organics

Improving water quality in catchments *using compost*

FACT SHEET

Approximately 11% of the Sydney Catchment is affected by high or very high sheet and rill erosion, which impacts on the quality of waterways, river systems and the productivity of agricultural land[1]. Whilst soil erosion by water and wind is a natural process, many of Australia's soils are old and are susceptible to erosion. Erosion increases when soil is disturbed or exposed by the removal of protective vegetation and during high intensity rainfall or wind[2].

Eroded topsoil carried into our waterways can contain toxic chemicals and fertilisers, which can reduce water quality in catchment areas and impact on aquatic flora and fauna. Reducing soil erosion lowers the cost of water treatment for drinking and improves the environmental quality of recreational areas such as beaches and lakes.

Example of an eroded gully in the Hawkesbury-Nepean catchment.

One way to reduce sediment loss and improve water quality is to revegetate degraded soils. The use of composts in the form of mulch and/or soil conditioners have been demonstrated as being very effective in combating soil erosion by physically protecting soils and assisting in plant establishment[3].

Compost trials

To evaluate the use of composts for erosion control in catchments, the Department of Environment and Conservation (NSW) is working in partnership with the Department of Primary Industries (DPI) and Catchment Management Authorities.

Scientific trials have been completed at the DPI's Centre for Recycled Organics in Agriculture (CROA) in Camden and a large-scale catchment trial in Bungonia, located in the upper reaches of the Shoalhaven catchment.

Two approaches have been chosen to evaluate the use of compost complying with quality parameters as defined in Australian Standard AS 4454 (2003)[4].

These are:

Surface mulching: Composted mulch is surface applied to physically protect soils and reduce soil loss. Coarse composted particles help conserve soil moisture and aid in the growth of primary vegetation such as sown pasture species. Establishment of deep-rooted native trees and shrubs via seed or tube stock provides long-term erosion control.

Soil conditioning: Composted soil conditioner is applied to soils to assist in rapid establishment of primary vegetation such as sown pasture species. The fine material is high in organic matter and helps in controlling soil erosion by encouraging vegetation establishment. Establish-ment of deep-rooted native trees and shrubs via seed or tube stock provides long-term erosion control.

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Department of Environment and Conservation (NSW)

Trials established at CROA and Bungonia have evaluated the benefits of these approaches. This fact sheet describes the results on the performance of composted mulches and soil conditioners before and after the establishment of vegetation. Erosion control performance of the composts is compared to bare soil (control) and conventional practice (straw mulch).

Runoff trials at CROA

The first stage of the trials showed that composted mulch (2.5 - 5.0 cm deep or 250 - 500 m³/ha) and composted soil conditioner alone (1 - 2.5 cm deep or 100 - 250 m³/ha) applied to a Chromosol b-horizon subsoil can reduce soil loss in runoff by more than 85% when compared to bare soil (Figure 2) under very high rainfall conditions (i.e. 1 in 10 year rainfall event, or 67 mm/hr over 30 minutes).

Figure 1. *CROA catchment trial site evaluating the benefits of compost.*

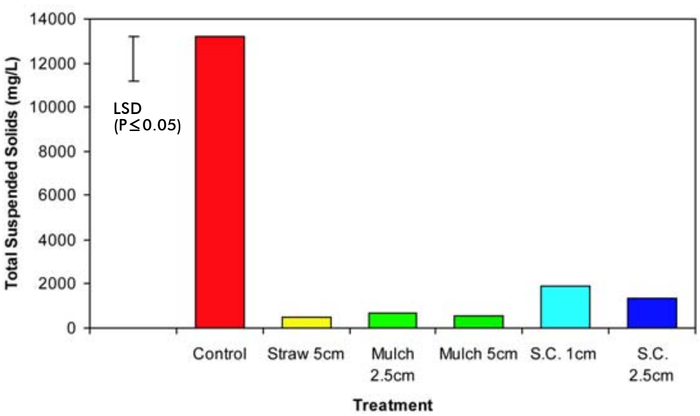

Figure 2. *Erosion control performance of composted mulch and soil conditioner (S.C.) compared to bare soil (control) and conventional practice (straw) before establishment of vegetation at CROA. Erosion is measured by the amount of suspended solids in runoff. Differences between treatments larger than the LSD (least significant difference) are statistically significant at the P≤0.05 level.*

The performance of composted mulch and soil conditioner was equivalent to the straw treatment in terms of erosion control.

At higher rates of soil conditioner application (2.5 cm deep or 250 m³/ha), low levels of soluble plant nutrients (nitrogen and phosphorus) and organic matter can be released by the material. These low levels of nutrients and organic matter would usually be retained by vegetation and are not likely to affect water quality.

The volume of runoff from the test plots was not reduced by the application of compost or straw compared to the bare soil treatment. Usually, compost helps improve soil structure and enables more water to enter soil. However, the experiment was conducted under drought conditions which may have reduced compost treatment effects on improving soil infiltration.

Eight months after sowing of pasture grasses and clovers, a second rainfall simulation was performed to assess the combined effect of compost and vegetation on erosion control (Figure 3).

Control — *Soil conditioner, 1 cm*

Composted mulch, 2.5 cm — *Composted mulch, 5 cm*

Figure 3. *Vegetation establishment on the CROA plots eight months after compost application.*

Vegetation establishment was significantly better on plots receiving composted soil conditioner, mulch (2.5 cm deep) or straw compared to the bare soil control. However, the high rate of mulch (5 cm deep) had significantly less vegetation cover than the other treatments (Figure 4).

Despite the suppressive effect of the high mulch application rate on pasture establishment, erosion control performance was still very good (Figure 5). This was because the coarse mulch particles remained on the soil surface and had not fully broken down, providing continuing soil protection. For long term erosion control, however, vegetation establishment is required.

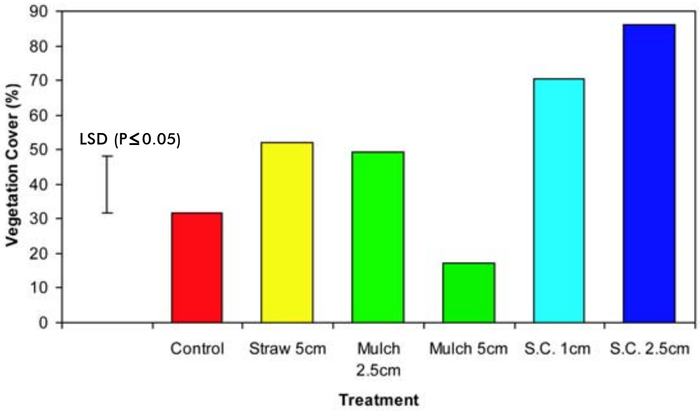

Figure 4. *Vegetation establishment on the CROA plots eight months after compost application. S.C., soil conditioner. Differences between treatments larger than the LSD (least significant difference) are statistically significant at the P≤0.05 level.*

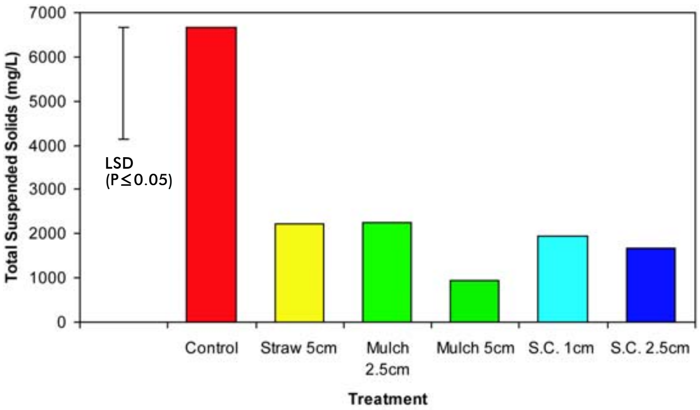

Figure 5. *Erosion control performance of composted mulch and soil conditioner (S.C.) compared to bare soil (control) and conventional practice (straw) after establishment of vegetation at CROA. Erosion is measured by the amount of suspended solids in runoff. Differences between treatments larger than the LSD (least significant difference) are statistically significant at the P≤0.05 level.*

In deep mulch applications (5 cm or more), improved vegetative cover may be achievable by planting tube stock rather than surface seeding with pasture or native shrub and tree seed.

Good levels of erosion control continued in the low mulch and two soil conditioner treatments (Figure 5). However, in these treatments, continuing erosion control was assisted mainly by good pasture establishment. Results suggested that these treatments can provide good erosion control over the longer term by assisting in the establishment of vegetation via surface seeding, and are likely to be more economically viable than deep mulching and tube stock planting.

Bungonia trial

Selected treatments from the CROA trial were further evaluated in a combined scientific and demonstration trial, on a 1.5 ha rehabilitated gully site located in Bungonia. Soil present on site consisted of a degraded, sodic B-horizon Sodosol. Following earthworks, very little vegetation had established on the site due to drought, low soil fertility and absence of organic matter in the upper soil profile (Figure 6).

Treatments evaluated included a control (bare soil), straw mulch (5 cm deep or 500 m^3/ha), composted mulch (2.5 cm deep or 250 m^3/ha) and two different composted soil conditioners (1cm deep or 100 m^3/ha). Composted mulch was spread on the batters and floor of the gully, and composted soil conditioner was applied to the flatter areas of the site. Composted products were applied using a 4m^3 capacity belt spreader towed by an articulated tractor. The site was seeded with a pasture mix before and after compost application.

Results showed that soon after compost application, pasture grasses and clovers rapidly established on the site. Mulches were particularly effective in encouraging vegetation establishment, by keeping the upper soil profile moist. Mulches were also highly effective in stabilizing the soil in steeper areas of the site. A photograph of the site six months after compost application is given in Figure 7.

Figure 6. *Bungonia trial site prior to application of compost.*

Figure 7. *Bungonia trial site six months after compost application.*

A rainfall simulation 8 months after compost application and vegetation establishment showed that composted mulch at 2.5 cm deep is highly effective in reducing soil erosion, with low levels of nutrient release. Results were consistent with CROA trials. The composted soil conditioner treatment performed poorly because the material was not tilled into the soil, and most moved off the site due to wind. The trial found that soil conditioner incorporation is important to maximize its benefits.

Although composted mulch helped to stabilize soil on the gully floor during low rainfall events, a large rainfall event in January 2005 resulted in mass movement of mulch because concentrated water flow occurred.

This result demonstrated that composted soil conditioners and mulches are suited to controlling sheet erosion, but not rill erosion where concentrated water flows can occur. Netting of mulch in place may be needed where concentrated water flow is expected.

Total suspended soils, total nitrogen, phosphorus and organic carbon in water above the trial site and at various locations in the drainage line was monitored to evaluate whether compost could negatively impact on water quality during site establishment. Results showed that levels of total suspended solids, nutrients and organic carbon in runoff above the trial site (where compost was not applied) was similar to the runoff after it left the trial site. This suggested that the use of compost for repairing land has a low risk of impacting on downstream water quality.

Conclusions

The study found that composted mulches and soil conditioners complying with AS 4454 (2003) (with 10% of the contamination limit for light plastics) are effective in controlling soil erosion, and in assisting in vegetation establishment on degraded sites. Preferred application rates for mulch (surface applied) is 2.5 cm deep (250 m^3/ha) and soil conditioners (with incorporation) is 1 cm deep (100 m^3/ha).

Higher application rates of soil conditioner may be beneficial on poorly structured, low fertility soils susceptible to erosion, though this will increase costs.

A cost benefit analysis showed that composted mulch and soil conditioner use is comparable to the use of cereal straw, though this will depend on location of the site as transport costs for compost can be significant.

How to purchase compost

Landholders and catchment managers 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 online at http://register.sai-global.com/ and type in "4454" in the "known standard" field.

References

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