Using Compost to Improve Post-fire Water Quality

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Acknowledgements

CalRecycle
UCR Ag Ops
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Aguinaga Green

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Freeway Complex Fire, Nov. 2008

30,305 Acres Burned
Freeway Complex Fire, Nov. 2008

K-rail
Facing slopes in Temecula, CA

Experimental Site
After the burn

Riverside Station 1 Fire Crew
Installed Slope

Collection Basin
Bins

Maintenance
It’s wet out here...

...but still dry in there
Four captured events (mm)

- December 15, 2009, 12.5 mm fell over 48 hours
- January 19, 2010, 32 mm fell over 36 hours
- January 21, 2010, 39 mm fell over 36 hours
- January 23, 2010, 49 mm storm fell over 36 hours

After the first rains...
Materials
- Greenwaste compost fines
- Greenwaste compost overs
- Biosolids compost
- No compost

Rates
- 1 inch
- 2 inches
- 2 inches incorporated

Randomized Complete Block Plot Design

Total Runoff Depth

3:1 slope
Total Solids

Total Dissolved Solids

CalRecycle
Exported Mass
Total Dissolved Phosphorus

Orthophosphate
Significant improvements over controls

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Fine GWC</th>
<th>Coarse GWC</th>
<th>BSC</th>
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<tbody>
<tr>
<td>TDS</td>
<td>IMPROVED</td>
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<td>TSS</td>
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<td>TS</td>
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<td>TDP</td>
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<td>OP</td>
<td>IMPROVED</td>
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<td>NH$_4^+$-N</td>
<td>IMPROVED</td>
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<td>NO$_3^-$-N</td>
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Only one significant increase observed in experiment: 2" biosolids compost increased NH$_4^+$-N losses.
Metals

- Metal exports from all plots were mostly in suspended form. Mo was the exception.
- Elevated flow rates in the controls often diluted metal concentrations below detection limits, but observations of metals where they were detected suggest that untreated soil metal exports were comparable to or higher than those with composts applied.
- All compost treatments reduced losses of suspended Cd, Cu, Cr, Pb, Ni, and Zn compared to the controls based on novel Kaplan-Meier nonparametric approach.

Conclusions

- Compost mulches effectively reduce runoff pollution
- Runoff is reduced
  - Absorb water
  - Protect the soil
  - Promote infiltration
- Normalized pollutant export declined after two storms
  - Studies limited to one or two storm events will exaggerate pollutant losses from mulched plots.
- 1” was as effective as 2” and retained more pollutants
  - Biosolids compost applied to 2” depth (B5) exported more TDS and NH₄⁺-N than did the 1” application, as well as more Cd, Cr, Cu, and Mo.
- Incorporation is unnecessary
Conclusions

- Compost blankets reduced
  - Runoff by 86%
  - Total dissolved solids (TDS) by 88%
  - Total suspended solids (TSS) by 96%
  - Total solids (TS) by 97%
  - Total dissolve phosphorus (TDP) by 72%
  - Orthophosphate (OP) 77%
  - Suspended phosphorus (SP) 98%
  - Nitrate (73%)

- Surface mulching and incorporation performed similarly
- Applying 2" offered no benefits over 1", and increased some pollutant losses
- Results similar for greenwaste compost “overs” (>3/8") and “fines” (<3/8")

Conclusions

- Significant decreases for all coarse greenwaste compost treatments were shown in TDS, TSS, TS, TDP, OP, NH$_4^+$-N, and NO$_3^-$-N.
- Fine greenwaste compost treatments performed similarly although, compared to the controls, improvements in TDP and OP, while substantial, were not always statistically significant.
- Metal losses were observed more frequently in the runoff from the biosolids compost treatments than from the greenwaste compost plots, but values were frequently below detection limits.