organics

Using Compost Materials on Council Sporting Fields

CASE STUDY

The use of compost manufactured from recycled organic material in the construction of sporting fields, or as an annual topdressing to existing fields is recognised as an important way to improve the quality of turfed surfaces for sporting activities[1].

Reduced water and fertiliser application can provide good financial cost savings to councils if quality composted topdressings, for example, are applied to maintain turf growth and condition.

Compost can also reduce reliance on mined soils and sands used in turf construction and maintenance, which are costly and have environmental impacts through their extraction from river beds and the natural environment.

This fact sheet summarises outcomes from a joint project with Penrith City Council to evaluate the benefits of compost in the construction and maintenance of three sporting fields used by the community.

Spreading of compost top dressing on Greygums Rd Oval, Cranebrook.

About the sporting fields

Three sporting fields managed by Penrith City Council were selected to participate in compost trials. All three had a history of heavy usage by sporting teams, were compacted and had variable turf cover that often affected playability. Water restrictions and the drought have further exacerbated the problems on these fields.

All fields experience high rates of turf wear and poor turf re-growth due to high clay, weakly structured and infertile subsoil as the turf base. Drainage on the fields is poor because of the soil material present.

A brief description of each field is given below:

Ched Towns Oval, Glenmore Park

The oval is used by soccer and cricket teams. It is periodically irrigated with water from a nearby water course. Kikuyu is the main turf grass on the field.

Andromeda Dr, Cranebrook

This oval is also used by soccer and cricket teams. The oval has relied mainly on natural rainfall since level 3 water restrictions were introduced. Couch is the main turf grass on the field.

Greygums Rd, Cranebrook

This oval is also used by the local AFL team and little athletics. The oval has relied mainly on natural rainfall since level 3 water restrictions were introduced. A mix of couch and kikuyu is present on the field.

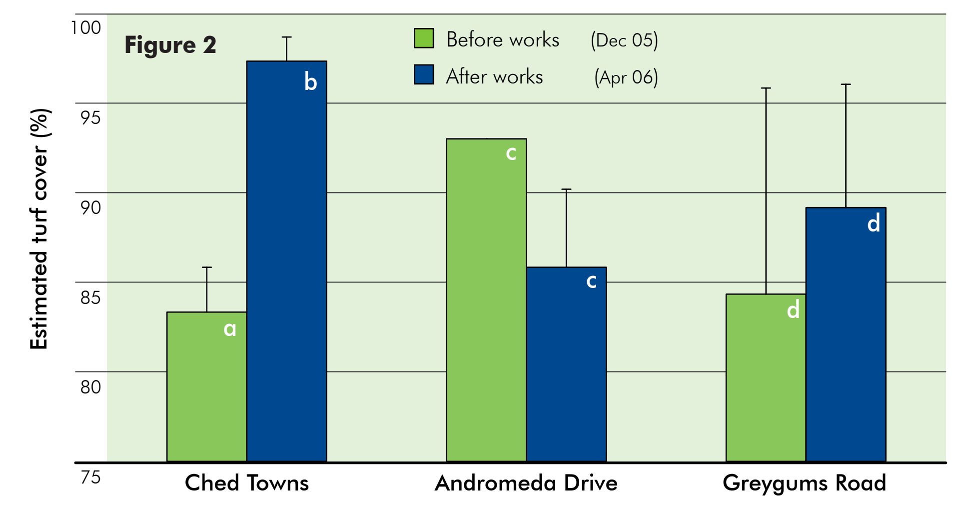
Works performed and compost used

A range of soil preparation and topdressing works were performed on the fields, as follows:

Ched Towns, Glenmore Park

Topsoil was imported to the site in November 2005 and spread to form a layer of ~150

Turf surface (couch grass) after application of top dressing containing compost. Note the amount of turf wear and exposed soil surface.



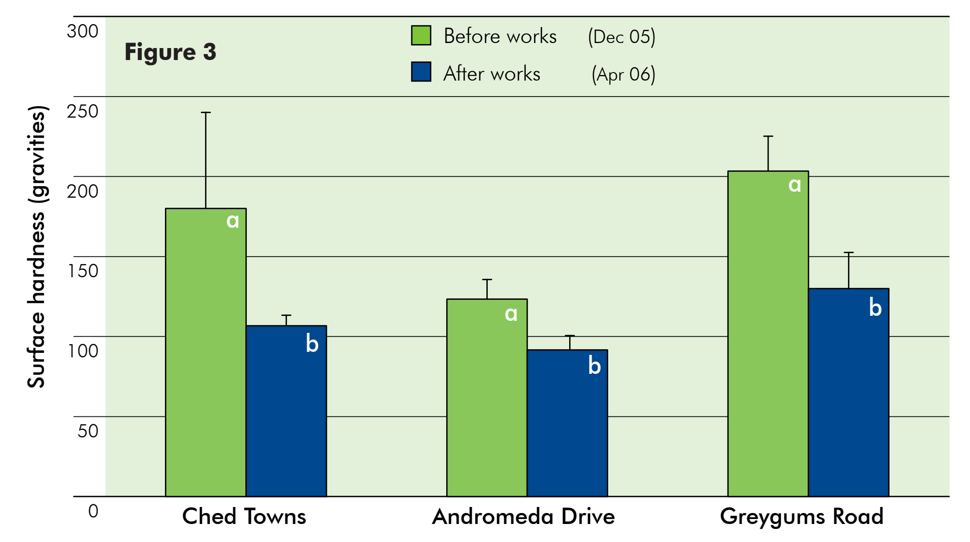


***Figure 2**. Turf cover on the sporting fields before and after works. Results followed by a different letter are statistically significant at the P≤0.05 level. Bars represent standard error.*

***Figure 3**. Surface hardness of the sporting fields using the Clegg Hammer test (2.25 kg hammer, first drop). Results followed by a different letter are statistically significant at the P≤0.05 level. Bars represent standard error.*

mm deep above the existing turf surface. After this, a 25 mm layer of composted soil conditioner meeting AS 4454 (2003)[2] was spread and then incorporated into the new topsoil layer. An irrigation system was installed and kikuyu sprigs were planted to re-turf the field. After turf had established, the site was top dressed with a compost/manure/sand/soil mix to a depth of 25 mm, to help in turf growth and leveling of the playing surface. Topdressing was raked into the surface. The compost component met the requirements of AS 4454 (2003).

Andromeda Dr, Cranebrook

Soil aeration was performed in November 2005 (Earth Quake Decompactor™), followed by the surface application of 25 mm deep of topdressing with a compost/manure/sand/soil mix. The compost component met the requirements of AS 4454 (2003). Topdressing was raked into the surface. Further subsoil aeration was performed in February 2006 followed by an application of 500 g/m^2 of gypsum to correct Ca and S levels. A photo of the turf surface after topdressing is shown in Figure 1.

Greygums Rd, Cranebrook

Soil aeration was performed in November 2005 (Earth Quake Decompactor™), followed by the surface application of 25 mm deep of topdressing with a compost/manure/sand/soil mix. The compost component met the requirements of AS 4454 (2003). Topdressing was raked into the surface. Further subsoil aeration was performed in February 2006 followed by an application of 500 g/m^2 of gypsum and 20 g/m^2 of potash to correct Ca, S and K levels.

Monitoring of trials

Soil chemical / physical properties and turf leaf nutrient testing was undertaken before works in December and five months later, in April 2006. This was undertaken by sampling six locations across each field in a grid pattern, and samples were combined to form an aggregate sample.

Turf cover on each field was visually estimated within a 400 x 400 mm quadrat. Surface hardness testing was carried out on each field in April 2006 with a 2.25 kg Clegg Hammer, and the perimeter of each field was tested at the same time to indicate approximate surface conditions before works. Readings from the first drop were recorded. The same sampling pattern was followed for these tests.

Were the fields improved?

Turf quality

Turf cover on Ched Towns improved significantly following works undertaken, but there was no obvious difference for Andromeda Dr and Greygums Rd (Figure 2). This may have been because the latter two fields were not irrigated, and turf recovery following field usage was impaired by continuing drought conditions. In fact, only 55% (245 mm) of average rainfall (445 mm) fell in Penrith over the five month trial period.

Surface hardness across all fields was reduced by 25 to 40% five months after works, indicating that the fields were more playable with potentially less risk of knee injuries occurring[3] (Figure 3). This is particularly important during periods of reduced irrigation or drought, when surface hardness usually increases due to low soil moisture and poor turf coverage.

A photo of the Clegg Hammer test is shown in Figure 4, with before and after photographs of the turfed surface at Ched Towns given in Figure 5. A photo of the Ched Towns field five months after works is shown in Figure 6.

Although the surfaces of all three fields softened following sub-soil aeration and compost application, surface hardness was considered to be still reasonably high. Football players report that surfaces with a hardness level of >110 gravities are too hard to play on[4]. Greygums Rd had a surface hardness of 130 gravities

Figure 5. *Clegg hammer impact testing of surface hardness on Ched Towns Oval.*

in April, whilst Ched Towns (108 gravities) and Andromeda Dr (92 gravities) were within a more optimum range.

Note that surface hardness comparisons on the fields made in April 2006 were compared to the perimeter of each fields where works were not undertaken, as the testing service was not available in December 2005. As a result, surface hardness results are indicative only.

A range of turf leaf tissue nutrients were assessed before and after works to see whether compost had any affect on turf nutrition. Macronutrients (N, P, K, S, Ca, Mg), micronutrients (Fe, Mn, Zn, Cu and B) and others (Na) were generally at adequate levels for good turf growth, though calcium levels at Greygums Rd (0.27%) and Ched Towns (0.29%) were low. These results were consistent with soil tests.

Five months after works were completed, turf leaf tissue nutrients were generally similar, though levels of N, P and K were slightly lower. This may have been due to the season as plant growth slows in the cooler weather, rather than any affect caused by the compost. Tissue levels of Ca did not change appreciably at Andromeda Dr and Greygums Rd given the application of gypsum in February, but this may be due to low rainfall impacting on gypsum reaction with the soil profile.

Soil properties

Soil bulk density in the upper soil profile reduced following works by 28 to 35%, and organic matter levels increased from around 3.4% to almost 9.5% across all fields.

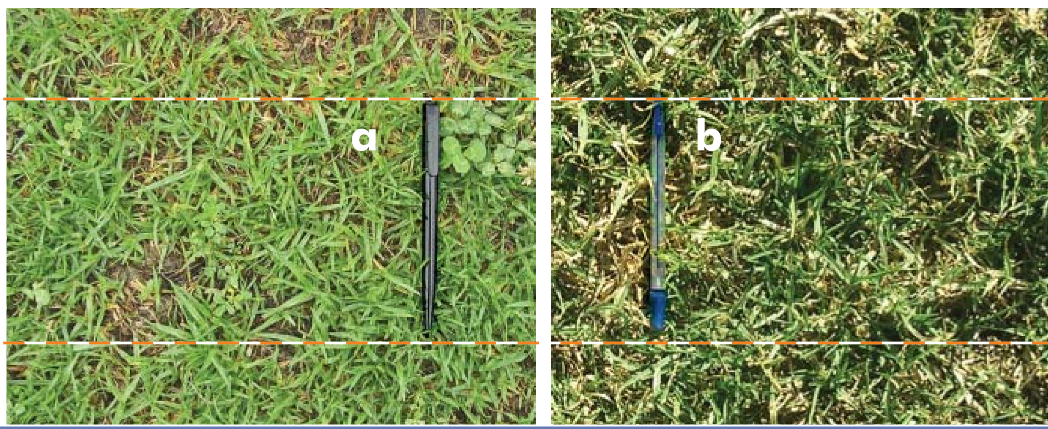


Figure 5. *Turfed surface of Ched Towns Oval, Glenmore Park before works in (a) December 2005 and (b) five months after works in April 2006. Note the improved turf cover and density after compost application.*

Permeability (or drainage) varied between sites, being improved by 34% on Ched Towns and 74% on Greygums Rd, but decreased by about 9% on Andromeda Dr. The Andromeda Dr result is not consistent with the reduced soil bulk density result. Usually, soils with a reduced bulk density are less compacted and are generally more permeable and better drained. The range may indicate the difficulty in estimating permeability in the laboratory on partly disturbed soil core samples.

Before works, all fields were deficient in available N (< 10 mg/kg of NH_4^+ and NO_3^-), P (< 5 mg/kg) and Ca (~ 800 mg/kg), whereas only Andromeda Dr had sufficient levels of soil S (30 mg/kg).

Composted soil conditioners and topdressings improved soil levels of available P well above levels required for sufficient turf growth across all fields (55 - 185 mg/kg). The increase in soil phosphate was due to the manure component of the topdressing used. Use of topdressing with a lower manure component may be better suited to such fields to avoid over fertilisation with P.

Composts did not consistently affect levels of soil available N. Generally, all soils were deficient in N before works, and the situation was only improved at Andromeda Dr. Results could indicate that available amounts of available N released by compost at Ched Towns and Greygums Rd had already been taken up by turf. Slow release of N from the composts would be expected over time as organic forms of N are mineralized into ammonium and nitrate.

After compost application, soil levels of available Ca improved substantially across all fields, from about 800 mg/kg before works to between 1,100 and 1,800 mg/kg after works. This suggested the gypsum application, particularly to Greygums Rd and Andromeda Dr, was successful in improving levels of calcium to a more optimum level.

How did the works improve field conditions?

On Ched Towns, construction of a new soil profile, incorporation of compost and topdressing the turf following establishment clearly improved turf growth, cover and reduced overall surface hardness. However, the direct effect of compost used is difficult to determine because the topsoil layer of the soil profile was replaced during works.

However, results suggest that the effect of improving organic matter and nutrient levels in the topsoil layer aided in turf establishment and development of a turf cover which was superior to the previous turfed surface. Improved organic matter levels in the topsoil would have increased water holding capacity and improved the efficiency of irrigation, but this was not tested for.

Results from the trial suggest that on fields that receive some irrigation in times of drought, composts can play an important role in improving soil fertility, soil physical properties and turf quality.

Despite drought conditions and the fact that Greygums Rd and Andromeda Dr could not be irrigated due to water restrictions, works undertaken reduced soil bulk density, surface hardness and improved the playability of the surface. The direct effect of compost was again difficult to establish given that sub-soil aeration was performed as part of the works program.

Improved organic matter levels in the topsoil did not produce significant increases in available nutrients, but it would be expected that nutrient release would occur over time as the organic fraction breaks down. This would also assist in water holding capacity and could improve the efficiency of rainfall.

Although soil physical and chemical conditions had improved following works, improved turf growth was not observed at Andromeda Dr and Greygums Rd, likely to be due to the drought. If the fields had received irrigation, improved turf growth and cover would have been expected.

What did we learn?

A summary of things we learnt from the trials is given below. These outcomes can be used to help in optimising the use of composts for improving sporting fields.

1. The use of composted soil conditioner as a soil amendment, and surface applied top dressings when combined with sub-soil aeration can improve the physical properties and fertility of soils, as well as turf growth when sufficient irrigation or rainfall is received.
2. Works undertaken reduced surface hardness across all fields, through the combined effect of sub-soil aeration and topdressing. This improved the overall playability of the fields.
3. In periods of continuing drought, topdressing of sporting ovals with compost may have limited benefits as turf growth and recovery will be limited by available soil moisture. Although soil physical conditions may be improved, this will not affect turf cover and overall turf condition. Topdressing may be more advisable in periods of better rainfall, particularly in early spring to coincide with the period of rapid turf growth.
4. Use of topdressings with a large composted manure component (~10%) may not be advisable on sporting fields, where phosphorus levels may be increased excessively, and could impact on the quality of runoff. Topdressing with an increased garden organics compost component (>40%) (with a lower P content), perhaps with some additional nitrogen may be better suited to sporting fields in Western Sydney that are sited on relatively heavy and infertile clay soils.
5. Topdressings with a higher level of garden organics compost and better incorporation of the material into the root zone of turf may help in improving nutrient uptake by turf, maximise improvements to soil physical conditions and overall turf response. This may be achieved by soil coring, compost application then mechanical sweeping of compost across the field surface to ensure good penetration into the root zone.

How to purchase compost

Councils can purchase compost directly from composting facilities around the State. Prices range from ~\$10 - 30 / m^3.

When purchasing compost, it is preferable that product certified to the Australian Standard AS 4454 (2003) be used to ensure that quality product is obtained. Ask the supplier to show their 'StandardsMark Licence Certificate' demonstrating that they can supply certified product to the Standard.

It is also recommended to discuss your project with the supplier as they may be able to assist in providing a tailored product for your application.

A full list of quality assured compost suppliers are given in the SAI Global Ltd Certification Register, available on-line at http://register.sai-global.com/ and type in '4454' in the 'known standard' field.

References

1. Department of Environment and Conservation NSW (2006). Cost/benefit of using recycled organics in Council parks and gardens operations in NSW. Printed by DEC. Internet: http://www.environment.nsw.gov.au
2. Standards Australia (2003). Australian Standard AS 4454 – Composts, soil conditioners and mulches. Standards Australia International, Sydney NSW.
3. Handreck, K. and N. Black (2005). Growing media for ornamental plants and turf. Third edition. Printed by UNSW Press, Sydney.
4. Ford P. (1999). Ground hardness measurement. Golf & Sports Turf Australia, June: 42-48.

***Figure 6**. Photo of Ched Towns Oval, Glenmore Park five months after works were completed.*

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