Compost use in vineyards

Declan McDonald
Senior Soil Scientist
B.Sc (Urban Hort), M.SustAg (Soils)
Where we are
Today’s talk

• Reasons to use compost or not
• Define compost and variants
• Compost quality factors
• Determining rates
• How to apply – timing, equipment etc.
• Results from trials
• Where to from here?
Why is there so much interest in compost?

• Large research bank showing positive effects of compost on soils – resilience, water, nutrients etc.

• Future risks – climate change, input prices

• Desire to embrace more sustainable land mgt practices

• Weed and water management
Potential uses for compost

- Add nutrients to soil
- Add organic matter to soil
- Increase soil microbial activity
- Suppress weeds
- Reduce water use
- Pest and disease suppression
- Soil structure
What is compost?

• Compost is:
  – Well decomposed organic matter
  – A source of stable carbon and plant nutrients
  – Produced under careful temperature and moisture conditions over time (3-6 months)

• Compost is not:
  – Raw manure or animal bedding
  – Fresh or aged grape marc
  – Mulch, sawdust, woodchips, straw etc.
  – Only pasteurised
Types of compost

• Greenwaste:
  – Municipal greenwaste from kerb-side collections
  – Generally high in potassium w moderate levels of carbon and nitrogen (high C:N)
  – Grape marc composts, typically high in carbon w moderate nutrients

• Animal manure blends:
  – Typically chicken, pig or cow manures blended with a carbon source (woodchips, straw, greenwaste etc.)
  – Generally higher in nutrients w a lower C:N ratio
## Grape marc analysis

<table>
<thead>
<tr>
<th>Major Elements %</th>
<th>Nitrogen (N)</th>
<th>1.3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Phosphorus (P)</td>
<td>0.15</td>
</tr>
<tr>
<td></td>
<td>Potassium (K)</td>
<td>0.79</td>
</tr>
<tr>
<td>Minor Elements %</td>
<td>Calcium (Ca)</td>
<td>1.33</td>
</tr>
<tr>
<td></td>
<td>Magnesium (Mg)</td>
<td>0.21</td>
</tr>
<tr>
<td></td>
<td>Sulphur (S)</td>
<td>0.13</td>
</tr>
<tr>
<td></td>
<td>Sodium (Na)</td>
<td>0.11</td>
</tr>
<tr>
<td></td>
<td>Chloride (Cl)</td>
<td>0.15</td>
</tr>
<tr>
<td>Trace Elements mg/kg</td>
<td>Iron (Fe)</td>
<td>3560</td>
</tr>
<tr>
<td></td>
<td>Manganese (Mn)</td>
<td>113</td>
</tr>
<tr>
<td></td>
<td>Zinc (Zn)</td>
<td>129</td>
</tr>
<tr>
<td></td>
<td>Copper (Cu)</td>
<td>33</td>
</tr>
<tr>
<td></td>
<td>Boron (B)</td>
<td>27.3</td>
</tr>
</tbody>
</table>

- **pHw**: 5.3
- **EC**: 4.54 dS/m
- **Organic matter**: 71.8% dry weight
- **Organic carbon**: 42.2% dry weight
- **C:N ratio**: 33
- **Moisture content**: 42.2% water
Who is using compost?

• d’Arenburg winemakers, McLaren Vale have been making compost from grape marc and garden organics
  – Heavy applications to counter problem soils
• DeBertoli Wines, Yarra Valley broader embrace of biological farming practices.
  – Broadcast, banded and compost teas
• Treasury wines, SA.
  – Evaporation, soil health and temperature control
Local activities

• Three vineyards today
• Apple orchards
• Kooyong / Pt Phillip Estate w RMIT – focus on biological principals in conjunction with conventional mgt
  – Addressed salinity and pest and disease pressure through drainage, deep ripping and green manure cropping. Also using compost teas.
Near local activities

• Compost use in Tasmanian horticulture
  – Winegrapes, hops and olives
• Grapevines under composts had increased trunk diameter after 12 months, increased earthworms counts and higher levels of available P and K than straight mulch or controls
• Olives showed 35% higher growth in year one under compost (Bound, 2014)
Composts ain’t comports

• Identify the issue you are trying to manage
• Is compost a suitable solution?
• What kind of compost do you need to best address the issue?
• Is it available?
• How do I access customised comports?
• How do I monitor the effectiveness of the treatment?
Soil issues in vineyards

• Some chemical, some physical
• pH, EC, cations, nutrients need specific inputs
• Physical issues mostly relate to structure
• Is high compost application a risk?
• Nutrient release is slow but don’t overdo
• Focus on managing physical environment
Common soil physical issues

• Ground preparation – or lack of it
• Sodic/magnesic conditions, pH, EC
• Compaction
• Slaking
• Dispersion
• Low organic matter
• Low biological function
Why is the physical environment important?

Aggregation is flocculation plus cementation (Bradfield, 1950)

Soil pores
- water
- air

Micropores

Macropores

Soil aggregate (ped)

Ca  Mg OM
How is physical condition maintained?

- Workers maintaining the house – soil is a self-organising ecosystem
- Critical importance of pore space diversity and continuity for air, water, roots and habitat
- Organic matter is the substrate for biological function but must be applied with some regularity
- Root activity perpetuates this exchange
- Inter row management
Soil health
Low soil function
Structure under compost
Application rates

20 tons/acre Broadcast
Banding compost
Results from three vineyards

• Parameters being monitored
  – Soil temperature
  – Soil moisture
  – Air temperature and humidity

• Focus on soil temp and soil moisture
  – Assumptions include increased OM in soil driving biological processes encouraged by regulated moisture and temperature

• Bulk Density also evaluated
Soil Moisture (Hunts Rd, January 16)
Soil Temp. (Hunts Rd January ’16)
Soil Temp (Hunts Rd, January 16)

Control: high variation
Soil Temp (Lynstead Grange, Jan ‘16)
Soil Moisture (Lynestead Grange, Jan ‘16)
Soil Temp (10 mins x Tractor, Jan ‘16)
Analysing soil data

• Graphs can be difficult to read
• Need to establish if relationships exist within the data, i.e. do measured parameters correlate with treatments?
• How to evaluate changes in soil physical properties?
  – Structure, porosity, bulk density, aggregate stability etc.
Analysing soil data

• Relationships:
  – Control and coarse
  – Control and fine
  – Coarse and fine

• Positive correlations between most but ranged from weak to strong

• Some negative correlations
Analysing soil data

- Soil moisture and soil temperature

<table>
<thead>
<tr>
<th>Location</th>
<th>Date</th>
<th>Treatment</th>
<th>Moisture</th>
<th>SoilTemp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lynstead</td>
<td>Apr-16</td>
<td>Fine &amp; control</td>
<td>0.90256</td>
<td>0.97246</td>
</tr>
<tr>
<td>Lynstead</td>
<td>Apr-16</td>
<td>Fine &amp; coarse</td>
<td>0.98717</td>
<td>0.99317</td>
</tr>
<tr>
<td>Lynstead</td>
<td>Apr-16</td>
<td>Control &amp; coarse</td>
<td>0.95689</td>
<td>0.99162</td>
</tr>
<tr>
<td>10 minutes</td>
<td>Apr-16</td>
<td>Fine &amp; control</td>
<td>0.47805</td>
<td>0.50867</td>
</tr>
<tr>
<td>10 minutes</td>
<td>Apr-16</td>
<td>Fine &amp; coarse</td>
<td>0.49648</td>
<td>0.49271</td>
</tr>
<tr>
<td>10 minutes</td>
<td>Apr-16</td>
<td>Control &amp; coarse</td>
<td>0.995</td>
<td>0.99385</td>
</tr>
<tr>
<td>100 Hunts</td>
<td>Apr-16</td>
<td>Fine &amp; control</td>
<td>0.99203</td>
<td>0.99858</td>
</tr>
<tr>
<td>100 Hunts</td>
<td>Apr-16</td>
<td>Fine &amp; coarse</td>
<td>0.91524</td>
<td>0.95764</td>
</tr>
<tr>
<td>100 Hunts</td>
<td>Apr-16</td>
<td>Control &amp; coarse</td>
<td>0.94626</td>
<td>0.95224</td>
</tr>
</tbody>
</table>
### Analysing soil data

- **Bulk density**

<table>
<thead>
<tr>
<th>Location</th>
<th>Bulk Density</th>
<th>Location</th>
<th>Treatments</th>
<th>Correlation coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 Hunts Coarse</td>
<td>1.0247</td>
<td>100 Hunts Rd</td>
<td>coarse vs. control</td>
<td>0.62648</td>
</tr>
<tr>
<td>100 Hunts Fine</td>
<td>1.0286</td>
<td>100 Hunts Rd</td>
<td>fine vs. control</td>
<td>0.99305</td>
</tr>
<tr>
<td>100 Hunts Control</td>
<td>1.0095</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ten x Tractor-Control</td>
<td>1.0316</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ten x Tractor-Fine</td>
<td>1.0293</td>
<td>10 min by tractor</td>
<td>coarse vs. control</td>
<td>0.44023</td>
</tr>
<tr>
<td>Ten x Tractor-Coarse</td>
<td>1.0472</td>
<td>10 min by tractor</td>
<td>fine vs. control</td>
<td>0.9464</td>
</tr>
<tr>
<td>Lynsted- Control</td>
<td>1.036</td>
<td>Lynsted Grange</td>
<td>coarse vs. control</td>
<td>0.55007</td>
</tr>
<tr>
<td>Lynsted- Fine</td>
<td>0.9376</td>
<td>Lynsted Grange</td>
<td>fine vs. control</td>
<td></td>
</tr>
<tr>
<td>Lynsted- Coarse</td>
<td>0.9533</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
So what does it all mean?

- Steady state soil temperatures and soil moisture are conducive to biological function (soil organisms as well as plant roots)
- Provision of organic inputs drives biological function
- Improved biological function enhances soil function (decomposition and nutrient cycling) and soil condition (structure, aeration, infiltration, water holding capacity)
- Improved soil condition demonstrated by BD assessments
- Improved soil condition improves plant health and reduces water stresses.
In summary

Two years of trial data confirms previous research that shows:

• Improvement in soil moisture
• Improvement in soil structure
• Improvement in evenness of soil temperature
• Improved protection on very hot days
• Probable increase in soil microbial biomass
In summary

• Treatments can not be one-offs
• More strategic assessment of soil needs and complementary (customised) composts is required
• Additional evaluation and monitoring is required, e.g. bunch weights, baume, pest & disease pressure, resistance to wilting, timing of verasion, timing of harvest, resistance to extreme weather events, etc.
• Additional research is required to more fully quantify benefits from compost
“Soil – too precious to ignore”

THANK YOU

Declan McDonald
Senior Soil Scientist
B.Sc (Hort), M.SustAg (Soils)

www.sesl.com.au 1300 30 40 80