Recycled Organics Unit

SUMMARY SPECIFICATIONS

Product Specifications and Application Guidelines for Compost Mulches for Grape Production in NSW

Department of
Environment and Conservation (NSW)

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1 What is composted mulch?

Composted mulch refers to composted products that are used as surface application around plants and are not incorporated into the soil. The general characteristics for composted mulch are defined in the 3rd Edition of Australian Standard AS 4454 for *Composts, Soil Conditioners and Mulches* (Standards Australia, 2003).

Compost is produced from organic materials that have undergone controlled aerobic and thermophilic (hot) biological transformation to achieve pasteurisation and a level of maturity specified in AS 4454. Pasteurisation refers to the thermal destruction of pathogens (disease organisms) and weed seeds that may have been present in the original materials. AS 4454 addresses all general risks that can otherwise be associated with poorly manufactured products sold as "compost" Important to note is that AS 4454 does not specify products to optimise performance for any particular application, that is the purpose of this complementary specification.

A list of bulk compost suppliers in NSW is available
http://www.recycledorganics.com/product/selector/suppliers.htm

2 Purpose of product specifications and application guidelines

These product specifications and application guidelines are targeted at maximising agricultural performance from the application of composted mulches for grape production in NSW. These specifications build upon the Australian Standard AS 4454, and recommend additional specifications for different regional soil and climatic conditions in NSW.

This guide specifies preferred mulch characteristics, application rates and application timing to support growers to select and apply mulch that will deliver performance and value.

3 Benefits of composted mulch

The potential benefits summarised below are achievable only from the proper application of composted mulch products that have suitable chemical, physical and biological characteristics, that are applied at an appropriate rate (i.e. thickness and width of mulch layer) and timing (as related to cropping cycle) as documented in this specification.

Many of the performance benefits arise from the presence of a thick (up to 10 cm) blanket of predominantly coarse woody composted mulch that has been sanitised and biologically stabilised via hot composting. Such characteristics provide a long lasting surface cover, and avoid fundamental risks associated with unprocessed organic amendments and products that have not been effectively pasteurised to destroy weed seeds, plant and human disease organisms, and may contain a range of compounds that are toxic to plants.

Benefit	Benefit range	Reasons for benefit
Reduces weed growth*	60 to 100%	Physical presence of mulch layer on the soil surface suppresses emergence and growth of weeds. Weed suppression improves as the thickness of mulch layer increases, provided particle size grading of mulch meets documented specifications.
Reduces irrigation water use and reduces risk of crop failure*	By 30% or more	Mulch layer reduces solar radiation and wind speed at the soil surface reducing water evaporation. Increase in organic matter improves soil aggregation, porosity and pore size distribution, which results in increased storage of water. Under irrigated conditions these benefits result in more efficient water use and enable reduced irrigation water requirement (irrigation reduction will depend upon climatic conditions, soil types, irrigation system and farm management practices). Under non-irrigated and/or dryland conditions this benefit reduces incidence and degree of plant stress, and reduces the risk of crop failure and increases likelihood of producing market quality crop.
Reduces soil temperature fluctuations*	**Up to 3 degrees**	Physical presence of mulch buffers soil temperatures reducing soil temperature fluctuations. This results in more even soil temperatures which reduces plant stress (benefits of which are documented above).
Reduces soil erosion and nutrient loss*	Up to 100%	Mulch cover protects the soil surface layer from the direct impact of rain and wind, reducing soil erosion compared to bare soil, avoiding associated loss of nutrients, and preventing land degradation.
Improves overall soil health and land productivity.	By 5 to 25%	Composted mulch contains >50% organic matter on dry weight basis. Increase in soil organic matter improves soil aggregation and soil structure; reduces surface crusting and sealing and increases water infiltration of hardsetting surface soils. This also improves water percolation and drainage of heavy clay soil types; and increases water holding capacity and reduces water percolation of sandy soil types.
Provision of nutrients (fertiliser value)	Up to 100% of requirements particularly phosphorus and potassium	Composted mulch contains macro and micronutrients. These nutrients are mainly present in organic form and some in inorganic form. Inorganic nutrients become available immediately while nutrients in organic form are released slowly over time as composted products undergo further microbial decomposition in the soil. The decomposition of organic matter and release of nutrients are influenced by climate, soil types and farm management practices. Nutrients are supplied in a slow release form over 2-4 years, however the highest nutrient contribution is in 1st year. Composts can also make mineral fertiliser programs more effective by reducing nutrient loss through leaching and topsoil erosion. Composted mulch application can significantly replace use of fertilisers particularly phosphorus and potassium. Contribution of mulch nutrient should be accounted for fertiliser applications. Crop and soil nutrient monitoring in accordance with NSW DPI *Fertiliser Replacement Strategy* is required for application of supplementary fertilisers.
Reduce pest and disease incidence	A range of soil borne diseases	Composted mulch increases population, diversity and activity of beneficial microorganisms. This reduces potential for pathogen growth via increased competition for nutrients; predation and parasitism; and induced systematic resistance against diseases in plants. This can reduce incidence and severity of pest/disease and associated risk of crop failure and loss.

*__Note:__ The benefits provided in the table are achieved from the physical presence of a long lasting mulch blanket of up to 10 cm.

4 Soil types

Soils used for grape production in the Hunter and Central West regions are highly variable. Soil types under grape production in these two regions have been arranged into 4 general groups with consideration of relevant soil characteristics of soil texture, soil structure, drainage, water holding capacity and soil fertility. These soil characteristics are important for the selection and application of suitable composted mulch products. Each soil group requires different product specifications and application rate. These readily identifiable general soil groupings are provided below:

- **Moderately structured clay subsoils with hardsetting surface condition-duplex soils (*Soil Group 1*)** – Soils with moderate water holding capacity, moderate permeability and low to moderate soil organic matter (SOM) levels.
- **Well structure clays (*Soil Group 2*)** - Well drained soils with moderate water holding capacity and moderate soil fertility.
- **Rapidly drained and highly permeable sandy soils** (***Soil Group 3***) – Soils with low water holding capacity, high permeability and low to very low SOM.
- **Imperfectly to poorly drained low lying soils (*Soil group 4*)** – Soils with slow permeability, generally sodic, have low to high salinity and prone to waterlogging.

5 Composted mulch specifications for grape production

These product specifications for composted mulch build upon the existing general compost product standard, AS 4454 (Standards Australia, 2003). These specifications are targeted at maximising agricultural performance and grower value specifically for viticulture applications in NSW. These specifications provide

- General product specifications consistent with AS 4454 (Standards Australia, 2003);
- Additional product specifications that are important to maximise agricultural performance for viticulture applications, including
    - particle size grading and application rate;
    - nutrient value and loading rate; and
    - nutrient availability and application timing.

5.1 Product specifications for viticulture application in the Hunter region.

Specifications consistent with AS 4454 (2003)	Units	Limit			
		Soil group 1[1]	Soil group 2[2]	Soil group 3[3]	Soil group 4[4]
pH	-	5.5 to 8.0			
EC	dS m^{-1}	<2 (≤ 1 preferable on sensitive sites)			
Moisture content	% wet weight	>25 (preferably < 50)			
Organic matter	% dry weight	>50			
Plant toxicity	mm	≥60			
Glass, metal and rigid plastics of size greater than >2 mm	% dry matter (w/w)	≤ 0.5			
Plastics light, flexible or film >5 mm	% dry matter (w/w)	≤ 0.05			
Stones and lumps of clay ≥5 mm	% dry matter (w/w)	≤ 5			
Plant propogules/pathogens		Temperature based pasteurisation			
Phylloxera		Compliance with NSW DPI (NSW Agriculture) Compliance Agreement (CA-05) provides assurance that compost products, management and distribution systems are free of Phylloxera risk.			
Chemical contaminants	ppm dry weight basis	Refer NSW EPA Biosolids Guidelines (NSW EPA, 1997) for relevant requirements for agricultural application			
Additional specifications		**Soil group 1[1]**	**Soil group 2[2]**	**Soil group 3[3]**	**Soil group 4[4]**
Particle size grading[5]	mm	15% (<10 mm); 85% (>10 mm); min 45% >16 mm; max 5% (>100 mm) particles.	15% (<10 mm); 85% (>10 mm); min 45% >16 mm; max 5% (>100 mm) particles.	30% (<10 mm); 70% (>10 mm); min 30% >16 mm; max 5% (>100 mm) particles.	Mulch application is not recommended.
Application rate (maximum)[10]	Depth (cm)	7.5	7.5	7.5 to 10.0	
	Width (cm)	50 to 75	50 to 75	50 to 75	
Total N loading[6]	kg/ha	128-**190**[8]	128-**190**	128-**190**	
N content in mulch[7]	% dry weight	(0.4)[7]	(0.4)	(0.3)	
Total P loading	kg/ha	32-48	32-48	43-**64**	
P content in mulch	% dry weight	(0.1)	(0.1)	(0.1)	
Total K loading	kg/ha	**32-48**	**32-48**	**43-64**	
K content in mulch	% dry weight	(0.1)	(0.1)	(0.1)	
Application time	Hunter region	August to September			

[1] **Soil group 1** - Moderately structured clay subsoils with hardsetting surface conditions
[2] **Soil group 2** - Well structured clays
[3] **Soil group 3** - Rapidly drained and highly permeable sandy soils
[4] **Soil group 4** – Imperfectly to poorly drained soils located mainly on low lying areas
[5]Note that <10mm referrs to particles passing though a 10mm sieve, >10mm referrs to particles being retained by a 10mm sieve and >16 mm referrs to particles being retained by a 16 mm sieve.
[6]Total nutrient loading rate in kg per ha. Note this is not the total amount of nutrient available for plant use in first year. Nutrients from compost are released over 2 to 4 years, the highest nutrient release is in the first year.
[7] Nutrient values on % dry weight.
[8]Figures in bold indicate that nutrient loading from mulch application can exceed nutrient application rate commonly applied via growers' fertiliser practices. Excess nutrient, particularly nitrogen can be detrimental for grape production and/or environment. Nutrient loading can be varied by selection of composts with higher or lower nutrient content, and variation in application rate (depth or width). Reduced application width of 30-50cm may be considered to avoid excess nutrient loading .
[9]Whilst nutrient contribution is based on best information available, it will not be accurate for any specific site as release of nutrients will vary with climate and site conditions. It requires normal nutrient monitoring in accordance with DPI *Fertiliser Replacement Strategy* to inform suitable fertiliser application rates for your site.
[10]Agronomic performance would generally prefer application widths of 50-75 cm however reduced widths of 30-50 cm may be more economical for growers.

5.2 Product specifications for viticulture application in the Orange sub-region.

Specifications consistent with AS 4454 (2003)	Units	Limit			
		Soil group 1[1]	Soil group 2[2]	Soil group 3[3]	Soil group 4[4]
pH	-	5.5 to 8.0			
EC	dS m^{-1}	<2 (≤ 1 preferable on sensitive sites)			
Moisture content	% wet weight	>25 (preferably < 50)			
Organic matter	% dry weight	>50			
Plant toxicity	mm	≥60			
Glass, metal and rigid plastics of size greater than >2 mm	% dry matter (w/w)	≤ 0.5			
Plastics light, flexible or film >5 mm	% dry matter (w/w)	≤ 0.05			
Stones and lumps of clay ≥5 mm	% dry matter (w/w)	≤ 5			
Plant propogules/pathogens		Temperature based pasteurisation			
Phylloxera		Compliance with NSW DPI (NSW Agriculture) Compliance Agreement (CA-05) provides assurance that compost products, management and distribution systems are free of Phylloxera risk.			
Chemical contaminants	ppm dry weight basis	Refer NSW EPA Biosolids Guidelines (NSW EPA, 1997) for relevant requirements for agricultural application			
Additional specifications		**Soil group 1[1]**	**Soil group 2[2]**	**Soil group 3[3]**	**Soil group 4[4]**
Particle size grading[5]	mm	15% (<10 mm); 85% (>10 mm); min 45% >16 mm; max 5% (>100 mm) particles.	15% (<10 mm); 85% (>10 mm); min 45% >16 mm; max 5% (>100 mm) particles.	30% (<10 mm); 70% (>10 mm); min 30% >16 mm; max 5% (>100 mm) particles.	Mulch application is not recommended.
Application rate (maximum)[10]	Depth (cm)	7.5	7.5	7.5 to 10.0	
	Width (cm)	50 to 75	50 to 75	50 to 75	
Total N loading[6]	kg/ha	167-**251**[8]	167-**251**	173-**260**	
N content in mulch	% dry weight	(0.45)[7]	(0.45)	(0.35)	
Total P loading	kg/ha	37-56	37-56	50-**74**	
P content in mulch	% dry weight	(0.1)	(0.1)	(0.1)	
Total K loading	kg/ha	**37-56**	**37-56**	**49-74**	
K content in mulch	% dry weight	(0.1)	(0.1)	(0.1)	
Application time	Central West region	September or later			

[1] **Soil group 1** - Moderately structured clay subsoils with hardsetting surface conditions.
[2] **Soil group 2** - Well structured clays.
[3] **Soil group 3** - Rapidly drained and highly permeable sandy soils.
[4] **Soil group 4** – Imperfectly to poorly drained soils located mainly on low lying areas.
[5] Note that <10mm referrs to particles passing though a 10mm sieve, >10mm referrs to particles being retained by a 10mm sieve and >16 mm referrs to particles being retained by a 16 mm sieve.
[6] Total nutrient loading rate in kg per ha. Note this is not the total amount of nutrient available for plant use in first year. Nutrients from compost are released over 2 to 4 years, the highest nutrient release is in the first year.
[7] Nutrient values on % dry weight.
[8] Figures in bold indicate that nutrient loading from mulch application can exceed nutrient application rate commonly applied via growers' fertiliser practices. Excess nutrient, particularly nitrogen can be detrimental for grape production and/or environment. Nutrient loading can be varied by selection of composts with higher or lower nutrient content, and variation in application rate (depth or width). Reduced application width of 30-50cm may be considered to avoid excess nutrient loading .
[9] Whilst nutrient contribution is based on best information available, it will not be accurate for any specific site as release of nutrients will vary with climate and site conditions. It requires normal nutrient monitoring in accordance with DPI *Fertiliser Replacement Strategy* to inform suitable fertiliser application rates for your site.
[10] Agronomic performance would generally prefer application widths of 50-75 cm however reduced widths of 30-50 cm may be more economical for growers.

5.3 Product specifications for viticulture application in the Mudgee sub-region.

Specifications consistent with AS 4454 (2003)	Units	Limit			
		Soil group 1[1]	Soil group 2[2]	Soil group 3[3]	Soil group 4[4]
pH	-	5.5 to 8.0			
EC	dS m^{-1}	<2 (≤ 1 preferable on sensitive sites)			
Moisture content	% wet weight	>25 (preferably < 50)			
Organic matter	% dry weight	>50			
Plant toxicity	mm	≥60			
Glass, metal and rigid plastics of size greater than >2 mm	% dry matter (w/w)	≤ 0.5			
Plastics light, flexible or film >5 mm	% dry matter (w/w)	≤ 0.05			
Stones and lumps of clay ≥5 mm	% dry matter (w/w)	≤ 5			
Plant propogules/pathogens		Temperature based pasteurisation			
Phylloxera		Compliance with NSW DPI (NSW Agriculture) Compliance Agreement (CA-05) provides assurance that compost products, management and distribution systems are free of Phylloxera risk.			
Chemical contaminants	ppm dry weight basis	Refer NSW EPA Biosolids Guidelines (NSW EPA, 1997) for relevant requirements for agricultural application			
Additional specifications		**Soil group 1[1]**	**Soil group 2[2]**	**Soil group 3[3]**	**Soil group 4[4]**
Particle size grading[5]	mm	15% (<10 mm); 85% (>10 mm); min 45% >16 mm; max 5% (>100 mm) particles.	15% (<10 mm); 85% (>10 mm); min 45% >16 mm; max 5% (>100 mm) particles.	30% (<10 mm); 70% (>10 mm); min 30% >16 mm; max 5% (>100 mm) particles.	Mulch application is not recommended.
Application rate (maximum)[10]	Depth (cm)	7.5	7.5	7.5 to 10.0	
	Width (cm)	50 to 75	50 to 75	50 to 75	
Total N loading[6]	kg/ha	124-**185**[8]	124-**185**	134-**200**	
N content in mulch	% dry weight	(0.37)[7]	(0.37)	(0.3)	
Total P loading	kg/ha	33-50	33-50	45-**67**	
P content in mulch	% dry weight	(0.1)	(0.1)	(0.1)	
Total K loading	kg/ha	50-75	50-75	45-67	
K content in mulch	% dry weight	(0.15)	(0.15)	(0.1)	
Application time	Central West region	September or later			

[1] **Soil group 1** - Moderately structured clay subsoils with hardsetting surface conditions.
[2] **Soil group 2** - Well structured clays.
[3] **Soil group 3** - Rapidly drained and highly permeable sandy soils.
[4] **Soil group 4** – Imperfectly to poorly drained soils located mainly on low lying areas.
[5] Note that <10mm referrs to particles passing though a 10mm sieve, >10mm referrs to particles being retained by a 10mm sieve and >16 mm referrs to particles being retained by a 16 mm sieve.
[6] Total nutrient loading rate in kg per ha. Note this is not the total amount of nutrient available for plant use in first year. Nutrients from compost are released over 2 to 4 years, the highest nutrient release is in the first year.
[7] Nutrient values on % dry weight.
[8] Figures in bold indicate that nutrient loading from mulch application can exceed nutrient application rate commonly applied via growers' fertiliser practices. Excess nutrient, particularly nitrogen can be detrimental for grape production and/or environment. Nutrient loading can be varied by selection of composts with higher or lower nutrient content, and variation in application rate (depth or width). Reduced application width of 30-50cm may be considered to avoid excess nutrient loading .
[9] Whilst nutrient contribution is based on best information available, it will not be accurate for any specific site as release of nutrients will vary with climate and site conditions. It requires normal nutrient monitoring in accordance with DPI *Fertiliser Replacement Strategy* to inform suitable fertiliser application rates for your site.
[10] Agronomic performance would generally prefer application widths of 50-75 cm however reduced widths of 30-50 cm may be more economical for growers.

6 Application guidelines

6.1 General

- Composted mulches are applied on the soil surface around vines after planting.
- Avoid application of composted mulches on heavy soil types that are prone to waterlogging.
- Composted mulches can be applied any time of the year. However maximum benefits to vines should be achieved from applications in August to September in the Hunter region, and September or later in the Central West regions.
- Avoid direct contact between mulch and vine as this can result in stem rot.

6.2 Risk avoidance

Excess application rate

- Application of mulches at excessive thickness (>10 cm depth), or application of composts with excessive proportion of fine particles can:
    - Reduce water infiltration into soil,
    - Support weed growth,
    - Suffocate soil, which will have detrimental effect on plant growth, and
    - Increase frost damage (no evidence of risk at ≤10 cm deep application rate).

Excess soil moisture

- Mulch can exacerbate waterlogging of poorly drained soils by reducing soil water evaporation,
- Excess soil moisture from prolonged rainfall can promote excessive vegetative growth in spring, potentially delaying fruiting, and
- Approaching harvest, reduced soil moisture aids development of fruit maturity, the effectiveness of mulch risks delaying fruit maturity by prolonging soil moisture after heavy rain events approaching harvest.

Other

- Excess N can cause problems for fruit maturation and quality. Nitrogen contribution from mulch should be taken into account in nutrient budgeting.
- Composts with high EC levels can cause phytotoxicity and increase soil salinity. EC levels specified for composted mulch avoid risk of increasing soil salinity.
- Temperature based pasteurization required under the Australian Standard (AS4454) destroys pathogens and plant propogules that may be present in raw materials.

7 Integration into farm management practices

The following recommendations are provided to support integration of composted mulch application into annual vineyard management practices. These recommendations are relevant guidance for all vineyards, and all mulch applications:

1. It is suggested that growers start with a small area of application to identify and resolve any issues of application and integration into farm management practices at small scale, and to identify and realise the benefits of reducing irrigation and fertiliser requirements. Growers are encouraged to apply mulch to an area managed as a unique block or row to enable benefits (such as reduced irrigation) to be realised. This enables growers to make informed decisions for subsequent broader application of composted mulch based on financial benefit through reduced inputs, financial benefits due to improved quality and market price, and reduced risk of crop failure.
2. Growers are encouraged to target mulch applications to poor performing areas in the first instance, as mulch application has shown to increase yield and quality even with reduced irrigation application.
3. Whilst the mulch blanket is expected to provide agricultural performance for up to 4 years at higher application depths, the longevity and duration of performance is based on anecdotal evidence rather than applied trials. The performance longevity of mulch will require monitoring over time to quantify value to growers and to confirm optimum reapplication period.
4. Growers commonly reduce or stop irrigation to reduce soil moisture, which assists in maturation of fruit. The period required for reducing soil moisture for vine rows will be different to that required for bare soil. Soil moisture approaching harvest should be monitored to manage soil moisture under mulched rows.
5. Data shows no increase in risk of frost damage at recommended application rates and shows reduced risk of frost damage compared to straw mulch. Growers should report any problems that arise.
6. Estimated nutrient contribution from compost is based on comprehensive review of international literature. The rate of nutrient release from compost will vary due to climate, soils and management practices. It is not suggested that the figures calculated here will be accurate for any specific property, but figures provide a general estimate on basis of current data. Soil testing and/or leaf analysis and normal nutrient monitoring in accordance with NSW DPI Fertiliser Replacement Strategy should continue be used to better inform site specific performance and application of mineral fertilisers.

8 References

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