The winter Evapotranspiration (ET) Rate of pure Couch in comparison with Couch oversown with Perennial Ryegrass or *Poa trivialis*

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Introduction

Couchgrass provides an excellent, low input sporting surface, but goes into dormancy over winter, losing colour and activity. The dormancy period of the hybrid couchgrass cultivar 'Santa Ana' is usually from around late June to late August in southern Victoria. The practice of winter overseeding a couch sward with a C_3 grass such as Perennial Ryegrass takes time and money, and can interfere with couchgrass recovery in the spring, but potentially offers benefits such as improved colour and turf resilience and recovery through the winter season. The decision to oversow or not is finely balanced for many Turf Managers, and it is important that all relevant information on the costs and benefits are available to support the decision.

One potential benefit to be factored in is that a C_3 grass such as Perennial Ryegrass or *Poa trivialis* uses water over winter, as it is still actively growing. This transpiration will remove water from the rootzone, and should result in lower soil moisture and a firmer, more resilient surface. Adam Robertson, Superintendent at Kew Golf Club, did some work on this many years ago and concluded that the 'pump action' ET effect of a winter active grass was often as high as 1mm per day. But we could find no recent data on this, so a trial was established to accurately measure the ET rate of pure couch compared to oversown couch.

Method

Turf was established in 12 mini-lysimeters, constructed of 150mm diameter PVC pressure pipe to a depth of 300mm, fitted with an end cap with two drainage holes (see Photo 1). The profiles consisted of a 40mm drainage gravel layer and 260mm depth of USGA Specification rootzone, mixed with suitable amendments and organic and slow release fertilizers to support healthy turf growth. The 12 pots were then used to create three replicates of four different treatments (pure Couch, Couch + Ryegrass, Couch + *Poa trivialis*, and pure Ryegrass). Nine of the pots were planted with Santa Ana sprigs in January 2011. Six of these pots were then oversown in late April with either Perennial Ryegrass (cv Colosseum at 50g/m^2) or *Poa trivialis* (cv Sabre at 20g/m^2), with 3 replicates of each. At the same time, the final three pots were sown with Perennial Ryegrass (Colosseum at 50g/m^2) on its own.

Each mini-lysimeter pot weighs around 8kg, of which about 1.2kg is water being held in the soil. When the drainage holes are taped up the pot becomes a closed system, and the only way for water to leave the pot is by direct drying of the surface (evaporation) or via root uptake and transmission through the leaves (transpiration). The combination of these two losses is 'evapo-transpiration' (ET). In a pot of this size the daily losses are in the order of 20 grams to 200 grams, which can be easily measured by weighing. The weight loss can then be converted to ET in mm. To answer a common question, the clipping weight on a pot like this is around 0.5g per week, so the effect is tiny compared to the water loss effect.

These lysimeter studies are normally done to measure ET rates of grasses in summer, perhaps to identify drought resistant species that use less water. But in this case we were using them in winter, looking to measure the water use over the cold months rather than in summer.

While not an essential element of the trial, it was felt that some measurement of evaporation rate (E) was needed. E rates can be estimated from a pan evaporimeter (eg. Class A pan), from Bureau of Meteorology data, or by using a weather station, or by using an atmometer. We were able to use three Livingston atmometers, which consist of a 75mm ceramic globe connected to a water reservoir (see Photo 2). Water evaporates through the ceramic globe under the influence of sunlight, temperature, humidity and wind (in other words, the same influences that affect plant water use). Weight loss of the Livingston atmometers (in grams per day) can be related by a specific coefficient (in this case 0.1275) to convert weight loss measurements to Evaporation values in mm. A big advantage is that the atmometer is placed right alongside the lysimeters, and weighed at exactly the same time. But it must be stated that the atmometer is just a tool to estimate evaporation, and may not mimic exactly the effects of sun, temperature, humidity and wind on a grass sward, particularly if the foliage is dark in colour.

Photo 1: Mini-lysimeter

Photo 2: Livingston atmometer

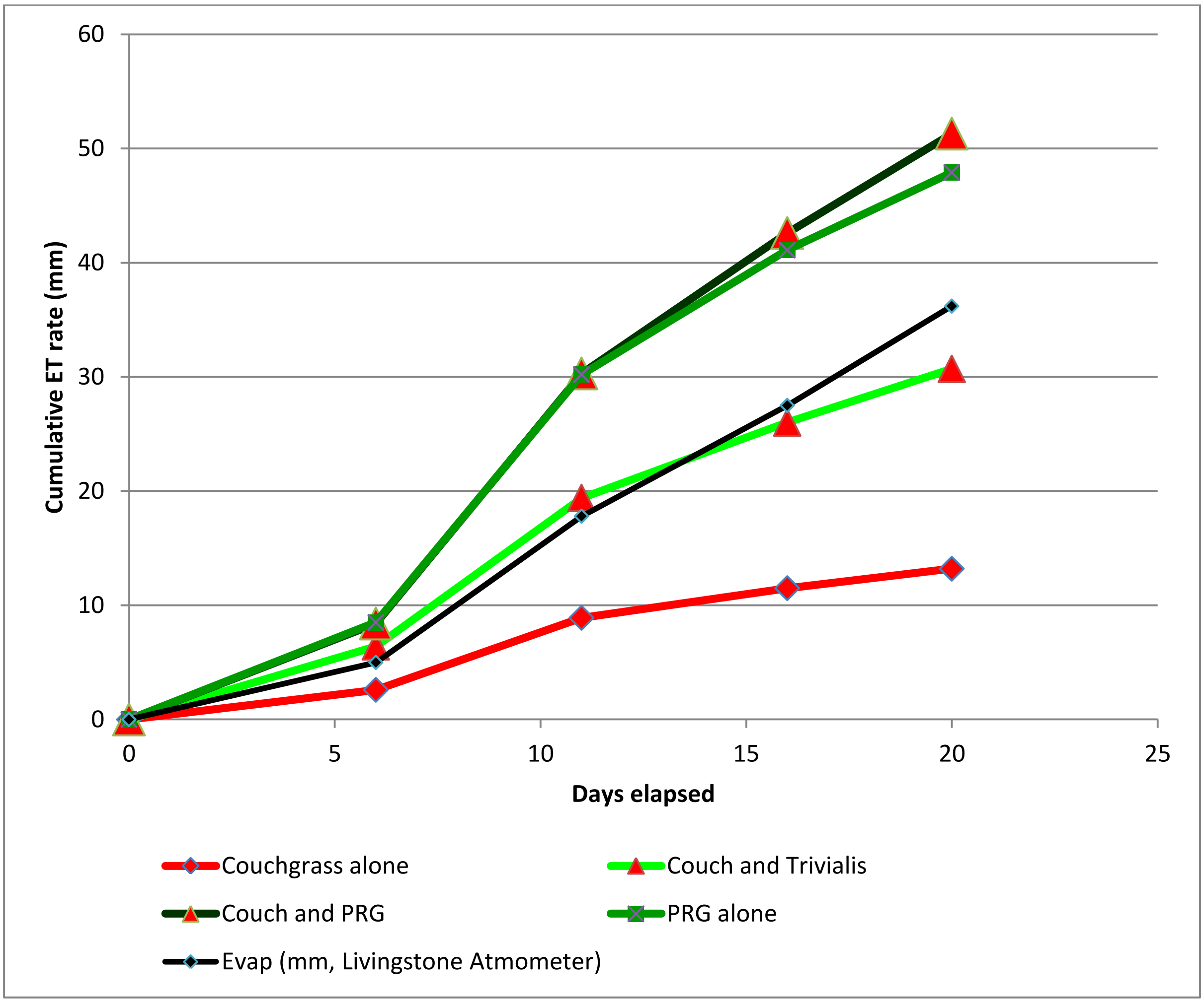
All grass samples established satisfactorily, and were maintained at 20mm cutting height. By late July the Santa Ana couch was completely dormant. After a period of rainfall in mid-August the mini-lysimeters were allowed to drain the excess water from the profile, and the drainage holes on each pot were then sealed with tape. The mini-lysimeter pots and atmometers were then weighed and placed in an exposed location, and then re-weighed after 6, 11, 16 and 20 days. Weight loss values were converted to ET and E values (mm), and the accumulated values plotted over time. Results are shown in Table 1 and Graph 1.

Results

Table 1: Mean cumulative lysimeter ET and Atmometer Evaporation rates (in mm) over a 20 day winter period (14th August – 2nd September 2011). At any particular assessment (eg. after 6 days) ET values followed by the same superscript letter are not statistically significantly different.

	Days of drying				
	0	**6**	**11**	**16**	**20**
Couchgrass alone	0	2.60 [a]	8.90 [a]	11.50 [a]	13.2 [a]
Couch and Trivialis	0	6.40 [c]	19.40 [b]	26.00 [b]	30.7 [b]
Couch and PRG	0	8.40 [d]	30.30 [c]	42.60 [c]	51.3 [d]
PRG alone	0	8.50 [d]	30.20 [c]	41.10 [c]	47.9 [d]
E (mm, Livingstone Atmometer)	0	5.00 [b]	17.80 [b]	27.50 [b]	36.2 [c]
LSD (P=0.05)		0.70	3.30	4.50	4.5

Graph 1: Mean cumulative lysimeter ET and Atmometer Evaporation rates over a 20 day winter period (14th August – 2nd September 2011).



Discussion of results

Couchgrass on its own continued to exhibit some drying through the 20 day trial. As the grass was completely dormant it is assumed that this drying was not through root uptake, but simple surface drying, as would be expected in the field from the action of sun and wind.

Poa trivialis had significantly higher ET rates compared to couch on its own, and at times its ET rates were actually higher than the atmometer estimate of evaporation. This means that the Crop Factor in Australia of *Poa trivialis* can actually be greater than 1, which is quite feasible and has been seen in other agricultural research, especially during the winter months.

The greatest water use during the trial period was from Perennial Ryegrass, either on its own or when oversown into couch. It exhibited significantly higher ET rates than all the other treatments, including *Poa trivialis*. Again, the Perennial Ryegrass ET rates were higher than the atmometer estimates of E, and the Crop Factor was up to 1.5. This is probably due to the high winter activity and growth of this cultivar, its dark foliage, and possibly because the weather during this period (sunny, with light winds) was conducive to grass ET more than atmometer evaporation.

The average ET rate from the ryegrass sward was around 2.5mm/day, or around 17.5mm per week, compared to less than 0.7mm per day (4.6mm/week) from the pure couch sward. One would expect that the extra 13mm/week of water removed from the profile in the ryegrass sward is via active root uptake and transpiration by the actively growing plant, and the benefit could be seen in two ways. First, it can be imagined as 13mm of rainfall that you didn’t get that week. Or second, it can be equated to around 250,000 litres of water per week on an Australian rules football oval that is now in the atmosphere, not still in the profile. Although we didn’t test this, the benefit should be apparent in a firmer and better quality surface that won’t get chopped up as much during a game.

But there are a couple of provisos. The extra drying effect of the ryegrass is only useful if there are a number of days without rain to allow the benefit to accrue. If it just keeps raining, they’ll all be wet. Second, if the oval profile is sandy and well drained, any extra removal of water by ryegrass is not really relevant. The extra water use by ryegrass over winter would be most beneficial in heavy soils with poorly drained profiles, and would be only be evidenced after several dry days.

Conclusions

This simple trial validates the hypothesis that a winter active grass will result in higher ET rates from a turfgrass surface over winter, compared to a dormant turfgrass surface. The result provides evidence of a beneficial drying effect where the winter-active grass is present. Perennial Ryegrass was found to have a significantly higher benefit than *Poa trivialis*. In many situations the drying effect of this ET would be expected to result in firmer surfaces that are less susceptible to disruption from football traffic, resulting in a higher quality and more resilient sward through the winter. This conclusion should be considered by Turf Managers weighing up whether or not to go with winter oversowing of couch fields.