Evaluation of Grape Marc as an undervine mulch

Jason Cappello  Extension Viticulturist, NSW DPI Griffith

GRAPE marc, an organic fertiliser option not commonly used in the Riverina is on trial in 2012. At the DPI vineyard in Hanwood, grape marc will be applied as mulch in various forms.

Why is the project occurring
- The region has over 70,000 tonnes of aged grape marc for use. In other regions grape marc is used annually by vineyards to improve soil conditions in the vineyard.
- Locally due to previous experiences and supply vineyards have not favoured the regular use of grape marc with only a small number of producers making use of the product.
- Through the project we will aim to quantify and obtain relevant local information to identify the positive and negative aspects of using grape marc undervine in drip irrigated vineyards.

What is being done
1. No treatment to vines
2. Grape marc applied at approx. 100t/ha with added mixed NPK fertiliser at 250kg/ha
3. Grape marc applied at approx. 100t/ha to achieve a mulch layer
4. Grape marc applied at approx. 50t/ha to achieve a ½ rate mulch layer
5. Grape marc with added chicken manure/litter applied at approx. 50t/ha
6. Mixed NPK fertiliser applied at 250kg/ha with no grape marc applied

Trial Site Details
Location
- NSW DPI Griffith Centre for Irrigated Agriculture, farm 217 Hanwood

Soil Type
- Banna Sand - Sandy Loam

Soil Slope
- Flat to Gentle fall from east to west

Trellis type
- Single fruiting wire @ 1.2m above soil

Surroundings
- Vineyards

Plant Spacing
- 3.0m (10ft) x 2.5m (8.6ft)

Irrigation System
- Drip irrigation

Through consultation with local clients, outcomes to be measured and evaluated on the vine, fruit and wine will be carried out where resources permit, but not limited to the following
- Brix
- pH
- TA
- Berry anthocyanin levels
- Fruit Yield kg/metre
- Bunch numbers per metre
- Soil and Vine nutritional influence
- Wine chemical influence

Things to think of using mulches undervine
- Aim to have a clean soil free from weeds and prunings prior to applying organic material in thicker amounts – prunings will create roots and develop.
- Ensure the source material has had a recent nutrient analysis test conducted – this allows for you to identify if there are any issues with the material – particularly pH and the carbon to nitrogen (C:N) ratio.
- If the organic material has high Carbon to Nitrogen ratio (C:N) > 25:1, add a Nitrogen fertiliser before apply the organic material to reduce draw down of soil nitrogen stocks.
- Consider its use to target poorer areas of a vineyard rather than the whole vineyard – i.e. poorly designed irrigation setups or lighter soil types in a vineyard patch.
- Consider using pre-emergent herbicides prior to application for improved weed management.
Other information of interest

The project is being made possible through the Wine Grapes Marketing Board under the 2012-2013 Grape and Wine Research and Development Corporation grassroots regional extension program.

Tarac technologies at Beelbangera will supply the marc, to make way for their 2013 vintage material. Tarac has the only major distillation processing facility in NSW and presently has a large quantity of aged material that could be put to use.

Aged grape marc 18 – 36 months old appears to be most suitable for vineyard use. This is based on nutrient assessments on free and older stock. Changes in pH, carbon and potassium levels indicates leeching of the material as it ages makes it more suitable for use particularly in vineyards, where concerns for high potassium uptake in vines can cause winemaking issues.

While grape marc is used commonly on vineyards in other districts, past local experiences in the Riverina, coupled with a lack of supply of material and solid information about its benefits have restricted its uptake, compared to other organic materials like chicken or cow manure.

The project will use past research information from studies done elsewhere. Soil, vine and wine quality parameters will be measured and observed.

<table>
<thead>
<tr>
<th>Treatments Grape Marc Mulching</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pink</strong></td>
</tr>
<tr>
<td>Standard practise (bare undervine)</td>
</tr>
<tr>
<td>with no mulch addition.</td>
</tr>
<tr>
<td><strong>White</strong></td>
</tr>
<tr>
<td>100% steam distilled aged grape marc</td>
</tr>
<tr>
<td>approx. 5cm mulch layer with hydro</td>
</tr>
<tr>
<td>complex fertiliser application</td>
</tr>
<tr>
<td>(estimated to about 100t/ha of material at 300-400mm wide each side using a 3m row spacing).</td>
</tr>
<tr>
<td><strong>Blue</strong></td>
</tr>
<tr>
<td>100% steam distilled aged grape marc</td>
</tr>
<tr>
<td>approx. 5cm mulch layer (about 100t/ha of material at 300-400mm wide each side using a 3m row spacing).</td>
</tr>
<tr>
<td><strong>Red</strong></td>
</tr>
<tr>
<td>100% steam distilled aged grape marc</td>
</tr>
<tr>
<td>approx. 2-3cm mulch layer (about 60t/ha of material at 300-400mm wide each side using a 3m row spacing).</td>
</tr>
<tr>
<td><strong>Yellow</strong></td>
</tr>
<tr>
<td>Blend of 1 part chicken manure and 5 parts grape marc mulch layer approx 2-3cm mulch layer (about 60t/ha of material at 300-400mm wide each side using a 3m row spacing).</td>
</tr>
<tr>
<td><strong>Green</strong></td>
</tr>
<tr>
<td>Hydro Complex fertiliser application only from treatment 2</td>
</tr>
</tbody>
</table>
Images during the trial establishment

Sensors installed in the soil to monitor the soil temperature for each treatment

Application of marc and materials made on September 25th 2012

Vineyard area slashed and setup in preparation for the trials just 3rd week of September

Photo taken of marc 1 month after application October 24 2012, vines at growth stage
Comparison of nutrient analysis for the various inputs products to the trial pre application.

<table>
<thead>
<tr>
<th>COMPOST 'TOTALS' ANALYSIS REPORT</th>
<th>GUIDE Typical Nutrients</th>
<th>Standard Cow Manure</th>
<th>Standard Chicken Manure</th>
<th>Standard Grape Marc</th>
<th>2012 Trial Chicken &amp; Grape Marc blend</th>
<th>2012 Trial Grape Marc Load 1</th>
<th>2012 Trial Grape Marc Load 2</th>
<th>Hydro complex fertiliser</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Macronutrients</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nitrogen N %</td>
<td>2.0</td>
<td>1.80</td>
<td>4.40</td>
<td>2.20</td>
<td>4.57*</td>
<td>1.91</td>
<td>2.48</td>
<td>12.00</td>
</tr>
<tr>
<td>Phosphorus P %</td>
<td>0.5</td>
<td>1.70</td>
<td>2.90</td>
<td>0.29</td>
<td>0.56</td>
<td>0.28</td>
<td>0.32</td>
<td>4.80</td>
</tr>
<tr>
<td>Potassium K %</td>
<td>0.8</td>
<td>2.10</td>
<td>2.10</td>
<td>1.90</td>
<td>1.90</td>
<td>1.99</td>
<td>2.35</td>
<td>15.00</td>
</tr>
<tr>
<td>Sulphur S %</td>
<td>&lt;0.5</td>
<td>0.70</td>
<td>0.36</td>
<td>0.15</td>
<td>3.532*</td>
<td>0.17</td>
<td>0.21</td>
<td>8.00</td>
</tr>
<tr>
<td>Calcium Ca %</td>
<td>3.0</td>
<td>1.74</td>
<td>4.40</td>
<td>0.52</td>
<td>1.27</td>
<td>0.61</td>
<td>0.64</td>
<td>2.50</td>
</tr>
<tr>
<td>Magnesium Mg %</td>
<td>0.5</td>
<td>0.76</td>
<td>0.80</td>
<td>0.12</td>
<td>0.21</td>
<td>0.19</td>
<td>0.12</td>
<td>1.60</td>
</tr>
<tr>
<td>Carbon C %</td>
<td>&gt;30</td>
<td>22.2</td>
<td>29.0</td>
<td>55.0</td>
<td>38.61</td>
<td>37.49</td>
<td>52.54</td>
<td></td>
</tr>
<tr>
<td><strong>Micronutrients</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Copper Cu mg/kg</td>
<td>60</td>
<td>38</td>
<td>182</td>
<td>27</td>
<td>53.68</td>
<td>41.57</td>
<td>39.08</td>
<td></td>
</tr>
<tr>
<td>Zinc Zn mg/kg</td>
<td>180</td>
<td>250</td>
<td>267</td>
<td>22</td>
<td>107.01</td>
<td>25.81</td>
<td>20.99</td>
<td></td>
</tr>
<tr>
<td>Manganese Mn mg/kg</td>
<td>300</td>
<td>168</td>
<td>634</td>
<td>100</td>
<td>172.19</td>
<td>114.25</td>
<td>37.88</td>
<td></td>
</tr>
<tr>
<td>Iron Fe mg/kg</td>
<td>12,000</td>
<td>11,950</td>
<td>1,692</td>
<td>320</td>
<td>2,508.20</td>
<td>6,240.78</td>
<td>840.62</td>
<td></td>
</tr>
<tr>
<td>Boron B mg/kg</td>
<td>40</td>
<td>8.8</td>
<td>-</td>
<td>4.0</td>
<td>29.18</td>
<td>34.29</td>
<td>34.72</td>
<td></td>
</tr>
<tr>
<td>Silicon Si mg/kg</td>
<td>1,200</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>755.60</td>
<td>742.64</td>
<td>37.86</td>
<td></td>
</tr>
<tr>
<td>Carbon : Nitrogen Ratio units</td>
<td>&lt;25</td>
<td>0.98</td>
<td>-</td>
<td>25.00</td>
<td>8.44</td>
<td>19.56</td>
<td>21.18</td>
<td></td>
</tr>
<tr>
<td>pH (1:5 water)</td>
<td>na</td>
<td>5.0 - 7.5</td>
<td>8.1</td>
<td>8.4</td>
<td>4.6</td>
<td>6.4</td>
<td>7.4</td>
<td>6.3</td>
</tr>
<tr>
<td>Electrical Conductivity (1:5 water) dS/m</td>
<td>No limit</td>
<td>-</td>
<td>-</td>
<td>7.3</td>
<td>28.9</td>
<td>2.2</td>
<td>4.6</td>
<td></td>
</tr>
<tr>
<td>Moisture %</td>
<td>&gt; 25</td>
<td>28.0</td>
<td>-</td>
<td>-</td>
<td>35.0</td>
<td>31.3</td>
<td>37.8</td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**
1. Sample digested with Aqua Regia acid for total nutrients/salts and metals (NOT COMBUSTED PRIOR TO DIGESTION)
2. **ALL ANALYSIS IS DRY WEIGHT** - Samples dried at 60°C for 24 hours prior to fine grinding
3. ppm = mg/Kg; 1% = 10,000 ppm
5. By Calculation:- Crude Protein = %N x 6.25
6. In regard to soil guidelines, geology and soil bedrock typically dictate the 'totals' in soil - Fertiliser programs should not be designed using 'totals'
7. Slight increase in Nitrogen and Sulphur due to sulphate of ammonium runoff from nearby stockpile

Evaluation of Grape Marc as an undervine mulch  p 4
Evaluation of Grape Marc as an undervine mulch

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pink 1</td>
<td>Standard practise (bare undervine) with no mulch addition.</td>
</tr>
<tr>
<td>White 2</td>
<td>100% steam distilled aged grape marc 5cm mulch layer with extra nitrogen application (about 100t/ha of material).</td>
</tr>
<tr>
<td>Blue 3</td>
<td>100% steam distilled aged grape marc 5cm mulch layer (about 100t/ha of material).</td>
</tr>
<tr>
<td>Red 4</td>
<td>100% steam distilled aged grape marc 2-3cm mulch layer (about 40t/ha of material at 400mm wide each side using a 3m row spacing) at 3.6m its about 30t/ha.</td>
</tr>
<tr>
<td>Yellow 5</td>
<td>Blend of 1 part chicken manure and 5 parts grape marc mulch layer 3-5cm mulch layer (about 40t/ha of material at 400mm wide each side using a 3m row spacing).</td>
</tr>
<tr>
<td>Green 6</td>
<td>Nitrogen application only from treatment 2.</td>
</tr>
</tbody>
</table>

**Delivery Method - single delivery sided spreader**

1 indicates no of vines in the panel 1 vine = 2.5m, 2 vines = 5m panel space.
Evaluation of Grape Marc as an undervine mulch

Things that are being conducted and collected during the project

Soil Moisture levels

Soil Moisture Monitoring is being carried out with Sentek system monitoring soil moisture within one replicate of the trial. There are 12 graphs following displaying where the moisture levels are as of Monday the 19th of November.

To date the treatments have the following total soil moisture stored for the top 50cm (data not statically assessed)

<table>
<thead>
<tr>
<th>Colour</th>
<th>Treatment</th>
<th>2-Oct-12</th>
<th>19-Nov-12</th>
<th>Change (mm)</th>
<th>Change %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pink</td>
<td>1</td>
<td>103.8</td>
<td>118.5</td>
<td>14.7</td>
<td>12%</td>
</tr>
<tr>
<td>White</td>
<td>2</td>
<td>123.3</td>
<td>141</td>
<td>17.7</td>
<td>13%</td>
</tr>
<tr>
<td>Blue</td>
<td>3</td>
<td>120.7</td>
<td>164.6</td>
<td>43.9</td>
<td>27%</td>
</tr>
<tr>
<td>Red</td>
<td>4</td>
<td>97.2</td>
<td>107.8</td>
<td>10.6</td>
<td>10%</td>
</tr>
<tr>
<td>Yellow</td>
<td>5</td>
<td>85.8</td>
<td>111.5</td>
<td>25.7</td>
<td>23%</td>
</tr>
<tr>
<td>Green</td>
<td>6</td>
<td>97.8</td>
<td>115.4</td>
<td>17.6</td>
<td>15%</td>
</tr>
</tbody>
</table>

The heavier grape marc application is holding more moisture in the soil than the other treatments to date. We will continue to monitor this through to harvest.

Soil temperature levels

Temperature sensors have been installed in the soil to collect temperature data within the top 10cm of the soil profile. This will be collected and viewed after harvest to understand the effect of the mulch on soil temperature.

Petiole and Soil chemical analysis

Petiole samples have been collected at 80% capfall and sent away for analysis. Unfortunately the results have not yet returned to provide today.

A second set of petiole samples will be collected at veraison to view any changes from flowering to veraison and provide more time from the application of the soil mulch treatments to have an effect on the vines.

Soil samples have been collected from the plots prior to any application of the treatments. Soil samples will be collected after harvest to view changes to the nutrient levels within the soil.

Maturity and Yield Analysis

Fruit maturity will be analysed and quality parameters used commonly will be assessed. The option to look at producing small lot wine batches for the different treatments is being considered. This would allow both growers and winemakers to understand any effects the treatments make to fruit nutrient loads and wine chemistry.

Undervine weed management

Weeds have established under all treatments of the trial. Where thicker grape marc has been applied weeds have been reduced to 1 - 2 plants per metre compared to exposed soil with more than 10 plants per metre.
Treatment 1 (panel 22) - “Standard Practice- bare under vine” (pink)

Sensors summed 10cm + 20cm + 30cm + 50cm + 70cm
Treatment 2 (panel 34) - “Grape Marc 5-7cm layer, extra N” (white)

Sensors summed 10cm + 20cm + 30cm + 50cm + 70cm
Treatment 3 (panel 28) - “Grape Marc 5-7cm layer” (blue)

Sensors summed 10cm + 20cm + 30cm + 50cm + 70cm
Treatment 4 (panel 4) - “Grape Marc 2-3cm layer” (red)

Sensors summed 10cm + 20cm + 30cm + 50cm + 70cm
Treatment 5 (panel 10) - “Chicken Manure & Grape Marc 3-5cm layer” (yellow)

Sensors summed 10cm + 20cm + 30cm + 50cm + 70cm
Treatment 6 (panel 16) - “Nitrogen only” (green)
Sensors summed 10cm + 20cm + 50cm + 70cm (no 30cm)
Treatment 1 (panel 22) - “Standard Practice- bare under vine” (pink)

Sensors separated black 10cm, blue 20cm, green – 30cm, light blue – 50cm, maroon- 70cm, purple/pink – 100cm
Treatment 2 (panel 34) - “Grape Marc 5-7cm layer, extra N” (white)

Sensors separated black 10cm, blue 20cm, green – 30cm, light blue – 50cm, maroon- 70cm, purple/pink – 100cm
Treatment 3 (panel 28) - “Grape Marc 5-7cm layer” (blue)

Sensors separated black 10cm, blue 20cm, green – 30cm, light blue – 50cm, maroon- 70cm, purple/pink – 100cm

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Treatment 4 (panel 4) - “Grape Marc 2-3cm layer” (red)
Sensors separated black 10cm, blue 20cm, green – 30cm, light blue – 50cm, maroon- 70cm, purple/pink – 100cm
Treatment 5 (panel 10) - “Chicken Manure & Grape Marc 3-5cm layer” (yellow)
Sensors separated black 10cm, blue 20cm, green – 30cm, light blue – 50cm, maroon- 70cm, purple/pink – 100cm
Treatment 6 (panel 16) - “Nitrogen only” (green)

Sensors separated black 10cm, blue 20cm, green – 30cm (errors), light blue – 50cm, maroon- 70cm, purple/pink – 100cm
Where to from here…..

Soil Moisture levels
Soil Moisture Monitoring will continue to be monitored during the season through to harvest.

Soil temperature levels
Temperature will be collected and view after harvest to understand the effect of the mulch on soil temperature.

Petiole and Soil chemical analysis
A second set of petiole samples will be collected at veraison to view any changes from flowering to veraison and provide more time from the application of the soil mulch treatments to have an effect on the vines. Soil samples will be collected after harvest to view changes to the nutrient levels within the soil.

Maturity and Yield Analysis
Fruit maturity will be analysed and quality parameters used commonly will be assessed.

Undervine weed management
Spray applications and weed counts will be conducted and assessed to determine differences between treatments.

Soil microbial health
If funds permit we will collect and assess the soil for microbial activity after harvest to review the microbial development under each treatment.

Small lot wine making
Feedback from local producers and winemakers regarding the value to undertake producing small lot wine batches for the different treatments will be appreciated.

We do have options through the NWGIC at Wagga to carry this out, if it is seen valuable to do this.

Feedback is welcome for this project and other or new areas needed to improve viticulture management within the Riverina.

Please speak with myself (Jason) or Kristy Bartrop - Industry Development Officer with the Wine Grapes Marketing Board, to let us know.
Have a look at current project activities in using grape marc undervine plus other works being carried out through local projects and activities, I encourage all grape growers, winery and vineyard operators, and spreading operators to attend!

Update and walk in Grape marc mulch trial site at DPI vineyard

- Bare versus 50t/ha undervine versus 100t/ha undervine
- Discuss what is being done
- Outcomes to be achieved
- See reworked Shiraz vines
- and other vineyard and project activities being conducted locally for vineyard owners through Riverina Grassroots Extension program