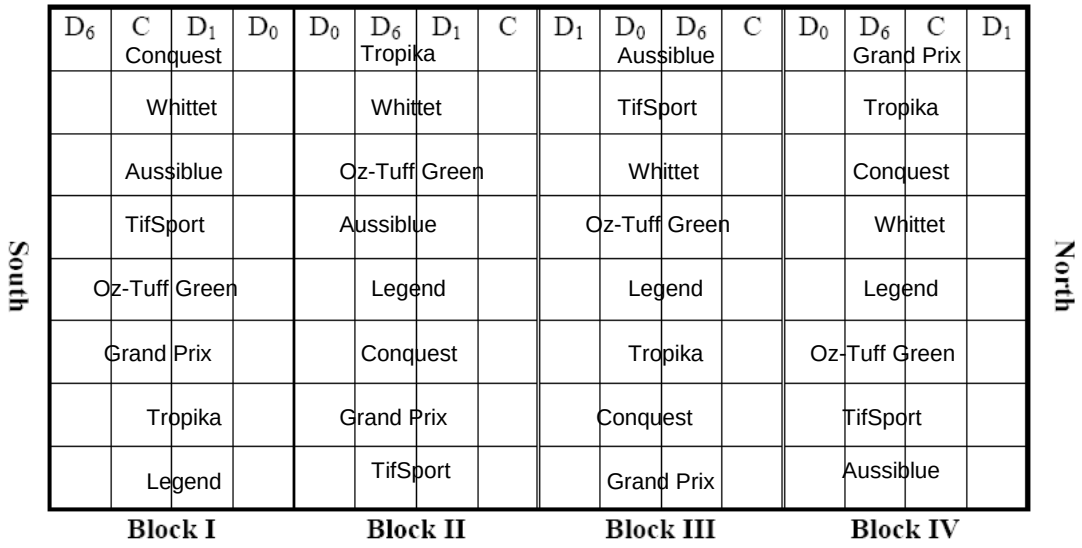
The basic experiment was a randomised block design, with 4 replications of 8 warm-season cultivars in individual plots measuring 6 x 2 m. The turfgrasses included in the experiment were the *Cynodon dactylon* (green couch) cultivars 'C1' (marketed as Legend®), 'Grand Prix', OZ

TUFF™ and 'Riley's Evergreen' (marketed as Conquest™); the *C. dactylon* x *C. transvaalensis* (*Cynodon* hybrid) cultivar 'Tift 94' (marketed as TifSport™); the *Digitaria didactyla* (blue couch) cultivars 'Aussiblue' and 'Tropika'; and the single *Pennisetum clandestinum* (kikuyu grass) cultivar 'Whittet'. Subsequent references to these cultivars in the report are made under the names by which they are sold commercially.

Superimposed over the basic randomised block experiment was a strip-plot design to accommodate 4 wear treatments (combination of wear and decompaction). Wear treatments were C (control, no wear, no decompaction), D0 (wear applied weekly, no decompaction), D1 (wear applied weekly, decompaction ≈ once per year) and D6 (wear applied weekly, decompaction ≈ at six-week intervals). Each subplot measures 1.5 x 2 m.

The D1 and D6 decompaction treatments were applied 3 and 13 times respectively throughout the duration of the study. They were D1: 15 Jun 2009, 17 Jun 2010 and 15 Jul 2011; and D6: 15 Jun, 31 Aug, 20 Oct, 21 Dec 2009, 11 Mar, 17 Jun, 5 Aug, 7 Oct, 3 Dec 2010, 30 May, 15 Jul, 21 Oct 2011 and 22 Feb 2012. Decompaction was undertaken with a Verti-Drain machine using 20 mm solid tynes to a depth of 150 mm with (usually a) 3 % kick. Inclement weather and the availability of the decompaction machine often stretched the dates between applications.

FIGURE 1 RRF wear trial plan showing the setup of the turf varieties (plots running south to north) and the overlay of wear and decompaction (D0, D1, D6) treatments (applied east to west). Refer to PLATE 3 to see digital images of the plot layout.



All 8 cultivars were laid as (unwashed) sod between 8 and 12 Jan 2009. Further sod installations of Whittet took place on 22 Jan 2010 and 21 Sep 2011 because of traffic damage and poor recovery following wear applications. All sod following planting was rolled, mown and top dressed to facilitate their establishment before starting the first wear trial (Year 1) just 4 months later. Four series of wear trials were conducted throughout the duration of the study which is grouped as follows: Year 1 – 13 May 2009 to 6 Apr 2010; Year 2 – 7 Apr 2010 to 3 Feb 2011; Year 3 – 4 Feb 2011 to 6 Feb 2012; and Year 4 – 7 Feb to 1 May 2012. The fourth year wear study only ran for a short duration because of the project end date being 31 May 2012.

Wear was applied using the Redlands Wear Traffic Simulator which is a modified Brinkman design based on the self-propelled GA-SCW Traffic Simulator (Carrow *et al.*, 2001). The major difference between the GA-SCW Traffic Simulator and the self-propelled Redlands Traffic Simulator was the latter used smooth rubber galvanised rollers (1m wide) to cause scuffing of the turf surface rather than studded rollers rotating at different speeds. Except for the first 8

wear occasions in Year 1 where 20 passes of the Redlands Traffic Simulator was used, 10 passes was adopted for the duration of the study.

TABLE 1 Details of wear trial management between during 2009 and 2012 of the simulated wear study at Redlands Research Facility.

Wear trial year	Wear application periods		Duration (d)	No. of fertiliser applications	Nutrients applied (kg ha^{-1})			No. of wear events
	Start	Finish			N	P	K	
1	13 May 2009	9 Dec 2009	211	3	244	23	71	8† 12
2	7 Apr 2010	25 Nov 2010	233	5	250	21	94	25
3	4 Feb 2011	30 Nov 2011	300	3	205	52	52	29
4	7 Feb 2012	1 May 2012	85	1	39	0	31	11
Total	-	-	*829*	*12*	*738*	*96*	*248*	*85*

Note: † 20 passes of the wear machine was implemented 8 times between 13 May and 26 Aug 2009, but thereafter 10 passes was adopted.

Near the end of the study, 18 Jan 2012, leaf material (≈ 5g) were cut from each of the control (unworn and not decompacted) subplots to determine moisture content and the levels of fibre, lignin and ash using standard forage analytical techniques (e.g. Coleman et al, 2004) and adapted methodologies to determine Lignin, Neutral Detergent Fibre (NDF), Acid Detergent Fibre (ADF) Total Cell Wall content (TCW) as per Roche *et al.* (2009). Forage analytical testing was conducted by The University of Queensland and findings provided to DAFFQ research staff for analysis and interpretation.

Visual assessments of turf quality [1 (= worst) to 9 (= best); 6 = acceptable] and the percentage of bare ground in the worn sub-plots were made generally fortnightly by 1, 2 or 3 independent assessors to follow the effects of the different wear and decompaction treatments (D0, D1, D6). Rankings of wear tolerance were made based on mean wear data collected in separate studies (TABLE 2), but also collectively (group average) over the four years (TABLE 3).

Traction testing was conducted on 24 occasions throughout the study. On all but 1 occasion, the Redlands Automated Traction Tester (as detailed in Roche *et al.*, 2007 and herein referred to as the Redlands Traction Tester) was used. For testing on 27 May 2011 the manual Studded Boot Apparatus (Canaway and Bell, 1986) (Turf Tec Australia Manual Traction Tester) was used. Percentage moisture using a Field Scout® TDR 300 Soil Moisture Probe (Spectrum Technologies, Inc., USA) was used to take three readings per subplot. Surface hardness was assessed using a 2.25 kg Medium Clegg Impact Soil Tester (Dr Baden Clegg, WA) (1st and 4th drops from a height of 303 mm and 457 mm were taken; however, primarily the 4th drop at 457 mm will be discussed within this report) almost monthly of each subplot throughout the duration of study. Turf colour was also assessed using the Field Scout® Turf Colour Meter 500 (Spectrum Technologies Inc., USA). A single measurement per subplot was collected each day of testing (data not included in this report).

The whole experimental area was well-fertilised (as summarised in TABLE 1), irrigated routinely to maintain "unstressed" growth and mown regularly (to 25 mm) to simulate sports field management conditions. Pre-emergence applications of Ronstar® G (oxadiazon) or Ronstar® + fertiliser 18:10:9 was also utilised periodically throughout the duration of the study. Non-

selective herbicides (glufosinate ammonium) registered as Finale® and Basta® was applied to plot borders to prevent encroachment between cultivars. Root Barrier® was also installed to a depth of 100 mm between cultivars to limit rhizome movement between plots. Soil samples were taken annually and sent to the AGCSATech laboratory for comprehensive soil testing.

All data were analysed through GenStat® Release 14.2 for PC (Windows/XP) using standard Analysis of Variance procedures, which also generated Fisher's protected Least Significant Differences (LSDs) for comparison of treatment means. Graphs were constructed using SigmaPlot® Version 11.1 and Microsoft® Office Excel 2003.

Results

Turf quality was generally at or above acceptable (6 = acceptable) of the control plots throughout the duration of the study (TABLE 2). However, once traffic was applied to the turf wearable plots (DO, D1 and D6) using the Redlands Traffic Simulator noticeable damage was soon observed to shoot tissues through mechanical pressure, abrasion, scuffing and or tearing. After 8 weeks at 20 passes of Redlands Traffic Simulator, it was observed that turf quality of the worn plots had dropped significantly and it was decided to reduce the number of wear passes from 20 to 10. The reduction was also required initially to attempt to simulate wear damage seen at the Redlands Touch Association fields too (refer to chapter 3).

Turf quality was highest in the green couch varieties (herein includes the *Cynodon* hybrid variety) throughout the duration of the study (e.g. PLATE 1). The least impressive were the blue couch varieties and more so, the single kikuyu variety. The difference in quality was a direct result of wear and tear encountered by the turf and its ability to withstand and recover from traffic. The lowest turf quality readings were seen at the end of each wear application period of each year (TABLE 2); prior to the recovery process. The stand out cultivars at this point in time was once again the blue couch and kikuyu varieties which rated as low as 1.2 and 0.9 in turf quality. At this point in time little to no turf, only straw like material (minimal to no leaf matter) remained.

TABLE 2 Mean annual turf quality ratings of control (no wear or decompaction) and worn plots (D0, D1 and D6) for the 8 cultivars trialled within Year's 1, 2, 3 and 4. A mean turf quality rating of the worn plots is also shown. The latter (final rating) data is from when the wear application period finished within each trial year (refer to TABLE 1).

	Year 1			**Year 2**		
Cultivar	**Control Plot** (mean annual value)	**Worn Plots** (mean annual value)	**Worn Plots** (final rating*)	**Control Plot** (no wear or decompact.)	**Worn Plots** (D0,D1,D6)	**Worn Plots** (final rating*)
Aussiblue	7.5	3.5	1.4	7.5	2.7	3.0
Conquest	6.1	4.4	4.3	6.0	3.8	4.1
Grand Prix	6.8	5.3	5.6	6.9	4.6	5.2
Legend	6.5	5.0	5.2	6.4	4.3	4.9
OZ TUFF	7.2	5.6	5.4	7.0	5.8	6.0
TifSport	7.0	5.3	4.8	6.5	4.0	4.3
Tropika	7.4	3.7	2.8	7.2	2.0	0.9
Whittet	5.8	3.6	1.2	5.4	1.9	1.7
	Year 3			**Year 4**		
Cultivar	**Control Plot** (no wear or decompact.)	**Worn Plots** (D0,D1,D6)	**Worn Plots** (final rating*)	**Control Plot** (no wear or decompact.)	**Worn Plots** (D0,D1,D6)	**Worn Plots** (final rating*)
Aussiblue	7.6	5.4	6.8	7.6	5.8	5.6
Conquest	6.7	5.2	5.7	6.6	5.4	4.9
Grand Prix	7.3	5.8	6.5	7.2	6.1	5.9
Legend	6.9	5.5	6.2	6.6	5.9	5.6
OZ TUFF	7.4	6.9	7.2	7.3	7.0	7.2
TifSport	6.6	5.1	6.1	6.4	5.5	4.9
Tropika	7.3	4.7	6.6	7.4	5.7	5.1
Whittet	6.0	3.1	5.9	6.5	3.2	1.4

Note: Of the worn plots (D0, D1, D6), only D1 and D6 underwent physical (decompaction treatments). LSD values are not shown. * final rating refers to the rating undertaken immediately after the last wear event for that particular year i.e. Year 1 – 9 Dec 2009, Year 2 – 25 Nov 2010, Year 3 – 30 Nov 2011 and 1 May 2012.

PLATE 1 Variation in turf quality and percentage bare ground is clear between (left to right) green couch, blue couch and kikuyu species. Photos were taken 20 Oct 2009.

Wear patterns observed throughout the four-year study showed enormous variation in wear tolerance and recovery between the three species trialled (green couch, blue couch and kikuyu) (PLATE 1, TABLE 3 and FIGURE 2). If recommendations by McAuliffe and Roche (2009) were

followed, that is if a field comprises ≥15 % wear it should be considered unfit for play, the wear observed within the RRF study would have meant that closures hypothetically would have resulted. For example, if a sportsfield undergoes high usage (as simulated at the RRF trial site) and was planted with blue couch (e.g. Aussiblue, Tropika) the field would be out of play between 25-80 % of the time. If sufficient recovery time and sound turf management practices are available, complete recovery (100 % cover) is possible because of Aussiblue and Tropika's rapid stoloniferous growth produced when growing conditions are optimal (PLATE 2).

PLATE 2 *Digitaria didactyla* cv. Aussiblue recovery of treatment D6 (simulated wear plus decompaction at six-week intervals) at Redlands Research Facility (left to right: 9 Nov 2009, 3 Feb and 5 Mar 2010).

Following the same recommendations, if kikuyu (e.g. Whittet) was planted on a high usage sportsfield that had scheduled bookings and or illegal play, the field could be closed between 64-100 % of the season. Within the present study, insufficient stoloniferous recovery occurred and twice the kikuyu plots had to be re-established by DAFFQ staff in Jan 2010 and Nov 2011. Even after new turf was planted, the onset of decline soon followed having to undergo traffic often several weeks post planting (e.g. FIGURE 2a and 2c).

If a variety of green couch were planted (e.g. Conquest, Grand Prix, Legend, OZ TUFF, TifSport) there is a greater chance of not having to cancel team training runs or official fixtures because of the field being deemed unfit for play. This however would be largely dependent on varietal selection. On average, green couch cultivars produced ≥15 % wear between 0-65 % of the time. This was the lowest percentage of time for all three species of turf. However, significant variation was present within the green couch varieties with wear damage being between 2 % and 90 %.

Wear ranking remained very consistent over the four years, but to a lesser extent in its final year due to only a limited number of wear applications (11) being imposed. This mean that cultivar variation was less pronounced compared with earlier years that saw 20, 25 and 29 wear events applied respectively. Within the first three years, OZ TUFF was ranked number one, whereas in the fourth year, it was comparable to Grand Prix and Legend. The latter two varieties ranked equal second in the first three years, whereas TifSport ranked the same only within the first two years and not the third. During the third year, TifSport and Conquest ranked equal forth. Conquest showed the least wear tolerance out of all the *Cynodon*'s trialled at the RRF facility.

TABLE 3 The amount of wear (bare ground) observed following analysis of collected data from within the RRF simulated wear study during (a) Year 1 – 13 May 2009 to 6 Apr 2010 and Year 2 – 7 Apr 2010 to 3 Feb 2011; and (b) Year 3 – 4 Feb 2011 to 6 Feb 2012 and Year 4 – 7 Feb to 1 May 2012. With the exception of wear tolerance, data are expressed as percentages.

(a)

	Year 1			
Cultivar	**Time when wear is ≥ 15%**	**Mean bare ground**	**Maximum bare ground observed**	**Wear tolerance ranking***
Aussiblue	77	52	93	8
Conquest	61	26	65	5
Grand Prix	12	8	33	2
Legend	30	12	44	2
OZ TUFF	0	2	8	1
TifSport	8	8	30	2
Tropika	76	45	90	6
Whittet	76	41	93	6
LSD (P=0.05)	-	*5*	-	-
	Year 2			
Cultivar	**Time when wear is ≥ 15%**	**Mean bare ground**	**Maximum bare ground observed**	**Wear tolerance ranking***
Aussiblue	80	56	97	6
Conquest	65	32	90	5
Grand Prix	55	21	71	2
Legend	64	25	70	2
OZ TUFF	0	4	14	1
TifSport	65	28	89	2
Tropika	80	68	99	7
Whittet	100	69	88	7
LSD (P=0.05)	-	*5*	-	-

Note: Assessments totalled 66 in Year 1 and 55 in Year 2. Turf replacement of all Whittet plots occurred on 22 Jan 2010; therefore rankings and values of this cultivar are slightly skewed in Year 1. Wear ranking is based on mean bare ground data collected for each year; * 1=best, 8=worst.

(b)

	Year 3			
Cultivar	**Time when wear is ≥ 15%**	**Mean bare ground**	**Maximum bare ground observed**	**Wear tolerance ranking***
Aussiblue	41	23	88	4
Conquest	48	21	70	4
Grand Prix	36	14	57	2
Legend	41	16	41	2
OZ TUFF	0	2	9	1
TifSport	45	25	81	4
Tropika	68	33	91	7
Whittet	64	57	98	8
LSD (P=0.05)	-	*6*	-	-
	Year 4			
Cultivar	**Time when wear is ≥ 15%**	**Mean bare ground**	**Maximum bare ground observed**	**Wear tolerance ranking***
Aussiblue	25	10	30	4
Conquest	42	15	42	4
Grand Prix	8	7	24	1
Legend	8	8	18	1
OZ TUFF	0	0	2	1
TifSport	42	14	42	4
Tropika	33	13	49	4
Whittet	75	57	89	8
LSD (P=0.05)	-	*9*	-	-

Note: Assessments totalled 44 in Year 3 and 12 in Year 4. Turf replacement of all Whittet plots occurred on 21 Sep 2011; therefore rankings and values of this cultivar within Year 3 are slightly skewed. Wear ranking is based on mean bare ground data collected for each year; * 1=best, 8=worst.

Following forage analytical testing across 8 *Cynodon* spp. cultivars by Roche *et al.* (2009), chemical analysis was also carried out across the 8 varieties being trialled within the present RRF simulated wear study. Contradictory to findings in the previous study, lignin, neutral detergent fibre and total cell wall content values did not correlate to the cumulative wear tolerance ranking (TABLE 4), or with the Year 4 wear tolerance ranking (TABLE 3) in the same year samples were collected from the trial.

TABLE 4 Moisture content and chemical analysis of structural components in samples of leaf material taken from 8 warm-season turf varieties growing in the RRF wear facility on 18 Jan 2012. All chemical analysis data are expressed as percentages.

Cultivar	Wear tolerance ranking*	% moisture in fresh samples	Ash (%)	ADF (%)	Lignin (%)	NDF (%)	TCW (%)
Aussiblue	6	43.2	8.1	28.7	3.4	71.6	42.9
Conquest	5	53.3	9.0	33.9	4.1	81.9	47.9
Grand Prix	2	56.2	9.0	33.2	4.0	80.9	47.7
Legend	2	53.0	8.2	32.6	3.9	79.7	47.1
OZ TUFF	1	50.8	8.4	34.3	4.1	81.2	46.9
TifSport	2	57.2	8.5	32.8	3.9	81.0	48.3
Tropika	6	45.4	8.1	30.8	3.7	73.6	42.8
Whittet	8	47.3	8.3	31.9	3.8	76.7	44.8
LSD (P=0.05)	-	*9.8*	*0.4*	*1.9*	*0.2*	*2.7*	*1.9*

* 1=best, 8=worst; wear tolerance ranking is based on the mean ranking over four years (ranking data from TABLE 3).

PLATE 3 Aerial photographs of the RRF simulated wear facility taken (a) 16 Apr 2009 (facing south), (b) 24 Jun 2009 (facing west), (c) 4 Jun 2010 (facing north), and (d) 22 Mar 2012 (facing south).

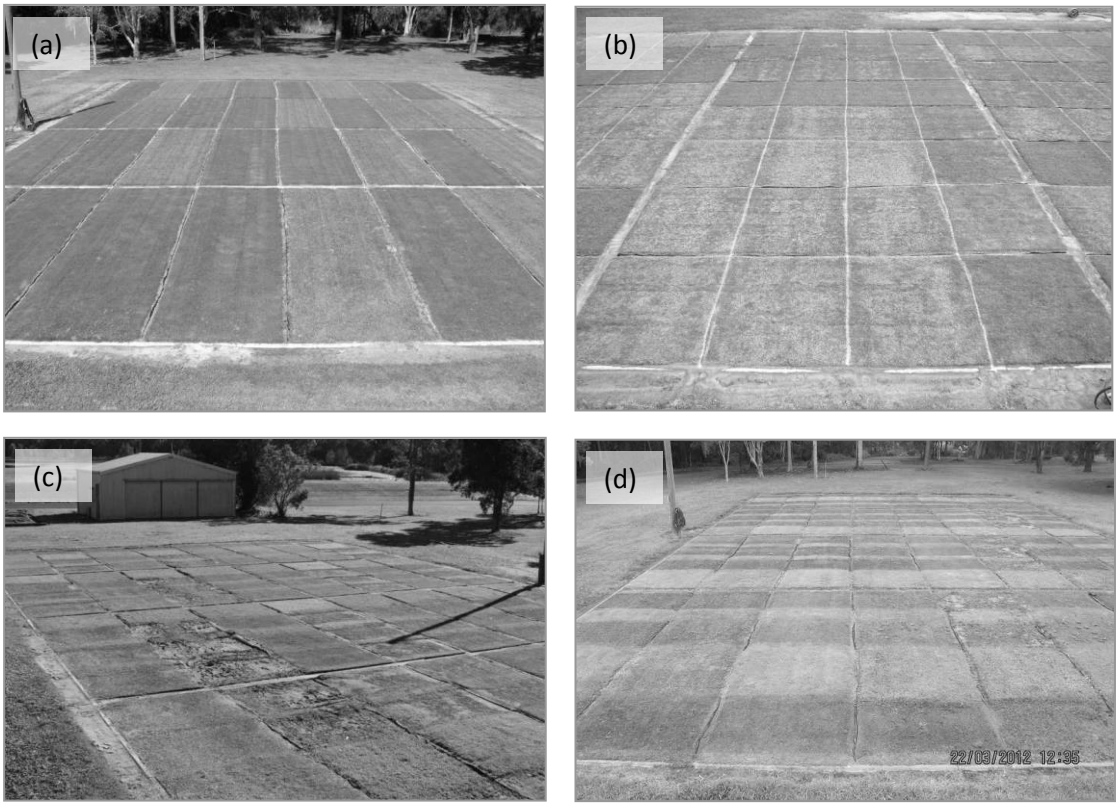
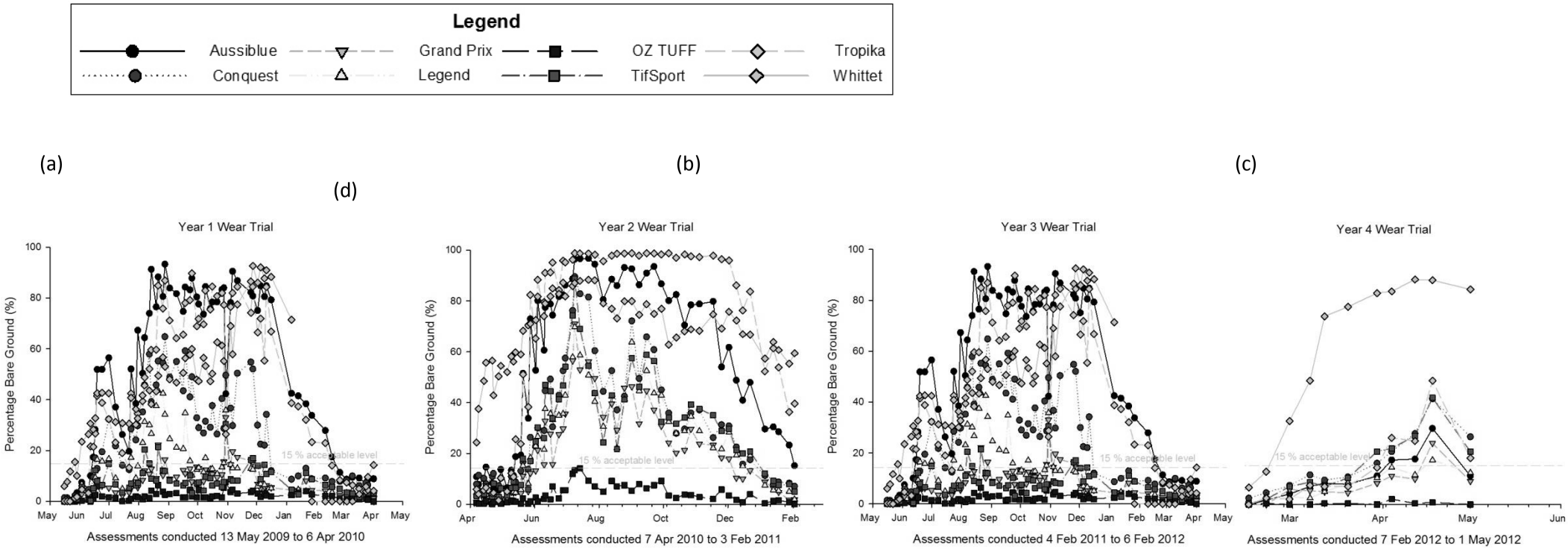


FIGURE 2 Mean combined (D0, D1, D6) percentage bare ground ratings undertaken of the RRF simulated wear trial during (a) Year 1, (b) Year 2, (c) Year 3 and (d) Year 4.



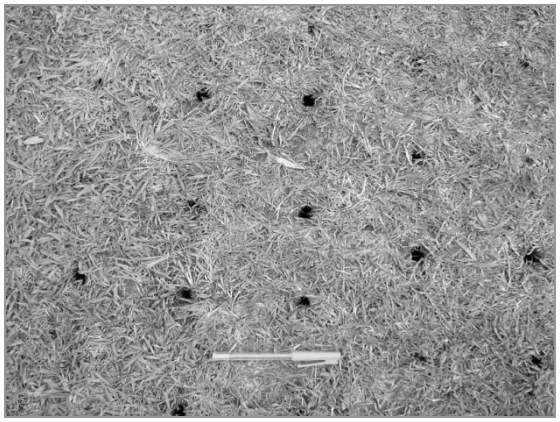
Note: Turf replacement of all Whittet plots occurred on 22 Jan 2010 (Year 1) and on 21 Sep 2011 (Year 3).

FIGURE 3 (a) Decompaction treatments being imposed to D1 and D6 plots on 15 Jun 2009 at RRF by Terry Griffiths of Q Turf Machinery; (b) Verti-Drain decompaction unit using 20 mm solid tynes; and (c) impact of decompaction treatment on worn plots showing 150 mm spacings.

(a)

(b)

(c)



Decompaction treatments were undertaken at the RRF simulated wear trial site on 3 and 13 occasions for the D1 (yearly) and D6 (≈ six week intervals) treatments respectively. The purpose of the amelioration program at diverse intervals was to simulate what a community sportsfield may encounter if a standard turf management (decompaction) program is in place (D1), verses an improved program (D6).

(De-)Compaction was assessed at routine intervals throughout the 4 year study to coincide with treatment work and other data collection e.g. percentage soil moisture. Of the control plots, which had no traffic stress (compaction or wear form the Redlands Traffic Simulator), the minimum and maximum 4th drop Gmax from a drop height of 457 mm over the course of the study was 58 and 98 Gmax (FIGURE 4). Soil moisture at the time of these observations were +0.7 % and -4.8 % off the mean percentage moisture value of 21.8 % which is within the recommended range of 15-30 % recommended by Henderson et al. (2007).

Hardness for worn plots (D0, D1, D6) showed that routine decompaction practices were beneficial in relieving surface hardness. The D0 treatment (wear only, no decompaction) revealed a mean Gmax of 103, whereas the mean D1 and D6 treatment values were 105 and 96. These findings coincide with the recommendations provided by Henderson et al. (2007) in that infrequent amelioration techniques will only provide short-term gain.

The peaks and troughs of the recorded Gmax values, on the most part, ignoring the decompaction work, tracked largely with seasonal changes and climatic conditions (rainfall).

FIGURE 4 Surface hardness (Gmax of 70-80 is ideal, ≥ 120 is concerning) of turf treatments (C, D0, D1 and D6) at Redlands Research Facility between May 2009 and May 2012. The control (C) treatment is included; however it should not be compared with the de-compaction treatments (D0, D1 and D6) because it is not undergoing simulated wear (compaction of the Redlands Traffic Simulator). Gmax values shown are of the 4th drop from a 457 mm height. LSD values are not shown.

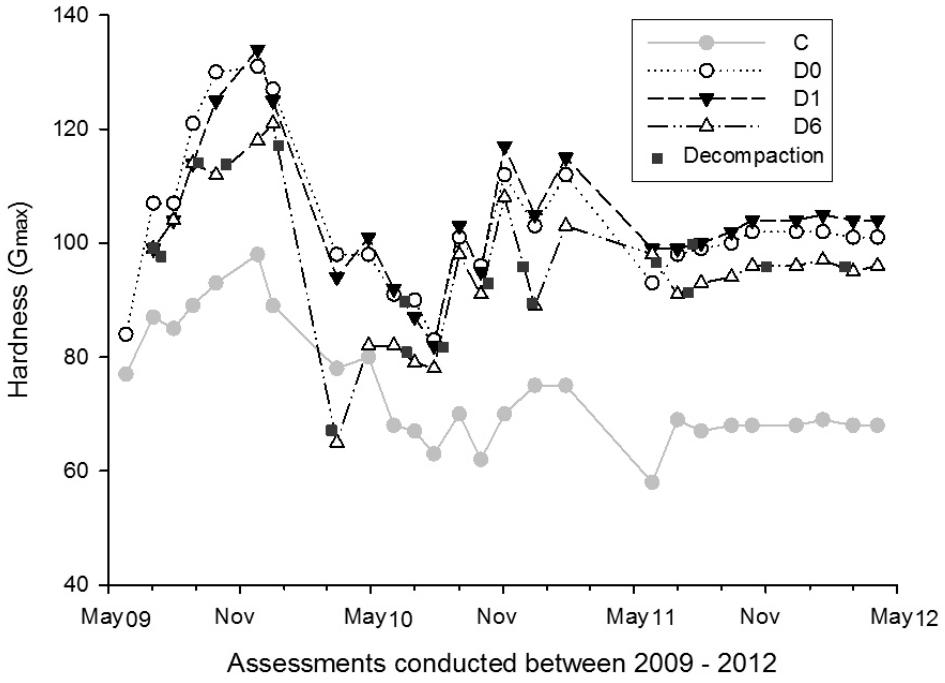
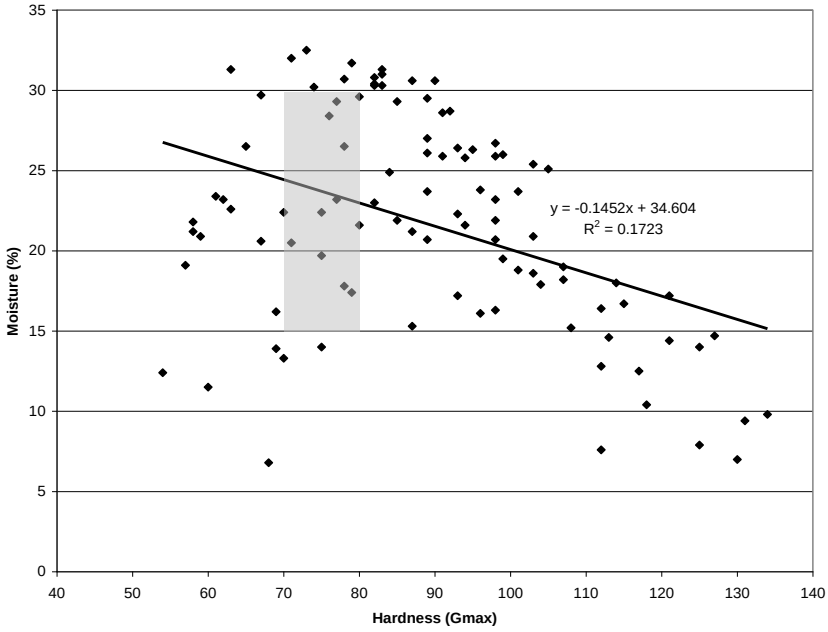


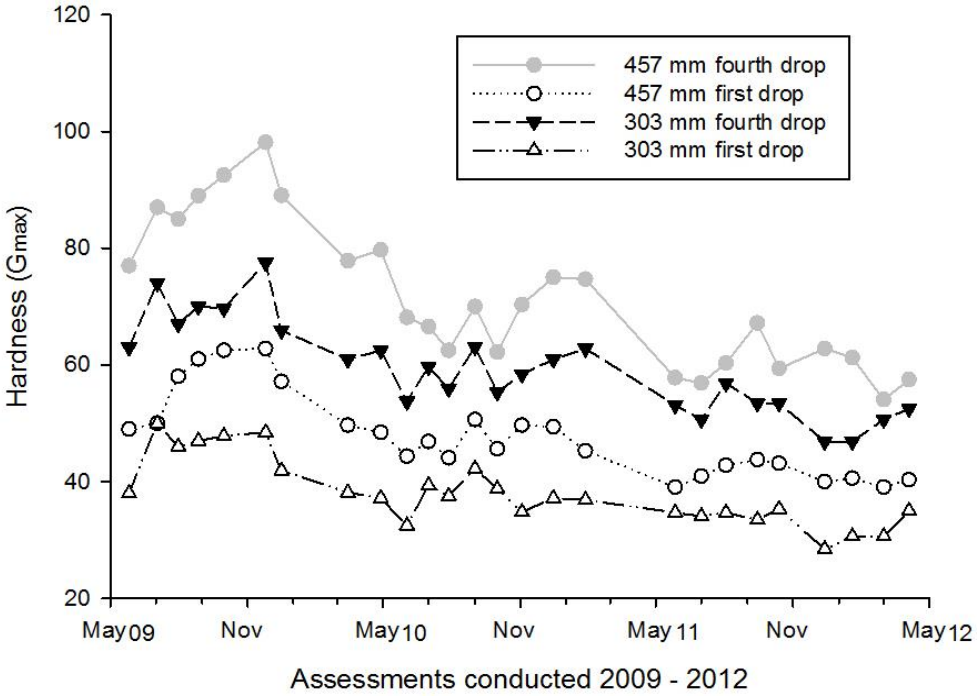
FIGURE 5 Correlation between soil moisture (%) and surface hardness (4th drop Gmax) from the mean data collected within the C, D0, D1 & D6 plots of the RRF simulated wear study between 26 May 2009 and 26 May 2011. The recommended range is highlighted in grey.



A moderate negative correlation (r = -0.42 or R^2 = 0.17) was observed between surface hardness (Gmax) and percentage soil moisture within the (fine bedding) sand profile (FIGURE 5). Generally speaking this means the higher the percentage soil moisture, the softer the ground.

Throughout the course of the RRF simulated wear study four different Clegg impact hammer readings were acquired, being the 1st and 4th drop of the hammer from a height of 303 mm and 457 mm. The data set was collected due to the large variation present within the turf industry when it comes to how to measure surface hardness. Values collected were from the control (unworn or decompacted) plots of each variety and grouped to show a collective mean across each day of testing (FIGURE 6). To a large extent the figures mirror each Clegg hammer treatment or test method as shown across the 25 test dates between 2009 and 2012.

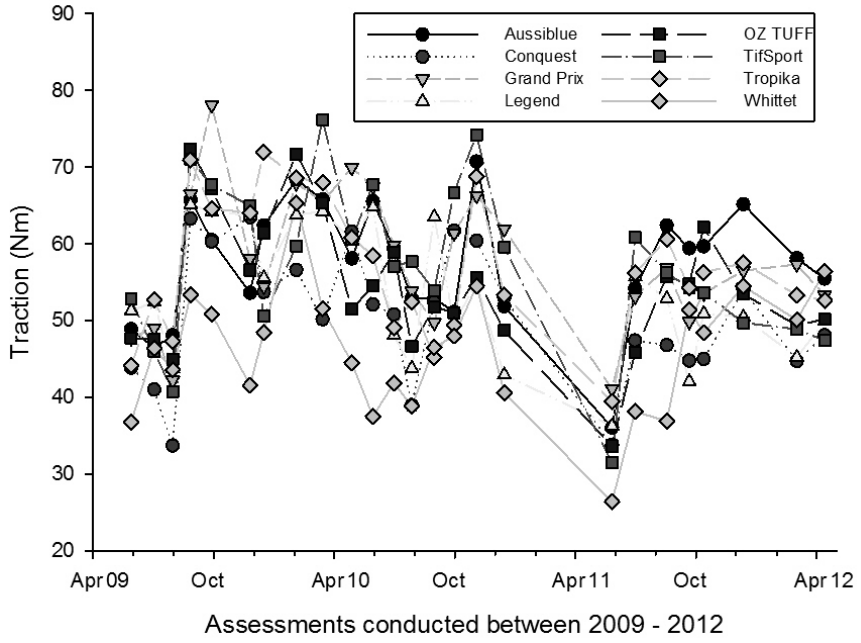
FIGURE 6 Comparison of 1st and 4th drops from a height of 303 mm and 457 mm from within the control plots of the Redlands simulated wear study site between 2009 and 2012. Gmax values are shown. LSD values are not shown.



A secondary variable assessed from within the RRF turf plots (all plots/treatments – however, only control data is shown within this report) was traction. Australia's elite sports bodies (e.g. Australian Football League (AFL), Australian Rugby Union (ARU)) consider traction and surface stability as the two most important factors in the playability and performance of a sports turf surface (McAuliffe and Roche, 2011).

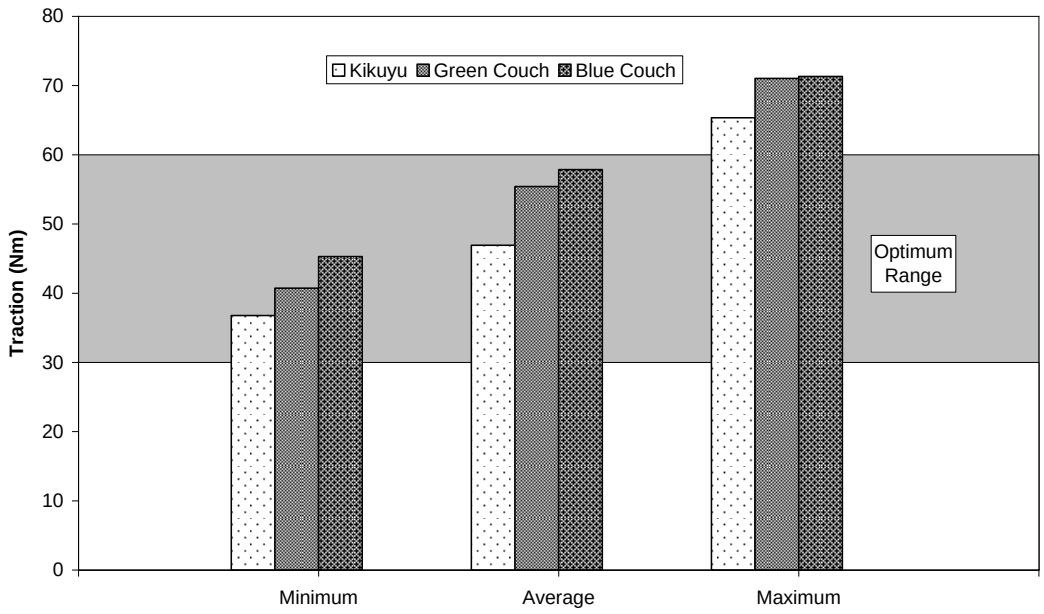
Traction (Nm) values varied significantly from within the control plots over the four year period which ranged from 34-78 Nm (FIGURE 7). Grouping by species proved interesting (FIGURE 8). On average the blue couch species showed to have a higher level of traction than the kikuyu or green couch varieties. However, varietal differences within species showed the green couch cv. Grand Prix as having the highest level of traction at 78 Nm, whereas Conquest within the same species only reached 63 Nm.

FIGURE 7 Traction (Nm) values of the control (no wear or decompaction) plots within the RRF simulated wear study using the Redlands Traction Tester*. On 25 occasions traction data was collected between 13 May 2009 and 1 May 2012.



*On the 27 May 2011 the manual Studded Boot Apparatus was used. The manual tester provided lower traction (Nm) figures compared with the automated tester and was discarded from analysis.

FIGURE 8 Mean traction (Nm) values collected of the blue couch (cv. Aussiblue, Tropika), kikuyu (cv. Whittet) and green couch (cv. Conquest, Grand Prix, Legend, OZ TUFF, Wintergreen and TifSport) control plots over the 25 testing dates between 13 May 2009 and 1 May 2012.



Discussion

This was the first time wear testing of this kind had been undertaken across such a diverse number of warm-season turfgrass species suited for recreational use and sportsfield. The wear tolerance and recovery figures collected provides distinct variation between turf species and highlights the need for serious consideration before user groups can decide on a grass variety before thinking of their (usage) requirements and user expectations.

Green couch varieties withstood the effect of traffic (wear and compaction) appreciably better than blue couch varieties and the single kikuyu variety. In a worst case scenario, if a field was to experience high usage as seen within the present study, and decided to plant either green couch, blue couch or kikuyu, the sporting club could pose to risk potential field closure for up to 65% (green couch), 80 % (blue couch) or 100% (kikuyu) of the season depending on their choice. Not to mention the need for turf replacement that may be needed. The kikuyu plots within the RRF wear trial were replaced on two occasions, in Year 1 and Year 3 of the four year study. In order to maintain suitable cover this number could have been much higher.

Wear tolerance rankings remained very much consistent throughout the course of the study. Only when wear levels were lower, as per Year 4 of the RRF study, are cultivars more comparable then under high or intense wear. This is a good thing particularly if usage requirements are low and wear patterns or high traffic areas (e.g. goal squares) are restricted to allow turf recovery.

Forage analysis/fibre testing results did not provide similar results to that of earlier work conducted by Roche *et al.* (2009) on *Cynodon* spp. for elite sportsfields. In the latter studies, researchers collected above ground vegetative material consisting of leaf and thatch for analysis. However, in the present study only leaf material was collected. It is possible that the lignin and Total Cell Wall content (TCW) concentration within the thatch layer is of greater importance than just the leaf material. This seems logical given that leaf material is often first to be removed from the turf plant through direct damage to shoot tissues (e.g. by mechanical pressure, abrasion, scuffing, tearing), leaving the thatch or stalks in place until complete loss (bare ground) is encountered. Further testing is warranted in this area to determine if this hypothesis is correct.

The mean percentage soil moisture observed during the RRF simulated study was 21.8 %. The latter value resulted in a moderate correlation ($r = -0.42$ or $R^2 = 0.17$) with surface hardness. The mean percentage moisture value is in the recommended range provided by Henderson *et al.* (2007). However, the soil type commonly seen in the latter studies (sandy loam to clay loam soils) is remarkably different to the fine bedding sand used within the RRF study. Therefore moisture levels required may need to be higher (e.g. nearer to 30 %) to provide hardness values between 70 and 80 Gmax.

However, even though only a moderate correlation between surface hardness and moisture was observed, the collected hardness data coincides with the recommendations provided by Henderson *et al.* (2007) in that infrequent amelioration techniques will only provide short-term gain. Should sports turf managers and or clubs wish to achieve maximum benefit in compaction relief, rooting depth, water infiltration etc. more frequent decompaction work needs to be programmed into maintenance schedules.

Clegg hammer (Gmax) values will be further analysed at a later date to determine if a formulae can be identified to determine a valid comparison ratio between different operating procedures when using the Clegg hammer.

Traction levels within the blue couch species were interestingly higher than expected. This was surprising given that blue couch species of turf do not have underground rhizomes, they are a

stoloniferous grass. Rhizomes which are present in green couch species provide resistance and high traction levels as reported by Roche *et al.* (2007).

This project was funded by Horticulture Australia Limited (HAL project code TU08018) using voluntary contributions from industry and matched funds from the Australian Government. Financial or in-kind support was provided by Redlands City Council, University of Queensland, Queensland Department of Agriculture, Fisheries and Forestry, sports turf and golfing associations, turf producers, fertiliser and pesticide companies and machinery companies. The diverse support to undertake the project signifies the wider turfgrass industries commitment to the quality and management of turfgrass in public open spaces, but more importantly at the grass roots level of community sport. A full list of participants can be seen below.

- Horticulture Australia Limited
- Redland City Council
- The University of Queensland
- Redlands Touch Association
- Q Turf Machinery
- Sports Turf Institute (Aust.)
- Sports Turf Assn QLD Inc. (STA QLD)
- Sports Turf Assn NSW Inc. (STA NSW) [2]
- Sports Turf Assn VIC Inc. (STA VIC)
- Golf Queensland
- Sygenta Crop Protection Pty Ltd
- Aust Golf Course Superintendents Association (AGCSA)
- Globe Australia Pty Ltd
- Oz Tuff Turf
- Australian Lawn Concepts
- Twin View Turf
- Turf Force
- Turf Solutions Pty Ltd
- Turf World
- Caboolture Turf
- Jimboomba Turf
- Progressive Seeds Pty Ltd
- Golf Course Superintendents Association Queensland (GCSAQ)

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Should you or your organisation require further information please do not hesitate to contact Matt Roche on either of the following particulars.

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PROTECTING YOUR ARSE! THE IMPORTANCE OF GOOD RECORD KEEPING

John Neylan

Introduction

Managing any sportsturf facility comes with numerous challenges and great rewards. Managing turf is no longer just about nurturing the turf and presenting high quality playing surfaces, it is about managing staff, reporting to management, communicating with user groups, environmental management and complying with a myriad of legislative requirements. Whether we like it or not the turf manager is going to spend more time than ever planning, communicating and documenting rather than being "on the tools".

We often hear turf managers ruing the fact that they are no longer able to spend the time they used to on the golf course or sportsfield. However, there have been many cases where turf managers have neglected the paper work and then when a serious situation occurs there is nothing in writing to support the manager's side of the story. Whether it is an OH&S incident, a pesticide spill, staff disputes or dealing with criticism regarding the playing surfaces, good documentation and a clear process will often avert the incident from escalating.

There are different levels of record keeping and reporting, from meeting legislative requirements to weekly communications with members about what is happening in the turf maintenance operation. Outside of the legal reporting requirements, the other crucial area is communicating with boards and keeping everyone informed of what is happening and why, including any problems. It is also important to report on your aims and objectives for the facility, how you intend to achieve these aims and to report on the achievements. There is nothing wrong with blowing your own trumpet from time to time.

Dealing with boards and volunteer committees can be one of the biggest challenges, given that you are usually dealing with people that have little or no knowledge of turf management – but often think they do (thank Google™ for that). It becomes very important that when contentious issues are discussed or directions and approvals are given that they are well documented in official minutes.

Record keeping and good corporate governance

Corporate governance is often thought about in the context of publically listed companies. However, it is just as important for any organisation (e.g. AGCSA, Golf Clubs and Sporting organisations) to adhere to good corporate governance policies and practices. Where there are many stakeholders, good corporate governance becomes even more important as there are many people with a vested interest in the organisation.

Definitions of corporate governance are many and varied. Broadly speaking, corporate governance generally refers to the processes by which organisations are directed, controlled and held to account. It encompasses authority, accountability, stewardship, leadership, direction and control exercised in the organisation (ANAO, 1999). This definition fits very well with the obligations of sporting organisations in Australia.

Central to good corporate governance is;

- Ensuring that **control mechanisms** are in place to run the organisation with care and diligence (e.g. banking – 2 signatures, pesticide use).
- Transparency and accountability – AGM's, audits (financial, OH&S, environmental).
- Acting ethically at all times – "doing the right thing".

The question is who is responsible for Corporate Governance at your work place? It is usually the responsibility of senior management and should be driven by the General Manager and

board. The reality is that in many turf based organisations it is often left to the turf manager to understand what the important compliance issues are (e.g. OH&S) and to develop these independently of the organisation.

To ensure good corporate governance, golf clubs and sporting organisations should develop as a starting point;

- A clear **vision** for the facility - what is the vision for your organisation/golf course/sports facility? What plans, goals and directions are in place to achieve the vision? This vision must be clearly described in the strategic plan.
- A **strategic plan** outlining goals and objectives.
- Well developed company **policies, procedures and processes** – must extend to the presentation of the golf course and sporting facilities. These are lacking in many golf clubs and sporting organisations.
- A **risk management policy** – across the entire organisation.
- Transparent performance reporting mechanism.
- Well developed **employee management system** – how are you judged and assessed in your work place.

Boards of directors and committees can help to ensure that a sporting organisation has good corporate governance. This is a critical area when we start dealing with aspects of turf management operations. In a recent presentation by Mal Speed (former CEO of the ICC) on Corporate Governance, he outlined several key areas that have to be considered by any organisation. The key concept or question is "w*ill your club or organisations governance withstand intense public scrutiny?* This is when the organisation has to deal with crisis or litigation.

The recent pesticide issue in NSW is an example of when corporate governance can be severely tested. What were the Board told? What did they agree to? Did they sign off on the policy/procedure? Other examples include; criticism over the playability and safety of playing surfaces, public condemnation of water use and irrigation practices during drought, workplace incident where a staff member is injured.

There have been several recent public governance challenges that have made the media with intense scrutiny and opinion. These notably include;

1. Australian Swimming – Swimmers taking Stilnox™, poor behaviour and poor performance in the pool.
2. AFL – tanking and doping. Essendon Football Club is undertaking a corporate governance review (starting with the Board) as it relates to Club and player management.
3. Cycling and doping. The Lance Armstrong incident and the implications across the governance of the sport have been widespread over many years.
4. The Catholic Church has also been questioned about its governance as it relates to the abuse of children.

From a sporting organisation or Club perspective, issues that frequently arise include;

1. Wrongful dismissal.
2. Fraud – "fiddling" the books.
3. Chemical use.

The key starting points for good corporate governance are;

1. **Strategic Planning:** The strategic plan is a key document as it provides a road map for the organisation. Good planning and a clear vision and direction for the organisation equal good governance. The vision statement must be clearly stated at the top of the strategic plan outlining the "big picture" for the organisation.

2. **Providing Role Clarity:** Who is responsible for what? It is essential that every organisation clearly defines each position in the organisation, what they are responsible for, who they are responsible to and how they communicate within the organisation. This includes all levels of the organisation including the board, management and staff.

GOOD GOVERNANCE = GETTING PROCESSES IN ORDER

Corporate governance fits strongly with the roles and responsibilities of the turf manager in terms of;

1. Understanding his/her role in the organisation.
2. What are the responsibilities of the position?
3. Is there a position description?
4. Do you know where your position and responsibilities fit within the organisations strategic plan? Does the organisation have a strategic direction?
5. What are the legislative obligations of the position? For example is the position responsible for OH&S compliance, environmental management, pesticide handling and storage, staff induction etc.
6. Within the organisation does the position require regular reporting to management on operational issues and future planning?

Pesticide management and good governance

Pesticide use is a key maintenance activity undertaken in the turf industry and possibly the most heavily scrutinised and regulated responsibility. A constant challenge for turf managers is to operate within the law while meeting the high standards required for many turf facilities, particularly golf courses. It is in this area of operations that potentially requires the most care in terms of following good practice and ensuring that the appropriate paperwork is completed. Whether it is keeping pesticide inventories, procedures for applying pesticides or making sure that staff are appropriately trained all require good documentation.

Over the past 25 years there has been a considerable change in the pesticides available to the turf industry with a move to less toxic and more environmentally friendly chemistry. We used to have; PMA (mercury based), Cadex (cadmium based), DDT and Lindane mixed with superphosphate. They were all highly effective pesticides but damaging to the environment. The organochlorine based insecticides for example had long term residuals and caused considerable environmental damage and were consequently taken off the market.

In addition to the shift towards safer pesticides there has been an increase in the compliance requirements for the purchase and use of pesticides. The APVMA (Australian Pesticides and Veterinary Medicines Authority) is the regulatory agency responsible for the registration of all agricultural and veterinary chemical products into the Australian marketplace. Part of their duty is the on-going **review of pesticides** and whether they present an **unacceptable risk**. There is an on-going process of review and in recent times we have seen several commonly used pesticides removed from the market.

While there are on-going reviews of various pesticides registered for turf there is the underlying discussion regarding off-label use. For most states in Australia off-label use is illegal and turf managers should not put themselves in a position where they are tempted to use non-turf

registered pesticides. Taking risks on behalf of the Club or organisation for some potential "good outcome" or improvement in turf condition or to control a persistent problem is irresponsible. Do not take on risks on behalf of the organisation or put the organisation in a vulnerable position.

Record keeping and reporting

In the 30 years that I have spent in the turf industry the fundamental issues have not changed. It is still all about managing grasses, soils, water and pests and producing playing surfaces. What has changed is; the way operations are undertaken, the tools that are available (or in the case of some pesticides unavailable), the business of golf (greater emphasis on corporate play), expectations of members and legislative and compliance requirements. In particular the compliance requirements mean that turf managers are required to keep good records and report frequently on the activities undertaken.

So what reports need to be produced? Table 1 lists a number of the key reports and it should be recognised that there are records and documentation that need to be kept in order to generate these reports. Remember that from a corporate governance perspective, the test comes when SOMETHING GOES WRONG. For example;

- If a staff member gets injured – do you have all your OH&S policies, work orders, procedures and inductions up to date?
- If there is a pollution incident, fuel spill, accident with a pesticide – can your paperwork and procedures stand scrutiny?
- A staff member sues for wrongful dismissal – can your paperwork and procedures stand scrutiny?
- There is turf damage due to controlling *Poa annua* – did you explain the situation to the board and members, the possible ramifications and how the process will be managed?
- There is a directive NOT to renovate and the greens turn to pug during winter - did you explain the importance of renovations to the board and members and the possible ramifications?

When reports are produced they must go to key people in the organisation. It is important for any organisation that there is a clear chain of responsibility and this would typically be documented in the organisations strategic plan and procedures documents. If it is unclear, do not let it be, seek clarification. There will also be reports that need to go to external organisations e.g. water authorities, environmental agencies etc. Make sure these reports are reviewed by a second person and are clearly written and well scripted. Reports to external agencies should be reviewed by the organisations hierarchy before submission.

As another aspect to consider in the operation of the organisation it is what to do during meetings, both formal and informal. With greens or committee meetings make sure that minutes are taken, drafts sent to the attendees for review, actions and directions clearly stated. Meetings with staff, particularly performance reviews or disciplinary action should be documented and copies sent to all parties. With all other meetings, irrespective of their "importance", take notes, record minutes (they need only be brief) and send out a note to all parties. Where instructions are issued make sure they are recorded and ratified by those issuing the instructions.

Benchmarking – how well am I managing?

In my time inspecting golf courses and meeting with committees, there is undoubtedly a strong sense of ownership by members, committee members and the superintendent. Each group can often have a different perspective of what the golf course should be about. An inability to understand each side of the discussion or bamboozling them with science or just saying "it can't be done" creates an impasse and often at the expense of the superintendent's position. Because you understand what can be done does not necessarily mean that everyone else understands or for that matter agrees or even cares. Do you truly understand what your course

can deliver within the resource base available to you? Do you have any measureable standards or course quality objectives OR more pertinently does the golf club? If the following questions are asked can you provide an answer that is supported with measured data and reported?

- There is more *Poa annua* in the greens
- The greens are softer than last year.
- The greens are slow.
- The greens are wet (usually stated with a serious face after 25mm of rain).
- The bunkers are not as good as .....
- Do we have to renovate the greens, they are in excellent condition? *Take this as a key to measure thatch depth etc.*

These are factors that we can measure. However, **the Club** must set some realistic standards to benchmark against. There is still considerable "push back" or resistance from superintendents to establish benchmark standards and to take the time to measure them. This is a big impasse – "I don't have the time" is the frequent quote. Is it a fear of failure? There is certainly a fear of being "hung out to dry".

TABLE 1: Typical reports that need to be produced in a turf maintenance facility

REPORT	**FREQUENCY**
COURSE REPORT Cover all management areas: **1. TURF** • **Greens** • **Tees** • **Surrounds** • **Fairways** • **Rough** **2. BUNKERS** **3. IRRIGATION** • Water consumption vs Budget **4. ENVIRONMENTAL** **5. MACHINERY** **6. LANDSCAPE** **7. FINANCIAL** **8. WORK HEALTH & SAFETY** **9. HUMAN RESOURCES** • Staff leave **10. COURSE ENHANCEMENT** Include Photographs	Monthly
ANNUAL REPORT • Summary of last 12 months for publication in annual report • Provided to GM for circulation to membership	Yearly
ANNUAL MAINTENANCE PROGRAM • Includes course improvement/development works • Goes to GM for circulation to full committee	Yearly
ANNUAL BUDGET • Maintenance and capital • Goes to GM for circulation to full committee	Yearly
MEMBERS INFORMATION • Course works, specific conditions etc. • Written for circulation or presentation to membership	As required Club newsletter

SOCIAL MEDIA • Blogs, other electronic media to update on course maintenance	Weekly/Daily

OTHER

Annual:

- Irrigation management plan report
- EMS review
- WHS system review
- Financial
- Irrigation system audit
- Soil and water test results
- Vegetation surveys
- Course Quality Objectives
- Staff appraisals and PD reviews

Monthly:

- Rainfall
- Irrigation consumption against actual irrigation requirement
- Days lost to injury
- Staff leave
- Financial (included in monthly report)
- Spray unit calibration
- Stock levels
- Course Quality Objectives
- Environmental training
- WHS training

Weekly:

- Environmental checklist

Daily:

- Staff attendance
- Staff tasks

From where I sit, establishing standards and reporting on the data collected are going to become more prominent as part of the general operation of a golf course. As with a sales person who is benchmarked against their monthly budgets or numerous other senior management positions which have KPI's attached to performance reviews, I believe that there is no escaping them in golf course management. As part of your management responsibilities you should be starting the process. BUT you do not have to do it all yourself. Utilise some of your key staff and give them some extra responsibility. Pick 2 – 3 key areas for the golf course (they are most probably screaming out at you and you will not have to look too hard), present it to the club and then start monitoring (use 3 – 4 key indicative areas).

Easy ones;

1. Visual estimates of *Poa annua* – monthly.
2. Green speed - easy to do but many people are "afraid" of producing the numbers – linked to rainfall/weather can provide a good insight into the course.
3. Firmness – there are lots of Clegg hammers available – contract it in.

Any senior manager that is doing his/her job well will utilise a wide range of resources to make sure that they are current, relevant and the organisation is operating effectively and efficiently. There is often a reluctance to bring in outside expertise to review, oversee and audit the operation because it is seen by the manager as a "blight" on their ability. The sensible approach is to draw on the available resources so that you can do your job better to the betterment of the organisation. In many cases in the golf course industry it confirms what is already known, however, it provides an independent viewpoint that supports the current position. If it doesn't it will provide opportunities to finetune the operation and to improve the end product for which you will reap the praises. Yes we are talking about consultants. Whether it is designing a new shed, installing a new irrigation system or course design we are almost always going to employ people with a broader level of expertise to assist in the process. A knowledgeable agronomist will have

experienced many different situations and will often draw on those experiences to assist you through a dilemma.

The key take home messages;

1. Don't ignore the persistent "silly" question or comment.

2. If there is a regular theme about a particular aspect of the golf course (e.g. firmness of greens) do something to establish the "cause" of the concern. It may be real.

3. Draw on external expertise as required, investigate the issue and produce a report. Make the report simple and concise. Remember, your audience does not have your depth of knowledge and understanding.

4. Never present a PROBLEM without a SOLUTION. "*I understand the committee's concerns about the firmness of the greens. I have investigated the problem and it is due to the fact that we have not renovated for two years. The thatch (organic matter) layer (see picture) is holding moisture from rainfall and irrigation and we cannot get them firmer as a result. The solution is that next spring we will be hollow coring with 12 mm tynes and topdressing with sand. The greens will not be at their best for 4 weeks but long term will improve considerably. We are going to monitor this by measuring surface firmness every month for the next 12 months".*

Benchmarking is a reality. While we do not always like it we are all going to be judged in the work that we do. Initiating a benchmarking program can assist in developing a strong understanding of the capabilities of the golf course and the success of the management programs. It provides a real way of comparing the performance of the golf course between seasons and from year to year.

Conclusion

The role of turf manager has changed markedly over the past 15 – 20 years, where it is now truly a management position and not just that as a senior greenkeeper. There are numerous areas of compliance including; OH&S, pesticide application and storage, water and waste management, environmental management, budgeting and staff management. All require a clear and concise means of recording and reporting what is happening in these key areas of operation.

Poor record keeping leaves the turf manager vulnerable to dismissal and possible prosecution if there is an incident that results in harm to a person or user of the facility or an environmental incident. Good records will not prevent incidences and accidents from occurring, but they will demonstrate intent and process.

Every turf manager should understand the structure of the organisation they work for, its vision, strategic plan, policies and procedures and governance processes. All organisations must ensure that there are control mechanisms in place to run the organisation with; care and diligence, transparency and accountability, and acting ethically at all times. Keeping up to date records and reporting regularly is extremely important in meeting these objectives and ensuring that if there is an explanation required that good process can be demonstrated.

Acknowledgement

Thanks to Daryl Sellar for his invaluable input and counsel.

ANAO. 1999. Principles and Better Practices. Corporate Governance in Commonwealth Authorities and Companies. Discussion Paper. Australian National Audit Office. Commonwealth of Australia. http://www.ano.gov.au. May 1999.

DHS. 2007. Guidelines for the safe use of pesticides in non-agricultural workplaces. Published by Rural & Regional Health & Aged Care Services Division, Victorian Government Department of Human Services, Melbourne, Victoria. Department of Human Services, Pest Control Program website at: www.health.vic.gov.au/pestcontrol.

DPI. 2010. Chemical Use in Victoria – What I Can and Can't Do. Note Number: AG1210. Published: July 2005 Updated: April 2010

HEALTHIER TURF AT A REDUCED COST

Stephen Bernard
Bernhard & Company Ltd

The content
Until lasers, or whatever the next generation of mowing technology brings to turf maintenance, we are stuck with the same technology that was developed a century and a half ago in England for, believe it or not, the shearing of carpet nap.

The basic principles are still the current chosen method for cutting grass today. Of course the precision and tolerances have evolved, materials and design continue to improve – but the underlying concepts of reel mower geometry and function have not.

Much ado is made of the bells and whistles of the latest and greatest mowing equipment, but all that window dressing is heaped upon a reel blade passing across a bedknife in a manner suitable to slice through blade after blade of grass, cleanly and consistently, at a predetermined height above the ground. The engineering and geometry of that process — and its subsequent maintenance are key to the proper function of every reel mower.

Even the fanciest mowing machine will be brought to its knees by wrongly ground or maladjusted reels.

On the other side of the coin, the simplest machine will perform at its best with proper attention to grinding, adjustment and in-season maintenance.

A little history…
The original concept of a reel mower was developed by Edwin Budding as a means of shearing carpet nap in the textile works of England around 1830. Equipped with straight blades and without a bedknife, the threshing action of the first prototype reels produced an uneven cut due to the textile fibres moving around.

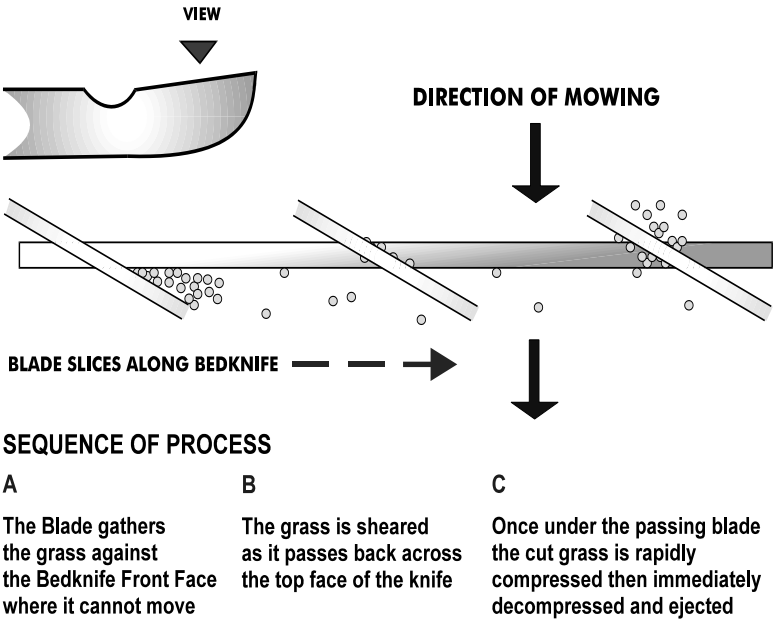
To solve this, a simple helix was created by twisting the blade disks in opposite directions to impart a bend to the reel blades. A “bottom blade” or bedknife was also added as a positioning device to hold the carpet fibres in place. The bend in the reel blades caused the cutting point to be drawn horizontally across the bedknife from one side to the other, creating a scything action. Edwin Budding then applied his textile shearing concept to mowing grass, patenting his first reel-type lawn mower in 1830.

Mowers built by Lloyds, Shanks and Ransomes needed to have cylinders. A local firm helped to produce their reels cylindrically at that time by using equipment originally designed for making grist mill grinders. Following that, Atherton’s, the local firm, developed the first commercial reel mower grinder. As local “mom and pop” mower repair shops proliferated throughout England, Atterton began supplying them with reel grinders for sharpening the lawn mowers. By 1870, Atterton and Ellis, Ltd. (which is owned by Bernhard & Co. today) had a range of four spin grinders on the market.

Single-blade grinding was initiated in the USA by Ideal and Simplex (SIP) with their Hook grinder around 1935, followed later by Foley who purchased the Modern Company.

The concept of lapping was developed because of the need to make single-blade-ground reels cylindrical again. This was the same problem Budding ran into one hundred years earlier, solved then by the use of the Atterton cylindrical grinder. Relief grinding, or blade thinning, was then created to reduce the braking effect of lapped reels.

The reel mowing process…
The process involved in reel mowing is quite simple. As it rotates, the reel blade gathers the grass blades against the front face of the bedknife, which holds them in one straight plane and positions them for a uniform cut. This also controls the height of cut. The leaf tissue is sheared as the reel blade passes back across the top face of the bedknife. The cut material is compressed momentarily, then rapidly decompresses and is ejected from the reel/bedknife interface.



The helix of a reel cylinder is designed to cause the reel blades to act like a succession of razor blades passing along the bedknife with little or no contact, creating the horizontal scything action so critical to a clean cut of the leaf tissue.

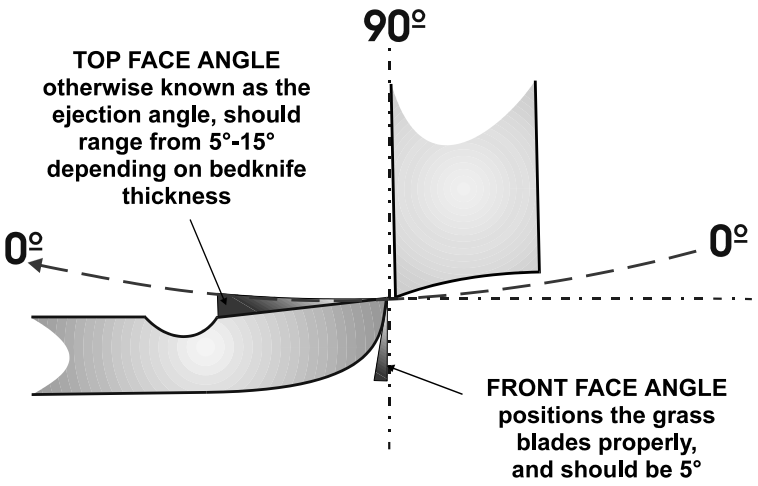
Taking a look at the geometry of the process, it becomes clear that several angles in the reel/bedknife interface are critical to the optimal functioning of a reel mower. With the wearing away of reel blade and bedknife material over time, the actual angles will change and must be restored to near ideal by the grinding process.

The bedknife positions the grass blade at the proper angle for mowing. The front face of the bedknife is the positioning face, while the top face is the ejection face. A correct front face angle must always be less than 90°. It ensures the grass blades are positioned at the proper angle for presentation to the reel blade. The top face angle is the ejection angle between the top face of the bedknife and the arc created by the rotating reel blade. Since this angle changes as the relative position of the reel blade moves, it's difficult to know what real angle does exist. Therefore, an average or range of ejection angles is calculated based on the size and thickness of the bedknife and reel blade. Generally speaking, the greater the ejection angle, the better the clippings would be ejected from the reel/bedknife interface.

Not only is the ejection angle ground into the top surface of a bedknife directly related to its ejection capability, but it also reflects upon the durability of the bedknife. The hardness of the matched reel blade and bedknife is a carefully calculated compromise between durability and grass ejection capability. The loss of sharpness is closely connected to the ejection angle of the bedknife and the constant friction between both.

Many superintendents perceive the problem of "rifling" after noticing streaking on the surface of the turf. Upon examination of the mower involved, it is usually evident that the bedknife has been excessively and severely tightened against the reel cylinder. Inevitably, this causes the leaf tissue to be cut in a mechanical scissors-like fashion in the middle of the reel blade surface, rather than by scything action at the edge of the reel and bedknife. Instead of the clean cut achieved by scything, the leaf tissue becomes pinched. It is then literally pulled apart and ruptured during the scissoring process, thus opening the grass blade to a myriad of potential problems.

Scissors vs. scythe



This difference between a scissors-cut and a scything action is important to understand. Scissors require two blades travelling in opposing directions, and will cut adequately if there is sufficient light contact along the length of the two blade edges. A scythe, as we have already determined, consists of a single cutting blade being drawn through the leaf tissue, damaging fewer cells in the process. Scissors will cut, but a scythe cuts better. This is precisely why a surgeon uses a single-blade scalpel to cut through flesh instead of scissors. The surgeon wants to limit tissue damage and avoid the ingress of disease.

In a reel mower, one difference between a scythe and scissors action is the velocity of the cutting edge moving down the bedknife. A properly ground and adjusted mower will operate in a scything action at up to 4x the velocity of an improperly ground or misadjusted reel functioning as a scissors. Remember the analogy of razor blades shooting along the length of the bedknife edge?

As the bedknife is an equal partner with the reel blade in the cutting process, equal consideration must be given to proper grinding and in-season maintenance of the front and top faces of the bedknife. If the bedknife is not sharp and true, those razor blades being fired down the bedknife by the helix of the reel blades will encounter both high and low spots on their journey, resulting in an imperfect cut.

SO now let's have a look at the effects of a sharp cut on turf.
It seems such a small thing, but it makes such an enormous difference, not only to the way your turf looks, but how much it costs to get it looking good.

All of the Agronomists and Greenkeepers and Groundsmen here today will know the most basic facts – that turf cut with a surgically sharp mower looses less moisture, is less susceptible to disease, and therefore requires less chemicals.

This one simple component is the key to sustainable, top quality turf maintenance.

Sustainability is really on everyone's lips now, as it should be, and it has been the key selling point for our company for a very long time. We need to take care of what we have, and protect it for future generations, and we need to save costs, wherever we can on fuel, water, fertilisers and fungicides.

As the sports and amenity turf industry demand a more environmentally sensitive maintenance programme, so clubs and providers of turf playing surfaces need to listen and be one step ahead. Everyone wants the turf to look good. If you are at the top of the game and you have the close eye of television cameras around, you need, even more, to ensure that the finish is perfect and impressive all the time.

Golfers, cricketers, footballers, lawn tennis players – whatever the sport – all want excellent conditions and consistency of play - but everyone also wants to feel good about how this is achieved. They need to know that sustainability is part of the maintenance programme. They

want to be reassured that large quantities of chemical, pesticides and fertilisers are not being used and that water is not being wasted.

So whether you are a polo ground in the Middle East, a football pitch in US, whether you are Wimbledon Lawn Tennis Club the Adelaide Oval, Real Madrid or Wembley, whether you are a park or sports ground – wherever you are, and whatever business you are in, you need to present the best possible finish at the lowest possible cost with your eye fixed firmly on being environmentally sensitive and aware.

This is the basis of the session that Stephen Bernhard will present. In depth discovery as to how the mower works, what the link is between cutting unit setup and speed of the ball – are all subjects that can be explored at another time and date. Fundamentally the message we have to understand and buy into is ….

Proper Cutting Unit Maintenance and Setup can produce Better Grass for Less Money.

TOP 10 CHANGES IN SPORTS GROUND MANAGEMENT IN THE PAST 25 YEARS

Peter Semos
Global Turf Solutions

The last 25 years have seen many new turf management techniques and innovations introduced into the Turf Industry. From the myriad of changes that have occurred, it is considered that theTop10 changes chosen would vary from Ground Manager to Ground Manager. It is for this reason that I have chosen the top 10 that seem to have had the biggest impact for sports fields across the board. Some of the changes could be considered as refinements rather than complete introduction of totally new technology.

1. Testing methodologies for sports field profile construction and cricket wickets
Up to the early 1990's most evaluations of materials for construction of sports fields were by particle size analysis, pH and total dissolved salt concentrations. Most of the particle size analysis were done as dry sieve analysis then these advanced to wet sieve analysis and then particle size analysis with silt and clay determinations.

In the early 1990's things began to change when tests became more diverse so that field design and performance could be determined more accurately. These test were developed from the USGA technology and by Bent Jakobsen (Rootzone Laboratories International) and are now performed by Ground Science Pty Ltd Victoria with some being refined by Ground Science Pty Ltd in more recent years.

Testing for gravels for drainage layers were developed at this time and included the following tests.

- Particle size analysis on Australian Standard sieves to see the makeup of the gravel.
- Hydraulic conductivities to determine the rate of lateral water movement in the gravel drainage layer.
- Gravel suction influences on the sand growing medium moisture retention.
- Gravel shape as angular or rounded to indicate stability for installation purposes.
- Percentage of calcium content to rule out high calcium based gravels that had probable degradation issues over time.
- Migration compatibility with bridging factors and uniformity factors with D15 and D90 determinations in order to verify that the growing medium sand and gravel were migration compatible.

Testing for growing medium selection performances were also developed primarily for free draining profiles and included the following procedures.

- Moisture release curves to determine ideal moisture content and depth of profile. These were reported in an article by Madison (University of California) about1980 but were not introduced into testing for sports fields until the 1990s when the methodology was developed by Bent Jakobsen (Rootzone Laboratories International)
- D85 determinations for migration compatibility with the gravel and D15 determinations to verify perched water production between the sand and gravel.
- The shape of sand particles as angular, sub angular and rounded to determine the stability of the sand.
- Hydraulic conductivity of sand at certain bulk densities to indicate the drainage capacity of the growing medium sand.
- Stability testing to ascertain if the growing medium sand is going to be difficult to form a playing surface due to instability.

- Determination of organic matter content, to increase moisture retention of the growing medium sand. The percentage of inclusion was tested as loss of ignition expressed as percentage by weight.
- The moisture retention including air filled and total porosity of the growing medium sand and organic amendment mixture, at the determined depth (suction) determined from moisture release curves and gravel suction influences.

Again, around the 1990's cricket wicket soil selection testing was introduced on a commercial basis to try and make some sort of selections of cricket soils. These were developed by Don McIntyre (CSIRO) and Bent Jakobsen (Rootzone Laboratories International) and included the following tests that are now done by Ground Science Pty Ltd Victoria:

- Clay content in a range that will provide the necessary cracking parameters and an indication of the makeup of the soil.
- Shrinkage cone tests that will provide indications of levels of shrinkage that will influence cracking.
- Cracking patterns that indicate the probable cracking pattern of the soil in the field.
- Crushing strength to indicate if the soil will have sufficient cohesion to withstand the constant ball impact.
- Emerson dispersion for the indication of potential drainage problems in new wickets and how well the clay soil particles stick together in peds and how well the soil holds its structure.
- CEC (cation exchange capacity) levels to indicate with the calcium magnesium ratio and the exchangeable sodium percentage, the probable firmness of the soil.
- Calcium Magnesium ratio to evaluate possible self mulching tendencies and with the CEC and the exchangeable sodium percentage, the probable firmness of the soil.
- Organic matter content to indicate if the organic matter is in a form or amount that will enhance cracking or cause problems with compaction.
- Exchangeable sodium percentage with the Calcium Magnesium ratio and with the CEC, to determine the probable firmness of the soil.
- EC- Soluble salts levels to avoid possible crumbling of the soil.

2. The introduction of couch grasses into predominantly cool season areas and the development of new couch grass selections

The main reason for couch introductions was for the reduction of water usage and additional wear even though colour dormancy occurred in the winter. In some instances this was compensated with rye grass winter over sowing and spring eradication procedures. Early studies indicated that couch grass water usage was approximately 45% of the evaporation from an A class pan in comparison to cool season indications of approximately 65% of the evaporation from an A class pan.

Now in Australia there are more couch grasses available for the ground manager to choose from than ever before with accompanying evaluations of wear resistance and recovery performances.

3. Water conservation and water harvesting

Water conservation ideology as mentioned earlier, was an influential factor for the promotion of warm season grasses in cool season areas.

Water conservation has led to designs considering water harvesting off buildings, surrounds and fields to designated storage areas for watering of the fields. This has also let to the introduction of using alternative water sources such as effluent water and water treatment procedures with filters or bioretention basins and storage tanks under the field.

4. Sustainable environmental management
This has involved organisations maintaining sports fields with considerations and developing procedures for:

- Pollution prevention of surrounding areas, neighbours and ground water.
- Management of waste materials.
- Controlling water usage.
- Health hazards from chemical handling and application and the avoidance of negative impact of chemical usage on non targeted wildlife and water ways.
- Work safety identification procedures and prevention of environmental liability.

5. OH&S risk management
In the last 25 years OH&S has taken on significant importance in sports field management to reduce injuries, litigation and liabilities and have included the following parameters:

- Security issues particularly on large stadiums.
- White card requirements for all work particularly on large stadiums.
- The introduction of inductions for all workers and contractors to understand the risks polices of the particular facility.
- Reduction of possible liability issues such as high sprinklers and valve boxes or concrete edges and fences on the perimeters of fields.
- Proper storage of chemicals and fertilisers and understanding safety data sheets.
- Training, accreditation and protection for the safe handling and application of herbicides and pesticides.
- Procedures for spectator safety and control.
- Training, accreditation and instruction for machinery operation.
- Ticketing of equipment and production for risk management of machinery operation.
- Identifying all operational risks and development of risk avoidance practices manuals.

6. Introduction of new maintenance techniques
Over the last 25 years the introduction of maintenances techniques has been numerous with changes to machinery, procedures and practices. Some of these include:

- The greater utilisation of buggies for everyday practices.
- Topdressing dusting practices rather than one heavy topdressing.
- Better aeration equipment with kick adjustments and different tine selections.
- Better seeders that penetrate the turf, drop the seed into the penetrations at the rate governed by the roller or the machine speed.
- The introduction of line planters for the planting of couch grass into fields.
- Using rotary and flail mowers in preference to cylinder mowers for reduced maintenance costs and repairs.
- The introduction of machines such as the Koro Top Maker to strip turf off a field by an easier procedure.
- Utilisation of growth retardants such as Primo Maxx (Trinexapac-ethyl) for the production of sward density and reduced mowing frequency without disturbing root growth.
- Utilisation of moisture sensors and weather stations for determining irrigation requirements.
- The utilisation of mobile growth lights for stadiums with higher shade affected areas.
- The introduction of immediately used turf such as Motz, MegAyr Turf and Transformer Sports Turf to increase field activities such as concerts to make stadiums multiuse and more economically viable.
- The utilisation of wash out paints for logo removal in order to protect the grass and to conduct multiple football usage.

- Better access to long range weather forecast in order to carry out particular maintenance or preparation procedures.
- The utilisation of washed turf as large rolls for cricket wickets and establishment of sports fields.
- Development of specific target chemicals for insect and disease control that is safer and less toxic.
- The greater use of growth and root stimulants and the introduction of beneficial microorganisms additives.
- The development of better slow release fertilisers by coating or nutrient formation releases.
- The development of an air inflatable cricket wicket cover roll up system for easy placement and removal of covers.

7. Perception of players and the general public of playing on wet, muddy or hard and dry grounds

Over 25 years ago fields were closed during excessive wet weather to avoid damaging or destroying the playing surface and therefore avoiding any costly restorations. Players did not question and seemed to not have concerns in playing in wet conditions. This however has changed with players, clubs, spectators and field managers being worried about litigation or players being injured which has led to the closing of fields if they are too wet or too hard. This has led to the development of field measurements with instruments such as the Cleg Hammer and traction apparatuses to provide data for safety requirements. It has led to increases in field safety studies and the introduction of essential requirements to maintaining a full grass cover by change of grass species, different management techniques and the distribution of wear patterns for training.

This has also led to the development of free draining all weather sand based fields and the introduction of reinforcement enhancers to help make the unstable sands used for these types of fields more manageable. It has also led to increase installations of sand slit systems as cheaper options to assist with water removal from fields.

In some ways this has also led to synthetic fields being introduced into traditional turf fields such as soccer and Australian Rules where fields can be intensely used without having issues with muddy fields or having to close fields.

8. Drop in wickets

The introduction of drop in wickets has come about owing to players, coaches, and clubs and football authorities not wanting to play over wet black soil pitches during the winter football period. The technology developed in the early1990s involves the utilisation of metal trays around 25 metres by 3 metres, containing approximately 230mm of black cricket soil. The process involves the removal of the wickets from the field at the beginning of the football season and the replacement into the field at the beginning of the cricket season. These exist on the MCG, ANZ Stadium Sydney, Etihad Stadium Melbourne, Eden Park Auckland, AMI Stadium Christchurch and now at Adelaide Oval with the Sydney Showground and Metricon Stadium at the Gold Coast having provisions for drop in wicket installation.

9. GPS and laser equipment

GPS and Laser controlled equipment have been developed and introduced for the accurate installation of profiled sections of sports fields to tolerances of ± 5mm for each layer being installed. This has broaden out to 3D laser system usage that has made installations quicker and more accurate to the tolerances required particularly for difficult shapes such as domed shape fields.

Satellite map technology has been adopted for identification of sites and for the formation of plans and drawings for sports field constructions, redevelopment and monitoring.

GPS positioning has been utilised for mapping of assets on fields and the accurate application of chemical sprays over fields.

10. IT communications

Communications have dramatically changed from when Ground Managers were only contactable at morning tea and lunch time or by two way radio. The introduction of emails, mobile phones iphones, notepad computers and ipads means that the grounds manager is now contactable at all times and can now obtain information virtually immediately where ever they are situated.

In the future

What will the Ground Managers of sports fields be doing in the next 25 years? It can be guaranteed that there will be huge advances in iT technologies to the point that pH, total dissolved salts and possibly soil moisture contents could be measured from their mobile phones. There is no doubt that further advances will be seen in grass selections, chemical developments, machinery, testing of soils, irrigation drainage materials and environmental issues. It is considered that the next 25 years will provide as many new innovations and challengers as the last 25years with possibly greater capacities to provide better surfaces than we have now.

WORKING AT TPC DEERE RUN DURING THE JOHN DEERE CLASSIC 2012

Colin Morrison
Flinders Golf Club

It was a great honour to be awarded the AGCSA Excellence in Golf Course Management for the construction of the new 11th hole at Flinders Golf Club. This award was presented in partnership with John Deere. As recognition, I had the opportunity to travel to the USA and spend 2 weeks working with the Course Superintendent Paul Grogan, preparing for the John Deere Classic which is a PGA TOUR Tournament held annually at TPC Deere Run, Moline, Illinois. The John Deere Classic is worth $4.6 million and was held July 9th to 15th July 2012.

TPC Deere Run is located in the Midwest, just over 2 hours drive west of Chicago, through cornfields and soybean crops – the food bowl of America. This is the heartland of John Deere. The John Deere World Headquarters and the John Deere Combine Harvester factory are located less than 2 miles away from TPC Deere Run. TPC Deere Run is built on the site of a former Arabian horse farm owned by the great, great granddaughter of John Deere. The land was bequeathed by the family for public use, and the building of a public access golf course fulfilled the family wishes.

The golf course was designed by three times Quad Cities champion D A Weibring to blend the rolling landscape overlooking the famous Rock River, and the dense hardwood forest into a magnificent championship layout. The strategic mounding around the tees and greens provides many vantage points for spectators, especially the terraced hillside that parallels the 18th hole. TPC Deere Run is operated by the PGA TOUR as a member of their TPC network of Golf Clubs. TPC Deere Run is certified as an Audubon Sanctuary.

My first day involved a 4.50am start at the maintenance facility at Deere Run where I met Course Superintendent Paul Grogan who was very welcoming. At 5am the 1st Assistant Tony Gustafson and 2nd Assistant Ryan Abbate led a procession of 23 gators and 34 staff out into the darkness to prepare for advance week. I was teamed with Tony who trained me on the use of the USGA Tru-firm which is used to measure firmness of the greens. This was to be my role for the next 2 weeks to take am/pm firmness and stimpmeter readings of the greens.

John Deere is the Official Golf Course Equipment Supplier of the PGA TOUR
All the equipment at the 33 TPC courses is exclusively supplied by John Deere

TPC Deere Run Equipment

Equipment	Equipment Inventory	Brand/Model	Height of Cut
Greens Mowers	10	JD 220E w/solid rollers	2.6mm
Green Collars Mowers	2	JD220B's	8 mm
Greens Rollers	2	Salsco	
Tee Mowers	6	JD220B's	8mm
Approach Mower	3	JD2500E	10mm
Fairway Mower	4	JD7500E	10mm
Rough Mower	3	JD8800	75mm
Fairway and Rough Blower	2	Buffalo Turbine	
Bunker Rakes	2	JD1200 w/front blade	
Transportation	23	JD Gators/Pro gators	

First impressions was how spectacular the course is and in such pristine condition. It was the middle of summer and extremely hot with four days in a row over 40 C, combined with 90%+ humidity, which lasted well into the night. The Midwest was experiencing record breaking temperatures and extreme drought conditions. Deere Run consists of bentgrass greens, tees and fairways which makes management an enormous task.

It was hard to imagine that in winter Deere Run can be covered in 2 foot of snow and the course is closed from late November to March. During the snow season 6 permanent staff are employed. Hiring staff starts in March when the course opens to allow time for employees to be trained for the John Deere Classic in July. Some staff returns from previous years, so they are familiar with equipment and expectations. Interns from other TPC courses are given the opportunity to help out and gain valuable tournament experience.

Tournament week roster: The staff operated two five-hour shifts (4.30am –9.30am), (4pm-9pm); Meal served after morning operations.

Course specs: D A Weibring design, Construction commenced 1998, Opened in 2000, 18 holes, par 71, 7527 yards.

Annual rounds: 23,000; Open to public daily fee $95 includes cart.

Greens

- Turf variety – L93 Bentgrass, Area 1.7 Ha.
- The soil type is clay and the greens are constructed using USGA specs with a rootzone depth of 300-350mm.
- Greens were walk mown with JD 220E equipped with power brushes.
- Ball marks are repaired on a daily basis commencing 3 weeks before tournament.
- Green speed was maintained at 10.5 to 11.0 feet for advance week and 11.0 to 11.5 feet for tournament week. These stimpmeter targets were not to be exceeded as excessive greenspeed can eliminate prime hole locations especially during windy conditions.
- There is limited air movement in areas around the course blocked by trees and undergrowth.
- Four greens have large Turf Breeze fans to improve air circulation and these fans were operating 24hrs a day until tournament week.

Tees

- Turf Variety- Southshaw bentgrass, Area 1.9Ha, Sand cap on tees is 150mm.
- There are 4 sets of tees per hole

Fairways

- Turf Variety- Southshaw bentgrass, Area 13 Ha
- Repetitive directional mowing to burn-in a striped pattern may negatively affect playability and was not encouraged.
- Carts were restricted to cart paths 3 weeks before tournament.

Roughs

- Turf Variety- Kentucky bluegrass/ Fescue mix.
- Rough was maintained at 60mm up to advance week to improve turf density and was raised to 75mm for tournament.

Bunkers

- Total- 80 bunkers.
- Consistent sand depth maintained at 75 to100mm on bunker floors and 25 to 50mm on faces. Bunker sand is imported from Ohio (600 miles away) as nothing suitable is available locally. This imported sand is called Sidley which locks tight and prevents balls burying.
- All bunkers are hand raked with rake placement outside of bunker in line of play.

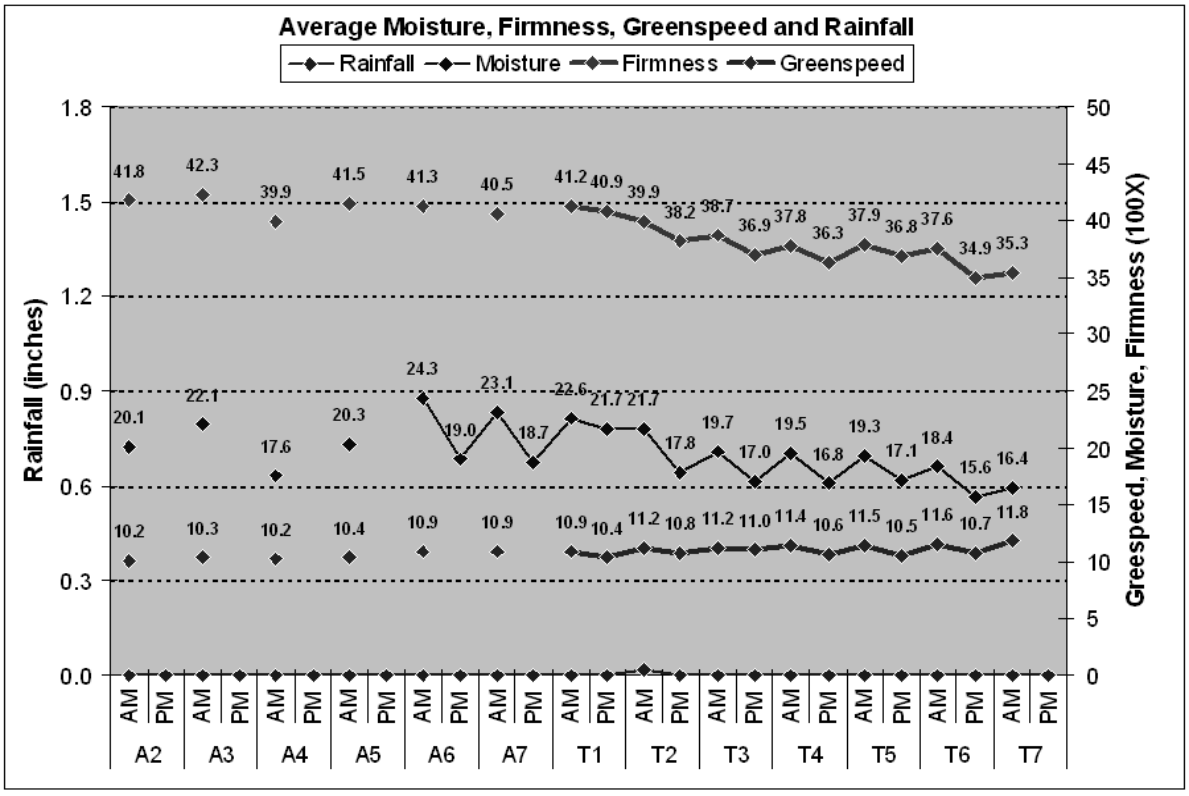
Irrigation

- Rainbird system -1300 heads -wall to wall irrigation- Irrigation supply drawn from Rock River.
- Can use up to 2 megalitres per day in summer; approx 160 megalitres used per year
- Wetting agent is injected through irrigation system.
- Average rainfall is 800mm, received only 400mm in last 12 months.

Data

New technology has been introduced to track course conditions and measure performance of the greens. The data collected from the Tru-firm was combined with the stimpmeter and moisture readings to allow the comparison of the am/pm conditions from one day to another.
This data is compiled into spreadsheets and viewed by the PGA TOUR agronomist, superintendents and assistants.

It is used in making decisions about what improvements have to be implemented to achieve desired results demanded by the PGA TOUR and the players themselves.



Firmness required range – average 35
Moisture required range - average 14% to 18%
Green speed required range – average 11 to 11.5 feet

Course preparation:
In the morning shift the greens were double cut with walk mowers and rolled if needed. Dew was removed from fairways, approaches and intermediate rough walkways. The pro tees were hand mown and the holes were changed. Two cup cutters worked during tournament week for independent set up of the front and back nines. Bunkers were all hand raked.

In the evening the fairways were mown with JD 7500E equipped with grass catchers. The greens were either hand mown or rolled. Approaches, collars, walkways and all the other tees were mown.

Two key staff members were trained to hand water greens and maintain constant moisture during tournament week. The Spectrum Technologies Field Scout TDR 300 soil moisture meters were used to monitor soil moisture content and irrigation was applied by hand using 14% to 18% threshold levels

Disease
Disease prevention is critical in this hot humid weather with dollar spot being the most prevalent. Greens, tees and fairways received a preventative fungicide application during advance week which is a total area of 17 Ha to be sprayed. The fairways and tees are sprayed with fungicide on average 13 times a year and the greens 15 times. Primarily every two weeks during the summer and every 3 - 4 weeks during the spring and autumn. Before winter closes in, a preventative fungicide application is made to protect the bentgrass from snow mould.

John Deere Classic
The John Deere Classic is always played the week before the British Open.

At the completion of the John Deere Classic, John Deere charters a private Boeing 767 Jet to transfer golfers from Quad Cities direct to the British Open in the ultimate comfort and style. The jet leaves at 8.00pm Sunday night and arrives in time for a midday practice round on Monday. Last year 25 golfers travelled over after the John Deere Classic and 14 made the cut in the British Open.

The community support for the John Deere Classic is second to none. To celebrate John Deere 175th anniversary – John Deere donated $175 to charity for every birdie holed during the last 2 days of the tournament. Fans who make donations to the tournaments charity arm, Birdies for Charity, can win a Chevy Malibu car if they correctly guess the number of birdies made during the John Deere Classic.

It was an exciting finish to the 2012 John Deere Classic when local Midwesterner Zach Johnson tied with Troy Matteson on 20 under. With a large pro-Zach crowd packed around the 18th hole amphitheatre on the second hole of a sudden death play-off, Zach Johnson rolled in a birdie putt for victory.

John Deere put on a wonderful show and it was an amazing experience. I can't thank the people of John Deere enough for their friendship, hospitality, generosity and commitment to the industry. I would especially like to thank Course Superintendent Paul Grogan and his Assistants Tony and Ryan and all the other staff at TPC Deere Run for making me feel so welcome and allowing me to be part of their team preparing for the John Deere Classic. Thank you to Rene Lubbers from John Deere for his time in organising the US Tour and Simone Staples from the AGCSA for her assistance.

Special thanks to the Captain of Flinders Golf Club Neil Cavanagh for nominating me for the AGCSA Excellence in Golf Course Management Award and the staff at Flinders Golf Club for their support.

INTERPRETATION OF SOIL TESTING

Dr Jim Hull
Independent Turfgrass Consulting

Introduction

Soil testing procedures for available nutrients are normally well founded on science, and well conducted by soil testing laboratories. The data that comes out of the laboratory is then often interpreted by a consultant or sales representative, and a recommendation of fertiliser input is made. The soil test data must be accurately and validly interpreted if a worthwhile recommendation is to be made.

The four steps of soil test correlation, calibration, interpretation and recommendation will be examined in this presentation, and it will particularly seek to promote the scientific basis for correct soil test interpretation. In addition, the origins and validity of some of the thoughts and methods currently in use in the industry will be examined.

The sensible turf manager will often use soil testing as a means of checking on the status of plant nutrients in the soil, and checking on soil conditions. Most of the commonly used soil test methods are well researched, and much thought has gone into their use on various turf soils. However, to be of use to the turf manager, the soil test has to be well interpreted and appropriate recommendations must be made based on the test results. This paper examines the process of interpretation, and looks at some of the processes by which recommendations are made.

Soil test methods

A soil nutrient test normally involves sampling the area to be tested, sending the sample to a laboratory, and the use of a liquid to extract the nutrients from the soil so that their concentration in the solution can be measured. The nature of the liquid to be used in the test process, and the method by which it is to be used, are developed by soil scientists to reflect the amount of nutrient that the plant can access from the soil. The process of developing a soil test for use on a particular crop (eg. turf grasses) can be described as having four major steps; Correlation, Calibration, Interpretation and Recommendation. Though the third of these steps will be the focus of this paper, all four steps must be examined to understand the processes involved.

Correlation of soil test

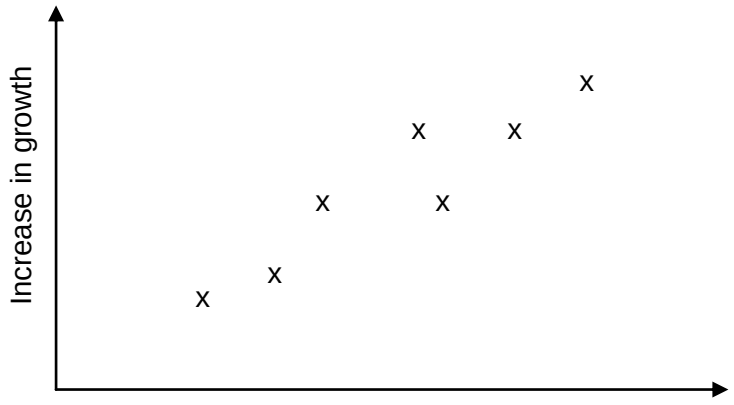
Prior to the mid-1800s agricultural researchers experimented with methods of extracting the plant nutrients from the soil and measuring the amounts. The means of extractions were often quite aggressive procedures such as boiling in strong acid. Unfortunately the results of the soil tests often did not correlate very well with the response of the plant to fertiliser application. For example the test might show that the soil had plenty of a nutrient but the plants grew much faster when fertiliser was added. The reverse could also happen; that the test showed little nutrient but the application of more fertiliser made no difference. The plant was already getting all that it needed.

In 1845 Charles Daubeny proposed that in soils there were ‘active’ and ‘dormant’ nutrients, with the active nutrients taking part in soil reactions and being available to plants and the dormant nutrients being inactive in the soil (Russell, 1973). The terminology probably came from Daubeny’s interest in volcanos and their influence on soil fertility. The concepts were taken up by others and soil nutrients were defined as ‘available’ and ‘unavailable’. The delineation between the two is not precise, as the rate that the nutrients are released from the soil for plant use also has to be taken into account.

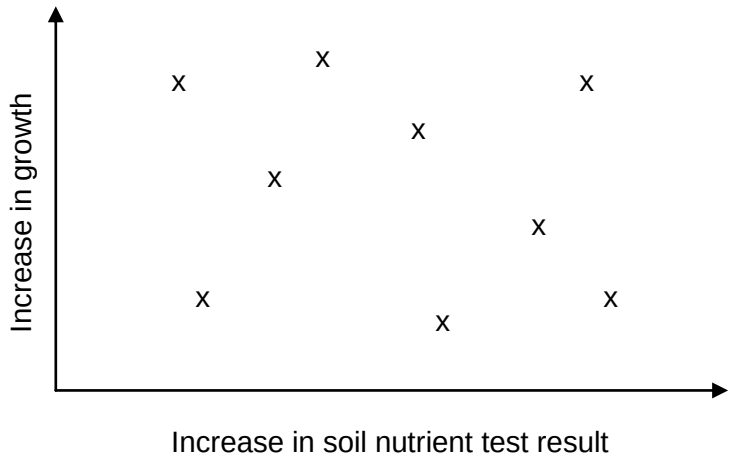
Available nutrients are those forms of the soil nutrient that are able to be accessed by the plant in some reasonable period of time. Nutrients that are dissolved in the soil solution are immediately available to the plant as are those that are readily exchanged from cation exchange sites. Other nutrient forms are not so readily available, but can be accessed by the plant over time. Minerals that are only slightly soluble, ions held firmly to mineral surfaces and nutrients bound in degradable organic matter are a part of this slowly available fraction. A large amount of the parent minerals that contain plant nutrients eventually become available to plants. Most substances dissolve or degrade eventually, but some stubborn mineral or organic nutrient forms play no realistic part in the nutrient supply of plants.

Once soil scientist recognised the concept of 'available' plant nutrients they had to develop methods that replicate the plant's ability to access this amount of nutrient. The previous practice of boiling the soil in strong acid released all of the nutrient and did not give a very good estimate of how much was plant available. Daubeny proposed an extractant of carbonic acid. Plant roots expel carbon dioxide into the soil during respiration and this forms weak carbonic acid in the soil. Daubeny therefore proposed that shaking soil in this weak acid would give a good estimation of how much nutrient the plant could access. Due to problems in determining the concentration of nutrients in the extract this test method was never widely used. The first widely used extractant was the 1% citric acid extract for phosphorus proposed by Bernard Dyer. He analysed the sap of plants and thought that it was approximated by 1% citric acid. Other test methods followed and many are specific to certain elements. Others, such as ammonium acetate and the Mehlich III extract, are designed to be used in multi-element tests, where the soil content of many of the nutrient elements are determined in one test.

When a new test is developed or an existing test is applied to a new situation it needs to be 'correlated' to plant response. This means that an increase in the amount of nutrient extracted from the soil by the test is mirrored by an increase in plant growth. The test will be of little use if it cannot be used to predict whether a plant will respond to an application of fertiliser.



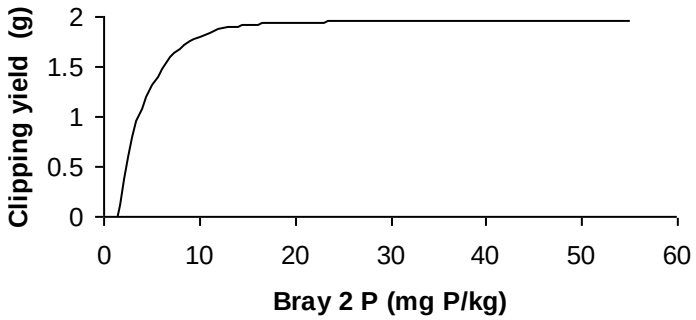
The above diagram represents a good correlation between test result and growth response. The soil test that this chart is based on would be a good choice of testing method in soils similar to those used in the tests that produced this data. The same test method may be completely inappropriate for a different soil type. The diagram below shows a poor correlation between soil test result and growth response. This test method would not be appropriate for use for the tested soil type and crop.



Take-home message 1 – If a soil test is not well correlated to a plant response in a particular soil then it is of very little use to the turf manager.

Calibration of soil tests

Once it is established that a soil nutrient test is well correlated to plant growth the test needs to be 'calibrated' to the relevant plant species. This process of calibration defines how much nutrient is enough for maximum (or near maximum) growth, what level of nutrient is deficient and what level might induce toxicity. This calibration is only really accurate on the soil type and plant species that the calibration was carried out on. Extrapolating the results to other soils and other plant species is just educated guesswork and observation.



The above chart shows a calibration curve for the Bray 2 soil phosphorus test in bent maintained as a putting green on sandy soil. The calibration indicates that any application of phosphorus to soil at a level above around 12 – 15 mg P/kg would produce no growth response, and would therefore be a waste of money and possibly environmentally damaging.

Once a sufficiency level or range is established, an estimation of deficiency can be made and a fertiliser recommendation can be made to remedy the deficiency.

Take-home message 2 – a soil test must be calibrated to the relevant soil and species to be of any use to the turf manager.

Interpretation of soil test results

BCSR vs. SLAN vs. Maintenance Rates

Though there is reason to have confidence in the basic results of a well-calibrated soil test procedure, there are differing philosophies regarding the amounts of soil nutrients that plants require for growth and health. These are promoted by various consultants and soil testing services, and sometimes parts of the different philosophies appear on one test report. The two major methods used on most Australian turf sol test reports are the Base Cation Saturation Ratio (BCSR) method, and the Sufficiency Level of Available Nutrient Method (SLAN)

Base Cation Saturation Ratios (BCSR) or Base Cation Saturation Percentage (BCSP)

The term 'basic cation' or 'base cation' refers to the ions of calcium, magnesium, potassium and sodium as they have an alkaline, or basic reaction with the soil. This is contrasted to the ions of aluminium, iron and manganese that have acid reaction in the soil, and hydrogen, which is the basis of acidity. These are the 'acid' cations. Because aluminium, iron and manganese are toxic to plants at relatively low levels of soil solution ion concentration the general rule is the less of these on the exchange sites the better.

In the 1930's in the United States a philosophy of plant nutrition developed that said that there was an ideal ratio of the basic cations (calcium, magnesium, potassium and sodium) in the soil, and that plant health depended on the maintenance of this ratio. The development of this ideal ratio is attributed by various people to the researcher Firman Bear and his co-workers and to William Albrecht. Albrecht in particular achieved a sort of messianic status among his followers and his theories are vigorously pushed by some in the turf field. Bear and Toth (1948) proposed that the ideal ratio of cations was 65% calcium (Ca^{2+}), 10% magnesium (Mg^{2+}), 5% potassium (K^{+}), and 20% hydrogen (H^{+}). This was varied by later workers to ranges of 65 – 85% Ca, 6 – 12% Mg, 2 – 5% K and the remaining exchange sites occupied by H^{+}. In most turf soils there is also a desired sodium (Na) level of <5% included in test reports.

The concept behind the BCSR theory is that the uptake of some cations is inhibited by an overabundance of others. Bear and Toth were working on a theory that plants take up a constant total amount of cations, so if they increased the amount of (cheap) calcium taken up from the soil, they would suppress the amount of (expensive) potassium that the plant absorbed. Based on this the conclusion was drawn that there must be an 'ideal' ratio of soil cation concentrations that caused the plant to take up nutrients in just the right ratios, reducing the luxury consumption of potassium and saving the farmers money. It is speculated (Wikipedia, 2013) that Albrecht was aware of the work of Bear and Toth and their data influenced his own speculations.

Unfortunately for the BCSR adherents later research found that altering the soil cation ratios very dramatically caused no adverse effects in plant growth. A former student of Albrecht, E.O. McLean (McLean & Carbonell, 1972), grew plants at calcium:magnesium ratios ranging from 2.3:1 to 26.8:1 and magnesium:potassium ratios of 0.6:1 to 3.6:1 and found no effect as long as sufficient levels of each nutrient were maintained. This led him to conclude that ideal cation ratios did not exist. Other researchers have found a similar lack of effect caused by the variation of soil cation ratios.

It has been noted by many turf soil scientists (Carrow, Waddington, & Rieke, 2001; Kopittke & Menzies, 2007) that the use of base cation ratios to develop fertiliser recommendations produces higher recommendations than using the sufficiency concept. Therefore the BCSR concept may lead to the unnecessary and expensive application of fertilisers. Wikipedia (2013) notes that "There is currently no publicly available research or trial data to support these claims", and "The main concern for farmers is simply the unnecessary expense of applying soil amendments beyond what the crop can actually utilise"

Sufficiency Levels of Available Nutrients (SLAN)

The SLAN concept of fertiliser recommendation is based on the belief that there is a level of availability of each nutrient element that is sufficient for plant growth or health. The normal method of establishing sufficiency levels is to grow a plant in soil with the relevant nutrient supplied in graded amounts and all other nutrients being supplied in sufficiency for maximum growth. A growth curve is derived, such as the one depicted above in the section on calibration of soil tests. This is a curve that describes the response of bent to soil phosphorus levels, and it can be seen that there is no increase in growth at any P level higher than about 12 mg P/kg as measured by the Bray 2 test.

Sufficiency levels can be affected by soil types and characteristics and by the species of grass that is being grown.

The SLAN approach is that fertiliser is added to achieve the sufficiency levels of each nutrient, regardless of the ratio of nutrients.

In some sandy soils with a low cation exchange capacity there could be ideal ratios of cations according to the BCSR approach but there could be deficiencies in some nutrients according to the SLAN approach and turf health can suffer. Consider a soil that has a CEC of 5 milli-equivalents per 100 grams of soil (meq/100g) when the extractant is ammonium acetate. The conversion of meq/100g follows the formula –

$$\text{mg/kg (ppm)} = \text{meq/100g} \times \frac{\text{atomic weight of element}}{\text{valency of ion}} \times 10$$

The valency of the ion is the number of charges of the ionic form of the element or the group of atoms that contains the element.

If we take calcium for an example the atomic weight is about 40 and the valency is 2+ (2 positive charges). If we have a CEC of 5 meq/100g and we have 70% of the CEC as calcium then we have 3.5 meq/100g as calcium. Following the above formula we would have a maximum of –

$$3.5 \times \frac{40}{2} \times 10 = 700 \text{ mg Ca/kg in the soil}$$

Carrow et al. (2001) give the common level of extractable Ca “used to determine nutritional needs” with the ammonium acetate extraction method as 500 – 1000 ppm. The above situation would be satisfactory. If the CEC were only 2 meq/100g in a very sandy soil then the calcium level at 70% of saturation would be 280ppm and it would therefore be deficient by the SLAN method of determination.

In a soil with a CEC of 5 meq/100 g a 5% saturation as K would give us –

$$0.25 \times \frac{39}{1} \times 10 = 97 \text{ mg K/kg}$$

- Which is moderate by sufficiency level standards

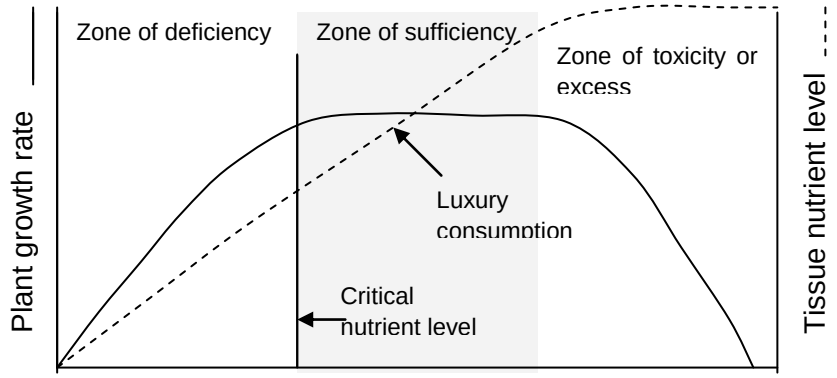
A 3% K saturation would still be in the desirable BCSR range but would have only 58 mg K/kg, which is deficient according to the SLAN recommendations. Similarly if the CEC were only 3 meq/100g then the potassium levels would also be deficient by the SLAN interpretation while being satisfactory by the BCSR interpretation.

In soils that have higher CECs there can be sufficient levels of all nutrients but fertiliser additions could be recommended to correct a nutrient 'imbalance' based on the BCSR approach. This BCSR approach in this case leads to the application of fertiliser that is not necessary for meeting the sufficiency needs of the turf and therefore is often considered wasteful and overly friendly to those who sell fertilisers.

Maintenance Rates

Some turf managers simply apply maintenance rates of fertiliser as specified by an advisor or company representative. If this approach was based purely on science it actually makes a bit of sense. Unfortunately many times this approach is based on the needs of a sales representative to make sales or on data derived from different climates and growing conditions.

Many nutrients have a response curve like the one for phosphorus given above. Phosphorus and potassium are classic examples. If accurate figures for loss as clippings and leaching are known then accurate replacement or maintenance rates could be calculated. The response curve for these elements may look like the following. Also marked on this chart is the curve for the increase in tissue nutrient level as soil nutrient supply increases.



It can be seen from the chart that the level of nutrient in the plant tissue continues to increase *even after the rate of growth had ceased to increase*. This means that the tissue is increasingly rich in that nutrient and subsequently any clipping collection removes an increasing amount of nutrient. If an accurate amount of clippings removed is established and an accurate critical level of tissue nutrient for the species is known then a replacement budget can be calculated (provided other losses are negligible). This is great in theory but the reality is that the data for clipping removal, tissue nutrient sufficiency levels for species and non-clipping losses are not normally accurately known. All things considered it is much easier to conduct soil and/or tissue testing.

Take-home message 3 – Interpretation of soil test data is subject to a variety of theories and ideas, many of which are not based on science. An educated turf manager will find out which theories are sound and will avoid paying for fertilisers that are not needed.

Recommendation

Once a deficiency is defined using sound science a recommendation needs to be developed to correct that deficiency. To make a recommendation in terms of how many kilograms of fertiliser to apply we need to make a calculation based on the deficiency in milligrams of nutrient per kilogram of soil.

Let us take an example of a soil test that is conducted by a laboratory and results in a calcium level of 500 mg/kg of soil. Let us also say that the recommended sufficiency level for our soil and our crop is 750 mg/kg of soil. It is obvious that we have a deficiency of 250 mg/kg of soil, so how much calcium do we have to apply?

To make this calculation we need to make an arbitrary decision on the quantity of soil that we are planning to amend. One figure often used is that the quantity of soil is the top 75 mm of the soil. Other figures that are used are the top 100mm or even the top 150 mm. If we use the top 75 mm of the soil profile in our calculation, then we round off the bulk density of the soil to 1.33 t/m^3. The volume of soil in the top 75 mm of soil over the area of one hectare is 10,000 x 0.075 = 750 m^3. At a bulk density of 1.33 the mass of soil is about 1,000 tonnes, or a very convenient 1,000,000 kg.

So if we go back to our calcium deficiency, if we have to amend the soil with 250 mg of calcium per kg of soil, then we have to put out 250 mg x 1,000,000 = 250 kgs of calcium. The conversion to kgs of actual fertiliser is then an easy calculation based on the percentage of actual calcium in the fertiliser.

The arbitrary nature of the calculation is apparent when we consider that if we just choose to use a figure of 150 mm of soil to amend, then our recommended input would be double. This probably doesn't matter within reason, as we would just correct our deficiency twice as fast, though it would sometimes be unwise to load up the upper soil layer with excessive nutrient salts or soil amendments. Large total inputs are often best applied in split applications, regularly and in small amounts.

The above calculation can be made for all deficiencies and turf managers can use this formula to check recommendations to make sure that they are moving in the right direction. Some recommendations of 'special' nutrient formulations applied at fractions of a litre per $100m^2$ are not going to change a soil nutrient content very quickly at all, leading to a situation where the turf manager is going to be buying that product for a very long time. For instance, if we applied a 6% calcium product at 50 l/ha then we are adding 3 mg/kg to the top 75 mm of the soil profile. If our deficiency from our above example were 250 mg/kg then we would need at least 80 applications of product to correct our deficiency, not allowing for losses from clipping harvest, immobilisation in soil and leaching.

Take-home message 4 – Recommendations of fertiliser inputs that are not feasibly going to correct deficiencies will keep the turf manager buying fertilisers for a very long time.

Conclusion

The process of interpreting soil tests and making recommendations is not overly complicated and educated turf managers can and should use the raw soil test numbers to make their own calculations. This will ensure that they are only buying what they need, and their soil nutrient status is moving toward sufficiency levels for their turf.

Bibliography

Bear, F. E., & Toth, S. J. (1948). Influence of calcium on availabiliy of other soil cations. *Soil Science, 65*, 69 - 74.

Carrow, R. N., Waddington, D. V., & Rieke, P. E. (2001). *Turfgrass Soil Fertility and Chemical Problems: Assessment and Management.* Hoboken, New Jersey: John Wiley and Sons.

Kopittke, P. M., & Menzies, N. M. (2007). A review of the use of the basic cation saturation ratio and the "ideal" soil. *Soil Science Society of America Journal, 71*, 259–265.

McLean, E. O., & Carbonell, M. D. (1972). Calcium, magnesium, and potassium saturation ratios in two soils and their effects upon yield and nutrient contents of German millet and alfalfa. *Soil Science Society of America Proceedings, 36*, 927–930.

Russell, E. W. (1973). *Soil Conditions and Plant Growth* (10th ed.). London, UK: Longman.

Wikipedia. (2013). *Base Cation Saturation Ratios*. Retrieved from Wikipedia: http://en.wikipedia.org/wiki/Base-cation_saturation_ratio.

RECLAIMING BERMUDA 328 PUTTING SURFACES FROM COUCH GRASS ENCROACHMENT

Ben Tilley
Headland Golf Club

Headland Golf Club was formed in 1955 and is located at Buderim, on the Sunshine Coast of Qld. We have 970 members and during the last 4 years have averaged 59,000 rounds of golf per year. Putting Surfaces average 500m2 and are Bermuda 328 Hybrid Couch grass. Our greens surrounds and rough are combinations of Greenlees Park Couch or Common Couch, which has evolved over time.

Both the Greenlees Park and Common Couch are larger plants in terms of leaf structure, stolon & rhizome size, and have very aggressive growth habits compared to the Bermuda 328, hence , encroachment into 328 putting surfaces is constantly occurring.

The desire for clean presentation and consistent surface results in the green perimeters being mown inside the invading heavier couch to keep a clean uniform look, but the trade off is a reduction in the putting surface area of Bermuda 328 with less pin locations and condensed traffic on a smaller area.

Trying to maintain the original green sizes by mowing down the larger couches out to the original perimeters at a mowing height that alternates between 3&5 mm, results in unsightly scalping of the larger couch, inconsistent ball roll and detracts visually from the whole putting surface.

This paper is a case study of the processes, pitfalls and successes we had in re claiming 328 surface area and increasing our putting green sizes on 2 greens, during 2012/13.

Having been reminded by our ‘A’ grade golfers on numerous occasions since I commenced my tenure at Headland Golf Club, that “the greens are getting smaller and it is affecting my game”, I chanced upon a presentation by USGA Senior Agronomist, (Florida Region), Todd Lowe, at the USGA Green Section Education Program Conference in March 2012.

Todd’s topic was on his observations of Superintendents in the Florida Region “Reclaiming Green Perimeters With Core Aeration Plugs”. Having viewed the presentation and with our spring renovations approaching I set about preparing to commence our own “reclamation”.

When assessing the project I had to decide between short term pain for long term gain for our members, or instant repair, using sod, and consequently long term maintenance pain for me.

I had had previous experience when I was Assistant at Twin Waters Golf Club with replacing imported sod in the “collars” and also patching out small sections of couch that had contaminated the putting surfaces in the green. Although using imported sod gives an instant coverage and seemingly quick repair it does have its drawbacks. It contains a thatch layer that is generally heavier than the existing surface, it may not be exactly genetically matched (328 isn’t always 328), it can be difficult to match the grain. It is even more difficult to lay it and leave an even consistent surface and it does come at a $cost. Imported sod also requires intense follow up verticutting to remove the excess thatch of the imported sod down to existing acceptable levels and then there is the task of trying to visually mask your new work so it blends with the rest of the putting surface.

The short term pain for the members would be disruption to the green perimeter surface while we prepared and vegetatively propagated the area we wanted to reclaim. Whilst there is “down time” waiting for the vegetative material to take root , grow and cover the area. There are a

number of advantages gained by sourcing the material from the existing surface Firstly it is free, secondly genetic continuity is maintained, thirdly the visual grain factor is removed and fourthly there is a relatively seamless transition from old surface into the new one in a much quicker time frame than would occur when grooming down the thatch and top dressing the sod over a few renovations.

As I had no large turf nursery to harvest my own sod and given the finished advantages of vegetative propagation over importing sod, I chose short term pain for the members.

Once I had selected the greens that had the most significant reduction in size, then came the task of determining the new perimeter. On both greens I used the green sprinklers, assuming they had been the original edge of the green when constructed, as a guide for the extensions. On parts of the greens this meant some sections of 3.5 meters to reclaim. My initial thoughts were to remove the couch out to the new green edge, replant with 328 and then create a higher cut collar of approximately half a meter to buffer the green and keep the marauding couch at bay. I will elaborate on this topic further in my paper but I can say I changed my mind very quickly once the grow in process started.

Once the new perimeters were marked out, I had an extra surface area of 500m2 in total for both greens. Cost for supply of Bermuda 328 sod was $12.50/m2 + GST and with the surface area I wanted to reclaim, the cost of $6,250.00 further reinforced my preference for vegetative propagation from on site.

The surface area to be reclaimed on Todd Lowe's presentation showed one pass of a sod cutter on the immediate edge of the green and then the relatively easy task of pushing renovation cores into the area. I did have some reservations about the size of the area I wanted to reclaim especially the 3.5 metres wide sections, but thought we would have enough cores from our hollow tyning during renovations to cover the proposed area.

With renovations due to commence on 24th September 2012 my pre planning involved glyphosate applications to the encroaching couch on the 27th of August. This was achieved by line marking the new perimeter and then using 2 x Core Flute signs (1200mm high x 2400mm long x 3mm wide) on the inside and outside lines to stop spray drift. We used a hand gun attached to a 400L Hardi spray tank to apply the glyphoste (3L / 300L of water + a surfactant). Walking backwards, we moved the core flutes in sync with the sprayer to keep the glyphosate application contained within the marked lines. As I hadn't closed the holes, one staff member remained at each of the greens to control traffic onto and off each green, to prevent tracking of the glyphosate, until the surface had dried. We followed up with a second application, using the same process, on the 4th of September.

On 21st September, the Friday before renovations were due to commence, we cut into the dead couch with our sod cutter set at 30mm. The couch was then removed and the remaining debris cleared up so the surface was clean. This was followed up with a 10cm dressing of our green top dressing sand, over the whole area to aid in bringing the final surface back up to finish grade.

As the green remained opened over the following weekend our new work did play mind games with our members as they tried to work out how to get their balls onto the green without their balls finishing up in the new “trench” (marked GUR) that surrounded the green.

Renovations commenced on the 24th September and I had selected 5/8” tynes to aerate the greens. After scarifying the greens and then commencing coring, it became apparent looking in the core harvester after one pass of the green that the cores were not holding up as I had hoped. We were going to be short of vegetative material if we were relying solely on the cores being collected in the core harvester. At this time a decision was made to use a combination of both stolons and cores from the green. Stockpiles were placed around the green and then manually spread as evenly and generously as possible over the prepared area. We then tracked the material into our top dressing sand with our bunker rake tyres and followed this up by constantly manually watering the area to keep all the vegetative material moist. A 12.10.12 Turf Starter fertilizer was applied at 2kg/100m2 for establishment.

My concern with the use of the stolons was that unlike the cores that have some established roots, the stolons would be very sensitive to drought stress. By keeping the greens in play some management issues would arise in trying to keep them moist, without wetting the golfers playing continuously on the course during this process.

As a buffer to help protect the stolons & cores from wind & traffic, I purchased some 2m wide bolts of brown hessian and covered all the stolons and cores. The hessian was pinned down (with 150mm bunker mat pins) on all joins and edges. Some artistic license was required to cover the area without having too much overlap as it was difficult to bend a rectangular shaped piece of hessian around the contours of the new green edge. This process was very time consuming but on the whole proved to be worth the effort.

The next two weeks were spent visually monitoring the new turf and manually watering to keep it moist. With the greens still being in play during the day it was not possible to have the greens on an automatic cycle for watering, hence the necessity for manual application in amongst competitions and general play.

As the main part of the greens were coming back out of renovation and requiring follow up top dressing we also included the new extensions. The benefit of having hessian over the new planting was that it enabled us to drive over the new work without any significant damage. The top dressing sand could also be worked through the mesh of the hessian with a broom to allow us to top dress the new growth without damaging it or pulling it up.

As the new growth began to poke up through the mesh in the hessian we used an old broomstick with a nail in one end and manually lifted the hessian up to keep the new leaf under it and not growing through it. The hessian also protected the new planting from foot and buggy traffic entering and exiting the green, or so I thought).

The hessian covered the new planting up until the 25th of October, and during this time we top dressed and broomed the area 3 to 4 times to help encourage lateral growth and also aid in building up the turf surface to finish grade.

Lifting the hessian on the 25th revealed some weaknesses in my traffic management for the initial establishment. I had assumed that the hessian cover would help to protect the turf from foot and buggy traffic but this was not the case. On both greens at the traffic exit points I had very minimal establishment. On one green the exit area had little or no establishment for up to 2 metres in width. The consistency of cover varied considerably over the new planting but with the hessian off I did have enough coverage and body to commence mowing with a cylinder walk mower and encourage some lateral growth.

Over the next month the thin areas and bare sections were plugged out using a hole changer. Plugs were taken from the edge of the existing green and placed where required in the bare areas.

The thin areas on the join lines between existing green surface and new extension were plugged out by turning the hole changer plug 180 degrees. Constant mowing with the walk mower and then top dressing continued, as required, to help promote lateral growth, build the levels up to finish grade and even out the surface. As the surface continued to grow, bare areas were monitored and plugged out and dressed as required.

Renovations commenced on the 24th of September and hot dry Northerly winds persisted to the end of October, with only 36mm of rain during that time. It was certainly not an ideal environment to encourage rapid growth. The new extensions received 10kg / 250m2 of dynamic lifter granules on the 29th October to try to encourage more vigorous growth. Another Turf Starter application was made on the 15th of November @ 2kg /100m2. By the end of November

the new areas had matured enough to be incorporated into regular green maintenance without further specific attention. Whilst the additional fertiliser applications did stimulate the new turf it also created excessive growth of the couch in the surrounds. During the early establishment phase and with not a lot of competition from the newly planted 328, some couch runners had grown 340mm into the new surfaces. It quickly became apparent that "edging greens" would now become part of our regular routine maintenance.

The extensions continued to mature through December and into January. Our Autumn renovations were completed at the end of January. (Verticutting over and back on the same pass at 3mm on 2 diagonals, followed by 12mm solid tynes to 125mm, then top dressed and fertilised.) Incorporating the extensions in renovations really helped to tie in and mask the old with the new and disguise the "join" line (to all those with an untrained eye).

With the new extensions maturing now and blended into the original surface I have changed my view on mowing a higher cut buffer of the 328 to keep encroachment of the surrounding Couches at bay. Left unchecked their aggressive growth would mean a recurrence of a reduction in surface area of the green in a very short space of time. Not wanting all our time and effort to be wasted by Mother Nature's influence, we have kept all the reclaimed area as putting surface. A Mowmaster Edger is used every 3 weeks at present to edge the perimeter and control encroachment. This has given us, not only control of the encroachment, but also a sharp clean contrast between putting surface and collar.

Using stolons & cores from our renovations to reclaim 500m2 of putting surface on 2 of our greens has been a successful project.

It has given us clean genetically matched extensions on those greens. There are now more available pin locations and the project was completed at minimal cost. The members have forgotten the disruptions during grow in and are happy with the larger surfaces. The most positive result from the project is no further follow up work to disguise and level the extensions and there is no sod that requires maintenance to reduce thatch and mask grain.

Given the successful completion on our 2 greens and the positive reaction from our members, we will be continuing this process on three more greens during the 2013 September renovations. I am looking forward to achieving another positive outcome.

GOLF COURSE MANAGEMENT IN QUEENSLAND WORKSHOP – RECONSTRUCTION

Robin Doodson
Sanctuary Cove Golf Club

Between April 2009 and April 2011 The Palms Golf Course at Sanctuary Cove underwent a major reconstruction project. Designed by Ross Watson, the course has now opened to rave reviews from both members and guests. In this workshop Golf Course Superintendent Robin Doodson will share his experiences of the process and now 2 years after opening the course will look back on some of the things that he may have done differently.

Planning

"*Failure to prepare is preparation to fail*"
Depending on the size of the project this can take many years. The most important decision to be made is the appointment of a golf course architect. Once appointed the architect should have final say over all design works with minimal input from outsiders. Any input will probably be ignored anyway.

Site surveys should be carried out to 0.25m. Location of services is critical, especially on an existing golf course. Damage to infrastructure can be very expensive and can hold up your project.

Project Management – putting together your team

"*The best committee is an even number less than 3*" – Dr. Alister Mackenzie
Less is more when it comes to building a project team.
Under no circumstances should amateurs be invited on to a project team, communication to club/owners should be done separately. Have meetings regularly and keep them short.
Ensure all stakeholders leave with a clear action plan and report back to the next meeting with outcomes.

Earthworks

Take time to understand the bulk earthworks plan. This will drive the whole schedule of works for the project.

Communication with stakeholders

Owners and members need to be kept informed of progress. This should be done through weekly reports and monthly committee meetings. Documenting any construction process is critical. You cannot take too many photographs. Keep them organised**.**

Irrigation

Overseeing the installation of the irrigation system is the most critical part of any construction project. Detailed specifications of work should be agreed between the irrigation designer, installer and course superintendent during the planning process. All installations should be signed off prior to backfilling.

Landscape

Do not underestimate the resources required to install and grow-in landscape areas. Quite often they are not under automatic irrigation and need regular attention to ensure success.

Grow-in

The grow-in of any construction should be delegated to a senior member of staff, not necessarily an assistant superintendent. A great position for a young qualified greenkeeper who is looking to learn and develop. Knowledge is not key, but work ethic and passion are critical as long hours will be required.

SPORTS FIELD MANAGEMENT IN FAR NORTH QUEENSLAND

Paul Sanson
Tony Ireland Stadium

Sports field management in North Queensland is quite unique; it has some pretty amazing differences to the southern states.

I have spent most of my career on the New South Wales/Victorian border in Albury Wodonga doing my apprenticeship on a golf course, then moved to Lavington sports club to maintain 2 Tiff dwarf bowling greens and a sports oval. I spent almost ten years there before seeing the light and making the move to Tony Ireland Stadium in Townsville.

The amazing new facility in Townsville was only three years old when I arrived; it was already starting to build an impressive list of significant events. The opening was a twenty/20 Qld v Vic which attracted 10000 spectators on new year's eve 2007, next was Mid-winter cricket series between Australia A and Pakistan A. Since then we have had Sri Lanka A, Queensland Bulls Ryobi cup and the U19s World Cup. Recently we have held our first AFL game with the Gold Coast Suns playing North Melbourne Kangaroos in the NAB Cup.

Stadium management in North Queensland and the different seasons took a little while to adjust to; I have been up here for 3½ years and in that time have had to evolve as a greenkeeper. In many ways it is the opposite, in summer when the rains start the irrigation is turned off, but the whole of winter; water, regular applications of wetting agents and hand watering is required. The daytime temperature in Townsville in winter is a fine and sunny 23 degrees with the coldest night temperature being 7 degrees, in the past three years. It is awesome not to have to worry about over sowing the couch to maintain colour through winter (or wearing long pants and jumper).

The most amazing difference that I found is the turf recovery rate especially on the cricket pitches, working with a full grass cover on every pitch makes life so much easier. It takes only three weeks after playing on a pitch for it to completely recover. When I first arrived I was quick to buy an Evergreen turf growth cover, this was going to help each pitch recover quicker, you could imagine my joy when I realised it was not required. The main time they are used is to maintain cover on the block during winter.

Some of my early challenges included using a different couch variety Legend to Conquest. The conquest seemed sparse and only seemed to want to grow up not sideways, there was also heaps of seed heads. To my surprise Primo Maxx had never been used. My first application was 2lt/ha this did a great job on the seed head but at that rate it really yellowed off the whole oval. So each time I used Primo Maxx I gradually dropped the rates to find the rate that worked for me, it ended up being 1lt/ha in the summer every 4-6 weeks. In the winter as required or as the seed head got out of control, mowing daily also was a way to control the seed head. At the same time the grass as expected became much tighter, which was the desired result.

The next issue was the constant battle against 'crow's-foot', having great weather during winter has its disadvantages, where if in southern states a correctly timed pre-emergent would be an easy fix. Tribute at 2lt/ha at seven day intervals has been the only way to get some sort of control, used in conjunction with Barricade sprayed every six months.

The oval was built well especially from a drainage and profile point of view, the drainage rate is phenomenal, we could have 200-300mm overnight and still play cricket (as long as the covers were pegged down correctly). In saying that it was clear that it was starting to build a layer of thatch as I don't believe it had been scarified hard since its opening. With a high usage of the facility the only window to renovate is as usual between footy and cricket season. The difficult

thing with moving to the far north is not having access to a large range of contractors to perform the renovation tasks at a reasonable price. The upside to contractors having high prices is I was able to justify the purchase of my own Amazone GL 150, the same used in most major stadiums throughout Australia. This saves all the hassles of borrowing turf vac's etc. from the local golf course. In saying that, since its arrival, there have been major events like Relay for Life and concerts eating into my four week break, so this year it is due to have a very aggressive renovation. The next issue is trying to find a suitable sand to use (that doesn't contain small rocks) at an acceptable price. I think my problem here is coming from an oval with a reasonably small budget that I'm not prepared to pay a premium price. I am slowly learning that it saves a lot of hassles to use the better quality products.

The longer I spend in the north the harder it will be to move south again as I think I get a little spoilt with the growing conditions. Slowly the stadium is becoming self-sufficient in regards to machinery; the next on the list is to replace my John Deere Aercore 1500 with a deep tyne aerator of some sort. Recently I acquired a Toro 5510 with groomer attachments (it's always nice to have good machinery).

From a stadium point of view the future is a busy one. We are in discussion of the possibility of hosting Shield & Ryobi cup games in October this year as a neutral venue, due to the fact that MCG (renovation), SCG (finishing of stands), Adelaide Oval (finishing new stands), Gabba (major surface renovation). This is exciting for the fact that we may get to do 4 day cricket, preparing for that will be something new for my team and the possibility of getting some former Australian cricket greats (Ricky Ponting or Michael Hussey) has everyone keen.

After the success of the U19s World Cup it would be nice to get the opportunity to host a warm up game for the real deal in 2015 or maybe even a lower level pool match but that may be pie in the sky, we'll have to wait and see.

On the AFL side of things we are already pencilled in for another first round NAB Cup fixture for 2014, the hope is that this will then lead to a normal season fixture in 2015. If I get my way the Suns to play the Swans would be perfect. Fingers Crossed!

COACHING ESSENTIALS WITH JACKIE STEWART

Sharon Kaibel
rightturn

? **What did you learn about Coaching from Jackie Stewart**?

The GROW Planning Tool

Coaching Goal

Specific, Measureable, Achievable, Relevant, Time-Bound

Current Reality

Ask, Observe, Third Party: Results, Activities

Options

Timing, Cost, Availability, Learning Style

What's Next

Who, What, When, How

KISS review

K	What went well that we need to **KEEP** doing? (Reward)	Who enabled this to happen?	How did they do it? Be specific.	What impact did this have?
Keep				
I	What worked but could be **IMPROVED**? (Enhance)	Who was involved?	What do they need to do differently? Be specific.	What will be the impact?
Improve				
S	What did NOT work that we need to **STOP** doing? (Learn)	Who was involved?	What did they do that didn't work? Be specific.	What was the impact?
Stop				
S	What COULD work that we could **START** doing? (Innovate)	Who needs to be involved?	What could they do? Be specific.	What will be the impact?
Start				

Introduction

- Build Rapport
- Provide Context
- Rationale / Benefits for coaching discussion

Self Feedback

The Wins

Examples and Benefit

The Learns

Examples, Consequence & Future Fix

Coach's Feedback

The Wins

Examples and Benefit

The Learns

Examples, Consequence & Future Fix

Next Steps

- Future Plan
- Review Period

Wrap up

- Conclude Discussion