# Developing Recycled Organic Products for Use in Viticulture

## Market Needs and Sensitivity

Department of
**Environment and Conservation (NSW)**

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Published by:
Department of Environment and Conservation NSW
Sustainability Programs Division
PO Box 644
Parramatta NSW 2124

Ph: (02) 8837 6000
Ph: 131 555 (environment information and publications requests)
Fax: (02) 8837 6099

Email: sustainability@environment.nsw.gov.au
Website: www.environment.nsw.gov.au

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# Executive Summary

In an effort to re-use significant quantities of resources, source-separated organic materials are being diverted from landfill for composting. Although this activity has been supported over the last ten years by local and state governments, the ongoing viability of garden-organics diversion depends on continuing market development for compost products.

Agricultural industries can use recycled organic products as supplements in their production systems. Interest in the use of composts has increased over the past five years with many growers considering these materials for improved soil and water management.

Currently, there is not the necessary demand from agriculture to drive further recovery of organics from waste streams. Creation of further demand from viticulture has been identified as a necessary step in achieving improved waste diversion. Interstate, garden-organics have been used with success in vineyards since 1996. Field-experiments conducted across Australia in a variety of climates, soil types and regions, have demonstrated significant benefits with appropriate quality, application rate and grade of compost.

Identification of the needs and sensitivities of viticultural producers in New South Wales forms part two of a five-stage program being conducted by the Department of Environment & Conservation (NSW). Grape growers in five viticultural regions have participated in a market research study to assist in establishing product specifications for compost products.

Through their associations, viticulturists were invited to attend a seminar on composts for viticulture covering compost for vineyard establishment, vineyard management, problems with inappropriate use, application, quality, field performance, standards and testing. Some 100 participants attended the seminars, completing a total of 76 pre and post-seminar questionnaires surveying their knowledge, needs and sensitivities in using compost.

Results were encouraging with one third of the participants currently using composts. Users identified the main benefits derived from using compost as reduced water use (84%), reduced evaporation (84%), better weed control (68%), increased grape quality (52%) and improved establishment of young vines (40%).

Over one third of users reported no disadvantages in using compost. Other users identified disadvantages with cost, difficulty spreading, availability of quality compost and reliability of delivery. Nearly 90% of current users will continue to use compost, with the remainder undecided. No current user stated they would not use compost in the future.

The two thirds of growers who were *not* compost users identified a lack of information as the main reason, with cost of compost and spreading also strongly identified. When surveyed again after the seminar, 61% of NON-users considered themselves at least likely to use compost in the future, 31% were undecided and 8% would not or were unlikely to use compost. Those who considered themselves “unlikely” or “undecided” identified the major disadvantage being the cost of compost (55%). Concerns over effects on vine vigour, yield and grape quality also rated highly (27%).

For those at least "likely" to use composts, the main reasons given were soil improvement (87%), water retention (78%), weed control (69%), increased soil organic carbon (67%), reduced evaporation (63%) and soil improvement for vineyard establishment (48%).

Overall, the main reasons given by growers for using compost were as a soil improver and for water retention. This may not be surprising given that nearly two thirds of current compost users identified issues with water management and slightly more than one third of NON-users did so. The identified problems were water availability and quality. Soil management problems appeared to be more prevalent than water problems for both compost users and NON-users; especially poor structure (33%), low organic carbon (29%), low biological activity (25%) and poor drainage (18%).

The recurring disadvantages reported by growers were the cost of compost and cost and accessibility of spreading. More information about costs and benefits of using compost needs to be provided for those that were "undecided" or "unlikely" to use compost.

No current users reported having the processor spread or supply machinery for compost application. The majority undertook spreading using their own machinery. Interstate, development of markets for garden-organics has only proceeded where processors have supplied both compost and spreading machinery; processors in New South Wales should consider supplying a complete product "package" of compost and spreading.

A number of other opportunities and potential impediments were also identified:

- Approximately 20% of compost users have organic vineyards. Processors can have their products certified as suitable for use in organic productions systems.
- 28% of growers have a vineyard quarantine program in place. Although processors must hold a Department of Primary Industries Compliance Agreement (CA-05) to supply compost into phylloxera exclusion and risk zones, this should be considered a minimum. Processors should outwardly demonstrate sensitivity to quarantine; delivery trucks and spreaders accessing vineyards must be free from soil and unprocessed organic matter.
- Compost users need to be confident about compost quality, compliance to Australian Standard AS 4454-2003, nutrient content and grade.
- Growers will be sensitive to visual contamination, bad odours, plant-pathogens, weed seeds and excessive temperature of the compost at spreading. They may assume the presence of -visual contamination when any of these factors are present.
- Composts incorporated in the soil will be in close contact with young plant roots and must be of an appropriate quality and grade and used at an appropriate rate. Processors can conduct simple pot tests to ensure compost is not phytotoxic.
- Processors should be prepared to work closely with growers to develop customised blends to address specific vineyard soil and water management needs.

Improved management of vineyard soil, irrigation and establishment were identified by growers as major reasons for using compost. Using these identified market needs and results of field-experimentation by Australian research organisations, the top four potential compost products for viticulture have been developed. The characteristics of these products are:

Compost-Mulch

- Use of inappropriate grade and application rate may have negative or reduced effects.
- Compost used as mulch should have relatively low nutrient levels.
- A mix of fine and coarse compost is most appropriate for surface application.

- Optimal application rate will depend on compost grade. Current recommendations suggest coarser mulches are applied at 50-75 mm, and finer materials at 25-50 mm.

Compost for Soil Conditioning

- Fine materials surface-applied at low rates can provide significant benefits.
- Reduced/negative results have been recorded with high rates (>50mm) of fine materials on the soil surface. High nutrient materials should be used at low rates (<25mm).
- Fine, high nutrient materials will not be suitable as mulches; they may restrict water movement to the soil, add excess nutrients and lead to root growth within the compost.
- Fine composts meeting the Standard for "Soil Conditioner" may be suitable at rates between 10 and 25 mm depth. Composts meeting the Standard for "Fine Mulch" may be appropriate at rates between 25 and 50 mm.
- With its lower application rates processors may be better able to deliver soil conditioning compost to new users at prices which will allow growers to try it.

Compost for Vineyard Establishment

- There is opportunity to offer growers a compost product for vineyard establishment.
- Research has shown benefits with appropriate grade, rate and quality of compost incorporated in the soil at planting. Negative results can occur with inappropriate use.
- Composts of appropriate grade and quality can be incorporated in the soil prior to vineyard establishment at rates that give up to 20-25% concentration in the soil.
- While the benefits of compost incorporated within the topsoil (10-30cm) have been demonstrated, use in the subsoil has not been tested; cautious users may avoid this.

Compost for Nutrient Supply and Mid-Row Management

- Compost can supply nutrients for vine growth. To do this, compost should have a carbon:nitrogen ratio of less than 20:1 and a total nitrogen content of at least 1.5%.
- Nutrient availability will vary depending on soil moisture, pH, temperature, soil organic carbon levels and biological activity. Effects may not be predictable.
- Research suggests fine, mature composts are more likely to be of benefit while coarser, woody composts are more likely to be detrimental.
- Application rates giving a concentration up to 10% may be beneficial and economic for soil incorporation. For broadcasting, lower rates could be used more frequently.

# 1 Introduction

Grape growers in five New South Wales viticultural regions have participated in this market research study to establish appropriate product specifications for source-separated recycled organic products. Identification of the needs and sensitivities of viticultural producers forms part two of a five-stage program being conducted by the Department of Environment & Conservation (NSW) to increase the beneficial use of recycled organic material.

The source-separated organic fraction of domestic and commercial waste streams is being diverted from landfill for composting, and over the past ten years, has been supported by local and state governments and international environmental regulations.

Currently, there is not the necessary demand from agricultural industries for these recycled organic products to drive further recovery of these materials from the waste stream. Creation of further demand has been identified as a necessary step in achieving improvements in waste diversion; the development of sustainable markets for quality recycled organic products manufactured from organic materials is necessary to drive further improvements in the diversion of organic resources from landfill.

Agricultural industries can use recycled organic products as supplements and amendments in their production systems. Interest in the use of composts has increased over the past five years, with many growers considering these materials for improved irrigation management and soil improvement.

Viticulture has been identified as a potential market for recycled organic products; "Studies have identified the viticulture industry as offering the greatest market potential for recycled organics products of any single agricultural sector within 100kms of the Greater Sydney region" (NSW Waste Boards, 1999). Recycled organic products are already being used with success in vineyards, and have been tested in scientific field experiments since 1996. A range of benefits and potential problems have been identified through this research, ie:

- *Soil Moisture* - Results have demonstrated the potential to reduce reliance on irrigation. A surface covering of compost mulch reduces loss of moisture from the soil by evaporation, and reduces fluctuations in soil moisture and temperature (Buckerfield & Webster, 1999). With a compost-mulch under vines, it has been calculated that water use could be reduced by a third. With the biggest inputs of salt often originating in irrigation water, mulch can have a significant impact in reducing soil salinity. Where compost is incorporated in the soil, either mechanically at vineyard establishment, or through the action of soil fauna, increased water-holding capacity can further improve the efficiency of water-used in irrigation.

- *Plant Growth and Yield* - Trunk diameter is a useful measure of plant growth, often correlating with yields. With sufficient measurements, differences related to compost application may be obvious within months. The increased trunk-diameter indicates a more rapid development of young plants and improved performance of established trees and vines. EcoResearch has recorded increased yield in response to compost-mulch on a range of crops including wine and table grapes. Benefit-cost analysis of trials in vineyards has demonstrated returns of

around $2.60 for every $1.00 invested in the mulch for an application 50mm deep (Lindsay *et al*, 2001).

- *Soil Properties* - Changes in water infiltration rate are consistently seen, and rates are often increased two to five times with compost. These results have been demonstrated on a variety of soils, from coarse sands to heavy clays (Buckerfield & Webster, 2003). Changes in soil strength have been seen within twelve months of establishing trials. Reduced soil strength enables plant roots to explore, and make more efficient use of the soil. With the additional carbon food source, compost can increase earthworm abundance and activity in the soil. The beneficial changes in soil structure are often associated with increased earthworm activity, with burrowing and mixing of the soil assisting movement of water and nutrients into the root zone.

- The effects of compost on plants and soils have been largely positive. EcoResearch conducted measures of soil strength, soil moisture, infiltration rate, earthworm activity and trunk diameter on over thirty sites in 2001 (Buckerfield & Webster, 2003). Each of these sites showed a positive response in at least one of the measures.

- But there are also results showing negative or reduced effects with compost (Buckerfield & Webster, 2003). Problems with lower soil moisture, reduced biological activity, increased soil strength, root growth above the soil surface, and effects on plant growth and yield appear to be related to the grade and application rate of the compost mulch.

- Negative or reduced results are likely to be related to the compost grade and application rate (Buckerfield & Webster, 2003). A deep layer of fine organic material is likely to be highly absorbent, and can reduce movement of water into the soil below. Fine materials also provide an alternative soil layer, and roots may establish above the soil surface, where the compost will no longer be acting as a mulch. A fine, deep layer of compost may also affect the burrowing activity of some earthworm species. Fine mulches are also likely to break down more quickly, leaving the soil exposed, and reducing the longevity of the investment in compost as a mulch.

This research and experience from around Australia can now be utilized in New South Wales, where a strategic approach is being taken to increase the beneficial use of recycled organic material through creation of demand from viticulture. This approach is likely to be of particular benefit in New South Wales; where there are unique market concerns over phylloxera quarantine and the distances associated with transporting compost from sources around Sydney to the markets outside of Sydney.

In this stage of the project, a study has been undertaken to determine the specific compost products/packages that growers in New South Wales wine regions would prefer, buy and continue to use, creating a demand for composted garden-organics.

# 2 Methodology

In conducting market research, we have considered that the viticulturists involved may not have had access to the background knowledge required to make informed comment on compost specifications. The approach taken in this study has been to survey growers using a questionnaire, and provide with them with current research and recommendations to evaluate and consider in their opinions.

Five viticulture regions throughout NSW were identified by the Department of Environment & Conservation for inclusion in the study; namely Hawkesbury-Nepean, Southern Tablelands, Hunter Valley, South Coast and Mudgee. Grape growers from within these regions, through their grower associations, were invited to attend a short seminar (ie 90 minutes) on composts for viticulture.

A two-part self-administered questionnaire (refer Appendix 1) was developed to be used at each seminar. The first section was to be completed by each participant at the commencement of the seminar. The seminar was presented lasting approximately 40 minutes plus a question period of 10-20 minutes. Participants were then asked to complete the second section of the questionnaire.

Some 100 participants attended the five seminars; with a total of 76 completed questionnaires returned. It should be noted that there were quite a few people from the same organisations that attended; and hence, only one questionnaire was completed.

During the seminars, the presentations covered topics on compost for vineyard establishment, compost/mulch for vineyard management, problems with inappropriate use of compost, application of composts, compost quality, field performance and compost standards and testing. Copies of slides used are included in Appendix 2.

The completed questionnaires have been collated and analysed and form the basis of the market analysis. Where possible, results are presented in table format to enable readers to quickly interpret them; however, it is not intended that the study is of a quantitative nature.

It should be noted that for some regions, there were relatively small numbers of participants, and therefore the statistical validity of these respondents representing those regions is not implied. However, they can be used as an "indicative" guide rather than "definitive"; and in aggregate, the 76 respondents have provided a valuable insight into the issues associated with composts, composting and recycled organic products within the viticulture industry.

# 3 Outcomes—5 Regional Seminars

As outlined in section 2 Methodology, the questionnaire used during the regional seminars was developed and structured to have two distinct parts. The first part was to be completed by the seminar participants before the seminar; whilst the second part was to be completed after the seminar.

Thus, the results and outcomes that follow shall be in a "Pre-Seminar" and "Post-Seminar" context.

## 3.1 Pre-Seminar

### Viticulturists or Non-Viticulturists

The table below indicates that the majority of seminar participants were grape growers (ie 70 or 92%); however, 6 participants (5 in the South Coast region and 1 in Mudgee) were non-viticulturists.

| Viticulturist or Non-Viticulturist | Hawkes-Nepean (N=13) | | Southern Tableland (N=22) | | Hunter Valley (N=13) | | South Coast (N=12) | | Mudgee (N=16) | | Total (N=76) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No | % | No | % | No | % | No | % | No | % | No | % |
| Viticulturist | 13 | 100 | 22 | 100 | 13 | 100 | 7 | 58 | 15 | 94 | 70 | 92 |
| Non-Viticulturist | - | - | - | - | - | - | 5 | 42 | 1 | 6 | 6 | 8 |
| **Total** | **13** | **100** | **22** | **100** | **13** | **100** | **12** | **100** | **16** | **100** | **76** | **100** |

**Table 1 Viticulturist or Non-Viticulturists by Region**

The non-viticulturists included growers of:

- Olives
- Flowers
- Orchards
- Kiwi fruit

One grape grower in the Mudgee region also produces grapes for the table market, but has been included as a "viticulturist" in the analysis. Specific barriers exist for use of compost in table-grape vineyards; these vineyards often have low trellises, restricting the height of machinery which can be used, and growers are often bound by quality assurance programs with their buyers, and can only use quality assured inputs.

### Area under Production

In looking at the various regions, there are some quite significant differences in the areas under production.

| Hectares | Hawkes-Nepean (N=13) | | Southern Tableland (N=22) | | Hunter Valley (N=13) | | South Coast (N=12) | | Mudgee (N=16) | | Total (N=76) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No | % | No | % | No | % | No | % | No | % | No | % |
| 2 Ha or less | 12 | 92 | 5 | 23 | 1 | 8 | 4 | 33 | - | - | 22 | 29 |
| 3 – 10 Ha | 1 | 8 | 13 | 59 | 1 | 8 | 3 | 25 | 2 | 13 | 20 | 26 |
| 11 – 50 Ha | - | - | 3 | 14 | 6 | 46 | 1 | 8 | 8 | 50 | 18 | 24 |
| 51 – 100 Ha | - | - | - | - | 2 | 15 | 1 | 8 | 3 | 19 | 6 | 8 |
| 100+ Ha | - | - | - | - | 3 | 23 | - | - | 3 | 19 | 6 | 8 |
| Not Indicated | - | - | 1 | 5 | - | - | 3 | 25 | - | - | 4 | 5 |
| **Total** | **13** | **100** | **22** | **100** | **13** | **100** | **12** | **100** | **16** | **100** | **76** | **100** |

**Table 2 Area under Grape Production by Region**

The Hawkesbury-Nepean region comprises predominantly smaller holdings of 2 hectares or less; the Southern Tablelands has "small – medium" areas; Hunter Valley has large areas under production (typically 11-50 Ha or greater); South Coast region was in the "small – medium" category; whilst the Mudgee region comprises large holdings.

*Key Finding*

*Just over half the seminar participants (55%) are "smaller producers" and have areas under production of 10 hectares or less.*

## Type of Grower

In order to determine the particular "types of growers", seminar participants were asked to choose from the choices offered; ie "uncontracted grower"; "contracted grower" or "grow for own winery".

Table 3 contains the results for each region.

| Type of Grower | Hawkes-Nepean (N=13) | | Southern Tableland (N=22) | | Hunter Valley (N=13) | | South Coast (N=12) | | Mudgee (N=16) | | Total (N=76) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No | % | No | % | No | % | No | % | No | % | No | % |
| Uncontracted | - | - | 8 | 36 | 2 | 15 | 4 | 33 | - | - | 14 | 18 |
| Contracted | - | - | 12 | 55 | 1 | 8 | 1 | 8 | 6 | 38 | 20 | 26 |
| Own Winery | 13 | 100 | 1 | 5 | 8 | 62 | 3 | 25 | 6 | 38 | 31 | 41 |
| Contract + Own | - | - | - | - | - | - | 2 | 17 | 3 | 19 | 5 | 7 |
| Other | - | - | 1 | 5 | 2 | 15 | - | - | 1 | 6 | 4 | 5 |
| Not Indicated | - | - | - | - | - | - | 2 | 17 | - | - | 2 | 3 |
| **Total** | **13** | **100** | **22** | **100** | **13** | **100** | **12** | **100** | **16** | **100** | **76** | **100** |

**Table 3 Type of Grower by Region**

Similarly to the previous table, there are differences in the type of grower within particular regions.

All participants from the Hawkesbury-Nepean region grow grapes for their own wineries. In the Southern Tablelands, just over half the growers (55%) are contracted to wineries and about one third (36%) are "uncontracted growers". Participants from the Hunter Valley region grow mainly for their own wineries (62%); whilst on the South Coast region, growers are predominantly "uncontracted" or produce for their own wineries. Nearly all of the Mudgee region participants (94%) are either "contracted" growers (38%), grow for their own wineries (38%) or do both (19%).

"Other" seminar attendees included consultants and sales representatives.

*Key Finding*

*As an aggregate, growers are most likely to be "contracted" to wineries or grow grapes for use in their own wineries.*

## Role within Viticulture Industry

In Table 4, participants at the five regional seminars described their roles as mainly vineyard owners (63%) or vineyard managers (22%). A further six seminar attendees were consultants or technical experts with another 6 of the vineyard owners also describing their roles as consultants.

| Description of Role | Hawkes-Nepean (N=13) | | Southern Tableland (N=22) | | Hunter Valley (N=13) | | South Coast (N=12) | | Mudgee (N=16) | | Total (N=76) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No | % | No | % | No | % | No | % | No | % | No | % |
| Vineyard Owner | 9 | 69 | 18 | 82 | 5 | 39 | 6 | 50 | 4 | 25 | 42 | 55 |
| Vineyard Owner + Consultant | 2 | 15 | 1 | 5 | - | - | 2 | 17 | 1 | 6 | 6 | 8 |
| Vineyard Manager | 1 | 8 | 2 | 9 | 5 | 39 | - | - | 9 | 56 | 17 | 22 |
| Consultant and/or Technical Expert | - | - | - | - | 3 | 23 | 1 | 8 | 2 | 13 | 6 | 8 |
| Other | 1 | 8 | 1 | 5 | - | - | 3 | 25 | - | - | 5 | 7 |
| **Total** | **13** | **100** | **22** | **100** | **13** | **100** | **12** | **100** | **16** | **100** | **76** | **100** |

**Table 4 Role within Viticulture Industry by Region**

The "Other" descriptions included:

- student or trainee (2)
- olive grower
- grove developer
- kiwi fruit grower
- contractor

*Key Finding*

*Almost two thirds of growers participating at the seminars were vineyard owners, with the remainder largely vineyard managers.*

## Currently Using Compost in Grape Production

| Currently using composts | Hawkes-Nepean (N=13) | | Southern Tableland (N=22) | | Hunter Valley (N=13) | | South Coast (N=12) | | Mudgee (N=16) | | Total (N=76) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No | % | No | % | No | % | No | % | No | % | No | % |
| Yes | 2 | 15 | 6 | 27 | 7 | 54 | 4 | 33 | 6 | 38 | 25 | 33 |
| No | 11 | 85 | 16 | 73 | 6 | 46 | 6 | 50 | 10 | 62 | 49 | 64 |
| Not answered | - | - | - | - | - | - | 2 | 17 | - | - | 2 | 3 |
| **Total** | **13** | **100** | **22** | **100** | **13** | **100** | **12** | **100** | **16** | **100** | **76** | **100** |

**Table 5 Use of Compost by Region**

Overall, one third of growers are currently using composts. Two regions that exhibited differing results from the overall total were the Hawkesbury-Nepean region where only 15% of the attendees use composts and the Hunter Valley where 54% of the participants indicated they use composts.

However it should be noted that the statistical significance may not be as robust due to the relatively small number of participants at these regional seminars.

*Key Finding*

*One third of the seminar participants indicated they currently use composts in grape production.*

## Knowledge of Composts and Uses

Prior to each seminar, attendees were asked to rate their knowledge of compost and the use of composts in production using a scale of 1 to 10 (where 1 = little knowledge and 10 = excellent knowledge).

There were four particular attributes, ie:

- quality of compost
- use of compost as a mulch
- use of compost as a soil conditioner
- using composts when establishing vineyards.

For this analysis, the ratings were scaled as follows:

- Low = 1-4
- Medium = 5-7
- High = 8-10.

Quality of Compost

| Knowledge | Users (N=25) | | Non-Users (N=49) | | Not Indicated (N=2) | | Total (N=76) | |
|---|---|---|---|---|---|---|---|---|
| | No | % | No | % | No | % | No | % |
| Low | 6 | 24 | 31 | 63 | - | - | 37 | 49 |
| Medium | 12 | 48 | 16 | 33 | 1 | 50 | 29 | 38 |
| High | 6 | 24 | 2 | 4 | - | - | 8 | 11 |
| Not Answered | 1 | 4 | - | - | 1 | 50 | 2 | 3 |
| **Total** | **25** | **100** | **49** | **100** | **2** | **100** | **76** | **100** |

**Table 6 "Quality of Compost" by Users and Non-Users**

Not surprisingly, those that are current users of compost tended to have a better knowledge on the quality of composts than non-users (ie 72% of users had a "medium-high" level compared to 37% of non-users).

| Knowledge | Hawkes-Nepean (N=13) | | Southern Tableland (N=22) | | Hunter Valley (N=13) | | South Coast (N=12) | | Mudgee (N=16) | | Total (N=76) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No | % | No | % | No | % | No | % | No | % | No | % |
| Low | 7 | 54 | 15 | 68 | 3 | 23 | 5 | 42 | 7 | 44 | 37 | 49 |
| Medium | 6 | 46 | 5 | 23 | 7 | 54 | 3 | 25 | 8 | 50 | 29 | 38 |
| High | - | - | 1 | 5 | 3 | 23 | 3 | 25 | 1 | 6 | 8 | 11 |
| Not Answered | - | - | 1 | 5 | - | - | 1 | 9 | - | - | 2 | 3 |
| **Total** | **13** | **100** | **22** | **100** | **13** | **100** | **12** | **100** | **16** | **100** | **76** | **100** |

**Table 7 "Quality of Compost" by Region**

Table 7 highlights the comparative regional knowledge base for "quality of composts" of both compost users and non-compost users aggregated.

The major point to note is the medium-high knowledge level of Hunter Valley growers at 77% compared to Hawkesbury-Nepean 46%; Southern Tablelands 28%; South Coast 50%; Mudgee 56%.

Compost as Mulch

| Knowledge | Users (N=25) | | Non-Users (N=49) | | Not Indicated (N=2) | | Total (N=76) | |
|---|---|---|---|---|---|---|---|---|
| | No | % | No | % | No | % | No | % |
| Low | 3 | 12 | 28 | 57 | - | - | 31 | 41 |
| Medium | 13 | 52 | 17 | 35 | 1 | 50 | 31 | 41 |
| High | 9 | 36 | 3 | 6 | - | - | 12 | 16 |
| Not Answered | - | - | 1 | 2 | 1 | 50 | 2 | 3 |
| **Total** | **25** | **100** | **49** | **100** | **2** | **100** | **76** | **100** |

**Table 8 "Compost as a Mulch" by Users and Non-Users**

Again, users of compost had a higher level of knowledge for this attribute (86 % had at least a "medium" level) compared to non-users (41 % medium or high).

| owledge | Hawkes-Nepean (N=13) | | Southern Tableland (N=22) | | Hunter Valley (N=13) | | South Coast (N=12) | | Mudgee (N=16) | | Total (N=76) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No | % | No | % | No | % | No | % | No | % | No | % |
| Low | 6 | 46 | 13 | 59 | 2 | 15 | 5 | 42 | 5 | 31 | 31 | 41 |
| Medium | 6 | 46 | 8 | 36 | 6 | 46 | 2 | 17 | 9 | 56 | 31 | 41 |
| High | 1 | 8 | 1 | 5 | 4 | 31 | 4 | 33 | 2 | 13 | 12 | 16 |
| Not Answered | - | - | - | - | 1 | 8 | 1 | 8 | - | - | 2 | 3 |
| **Total** | **13** | **100** | **22** | **100** | **13** | **100** | **12** | **100** | **16** | **100** | **76** | **100** |

**Table 9 "Compost as a Mulch" by Region**

On using compost as a mulch, the Hunter Valley region indicated a higher level of knowledge with some 77% of participants rating their knowledge level at "medium" or "high".

Compost as a Soil Conditioner

| Knowledge | Users (N=25) | | Non-Users (N=49) | | Not Indicated (N=2) | | Total (N=76) | |
|---|---|---|---|---|---|---|---|---|
| | No | % | No | % | No | % | No | % |
| Low | 5 | 20 | 25 | 51 | - | - | 30 | 39 |
| Medium | 12 | 48 | 18 | 37 | 1 | 50 | 31 | 41 |
| High | 8 | 32 | 4 | 8 | - | - | 12 | 16 |
| Not Answered | - | - | 2 | 4 | 1 | 50 | 3 | 4 |
| **Total** | **25** | **100** | **49** | **100** | **2** | **100** | **76** | **100** |

**Table 10 "Compost as a Soil Conditioner" by Users and Non-Users**

Some 80% of users compared to 45% of non-users rated their knowledge of compost as a mulch at "medium" or "high".

| Knowledge | Hawkes-Nepean (N=13) | | Southern Tableland (N=22) | | Hunter Valley (N=13) | | South Coast (N=12) | | Mudgee (N=16) | | Total (N=76) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No | % | No | % | No | % | No | % | No | % | No | % |
| Low | 4 | 31 | 14 | 64 | 3 | 23 | 4 | 33 | 5 | 31 | 30 | 39 |
| Medium | 7 | 54 | 6 | 27 | 7 | 54 | 2 | 17 | 9 | 56 | 31 | 41 |
| High | 1 | 8 | 2 | 9 | 2 | 15 | 5 | 42 | 2 | 13 | 12 | 16 |
| Not Answered | 1 | 8 | - | - | 1 | 8 | 1 | 8 | - | - | 3 | 4 |
| **Total** | **13** | **100** | **22** | **100** | **13** | **100** | **12** | **100** | **16** | **100** | **76** | **100** |

**Table 11 "Compost as a Soil Conditioner" by Region**

Table 11 indicates that for this particular attribute, knowledge levels between the regions were reasonably similar except in Southern Tablelands. In this region nearly two thirds of the participants had little knowledge of the use of compost as a soil conditioner.

Compost for Vineyard Establishment

| Knowledge | Users (N=25) | | Non-Users (N=49) | | Not Indicated (N=2) | | Total (N=76) | |
|---|---|---|---|---|---|---|---|---|
| | No | % | No | % | No | % | No | % |
| Low | 6 | 24 | 22 | 45 | - | - | 28 | 37 |
| Medium | 11 | 44 | 21 | 43 | - | - | 32 | 42 |
| High | 8 | 32 | 4 | 8 | 1 | 50 | 13 | 17 |
| Not Answered | - | - | 2 | 4 | 1 | 50 | 3 | 4 |
| **Total** | **25** | **100** | **49** | **100** | **2** | **100** | **76** | **100** |

**Table 12 "Using Compost for Vineyard Establishment" by Users and Non-Users**

Approximately three quarters of users of compost (76%) rated their knowledge of using composts for vineyard establishment at "medium" or "high" compared to 51% for non-users.

| Knowledge | Hawkes-Nepean (N=13) | | Southern Tableland (N=22) | | Hunter Valley (N=13) | | South Coast (N=12) | | Mudgee (N=16) | | Total (N=76) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No | % | No | % | No | % | No | % | No | % | No | % |
| Low | 3 | 23 | 13 | 59 | 3 | 23 | 5 | 42 | 4 | 25 | 28 | 37 |
| Medium | 9 | 69 | 5 | 23 | 6 | 46 | 2 | 17 | 10 | 63 | 32 | 42 |
| High | 1 | 8 | 4 | 18 | 3 | 23 | 4 | 33 | 1 | 6 | 13 | 17 |
| Not Answered | - | - | - | - | 1 | 8 | 1 | 8 | 1 | 6 | 3 | 4 |
| **Total** | **13** | **100** | **22** | **100** | **13** | **100** | **12** | **100** | **16** | **100** | **76** | **100** |

**Table 13 "Using Compost for Vineyard Establishment" by Region**

For this particular use of compost, both Southern Tablelands and the South Coast regions lagged behind the others. Approximately 59% of the Southern Tableland participants and 42% of those attending the South Coast seminar rated themselves as having a "low" level of knowledge for this particular use of compost.

Comparative Attributes

It should be noted that it was not the intention to try to determine whether participants had a better knowledge of one particular attribute over another.

| Knowledge | Compost Quality | | Compost as Mulch | | Compost as Soil Conditioner | | Vineyard Establishment | |
|---|---|---|---|---|---|---|---|---|
| | No | % | No | % | No | % | No | % |
| Low | 6 | 24 | 3 | 12 | 5 | 20 | 6 | 24 |
| Medium | 12 | 48 | 13 | 52 | 12 | 48 | 11 | 44 |
| High | 6 | 24 | 9 | 36 | 8 | 32 | 8 | 32 |
| Not Answered | 1 | 4 | - | - | - | - | - | - |
| **Total** | **25** | **100** | **25** | **100** | **25** | **100** | **25** | **100** |

**Table 14 Attributes by Level of Knowledge – Users of Compost**

However, in Table 14 (Users of Compost), it was evident that the rating of knowledge on compost as a mulch was somewhat higher than for the other attributes. That is, 88% of current compost users perceived they have a "medium" or "high" level of knowledge of compost used as a mulch compared to compost as a soil conditioner (80% "medium" or "high"); using compost in vineyard establishment (76% "medium" or "high") and compost quality (72% "medium" or "high").

Interestingly, the ranking of the attributes for the current non-users of compost are similar to those of the users of compost; albeit at a lesser proportion (refer Table 15).

The uses in order of rated knowledge ("medium" or "high") are;

- using composts for vineyard establishment (51%)
- compost used as a soil conditioner (45%)
- using compost as a mulch (41%)
- compost quality (37%).

| Knowledge | Compost Quality | | Compost as Mulch | | Compost as Soil Conditioner | | Vineyard Establishment | |
|---|---|---|---|---|---|---|---|---|
| | No | % | No | % | No | % | No | % |
| Low | 31 | 63 | 28 | 57 | 25 | 51 | 22 | 45 |
| Medium | 16 | 33 | 17 | 35 | 18 | 37 | 21 | 43 |
| High | 2 | 4 | 3 | 6 | 4 | 8 | 4 | 8 |
| Not Answered | - | - | 1 | 2 | 2 | 4 | 2 | 4 |
| **Total** | **49** | **100** | **49** | **100** | **49** | **100** | **49** | **100** |

**Table 15 Attributes by Level of Knowledge – Non-Users of Compost**

Thus, future seminars and other methods of communicating information should be structured around the pertinent issues about which users and potential users of composts require knowledge to make informed decisions.

*Key Finding*

*Users of compost rated themselves as having a better knowledge of compost than non-users of compost. Increasing the knowledge level of growers may result in an increase in the number of growers trying compost.*

## Preferred Sources of Information

| Sources of Information | Users (N=25) | | Non-Users (N=49) | | Not Indicated (N=2) | | Total (N=76) | |
|---|---|---|---|---|---|---|---|---|
| | No | % | No | % | No | % | No | % |
| Trade magazines | 13 | 52 | 32 | 65 | - | - | 45 | 59 |
| Seminars | 19 | 76 | 33 | 67 | 1 | 50 | 53 | 70 |
| Wine companies | 2 | 8 | 6 | 12 | - | - | 8 | 11 |
| Own research | 10 | 40 | 21 | 43 | 1 | 50 | 32 | 42 |
| Grower association | 10 | 40 | 25 | 51 | - | - | 35 | 46 |
| Technical experts | 13 | 52 | 23 | 47 | - | - | 36 | 47 |
| Other | 1 | 4 | 3 | 6 | - | - | 4 | 5 |

**Table 16 Preferred Sources of Information – Users and Non-Users**

There appears to little difference between current users and non-users as to how they would prefer to receive information about their industry.

The choices in order of preference are:

- Seminars
- Trade magazines or technical experts
- Grower associations.

| Sources of Information | Hawkes-Nepean (N=13) | | Southern Tableland (N=22) | | Hunter Valley (N=13) | | South Coast (N=12) | | Mudgee (N=16) | | Total (N=76) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No | % | No | % | No | % | No | % | No | % | No | % |
| Trade magazines | 11 | 84 | 18 | 82 | 5 | 38 | 4 | 33 | 7 | 44 | 45 | 59 |
| Seminars | 9 | 69 | 17 | 77 | 11 | 84 | 5 | 42 | 11 | 69 | 53 | 70 |
| Wine companies | 3 | 23 | 4 | 18 | - | - | - | - | 1 | 6 | 8 | 11 |
| Own research | 9 | 69 | 4 | 18 | 5 | 38 | 9 | 75 | 5 | 31 | 32 | 42 |
| Grower association | 6 | 46 | 16 | 73 | 4 | 31 | 2 | 17 | 7 | 44 | 35 | 46 |
| Technical experts | 7 | 54 | 8 | 36 | 7 | 54 | 6 | 50 | 8 | 50 | 36 | 47 |
| Other | - | - | 2 | 9 | 1 | 8 | 1 | 8 | - | - | 4 | 5 |

**Table 17 Preferred Sources of Information by Region**

Table 17 indicates there are some subtle differences within the specific regions with the South Coast participants preferring to do their "own research".

"Other" sources of information included "contractor", "email", "internet" and "school".

*Key Finding*

*Information should be communicated to growers via seminars promoted and facilitated through grower associations, and through trade magazines. There is scope to specifically target and educate technical experts and consultants.*

## Organically Managed Vineyard

Seminar participants were asked whether they manage their vineyards organically. Approximately 20% of users of compost do have organic vineyards compared to 10% of non-users of compost.

| Organic vine-yard | Users (N=25) | | Non-Users (N=49) | | Not Indicated (N=2) | | Total (N=76) | |
|---|---|---|---|---|---|---|---|---|
| | No | % | No | % | No | % | No | % |
| Yes | 5 | 20 | 5 | 10 | - | - | 10 | 13 |
| No | 18 | 72 | 44 | 90 | 1 | 50 | 63 | 83 |
| Other comment | 1 | 4 | - | - | - | - | 1 | 1 |
| Not Answered | 1 | 4 | - | - | 1 | 50 | 2 | 2 |
| **Total** | **25** | **100** | **49** | **100** | **2** | **100** | **76** | **100** |

**Table 18 Organically Managed Vineyard – Users and Non-Users**

| Organic vineyard | Hawkes-Nepean (N=13) | | Southern Tableland (N=22) | | Hunter Valley (N=13) | | South Coast (N=12) | | Mudgee (N=16) | | Total (N=76) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No | % | No | % | No | % | No | % | No | % | No | % |
| Yes | 3 | 23 | 1 | 5 | 1 | 8 | 2 | 17 | 3 | 19 | 10 | 13 |
| No | 10 | 77 | 20 | 91 | 11 | 85 | 9 | 75 | 13 | 81 | 63 | 83 |
| Other comment | - | - | - | - | 1 | 8 | - | - | - | - | 1 | 1 |
| Not Answered | - | - | 1 | 5 | - | - | 1 | 8 | - | - | 2 | 3 |
| **Total** | **13** | **100** | **22** | **100** | **13** | **100** | **12** | **100** | **16** | **100** | **76** | **100** |

**Table 19 Organically Managed Vineyard by Region**

Bearing in mind the relatively small samples for specific regions, Southern Tablelands and Hunter Valley were "lagging" in the proportion of vineyards that are managed organically.

The "Other comment" was from a consultant who has multiple clients of which some do have organic vineyards.

*Key Finding*

*One fifth of compost users (20%) compared to one tenth of non-users (10%) manage their vineyards organically.*

## Vineyard Quarantine Program

| Quarantine program | Users (N=25) | | Non-Users (N=49) | | Not Indicated (N=2) | | Total (N=76) | |
|---|---|---|---|---|---|---|---|---|
| | No | % | No | % | No | % | No | % |
| Yes | 9 | 36 | 12 | 25 | - | - | 21 | 28 |
| No | 15 | 60 | 35 | 71 | - | - | 50 | 66 |
| Other comment | - | - | 1 | 2 | - | - | 1 | 1 |
| Not Answered | 1 | 4 | 1 | 2 | 2 | 100 | 4 | 5 |
| **Total** | **25** | **100** | **49** | **100** | **2** | **100** | **76** | **100** |

**Table 20 Vineyard Quarantine Program – User and Non-User**

Just over one third (36%) of compost users have a vineyard quarantine program whereas this proportion was slightly lower at 25% for non-users of compost. Overall, 28% of growers have a quarantine program.

On a regional basis, Southern Tablelands has a lower proportion of growers that employ a quarantine program.

| Quarantine program | Hawkes-Nepean (N=13) | | Southern Tableland (N=22) | | Hunter Valley (N=13) | | South Coast (N=12) | | Mudgee (N=16) | | Total (N=76) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No | % | No | % | No | % | No | % | No | % | No | % |
| Yes | 4 | 31 | 3 | 14 | 3 | 23 | 3 | 25 | 8 | 50 | 21 | 28 |
| No | 8 | 62 | 18 | 82 | 10 | 77 | 6 | 50 | 8 | 50 | 50 | 66 |
| Other comment | - | - | - | - | - | - | 1 | 8 | - | - | 1 | 1 |
| Not Answered | 1 | 8 | 1 | 5 | - | - | 2 | 17 | - | - | 4 | 5 |
| **Total** | **13** | **100** | **22** | **100** | **13** | **100** | **12** | **100** | **16** | **100** | **76** | **100** |

**Table 21 Vineyard Quarantine Program by Region**

*Key Finding*

*Slightly more than one quarter of growers (28%) have a vineyard quarantine program.*

## Problems with Water Management

Approximately half (51%) of the participants have no issues with water management.

Problems that were experienced include:

- water availability (30%)
- irrigation capacity (17%)
- water quality (15%).

Since 61% of non-users of compost perceived "no issues" with water management, this may help to explain why they do not use compost. Conversely, 64% of compost users identified water management issues.

| Water Management Problems | Users (N=25) | | Non-Users (N=49) | | Not Indicated (N=2) | | Total (N=76) | |
|---|---|---|---|---|---|---|---|---|
| | No | % | No | % | No | % | No | % |
| No issues | 9 | 36 | 30 | 61 | - | - | 39 | 51 |
| Water availability | 10 | 40 | 13 | 27 | - | - | 23 | 30 |
| Cost of water | 3 | 12 | 1 | 2 | - | - | 4 | 5 |
| Water quality | 5 | 20 | 6 | 12 | - | - | 11 | 15 |
| Irrigation capacity | 7 | 28 | 6 | 12 | - | - | 13 | 17 |
| Other | 1 | 4 | - | - | - | - | 1 | 1 |
| Not answered | 1 | 4 | - | - | 2 | 100 | 3 | 4 |

**Table 22 Water Management – Users and Non-Users**

Hawkesbury-Nepean had the highest number of growers (62%) reporting “No issues” with water management. Almost one third of growers (31%) reported a problem with water availability.

Southern Tablelands had the second highest number of growers (59%) reporting “No issues” but just over one quarter (27%) reported problems with water availability.

Both water availability (31%) and water quality (23%) were reported as problems in the Hunter Valley. Less than half (46%) of growers reported “No issues” with water management. Almost one third (31%) of growers reported a problem with the capacity of the irrigation system. This may be related to the large size of vineyards in this region (refer Table 2).

Half of the participants (50%) from the South Coast reported “No issues” with water management. Cost of water was identified as a problem for growers in this region; more so than in other regions.

Of all regions, Mudgee had the lowest number of growers (38%) reporting “No issues”. Almost two thirds of growers in this region had problems. Water availability (44%) and quality (38%) were significant issues in the Mudgee region.

| Water Management Problems | Hawkes-Nepean (N=13) | | Southern Tableland (N=22) | | Hunter Valley (N=13) | | South Coast (N=12) | | Mudgee (N=16) | | Total (N=76) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No | % | No | % | No | % | No | % | No | % | No | % |
| No issues | 8 | 62 | 13 | 59 | 6 | 46 | 6 | 50 | 6 | 38 | 39 | 51 |
| Water availability | 4 | 31 | 6 | 27 | 4 | 31 | 2 | 17 | 7 | 44 | 23 | 30 |
| Cost of water | - | - | - | - | 1 | 8 | 2 | 17 | 1 | 6 | 4 | 5 |
| Water quality | 1 | 8 | 1 | 5 | 3 | 23 | - | - | 6 | 38 | 11 | 15 |
| Irrigation capacity | 2 | 15 | 2 | 9 | 4 | 31 | 2 | 17 | 3 | 19 | 13 | 17 |
| Other | - | - | 1 | 5 | - | - | - | - | - | - | 1 | 1 |
| Not answered | - | - | 1 | 5 | - | - | 2 | 17 | - | - | 3 | 4 |

**Table 23 Water Management by Region**

*Key Finding*

*Nearly two thirds of growers that are current compost users identified some issues with water management; whereas only slightly more than one third of non-users did so.*

## Problems with Soil Management

Soil management problems appear to be more prolific than water management. Overall, nearly two thirds (64%) of participants experience some degree of soil management problems.

| Soil Management Problems | Users (N=25) | | Non-Users (N=49) | | Not Indicated (N=2) | | Total (N=76) | |
|---|---|---|---|---|---|---|---|---|
| | No | % | No | % | No | % | No | % |
| No issues | 8 | 32 | 19 | 39 | - | - | 27 | 36 |
| Poor structure | 8 | 32 | 17 | 35 | - | - | 25 | 33 |
| Poor drainage | 8 | 32 | 6 | 12 | - | - | 14 | 18 |
| Erosion | 2 | 8 | 3 | 6 | - | - | 5 | 7 |
| Permeability | 4 | 16 | 3 | 6 | - | - | 7 | 9 |
| Low biol activity | 8 | 32 | 11 | 22 | - | - | 19 | 25 |
| Low organic carbon | 10 | 40 | 12 | 25 | - | - | 22 | 29 |
| Salinity/sodicity | 5 | 20 | 7 | 14 | - | - | 12 | 16 |
| Other | 2 | 8 | 2 | 4 | - | - | 4 | 5 |
| Not answered | 1 | 4 | - | - | 2 | 100 | 3 | 4 |

**Table 24 Soil Management – Users and Non-Users**

For users of compost, this was slightly higher at 68% than for non-users at 61%.

Users of compost identified the major issues as being low organic carbon, low biological activity, poor structure and poor drainage.

For non-users, the issues of soil management included poor structure, low organic carbon, low biological activity.

| Soil Management Problems | Hawkes-Nepean (N=13) | | Southern Tableland (N=22) | | Hunter Valley (N=13) | | South Coast (N=12) | | Mudgee (N=16) | | Total (N=76) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No | % | No | % | No | % | No | % | No | % | No | % |
| No issues | 5 | 39 | 10 | 46 | 2 | 15 | 4 | 33 | 6 | 38 | 27 | 36 |
| Poor structure | 5 | 39 | 7 | 32 | 6 | 46 | 2 | 17 | 5 | 31 | 25 | 33 |
| Poor drainage | 1 | 8 | 4 | 18 | 7 | 54 | 1 | 8 | 1 | 6 | 14 | 18 |
| Erosion | - | - | 1 | 5 | 3 | 23 | - | - | 1 | 6 | 5 | 7 |
| Permeability | 1 | 8 | 1 | 5 | 4 | 31 | - | - | 1 | 6 | 7 | 9 |
| Low biol activity | 2 | 15 | 3 | 14 | 6 | 46 | 4 | 3 | 4 | 25 | 19 | 25 |
| Low organic carbon | 3 | 23 | 4 | 18 | 7 | 54 | 1 | 8 | 7 | 44 | 22 | 29 |
| Salinity/sodicity | - | - | 2 | 9 | 6 | 46 | 2 | 17 | 2 | 13 | 12 | 16 |
| Other | 1 | 8 | 1 | 5 | - | - | 1 | 8 | 1 | 6 | 4 | 5 |
| Not answered | - | - | 1 | 5 | - | - | 2 | 17 | - | - | 3 | 4 |

**Table 25 Soil Management by Region**

Differences in soil management issues will vary depending on the region and geographic area and may well vary from vineyard to vineyard. The ability of growers to identify and report soil problems may also vary from region to region, in accordance with the degree of education and exposure growers have received on soil management. Growers in larger, more established regions may be better able to identify and report these problems.

Almost 40% of growers in Hawkesbury-Nepean reported “No issues” with soil management. Poor structure (39%), low organic carbon (23%) and low biological activity (15%) were significant issues in this region.

Nearly half of growers (46%) in the Southern Tablelands reported “No issues”. Growers reported poor structure (32%), low organic carbon (18%), poor drainage (18%) and low biological activity (14%) as significant issues.

Hunter Valley growers had the lowest number of growers (15%) reporting “No issues” with soil management. Growers strongly identified as problems all of the soil management issues presented to them. Over half reported low organic carbon and poor drainage as problems (54% respectively); and almost half identified poor structure, low biological activity and salinity/sodicity as problems (46% respectively). Low permeability (31%) and erosion (23%) were other significant issues.

One third of South Coast growers (33%) reported “No issues”. Poor structure (17%) and salinity/sodicity (17%) were the most significant problems identified by growers.

Over one third of Mudgee growers (38%) perceive “No issues” with soil management. A high number of growers reported low organic carbon (44%) as a problem. Poor structure (31%), low biological activity (25%) and salinity/sodicity (13%) were also significant issues.

The types of problems that growers are experiencing with respect to soil and water management in any particular region will have a great bearing on the benefits that composts can provide. Therefore, these issues need to be identified to ensure the growers receive the appropriate information on the benefits of composts.

*Key Finding*

*Both users and non-users of compost identified more problems with soil management than with water management.*

## Reasons for Using Composts

Table 26 below shows the major reasons for using composts as identified by the 25 respondents that are current compost users.

| Reasons for using composts | Total (N=25) | |
|---|---|---|
| | No | % |
| Soil improver | 22 | 88 |
| Water retention | 21 | 84 |
| Increase organic carbon | 20 | 80 |
| Weed control | 16 | 64 |
| Improve soil in vineyard establishment | 13 | 52 |
| Reduce use of other chemicals | 12 | 48 |
| Encouraged by grape buyers to compost | - | - |
| Other | 2 | 8 |

**Table 26 Reasons for Using Composts**

Soil improvement (88%), water retention (84%) and increased organic carbon (80%) were major reasons indicated for using compost.

Some of the other reasons given for using composts included weed control (64%), soil improvement at vineyard establishment (52%) and 48% use it to "Reduce use of other chemicals".

"Other" reasons for using composts were:

- vine stress reduction
- combat fungal root disease (flower grower).

*Key Finding*

*The predominant reasons for using composts relate to soil and water management.*

## Use of Compost as a Supplement or Alternative

Participants that use compost were asked whether they use it as a supplement to other products or as an alternative to other products.

| Supplement or Alternative | Total (N=25) | |
|---|---|---|
| | No | % |
| Supplement | 13 | 52 |
| Alternative | 2 | 8 |
| Both supplement and alternative | 4 | 16 |
| Not answered | 6 | 24 |

**Table 27 Compost as a Supplement or Alternative**

Some 52% use compost as a supplement and 8% use it as an alternative to other products. Those who use compost as an alternative to other products are likely to include the growers that identified themselves as organic producers.

The alternative products for which compost is used as a substitute were chemical fertilisers and inorganic matter.

The "Both supplement and alternative" included:

- fowl manure
- mulch and hay
- water
- fertilisers and soil conditioners.

*Key Finding*

*Composts are used as a supplement rather than an alternative to other products.*

## Spreading Composts

Spreading of composts within a vineyard can be a costly and time-consuming exercise that may preclude its use. Application of composts within a vineyard requires specialist equipment to optimise efficiency and therefore, reduce costs.

| Spreading composts in vineyard | Total (N=25) | |
|---|---|---|
| | No | % |
| Own machinery | 14 | 56 |
| Contract spreader | 6 | 24 |
| Both own machinery and contract spreader | 2 | 8 |
| Spreader supplied by compost processor | - | - |
| Other | 2 | 8 |
| Not answered | 1 | 4 |

**Table 28 Spreading Composts**

A most significant result was that not one of the current users of compost had used machinery supplied by the compost processor to spread the compost within the vineyards.

Eight growers used a contract spreader; however, the majority (14 or 56%) spread compost using their own machinery. The "Other" respondents indicating it was spread "by hand".

A comprehensive analysis on spreading technologies is contained in Section 4.

*Key Finding*

*None of the current compost users had accessed spreading machinery from the compost supplier; most used their own machinery.*

## Benefits of Using Composts

For those that do use composts, the greatest benefits relate to water usage; ie reducing water use and reducing evaporation (ie 84% respectively).

Just over two thirds of compost users (68%) also use it for better weed control.

Seminar attendees also identified major benefits as "increasing quality of grapes" (52%) and "increasing grape yields" (24%).

Another important benefit of compost identified was its use to "improve the establishment of young vines" (40%).

| Benefits of using composts in vineyard | Total (N=25) | |
|---|---|---|
| | No | % |
| Reduce water use | 21 | 84 |
| Reduce evaporation | 21 | 84 |
| Better weed control | 17 | 68 |
| Increase quality of grapes | 13 | 52 |
| Improve establishment of young vines | 10 | 40 |
| Increase grape yields | 6 | 24 |
| Other | 1 | 4 |

**Table 29 Benefits of Using Composts**

*Key Finding*

*Growers perceive that the most beneficial use of compost is to reduce water usage and evaporation.*

## Disadvantages of Using Composts

Whilst benefits of using composts were identified, the other side of the equation is to determine the disadvantages that may exist for compost users.

However, over a third of the compost users, ie 36%, did not identify any disadvantages.

| Disadvantages of using composts | Total (N=25) | |
|---|---|---|
| | No | % |
| No disadvantages | 9 | 36 |
| Some disadvantages | 16 | 64 |
| **Total** | **25** | **100** |

**Table 30 Disadvantages of Using Composts**

For the sixteen compost users (64%) that did identify "some disadvantages", the majority related to increased cost (5); difficulty and time to spread (3); availability of good quality compost and reliable delivery (2).

Other disadvantages noted were:

- use in heavy soils (1)
- too much can slow drying of soils (1)
- not able to use water in wet conditions (1)
- introduces weeds (1)
- frost in high altitudes and high vigour in shiraz (1)
- snakes (1)
- small plants can be smothered (flower grower) (1)

*Key Finding*

*Cost of compost and its application are seen as major disadvantages by users.*

## Continue to Use Compost

Of the 25 compost users, 88% will continue to use compost and 12% are currently "undecided". None of the users have suggested categorically that they will stop using composts in their specific applications.

| **Continue to use composts** | **Total (N=25)** | |
|---|---|---|
| | **No** | **%** |
| Yes | 22 | 88 |
| Undecided | 3 | 12 |
| No | - | - |
| **Total** | **25** | **100** |

**Table 31 Continue to Use Compost**

*Key Finding*

*Compost users are likely to continue to use composts.*

## Reasons for Not Using Composts

Table 32 highlights the reasons that the 49 non-users of compost indicated for not using composts or mulches.

The importance of this table cannot be over-emphasised; for it provides a very good strategic insight into planning future communication strategies.

| Reasons for not using composts | Total (N=49) | |
|---|---|---|
| | No | % |
| Not enough information about composts | 29 | 59 |
| Cost of compost | 28 | 57 |
| Cost of spreading compost | 21 | 43 |
| Excess vigour/late bud burst/frost damage | 13 | 27 |
| Composts not available locally | 12 | 25 |
| Accessibility of spreading compost | 10 | 20 |
| Risk of disease | 10 | 20 |
| Concerns about compost quality | 9 | 18 |
| Other organic products available | 3 | 6 |
| No direct benefits | 1 | 2 |
| Tried before | 1 | 2 |
| Winery does not permit use of composts | - | - |
| Other | 6 | 12 |

**Table 32 Reasons for Not Using Composts**

Firstly, potential compost users do not have sufficient information available to enable them to make informed decisions about using composts (ie 59%). The cost of compost (57%) and its spreading (43%) were other significant reasons given for not using composts.

To a lesser degree, "excess vigour/late bud burst/frost damage" (27%); composts not being available locally (25%); vineyard accessibility for spreading composts (20%); risk of disease attributable to composts (20%) and concerns about the quality of composts (18%) were also cited.

Of the six "Other" reasons given, four relate to costs and benefits, ie:

- overall costs against returns
- have not assessed benefits as yet
- not yet convinced
- need to use it – trial it
- colder soil – later bud burst versus water retention
- a new vineyard.

*Key Finding*

*Non-users of compost lack sufficient information about composts; and associated costs of purchase and spreading are impediments to its use.*

## 3.2 Post-Seminar

As mentioned in the "Methodology" section, there were a series of questions respondents were asked to answer after the seminars had been held. These questions were contained within the green page of the questionnaire.

At this point it should be stated that this section of the questionnaire was not intended to assess either the respondents' knowledge post-seminar, or indeed the information contained within the seminar.

Its major reason is to determine whether the seminar attendees had "fixed" notions and ideas on the use of composts and mulches; or whether they are open to change if presented with relevant information in an appropriate manner.

## Likelihood of Using Composts in Future

Question 23 asked the seminar attendees "Are you likely to use composts … in the next 1-2 years."

For current users, 22 or 88% are at least "likely" to continue to use composts with 2 (8%) undecided and 1 person "very unlikely". It should be noted that on further checking of this respondent's questionnaire, it appeared that they were not dissatisfied with using composts, but having applied it recently, were unlikely to apply composts within the next 1-2 years.

| Likelihood of using composts | Users (N=25) | | Non-Users (N=49) | | Not Indicated (N=2) | | Total (N=76) | |
|---|---|---|---|---|---|---|---|---|
| | No | % | No | % | No | % | No | % |
| Very unlikely | 1 | 4 | 1 | 2 | - | - | 2 | 3 |
| Unlikely | - | - | 3 | 6 | - | - | 3 | 4 |
| Undecided | 2 | 8 | 15 | 31 | - | - | 17 | 22 |
| Likely | 7 | 28 | 21 | 43 | 1 | 50 | 29 | 38 |
| Very Likely | 15 | 60 | 9 | 18 | 1 | 50 | 25 | 33 |
| **Total** | **25** | **100** | **49** | **100** | **2** | **100** | **76** | **100** |

**Table 33 Likelihood of Using Composts in the Future – Users and Non-Users**

For the 49 non-users of compost, 61% (ie 30) indicated they are at least "likely" to use composts in the near future; and 31 % or 15 are "undecided". Viewed from the opposite perspective, only 4 non-users (8%) are "unlikely" to use composts.

This "conversion rate" whilst it should only be considered as indicative rather than definitive, is most heartening and re-iterates the point made earlier regarding providing relevant information in the appropriate manner to enable people to make informed decisions.

| Currently using composts | Hawkes-Nepean (N=13) | | Southern Tableland (N=22) | | Hunter Valley (N=13) | | South Coast (N=12) | | Mudgee (N=16) | | Total (N=76) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No | % | No | % | No | % | No | % | No | % | No | % |
| Yes | 2 | 15 | 6 | 27 | 7 | 54 | 4 | 33 | 6 | 38 | 25 | 33 |
| No | 11 | 85 | 16 | 73 | 6 | 46 | 6 | 50 | 10 | 62 | 49 | 64 |
| Not answered | - | - | - | - | - | - | 2 | 17 | - | - | 2 | 3 |
| **Total** | **13** | **100** | **22** | **100** | **13** | **100** | **12** | **100** | **16** | **100** | **76** | **100** |

**Table 34 Use of Compost by Region**

| Likelihood of using composts | Hawkes-Nepean (N=13) | | Southern Tableland (N=22) | | Hunter Valley (N=13) | | South Coast (N=12) | | Mudgee (N=16) | | Total (N=76) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **No** | **%** | **No** | **%** | **No** | **%** | **No** | **%** | **No** | **%** | **No** | **%** |
| Very unlikely | 1 | 8 | 1 | 5 | - | - | - | - | - | - | 2 | 3 |
| Unlikely | - | - | 2 | 9 | - | - | - | - | 1 | 6 | 3 | 4 |
| Undecided | 3 | 23 | 8 | 36 | 3 | 23 | - | - | 3 | 19 | 17 | 22 |
| Likely | 5 | 39 | 10 | 46 | 3 | 23 | 4 | 33 | 7 | 44 | 29 | 38 |
| Very Likely | 4 | 31 | 1 | 5 | 7 | 54 | 8 | 67 | 5 | 31 | 25 | 33 |
| **Total** | **13** | **100** | **22** | **100** | **13** | **100** | **12** | **100** | **16** | **100** | **76** | **100** |

**Table 35 Likelihood of Using Composts in the Future by Region**

Tables 34 and 35 enable comparisons to be made on a regional basis; particularly when comparing the number of non-users pre-seminar to "unlikely" to use post-seminar.

For example, in the Hawkesbury–Nepean region, 11 seminar attendees did not use compost; but post-seminar only 1 indicated they were unlikely to use it. In Southern Tablelands, 16 did not use compost but 3 are unlikely to use and 8 are undecided. The South Coast region has exhibited a very good "conversion"; with 6 seminar participants not using compost pre-seminar; and all 12 at least likely to use composts in the future.

Overall, 54 participants (ie 71%) are likely to use composts.

*Key Finding*

*Providing relevant information in the appropriate manner, about compost, its uses and benefits is likely to persuade non-users to evaluate its overall benefits.*

## Reasons Likely to Use Compost

The above 54 seminar participants are likely to use composts in the future for the following reasons.

| Reasons will use composts | Total (N=54) | |
|---|---|---|
| | **No** | **%** |
| Soil improver | 47 | 87 |
| Water retention | 42 | 78 |
| Weed control | 37 | 69 |
| Increase organic carbon | 36 | 67 |
| Reduce evaporation | 34 | 63 |
| Improve soil in vineyard establishment | 26 | 48 |
| Increased quality | 25 | 46 |
| Increased yields | 22 | 41 |
| Reduce use of other chemicals | 20 | 37 |
| Encouraged by grape buyers to compost | 2 | 4 |
| Other | 3 | 6 |

**Table 36 Reasons Likely to Use Composts – Likely and Very Likely Users**

The "Other" responses included:

- manage wastes from olive press
- reduce soil temperature
- increased vigour.

*Key Finding*

*Compost is likely to be used as a soil improver and to reduce water usage.*

## Factors Contributing to Quality of Compost

If grape growers (and other horticultural producers) are to be encouraged to use composts, then compost processors should be aware of the particular factors that users perceive do contribute to the overall quality of compost.

| Factors contributing to quality of composts | Total (N=54) | |
|---|---|---|
| | No | % |
| Comply with Australian Standard AS 4454 | 27 | 50 |
| Macro-nutrient analysis (N, P, K) | 26 | 48 |
| Compost texture | 24 | 44 |
| Full analysis (including contaminants) | 20 | 37 |
| Compost smell | 20 | 37 |
| Organic certification (NASAA or BFA) | 17 | 32 |
| Compost appearance | 10 | 19 |
| Other | 1 | 2 |
| Not answered | 1 | 2 |

**Table 37 Factors Contributing to the Quality of Compost – Likely and Very Likely Users**

*Key Finding*

*Users need to be confident about the quality of compost, its compliance with Australian Standard AS 4454-2003, its macro-nutrient analysis and the suitability of the compost texture for the purpose.*

## Benefits of Using Compost

Table 38 below indicates the benefits of using composts that were identified by those participants likely to use compost.

| Benefits of using composts | Total (N=54) | |
|---|---|---|
| | No | % |
| Water retention/reduce evaporation | 41 | 76 |
| Soil improvement | 28 | 52 |
| Weed control | 18 | 33 |
| Increase in organic carbon/organic matter/soil nutrients/ biological activity | 17 | 32 |
| Increase plant/fruit/vine quality | 5 | 9 |
| Reduce chemicals | 4 | 7 |
| Increased yields/manage berry size | 3 | 6 |
| Decrease soil surface temperature | 2 | 4 |
| Good for establishment/young vines | 2 | 4 |
| Other | 9 | 17 |
| Not answered | 6 | 11 |

**Table 38 Benefits of Using Composts – Likely and Very Likely Users**

This table can be compared to Table 29 on page 22 in which only current users of compost identified the benefits.

An important difference in the two tables is that post-seminar, compost as a soil improver has been identified as a major benefit; along with increases in organic carbon/organic matter/soil nutrients/biological activity.

The "Other" benefits identified were:

- mulch effect
- less stress in late January
- reduce soil borne disease
- reduction in vine competition.
- pH balancer
- less expensive in time
- increase vigour

*Key Finding*

*Post-seminar, participants perceive water retention and soil improvement as prime benefits of using compost.*

## Disadvantages of Using Compost

Similarly to identifying benefits, those participants likely to use compost in the future were asked to identify disadvantages or problems when using composts.

Table 39 below lists the disadvantages nominated and can be compared to Table 30 on page 22.

| Disadvantages of using composts | Total (N=54) | |
|---|---|---|
| | No | % |
| Cost of compost | 24 | 44 |
| Access for spreading and application | 10 | 19 |
| Cost of spreading and application | 9 | 17 |
| Availability of compost | 8 | 15 |
| Availability of spreading equipment | 6 | 11 |
| Excess vigour/increase yield/overcropping | 6 | 11 |
| Frost | 5 | 9 |
| Risk of disease/spread phylloxera | 5 | 9 |
| Nutrient composition unknown | 3 | 6 |
| Contaminants/toxins/heavy metals | 3 | 6 |
| Variable/poor quality | 2 | 4 |
| Water logging/soil moisture | 2 | 4 |
| Root growth at soil surface | 1 | 2 |
| Other | 15 | 28 |
| No disadvantages | 1 | 2 |
| Not answered | 7 | 13 |

**Table 39 Disadvantages of Using Composts – Likely and Very Likely Users**

The three most prevalent disadvantages were cost of compost (44%); accessibility for spreading compost (19%) and cost of spreading or applying composts (17%). These disadvantages were also identified in Table 30.

Some 15% of participants who were at least "likely" to use compost also considered its lack of availability to be an impediment.

The fifteen (15) "Other" responses included:

- re-applications
- vermin or snakes
- introduces weeds and weed seeds (2)
- soil composition
- mulch depth
- roots/worms in compost
- wind stability
- decreased quality
- problems planting juvenile plants (wildflowers)
- smell for neighbours
- incorrect application
- too little or too much
- area too vast.

*Key Finding*

*The disadvantages of using compost were seen to be the cost of compost and spreading, access to the vineyard for spreading and lack of compost availability.*

## Further Information for Decision Making

In Table 33, there were a total of 22 participants that were either "undecided" (17), "unlikely" (3) or "very unlikely" (2) to use composts in the near future.

The questionnaire was structured to enable this group to nominate further information they would require to enable them to make an informed decision about using composts.

This is tabulated in Table 40 on the following page.

| Further information required | Total (N=22) | |
|---|---|---|
| | No | % |
| Cost of compost | 15 | 68 |
| Cost of spreading compost | 12 | 55 |
| Grades of compost | 8 | 36 |
| Risk of disease | 8 | 36 |
| Quality assurance of compost | 7 | 32 |
| Type of composts | 7 | 32 |
| Rate of application of compost | 6 | 27 |
| Benefits of composting | 3 | 14 |
| Other | 3 | 14 |
| Not answered | 3 | 14 |

**Table 40 Further Information Required – Unlikely and Undecided Users**

Again, we see costs of purchasing and applying composts were the two major issues.

Future users also require more practical information. After costs, the major issues identified were grades of compost, risks of disease, quality of compost and types of compost.

The "Other" responses were:

- cost-benefit analysis
- need in a given season
- grape quality for winemaking

*Key Finding*

*To convince those growers that are "undecided" or "unlikely" to use composts, more information needs to be provided about the costs, potential risks and the practical aspects of using it.*

## Disadvantages of Using Composts

The most prevalent disadvantages identified by the "undecided" and "unlikely" subset were cost of composts, impacts on vigour/yield/grape quality, availability of composts and cost of spreading.

| Disadvantages of using composts | Total (N=22) | |
|---|---|---|
| | No | % |
| Cost of compost | 12 | 55 |
| Vigour/yield/grape quality | 6 | 27 |
| Availability of compost | 5 | 23 |
| Cost of spreading | 5 | 23 |
| Availability of spreading equipment | 2 | 9 |
| Quality assurance of compost | 1 | 5 |
| Other | 9 | 41 |
| No disadvantages | 1 | 5 |
| Not answered | 3 | 14 |

**Table 41 Disadvantages of Using Composts – Unlikely and Undecided Users**

"Other" disadvantages included:

- removal if soil is too wet
- convincing the boss
- lack of correct information
- too much K
- don't know what is needed (2)
- soil is conditioned in other ways
- frost
- soil temperature retarded.

## Encourage Use of Compost

As a concluding question, all seminar participants were asked what would encourage them to use composts.

| Encourage use of composts | Total (N=76) | |
|---|---|---|
| | No | % |
| Cost of compost | 17 | 22 |
| Information on benefits | 11 | 15 |
| Availability of compost | 9 | 12 |
| Availability of spreading equipment | 7 | 9 |
| Cost of spreading and application | 6 | 8 |
| Meets industry standards/quality assurance | 4 | 5 |
| Quality/health of vines | 4 | 5 |
| Disease/pollutants/certification | 3 | 4 |
| Water restrictions | 2 | 3 |
| Other | 9 | 12 |
| Not answered | 31 | 41 |

**Table 42 Encourage Use of Composts – Users and Non-Users**

Table 42 comprises the results which have been listed previously.

The nine "Other" responses included:

- test to see results in small area
- reduced ripening period
- improved yields, water saving, less irrigation
- proven efficiency with weed control, soil disease control, reduction in water
- aim to improve uniformity
- reduced chemical use
- advice where applicable
- vine decline
- use on poor producing vines – if winery allows increase yield

*Key Finding*

*Growers will be encouraged to use composts if provided with more information about its costs and benefits.*

### 3.3 Worthy Comments

Some participants at the seminars took the time to include some additional comments with their questionnaires.

Below is a selection of the comments that are relevant to this project.

- "I had a quote when I established my vineyard … $14,000 for the mulch and no way of applying it except by hand … it was out of the question."
- "More detailed understanding of type and amount of mulch to apply."
- "Correct information on type and application rates to enable a good proposal for spending the money to my management."
- "Tangible proof of economic advantage."
-

# 4 Compost Spreading Technologies

One of the recurring issues that has been identified in this research is the cost of spreading composts within the vineyards. Growers identified problems with spreading as an impediment to the use of composts.

Around two thirds of current users (64%) thought there were some disadvantages in using composts (Table 30) and identified "difficulty and time to spread" as a disadvantage. In fact, the third most commonly cited reason (43%) for not using composts was the cost of spreading (Table 32). Growers who considered themselves "likely" to use composts in the future identified problems with spreading as important disadvantages (Table 39). Of the growers who considered themselves "unlikely to use composts" 55% required further information on the costs of spreading to be able to further consider using compost (Table 40).

However, only some 25% of respondents had used a "contract spreader"; with the majority of growers either using their own machinery (56%); and in two cases, "spreading by hand".

Notably, none of the current users used machinery supplied by the processor. Interstate, large-scale sales of compost only began to progress once processors built or bought machinery specifically for spreading compost.

In time, the growth of compost sales would possibly encourage contract spreaders and farm machinery operators to acquire appropriate machinery and supply contract spreading services. Interstate, several years after processors began providing machinery, other contractors who had offered services spreading straw mulch and bulk amendments such as lime, gypsum and manures, added compost spreading machinery to their services.

Few growers own machinery designed for spreading compost, so it is likely that the 56% of growers using their own machinery are dealing with the frustrations of inadequate equipment. General purpose spreaders may do an adequate job of spreading finely textured composts, but for coarser materials, such as those used for compost-mulches, growers are likely to be frustrated.

Anecdotally, growers from around Australia have reported to EcoResearch the difficulties in using unspecialized machinery for spreading. It is common for compost to "bridge" in the spreader, and it can cease flowing. Coarse materials can jam augers. Often, these problems are solved by having someone to ride in the spreader and "jump up and down" to move the compost through. Growers are aware that this is potentially a dangerous practice. Difficult experiences in spreading can be enough to deter growers from using compost. On the other hand, with machinery specifically designed to carry and spread composts of fine through to coarse grades, and an experienced operator to set-up, adjust and perform the spreading, the task can appear to be easy and efficient.

By its very nature, composts and mulches can be difficult materials to handle, but compounding this, is the confined areas in which composts need to be applied. Row spacings in vineyards are typically 3.0–3.5 metres, but in newer vineyards this has been reduced. For table grape producers, trellising is used to support vines, and thus there will be some restrictions on height.

Efficient and effective spreading will reduce the overall cost of composting and thereby enhance the cost-benefit ratio. Furthermore, design of a spreader that enables multi-purpose use will be more attractive to contractors and vineyard owners.

Discussions have been held with compost processors, a spreading contractor and vineyard equipment manufacturer to identify the essential requirements of an ideal spreader and hence, determine the optimum specifications for manufacture.

The table below highlights the features of an "ideal" spreader along with the relevant benefits.

| Feature | Benefits |
|---|---|
| Appropriate width, height and length of spreader | • Optimum width to enable access into newer vineyards that have narrower rows.<br>• Height to prevent damage to overhead trellises, vines or canopy if used in orchards. Also to ensure centre of gravity is kept relatively low to reduce risk of rolling over, particularly on inclines or uneven slopes.<br>• Length of spreader optimised to provide volume of load but a tight turning circle at end of rows. |
| Adaptation of extensions to sides of spreader | • Increase volume of spreader without restricting access or safety, especially centre of gravity. |
| Hopper design | • Needs to have vertical or near vertical sides to prevent "bridging" of composts or mulches; particularly those with a higher moisture content.<br>• Maximise volume of hopper for minimum external dimensions. |
| Volume of hopper | • Need to maximise volume to minimise time spent driving through rows without composts.<br>• Total weight needs to be commensurate with power of towing tractor.<br>• Load should not cause compaction of soil. |
| An agitator or auger fitted | • Agitator or auger will prevent "bridging" and ensure there is a constant volume delivered from hopper. |
| Moving floor in hopper | • Moving floor to be full width of hopper to enable movement of compost to delivery belt.<br>• Moving floor speed be variable to adjust volume of delivery.<br>• Speed to be adjusted from cabin of tractor. |
| Spreading belt | • Should be at front of spreader for ease of monitoring from tractor cabin.<br>• Belt should be variable speed to adjust volume of delivery.<br>• Speed to be adjusted from cabin of tractor. |
| Double or single sided delivery | • Double-sided delivery should be available, however a mechanism should be fitted to allow single-sided delivery (either side). |
| Rear "spinners" available | • Spreader would be more versatile if rear "spinners" are fitted to enable rear spreading of fertilisers etc. |

**Table 43 Features and Benefits of a Compost Spreader**

Ideally, a spreader should be versatile enough to deliver various products within a vineyard with maximum efficiency and minimum adjustment.

Two manufacturers of spreaders that were mentioned during the discussions were "Seymour" from Victoria and "Nu Farm" from Western Australia.

Processors should consider acquiring specialized compost spreading machinery for use by customers. Market development is unlikely to progress until growers can access suitable machinery.

*Key Finding*

*Compost processors should supply compost and spreading machinery as a complete product "package" for viticulturists.*

# 5 Product Specifications

The project has been undertaken to develop recommendations for the top four potential uses and applications for recycled organics in viticulture, to identify both compost specification (grade and maturity) and vineyard applications.

Four product specifications have been developed; compost-mulch, soil conditioner, compost for vineyard establishment and compost for nutrient supply and mid-row management. These specifications, along with additional recommendations on organic certification, spreading and vineyard quarantine are outlined below. The additional recommendations help to form a product "package" that can meet grower requirements and draw on the important factors in market development for composts.

### Product 1 - Compost-mulch

The use of compost-mulch for water saving was strongly identified by growers as a reason to use compost and one of the major benefits of doing so:

- 88% of compost users rated their knowledge of using compost-mulch as medium to high, and 41% of non-users rated themselves medium to high (Table 8).
- Half of the number of growers reported water management problems, with water availability, water quality, water costs and inadequate capacity of the irrigation system identified as the more common problems (Table 22).
- Problems with water management were most identified by growers in the larger regions of Hunter Valley and Mudgee (Table 23).
- Pre-seminar, when asked to identify the main reasons for using composts, use for water saving was chosen by 84% of growers (Table 26).
- Post-seminar, those growers who considered themselves likely to use composts identified water saving and reduction of evaporation as significant reasons to do so (Table 36).
- Growers identified that the major benefit of using compost was for water saving (Table 38).

The use of compost-mulch has been extensively researched across Australia, with largely positive results. Field experiments with compost-mulch have demonstrated potential irrigation savings in mature vineyards of 20-30%. In young vines, mulches have moderated fluctuations in soil moisture and temperature, allowing improved conditions for root growth and ability of the vine to withstand periods of extreme stress.

Compost-mulch has demonstrated the potential for increased yield and quality, increased growth of young vines, improved soil structure and increased biological activity. These results have been widely reported to grape growers (Buckerfield & Webster, 1998, 1999, 2000, 2001b, 2002, Webster, 2003, Wilkinson, 2001). Negative or reduced results with compost-mulch have been instructive in determining how to make mulches work. There is far too much data to permit a comprehensive presentation of the field-experimentation, but examples of the more instructive results include:

- Continued monitoring of trials for five consecutive harvests showed continuing responses to a 75mm compost-mulch applied once only to eighteen month old vines (Buckerfield & Webster, 2001b). Higher yields were recorded from the treated vines, without detriment to grape quality. Over five years, treated vines had yielded 40% more than non-mulched vines, or 66.6t/ha compared to 48.5t/ha. In addition, there were significant improvements in soil properties, with higher infiltration and water-holding capacity and reduced soil-strength. Trunk diameter increases correlated closely with yield increases. Positive responses were also seen with a 150mm mulch, but were less than the responses seen with the lower 75mm rate. Over the five years, the vines with 150mm mulch yielded 10% less than those with 75mm mulch, yet cost twice as much to apply. The results of this early trial first signalled the potential to identify optimal application rates and prompted the question “how much is too much?”
- Experiments in table grapes in Western Australia have also demonstrated the importance of application rate and grade (Buckerfield & Webster, 2001c). Yield four months after application of a relatively fine compost-mulch had significantly increased with higher rates, increasing by more than 15% with 100mm of compost-mulch. But at the second harvest, yield with the 100mm compost-mulch was not significantly different from the control. The reduced effect may be related to the depth and grade of the compost. Measures of soil moisture during winter showed that less water was held in the soil as application rate increased. High application rates of a fine compost reduced movement of water to the soil, and gave no further benefit over lower application rates.
- Further evidence of the importance of compost grade was seen in a field experiment with two grades of compost-mulch applied to newly planted vines (Buckerfield & Webster, 2003). Vine height was increased over 25% with 50mm of coarse compost-mulch three months after application. But a 50mm application of fine compost did not significantly increase vine growth, and yet was considered a more costly, mature and “higher quality” compost.

Problems with lower soil moisture, reduced biological activity, increased soil-strength, root growth above the soil surface and negative or reduced effects on plant growth and yield appear to be related to the grade and application rate of compost-mulch. A deep layer of fine organic matter on the soil surface is likely to be highly absorbent, and can reduce movement of water into the soil below. In using compost-mulch, the key to getting the best and most economical results is to apply the material at the optimum application rate, given its grade.

Fine materials provide an alternative soil layer, and roots may establish within the mulch above the soil surface where the compost will no longer be acting as a mulch. Fine materials often have a higher nutrient content, which can further encourage root growth within the mulch, and allow vines sudden access to a large source of nutrients, which the grower can’t control. At worst, this may reduce productivity of the vines.

Growers maintain a balance of nitrogen, potassium and phosphorous to encourage flowering and fruit set. Where a fine, high nutrient compost was used in apples, treated trees failed to produce fruit.

**Product Specifications – Compost-Mulch**

Compliance with the "Mulch" specifications of the Australian Standard (Standards Australia, 2003) should ensure that compost-mulch adheres to the minimum quality requirements of growers:

- Visual contamination not evident – growers are most likely to question the quality and safety of composted organic materials where there is a visual reminder that the material is derived from "waste". Processors should seek to at least comply with the Standard.
- Free of pathogens and plant propagules – compost must be free from plant disease and plant propagules to be acceptable in commercial horticulture. Processors should extend this requirement to the delivery trucks and spreading machinery which access the vineyard.
- Free of bad odours – growers are more likely to question the quality of the composting process if the compost is hot, steaming and odorous.
- Stabilized – sound composting practices must be employed to ensure the material is stabilized, and to minimize reheating during transport and excessive heat at spreading. Growers are suspicious of "hot" compost, and may readily associate the death of young vines with the compost.

Results suggest that a mix of fine and coarse compost is most appropriate for surface application. The finer fraction is readily incorporated into the soil through biological activity, while the coarser materials persist, providing surface protection. A single application of coarse compost-mulch may continue to provide benefits without re-application for three to five years. The longevity of the compost will affect its economic value.

To meet the Australian Standard, a compost mulch must have at least 70% (by weight) of the material retained on a 16mm sieve. EcoResearch has previously suggested a definition (Webster & Buckerfield, 2002b) where no more than one third passes through a 10mm sieve, and at least one third is retained on a 25mm sieve (by volume); this is probably a much coarser definition, and requires a high component of coarse material. It is this coarse component which persists on the soil for years, prevents the compost binding together in a dense layer on the soil, discourages root growth in the mulch, and encourages movement of air and water through the mulch.

Few processors are currently able to produce this grade of compost. Problems with visual contamination of garden organics from suburban collections are currently solved by screening the compost, and though meeting the Standard, the resulting compost may be of a finer than ideal grade. Results suggest that these materials may be perform well at lower rates, but effects are reduced at higher rates.

Certainly, further work is required to determine appropriate definitions of grade for compost-mulches. Ideally, we would have an index where composts were classified by their density and proportions of material within particle size ranges, and recommended application rates were given for each class.

Current recommendations on application rate suggest that coarse compost-mulches can be applied at rates of 50-75mm depth. There is no evidence to suggest significant additional benefit from higher rates. For finer compost-mulches, where the requirements of the Australian Standard are satisfied, but there is a relatively low proportion of very coarse material, rates of 25-50mm depth may be more appropriate (Webster & Buckerfield, 2002b).

In marketing compost-mulch to vineyard growers, processors should consider offering a "package" to growers, which includes access to spreading machinery, or the services of an experienced contract spreader. In more mature markets, sales have only progressed where processors have built or acquired specific machinery that is capable of spreading compost-mulches. Where growers have to use their own machinery, or organize spreading themselves, the option of using compost-mulch may be or seem "too hard".

In New South Wales, there is a specific barrier to further market development for compost-mulches; sources are at a distance from the markets. Compost-mulches have a lower density, and are used at higher application rates, making transport a large component of the on-farm cost. The cost of transporting large quantities the considerable distance from the source to the major markets in the Hunter Valley, Mudgee and Riverina regions may create a barrier to growers who are thinking of using compost. Compost-mulch is relatively expensive. At $\$20m^3$, the cost is around $1,650 per hectare (50mm deep, 500mm wide). Costs for transport and spreading will be additional. For vineyards, annual inputs of fertilizer, chemicals and materials are a similar cost, so use of compost-mulch will at least double, if not treble, the growers' annual expenditure on vineyard materials in the year of application. Considered over the 3-5 year life of the mulch, the annual cost will be lower, but growers must still outlay a large sum in order to try compost.

Although there is potential for considerable demand for compost-mulches, initially processors may choose to concentrate on developing markets for soil conditioning compost; the lower initial expenditure may enable growers who have been considering organic matter for soil conditioning to try using compost. Processors can develop ongoing customer relationships once growers have been satisfied of the benefits of compost.

**Summary**

- Half of the growers reported water management problems, with water availability, water quality, water costs and inadequate capacity of the irrigation identified as the more common problems.
- 84% of growers identified water saving as a reason for using composts. Demand for compost-mulch will vary regionally.
- Growers identified that the major benefit of using compost was water-saving.
- Pressure on water supplies available for irrigation is likely to continue, providing incentive for growers to reduce reliance on irrigation.
- Results of field experiments have demonstrated potential to reduce irrigation by 20-30% with a compost-mulch of appropriate grade and application rate.

- In young vineyards, compost-mulch can moderate fluctuations in soil moisture and temperature, improving conditions for root growth and allowing vines to withstand periods of extreme stress.
- Results of field experiments have shown that using the optimal application rate given the grade of the compost, is the key to getting the best performance from compost-mulches.
- Use of inappropriate grade and application rate may have negative or reduced effects.
- Compost used as a mulch should have relatively low levels of nitrogen, potassium and phosphorous.
- Growers will be particularly sensitive to visual contamination, bad odours, plant pathogens, weed seeds and excessive temperature of the compost at spreading. They may assume other non-visual contamination where any of these characteristics are present.
- A mix of fine and coarse compost is most appropriate for surface application, with the finer fraction providing soil improvement, and the coarser fraction persisting for some years.
- Optimal application rate will depend on the grade of the compost. Current recommendations are general, but suggest that coarser compost-mulches can be applied at 50-75mm, while finer materials can be applied at 25-50mm.
- Processors should offer compost-mulch as a product "package" to growers, with access to spreading machinery or an experienced contractor included.
- The cost of transporting large quantities of lower density compost-mulch may see processors concentrate on developing markets for compost as a soil conditioner, which has a higher density and is used at lower application rates.

## Product 2 - Soil conditioner for established vineyards

The use of compost for soil conditioning was strongly identified by growers as a reason to use compost, and one of the major benefits of doing so:

- 80% of compost users rated their knowledge of compost for soil conditioning as medium to high, and 45% of non-users rated themselves medium to high (Table 10).
- Almost two thirds of growers reported problems with soil management. Poor structure, low soil organic carbon and low biological activity were identified as the more common problems (Table 24).
- Problems with soil management were most identified by growers in the larger regions of Hunter Valley and Mudgee (Table 25).
- Pre-seminar, when asked to identify the main reasons for using composts, use as a soil improver was chosen by 88% of growers, and increasing soil organic carbon was chosen by 80% of growers (Table 26).
- Post-seminar, those growers who considered themselves likely to use composts identified use for soil improvement as the main reason to do so (Table 36).

- Growers included increased soil organic carbon, organic matter, soil nutrients, biological activity and soil improvement among the main benefits of using composts (Table 38).

A recent project with the Natural Heritage Trust (Buckerfield and Webster, 2003) reported on a range of soil and plant measures undertaken on 37 experimental sites across Australia where organic matter had been applied up to ten years previously. At least one positive response in soil properties, plant growth or yield was seen at the majority of these sites. However, it has been the instances of negative or reduced effects that have been most instructive in determining the factors that contribute to the performance of composts as soil conditioners:

- A fine and coarse compost were applied to the soil surface in a newly planted vineyard 500mm wide and 50mm deep. After three months, vines treated with coarse compost were 26% taller than untreated vines, while vines treated with the fine compost were only 6% taller than untreated vines (Buckerfield & Webster, 2003). A lower application rate of the finer material would have been more appropriate.
- A source of fine compost was used applied to the soil surface in field-experiments with table-grapes and mandarins (Buckerfield & Webster, 2001c). Where applied under table-grapes, soil moisture was increased by 13% with a 25mm depth, but was reduced by 17 and 29% with 50 and 100mm respectively. A lower application rate of fine material was effective in conserving moisture, but higher rates appeared to prevent movement of water through the mulch.
- A compost which was considered to be finer than appropriate was applied as a mulch under table-grapes on two sites (Buckerfield & Webster, 2003). On the first site, infiltration was not changed with 25mm of compost, increased by over 50% with 50mm, and increased by 14% with 75mm. On the second site, infiltration was increased by 27, 107 and 86% with 25, 50 and 100mm of compost respectively. In both cases, the beneficial effects were not enhanced by doubling the rate from 50 to 100mm depth. When yield was measured two years after application, results on site 1 showed that yield increased 18% with 25mm of compost, but was not changed with the higher 50 and 75mm rates. On the second site, yield was significantly reduced by 10% with the 75mm depth. In these trials, benefits from a fine compost, applied to the surface, were not seen at rates above 50mm.

Fine materials applied to the soil surface at low rates can provide significant benefits, with field experiments demonstrating increased infiltration, reduced soil-strength, increased water-holding capacity, increased biological activity and soil organic carbon, reduced evaporation, increased plant-growth and increased yield. However, where high rates of fine materials have been applied to the soil surface, reduced or negative results have usually been recorded.

High application rates of fine compost can also encourage root-growth above the soil surface within the compost. Finer materials tend to have a higher nutrient content. Vines tend to be opportunistic and can produce roots in the compost within six weeks of application. The sudden flush of nutrients the new vine roots will have access to in the compost may cause undesired additional canopy growth. At worst, the sudden flush of nutrients may affect flowering and fruit-set. Growers maintain a balance of nitrogen, potassium and phosphorous through the various growth phases during the season. Some growers may prefer that vines do not have sudden and less predictable access to a

source of nutrients. Higher nutrient materials will tend to decompose more quickly, leaving exposed any roots that have established in the compost.

**Product Specifications – Compost as a soil conditioner in established vineyards**

Compliance with the "soil conditioner" specifications of the Australian Standard should ensure that compost adheres to the minimum quality requirements of growers:

- Visual contamination not evident – growers are most likely to question the quality and safety of composts where there is visual evidence that the material is derived from "waste". Processors should seek to at least comply with the Standard.
- Free of pathogens and plant propagules – compost must be free from plant disease and plant propagules to be acceptable in commercial horticulture. Processors should extend this requirement to the delivery trucks and spreading machinery which access the vineyard.
- Free of bad odours – growers are more likely to question the quality of the composting process if the compost is hot, steaming and odorous.
- Stabilized – sound composting practices must be employed to ensure the material is stabilized, and to minimize re-heating during transport and excessive heat at spreading. Growers are suspicious of "hot" compost, and may readily associate the death of young vines with the compost.

In addition to meeting the Australian Standard, compost processors may find benefit in running simple pot-tests to check the quality of fine composts. Pots with 0, 10, 25, 50 and 100% compost mixed with propagating sand can be planted with seeds of rapidly growing radish. Within days, effects on germination and survival of seedling can be assessed, and within weeks, effects on plant growth can be observed (Webster & Buckerfield 2002a, Buckerfield *et al*, 1999). Using plants to test compost performance is a simple and indicative method of checking for phytoxicities and can assist in confirming optimal application rates.

Results of field experiments suggest that composts meeting the Australian Standard for "soil conditioner" can be applied to the soil at rates from 10-50mm, depending on the grade of the material. Very fine materials or those with high nutrient levels used as organic fertilisers should not be applied at more than 25mm depth, and materials with a coarser component may be suitable at rates up to 50mm. Results with fine materials applied at rates above 50mm have generally given negative or reduced effects.

With the finer texture of the materials and lower volumes of application, a wider range of machinery may be suitable for spreading fine composts than the specialized machinery used to spread coarser compost-mulches. However, the more common farm machinery, such as "super spreaders" and manure spreaders may still present considerable frustrations. Fine composts can "bridge" in the hopper and stop flowing along the moving floor. Well designed compost spreaders minimize this problem, and usually have a larger volume hopper allowing greater efficiency of spreading. Processors should consider making access to spreading machinery or a contract spreader a part of a complete product "package". Frustrations with spreading will be widely discussed by growers. Market development in other states has relied on growers having access to special machinery supplied by the processor.

Compost processors may choose to concentrate on developing markets for compost as a soil conditioner in the New South Wales viticulture regions. The higher density of the finer compost will allow more efficient transport, and with the lower volumes per hectare applied to vineyards, less compost will need to be transported to site. There are also opportunities to "value-add". Growers needing to apply other soil amendments such as lime and gypsum may find it more convenient to have the processor mix these materials through the compost, to allow a "one-pass" spreading operation. Lime and gypsum may also be more efficiently incorporated in the soil when applied in conjunction with organic matter (Buckerfield & Webster, 2001a). Processors should be willing to work with the grower to develop "customized" compost blends.

**Summary**

- Almost two thirds of growers reported problems with soil management.
- 88% of growers saw soil improvement as a reason to use compost, and 80% saw increasing soil organic carbon as a reason.
- Fine materials applied to the soil surface at low rates can provide significant benefits, with field experiments demonstrating improved soil properties, increased biological activity and increased growth and yield.
- Where high rates of fine materials have been applied to the soil surface, reduced or negative results have usually been recorded.
- Fine, high nutrient materials will not be suitable for use as mulches, and may restrict movement of water to the soil, add excess nutrients and lead to root growth above the soil within the compost.
- Compost for soil conditioning should meet the Australian Standard for Composts, Soil Conditioners and Mulches (AS 4454-2003).
- Growers will be particularly sensitive to visual contamination, bad odours, plant pathogens, weed seeds and excessive temperature of the compost at spreading. They may assume other non-visual contamination where any of these characteristics are present.
- Fine composts, meeting the Australian Standard for "Soil Conditioner" may be suitable for application at rates between 10 and 25mm depth, and composts meeting the Standard for "Fine Mulch" may be appropriate at rates between 25 and 50mm.
- High nutrient materials should be applied at low rates, less than 25mm.
- Results of field-experiments have suggested that negative or reduced effects may occur with application rates above 50mm.
- Processors should offer compost-mulch as a product "package" to growers, with access to spreading machinery or an experienced contractor included.
- Processors should be prepared to work closely with growers to develop customized blends.
- Transport of soil conditioning compost may be more efficient due to the higher density of the material. With the higher value of the material, and lower volumes applied, processors may be better able to get compost to vineyards at prices which allow growers to initially try using compost. Compost processors may choose to concentrate on developing markets for soil conditioner rather than compost-mulch.

## Product 3 - Compost for vineyard establishment

Using compost to improve the establishment of young vines has been one of the less promoted uses of compost but in established markets, has grown to become one of the significant uses. Growers surveyed recognized the value of compost for vineyard establishment, and even more so after having a chance to consider the results of field experiments:

- 76% of compost users considered they had a medium to high knowledge of using compost for vineyard establishment, and 51% of non-users rated their knowledge medium-high (Table 12).
- Almost two thirds of growers considered they had problems with soil management (Table 24). Many of these problems, such as poor structure, low soil organic carbon and low biological activity will have impacts on the efficiency of vineyard establishment.
- 52% of growers surveyed considered that improvement of soil in vineyard establishment was a reason to use compost (Table 26).
- Pre-seminar, 40% of current users considered improvement of vine establishment as one of the main reasons to use compost (Table 29).
- Post-seminar, 48% of those likely to use compost considered improvement of vine establishment as a reason to use compost (Table 36).

In 2002, the area under bearing vines in New South Wales was 34,005 ha. The area under young vines that were not yet bearing was 3,376 ha, or 9% of the total area, and the area planted was 1,326 ha (Australian Bureau of Statistics, 2003). From 2004 to 2008, the tonnes of grapes crushed in the regions surveyed is expected to increase on average by 9.5%, though in most regions, between 15 and 58% increase in crush is expected (refer Table 44).

| **Region** | **Projected Crush 2004-08** (tonnes) | | | | | **Change 2004-2008** (%) |
|---|---|---|---|---|---|---|
| | **2004** | **2005** | **2006** | **2007** | **2008** | |
| Northern Rivers | 192 | 203 | 213 | 224 | 233 | 21.4 |
| Southern NSW/Canberra | 839 | 995 | 1,242 | 1,258 | 1,319 | 57.2 |
| Hunter Valley | 25,735 | 25,824 | 25,954 | 26,141 | 25,817 | 0.3 |
| South Coast | 622 | 673 | 706 | 711 | 716 | 15.1 |
| Mudgee | 24,493 | 24,885 | 26,747 | 27,247 | 28,721 | 17.3 |
| **Total** | **51,899** | **52,580** | **54,862** | **55,581** | **56,806** | **9.5** |

**Table 44 Projected Crush of Wine Grapes**

(New South Wales Wine Industry Association, 2003)

The wine industry is still undergoing significant growth. To establish 1,000 ha of vines with 85 $m^3$/ha of compost incorporated in the topsoil prior to planting would require 85,000 $m^3$ of compost. In the small, rapidly growing regions and the larger regions with significant areas still being planted, there is opportunity to offer growers a "soil establishment" compost product. Compost for vineyard establishment will have a fine texture, and high density, which may make transport of the material over long distances more feasible than coarser, lower density compost-mulches.

The results of field experiments with organic matter incorporated in the soil prior to vineyard establishment have demonstrated significant benefits, but have also highlighted the need for care in using quality compost of an appropriate grade, applied at appropriate rates. Material incorporated in the soil will be in direct contact with young vine roots, making any toxicities more likely to cause detriment. Some of the research results seen include;

- Fine compost was banded 50mm deep and 500mm wide along the vine row, and incorporated to 250mm depth in the soil with a rotivator. The resulting concentration of compost in the soil was around 20%. Growth of the young vines was significantly increased, and within ten months, treated vines were 15% taller than control vines (Webster, 2003).
- Strong trends in results from a trial with 0, 5, 10 and 15L of compost incorporated in the hole prior to vineyard planting demonstrated the importance of application rate on vine response. One year later, 5, 10 and 15L applications had increased vine height 44, 39 and 36% respectively, compared to a 25% increase in the height of control vines. While all application rates appeared to benefit vine growth, the effect was reduced as application rate increased (Paulin, 2001; the volume of the planting hole was not specified in reporting, and the application rate could not be converted to a soil concentration for comparison).
- Compost grade (particle size composition) is also critical for optimal performance of soil-incorporated compost. Applications 10, 20 and 50mm deep were banded 500mm under vine and rotivated to 250mm depth in the soil. The compost supplied by the processor was of a coarse grade, more suited to surface application. Although not statistically significant, the unfavourable results seen 3 months later, with reductions in vine height of 7.4, 8.3 and 6.2% with 10, 20 and 50mm of compost respectively, were likely to be related to the inappropriate grade of the material (Webster & Buckerfield, 2002a). Composts for soil incorporation should be mature and of fine grade.
- With standardized pot tests, numerous records have been made of organic amendments from different sources producing quite different responses in plant growth. These tests highlight the benefit of predictive testing of organic amendments prior to incorporation in the soil. We also have evidence of soil-specific responses to incorporation of organic matter. The same organic amendment, applied to two different soils can result in very different growth of test plants. In one case, a positive response to compost in one soil, produced a negative response in another (Buckerfield & Webster, 2002a).

**Product Specifications – Compost for vineyard establishment**

As compost will be in close contact with young plant roots, it will be particularly important to ensure the quality of compost to be incorporated in the soil. At a minimum, compost should meet the ‘Soil Conditioner’ requirements of Australian Standard for Composts and Soil Conditioners (Standards Australia, 2003).

In addition, compost processors may find benefit in running simple pot tests to check quality of compost batches destined for soil incorporation. Pots with 0, 10, 25, 50 and 100% compost mixed with propagating sand can be planted with seeds of rapidly growing radish. Within days, effects on germination and survival of seedling can be assessed, and within weeks, effects on plant growth can be observed (Webster &

Buckerfield 2002a, Buckerfield *et al*, 1999). Using plants to test compost performance is a simple and indicative method of assessing quality, and avoids the confusion and contention over definitions of compost "maturity". EcoResearch encourages growers to conduct similar tests, using the soil to which the compost will be applied, to assist in selecting optimal application rate.

Results suggest that fine, mature composts can be safely incorporated in the soil prior to vineyard establishment up to rates that give a 20-25% concentration in the soil. Although there is no evidence of harm from higher application rates, there is no evidence to suggest further benefit either, and higher application rates will cost more.

Research results have indicated that coarse compost may give reduced or negative effects when incorporated in the soil. The Australian Standard specifies that for soil conditioner, not more than 20% of the compost (by weight) should be retained on a 16mm sieve. EcoResearch considers that an even finer grade could be aimed for.

As an example of application, compost could be banded 500mm wide along the vine row, 50mm depth, and using widely available rotivating machinery, could be incorporated to a depth of around 250mm. If done prior to installation of posts, a wider range of machinery can be used for spreading. Although there has been no research on incorporating compost in deeper layers of the soil, EcoResearch does not encourage this. The lack of oxygen at depth in the soil may encourage anaerobic decomposition and generation of phytotoxins. Compost incorporated within the top 10-30cm will have greater exposure to oxygen, and be in the area of the soil where most soil biological activity, root growth and nutrient turnover occurs. In nature, turnover of organic matter normally occurs mostly in the topsoil.

Materials such as lime and gypsum are often incorporated in the soil at vineyard establishment. Growers may find it convenient to have these materials incorporated through the compost by the processor, so spreading is a "one-pass" operation, minimizing trafficking in the vineyard. Processors should be willing to work closely with growers to achieve specific requirements, such as custom blends and composts with high macro-nutrient levels.

**Summary**

- 52% of growers surveyed considered that improvement of soil in vineyard establishment was a reason to use compost.
- The annual crush in New South Wales is expected to increase by 9.5% from 2004 to 2008, with most regions expecting growth of 15-58%. Much of this growth will come through new vineyard developments.
- There is an opportunity to offer growers a compost product for vineyard establishment.
- Results of field experiments have shown significant benefits with an appropriate grade, application rate and quality of compost incorporated in the soil prior to planting, and negative results with inappropriate grade, application rate or quality of compost.
- As the material will be in close contact with young vine roots, compost for soil incorporation must be of an appropriate quality and grade, and used at an appropriate rate.

- As a minimum, compost for soil incorporation should meet the Australian Standard.
- Compost processors can conduct simple pot tests to ensure that compost is not phytotoxic, and to assist in determining application rate.
- Composts of appropriate grade and quality can be incorporated in the soil prior to vineyard establishment at rates that give up to 20-25% concentration in the soil.
- Compost grade should at least meet the Australian Standard for soil conditioner, with no more than 20% of the compost (by weight), retained on a 16 mm sieve. Processors could aim for a finer grade, with even less retained on the sieve.
- The benefits of compost incorporated within the topsoil (10-30 cm) have been demonstrated. The use of compost incorporated in the subsoil has not been tested and cautious users may avoid doing this.
- Processors should be willing to work closely with growers to achieve specific requirements, such as custom compost blends and access to spreading machinery.

## Product 4 - Compost for nutrient supply and mid-row management

When surveyed, growers generally reported high levels of soil management problems, and considered compost as beneficial to improve these problems:

- 20% of compost users managed their vineyards organically (Table 18). These growers can not use synthetic fertilizers in the vineyard, and often utilize compost as an alternative
- Almost two thirds of growers reported problems with soil management (Table 24).
- 88% of compost users considered use as a soil improver as a reason they used composts, and 80% used composts to increase soil organic carbon (Table 26).
- 37% of growers who were likely to use compost in the future considered reduction in the use of other chemicals as one of their reasons to do so (Table 36).
- 32% of growers identified increased soil organic carbon, soil nutrients and biological activity as benefits of using composts (Table 38).

Until recently, the use of composts as an alternative to synthetic fertilizers to supply nutrients to mid-row cover crops has not been widely promoted. Wilkinson (2003) provided a review of composts and cover crops for managing soil health and fertility, and noted:

- In US vineyards, the use of composts and cover crops mid-row had resulted in better vine disease management and increased yield, particularly where compost was applied over four or five years (Porter, 1998).
- As a general rule, composts with a carbon:nitrogen ratio of less than 20:1 and nitrogen content of at least 1.5%, will provide nitrogen to the soil.
- With the low nutrient requirements of vines, the use of cover crops and compost can supply a vineyard's nutrient requirements.

Biala (2000), conducted an international review based largely on German research on composts for viticulture. In regards to use of composts for nutrient supply, he noted:

- Several research projects found inconsistent results; the use of immature compost added little nitrogen to the soil, while a mature compost provided a flush of nitrogen. Another trial found a mature compost to add nutrients to the soil, while two other trials showed limited addition of nutrients with a mature compost.
- A range of additional benefits were seen with improved soil properties; pore volume, air-filled porosity, water holding capacity, aggregate stability and soil biological activity were increased and soil erosion was reduced.
- Oversupply of nitrate in vineyards may be a problem; with the low nutrient requirements of vines, excess nitrate may leach from the soil with possible contamination of groundwater.

In Australia, there have not been any significant studies on the use of composts for nutrient supply in the mid-row. However, results from trials with compost in high nutrient requiring vegetable crops provide further indications of appropriate application rates:

- Positive results were seen in onions with application rates of 12, 25 and 150t/ha, and gave yield increases of 11, 13 and 32% (Paulin & Reid, 1999).
- Two trials in broccoli and carrots showed beneficial results, but only where compost was used as a supplement to the fertilizer regime, not an alternative (Wilkinson *et al*, 2000; Paulin & Reid, 1999).
- Two composts, one of "acceptable" quality, and one considered "unacceptable" were tested side by side. The "acceptable" compost increased yield at each application rate, while the "unacceptable" compost reduced yield at each application rate (Paulin & Reid, 1999).
- Yield of cauliflowers was enhanced with compost incorporated in the soil, but the effect was reduced with rates higher than 20t/ha (Paulin & Reid, 1999).

Results with compost incorporated in the soil prior to vineyard planting also provide indications on the use of compost for nutrient supply in the mid-row:

- Compost was incorporated to 250mm depth to give a concentration in the soil of around 20%. Growth of the young vines was significantly increased, and within ten months, treated vines were 15% taller than control vines (Webster, 2003).
- With 0, 5, 10 and 15L of compost incorporated in the hole prior to vineyard planting all application rates appeared to benefit vine growth. However, the effect was reduced as application rate increased (Paulin, 2001).
- Where a coarse grade of compost more suited to surface application was incorporated in the soil, reductions in vine height of 7.4, 8.3 and 6.2% were recorded with 5, 10 and 25% of compost concentration respectively (Buckerfield & Webster, 2003).

**Product specifications – Compost for nutrient supply and mid-row management**

Where compost is incorporated in the mid-row prior to planting of cover crops, care should be taken to ensure the material is free of toxicities. The compost will be in contact with germinating seeds and the root systems of young plants. As a minimum, the compost should meet the “Soil Conditioner” requirements of the Australian Standard for Composts, Soil Conditioners and Mulches (Standards Australia, 2003). In

addition, compost processors may consider running simple pot-tests to check quality of compost batches destined for soil incorporation. Pots with 0, 10, 25, 50 and 100% compost mixed with propagating sand can be planted with seeds of rapidly growing radish. Within days, effects on germination and survival of seedling can be assessed (Webster & Buckerfield 2002a, Buckerfield *et al*, 1999).

Results from field experiments have demonstrated the need to use compost of an appropriate grade. Fine, mature composts are more likely to be of benefit, while coarser, woody composts are more likely to be detrimental. Coarser materials, meeting the "Fine Mulch" requirements of the Australian Standard may be appropriate for broadcasting on the soil surface at low rates.

International research and results from other crops suggest that application rates which give concentrations in the soil up to 25%, may be appropriate. Likely economically attractive application rates will be 10-20 t/ha, giving a concentration in the soil of around 10% when incorporated to 20-25 cm in the soil. Lower rates of around 5 t/ha may be appropriate for broadcasting on the soil surface.

With the finer texture of the materials and lower volumes of application, a wider range of machinery may be suitable for spreading fine composts than the specialized machinery used to spread coarser compost-mulches. The more common farm machinery, such as "super spreaders" and manure spreaders may still cause considerable frustrations. Growers may appreciate being supplied with compost and access to compost spreading machinery as a product "package".

**Summary**

- Compost has the ability to supply nutrients for vine growth when used as a fertilizer with mid-row cover crops.
- To provide nutrients, compost should have a carbon:nitrogen ratio of less than 20:1, and a total nitrogen content of at least 1.5%.
- The availability of nutrients in compost will vary depending on soil moisture, pH, temperature, soil organic carbon levels and biological activity. Effects may not be predictable.
- A range of additional benefits may result from adding carbon to the soil.
- Compost should at least meet the Australian Standard for Composts, Soil Conditioners and Mulches (AS 4454-2003).
- Processors can conduct simple pot tests to confirm that the compost promotes plant growth and to assist in selecting optimal application rates.
- Research suggests fine, mature composts are more likely to be of benefit, and coarser, woody composts are more likely to be detrimental.
- Application rates which give a concentration in the soil of up to 10%, may be beneficial and economically attractive for soil incorporation.
- For broadcasting on the surface, even lower application rates could be used, with more frequent application for nutrient management.
- A wider range of machinery may be suitable for spreading finer materials; however, growers may still appreciate access to spreading equipment provided by the processor.

## Additional Product Specifications

In addition to the compost products, processors can add other specifications to allow marketing of a complete "package" of compost, quality and spreading.

### Organic Certification

Survey results indicated that one fifth of current compost users were managing their vineyards organically (Table 18). One tenth of non-users organically manage their vineyards. These results suggest that an organic grower is twice as likely to be a compost user.

Organic producers are certified by the Biological Farmers of Australia (BFA) or the National Association of Sustainable Agriculture Australia (NASAA). Certified growers must conform to a set of rules to achieve and maintain their certification (eg, see **www.australianorganic.com.au**). These rules prohibit the use of chemical fertilizers and synthetic pesticides. Farm inputs must either conform to the rules, or be certified as organic by the certifying body. Organic farming organizations actively encourage the use of composts to supply nutrients as replacements for the chemical fertilizers available to conventional growers – this becomes evident in the technical pages of the certifying bodies (eg. www.australianorganic.com.au/Pages/technical.htm). Handbooks on organic management include guides to composting, and on-farm composting, and use of compost-teas for disease control is encouraged.

Composts made from recycled organics can achieve organic certification. Certifying bodies often do not require that the materials used in composting come from certified sources, as long as the composting operation is able to meet organic standards. Many compost processors around Australia have had their material certified by one or both organizations.

Given that organic producers are more likely to become customers, composts marketed to viticulturists should be organically certified by either BFA and NASAA or both, to ensure the products are available to organic growers. Almost 50% of compost users reported "reduce use of other chemicals" as a reason for using compost (Table 26), though only 20% of growers were organic producers (Table 18). Of the 71% of growers who were at least likely to use compost in the future (Table 33), almost one third saw organic certification as a factor contributing to their perception of compost quality (Table 37). Organically certified compost may hold appeal to conventional growers as well.

Due to the restrictions on use of chemical fertilizers and synthetic pesticides, organic growers are likely to identify two major uses for compost:

- compost-mulch for non-chemical weed control
- compost for nutrient supply and soil amendment.

Compost-mulches with a high proportion of coarse woody material may provide weed control for around twelve to eighteen months. Conventional growers involved in EcoResearch field experiments have reported anecdotally being able to "turn off the spray unit" as they were going past mulched sections of the experiment. While compost-mulch may be effective over the shorter term, it will form only one of a number of tools in a strategy for managing weeds in an organic vineyard (Penfold, 2004). It should not be promoted as a solution to weed control. For example, users of compost in the regions

surveyed reported in discussion that compost-mulch was not effective in the longer term against kikuyu.

Composts for nutrient supply may need to have a specific balance of nutrients to meet grower requirements. In general, to achieve a higher nutrient content, higher nutrient materials such as manures will need to be included in the composting process. Organic producers will need access to a source of finely textured compost with consistent nutrient levels from season to season. In addition, they may require that compost processors produce specific blends, to achieve a desired balance of nutrients, or to blend the finished compost with other amendments, such as lime and gypsum. These amendments may be incorporated in the soil more effectively when applied in conjunction with organic matter (Buckerfield & Webster, 2001a). Compost processors should be prepared to work closely with organic producers, to provide customized blends.

In summary, when developing a package for organic producers, the following should be considered:

- Compost processors should seek certification from either or both BFA or NASAA for their products.
- A compost-mulch with a high proportion of coarse woody material may provide weed control for around twelve to eighteen months, and could be considered as one of the "tools" in a strategy for non-chemical weed management in organic vineyards.
- Organic producers are encouraged by certifying bodies to use composts as nutrient sources. These growers will require a source of finely textured, higher nutrient compost, with a consistent quality from season to season.
- In addition, organic producers may need to work closely with compost processors to achieve customized blends, to develop composts with a specific balance of nutrients, or to blend finished composts with other soil amendments, such as lime and gypsum.

*Key Finding*

*Compost processors should have their products certified as suitable for use in organic vineyards.*

**Vineyard Quarantine**

Some 28% of growers surveyed had a vineyard quarantine program in place (Table 20). In the past, concerns over the risks of spreading phylloxera had inhibited market development for composts in viticulture. In fact, it was prohibited to move compost from the Sydney area into phylloxera exclusion zones which include the largest regions of Hunter Valley, Mudgee and the Riverina. Processors can now access special permission which enables them to supply compost into phylloxera exclusion zones. Processors using accredited production systems that demonstrate the compost products are free of phylloxera can gain this permission in the form of a Compliance Agreement (CA-05) issued by the Department of Primary Industries. However in terms of market development, this compliance and accreditation should be considered as the minimum. Processors should outwardly demonstrate sensitivity to quarantine; delivery trucks and spreaders accessing vineyards must be free from soil and unprocessed organic matter.

Processors should assume that the Australian Standard (Standards Australia, 2003) requirement for composts to be free from diseases and plant propagules also extends to any machinery which will access the vineyard. Delivery trucks and spreading machinery should be inspected and cleaned before entering vineyards. Whether or not the vineyard has a quarantine program, great respect should be paid to the need for caution and cleanliness when using machinery on multiple vineyards.

It would only take for some suspicion or a loose link to be made between compost and the introduction of any disease or weed species to significantly set back market development.

*Key Finding*

*Any delivery trucks or spreading machinery accessing vineyards must be free from vineyard soil and unprocessed organic matter.*

# 6 Conclusions and Recommendations

From this research, most grape growers are likely to be contracted to wineries or produce for their own wineries. It was also apparent that nearly one third of the seminar participants use composts in grape production.

Therefore, if "wine industry leaders" or "trend setters" that have credibility with the growers were identified and convinced of the benefits of composts and composting, they in turn may be used as "mentors" to induce or assure the grape growers of the nett benefits.

Furthermore, the preferred sources of information through which grape growers gain information were identified as seminars, trade magazines and technical experts or consultants.
Thus, it is recommended that future seminars be conducted and facilitated through grower associations and target the "industry leaders" and technical experts/consultants as well as the growers. Ideally, seminars should be complemented with "test rows" that have been established where growers can quickly compare results in a practical fashion.

Reasons given why compost was not used were that growers lacked sufficient information about composts and the associated costs of spreading. Compost users also perceived the costs of composts and its application as major disadvantages.

Cost-benefit analyses should be undertaken and be available to enable the "decision makers" to make well-informed decisions. Specific outcomes of the cost-benefit analyses may need to be highlighted depending upon who is evaluating the analysis; ie a large winery finance manager may evaluate according to different criteria compared to a smaller grape grower.

Two key points in this research were that compost users are likely to continue to use composts in the future; ie they have, from a practical perspective, assessed the nett benefits. The second point was that in the post-seminar part of the questionnaire, non-users indicated they are likely to use composts in the future. Only four of the total of non-users are unlikely to use compost. This again illustrates that providing relevant

information about composts, its uses and benefits, in the appropriate manner, is likely to persuade non-users to evaluate the overall benefits.

Composts are most likely to be used for conditions allied with water and soil management; and are used as supplements to rather than substitutes for other products.

Users and potential users need to be confident about the quality of composts, its compliance with Australian Standard AS 4454 and its nutrient analysis. These points need to be re-inforced by the compost processors when attempting to market their products to grape growers.

The participants' comment in section 3.3 "Worthy Comments" again relate to the costs and benefits of using composts. One particular comment highlighted the fact that there appear to be very few efficient compost spreaders or contractors available. The additional time and therefore cost, to apply composts using plant and equipment that is not entirely suitable may impede the markets for compost use. Cost-effective spreading and application could tip the cost-benefit equation in favour of compost use.

In summary, this research has highlighted that grape growers are most likely to change their vineyard practices and use composts if provided with relevant information in an appropriate manner that identifies all costs and benefits; and emphasises the overall nett benefits of composts and composting.

## Market Development for Recycled Organic Products

EcoResearch has developed some guidelines that may assist in encouraging market development for recycled organic products in viticulture. The above results of the research undertaken within the five wine regions of NSW have complemented and are consistent with these guidelines.

### 1. Respect rural industries

Rural industries are not a dumping ground for low quality organic matter. Growers will resist being seen as collaborators in “waste-management” and take very seriously the risks of contamination and introduction of plant diseases and weeds.

*The quality and properties of compost should be targeted to the needs of commercial horticulturists.*

### 2. Identifiable product

Market development may be hindered by promotion of a variety of blends with unpredictable performance. Blends with other recovered resources should be developed and marketed only when demand for composted garden-organics has been established. Growers are likely to request specific blends once they have an understanding of composts and mulching.

*Develop markets for “straight” garden-organics compost products.*

### 3. Pasteurized and stabilized

Compost must be free from plant diseases and plant propagules to be used in commercial viticulture. These problems are controlled largely through good composting practices. Sound composting practices must also be employed to ensure the material is stabilized, to minimise "reheating" when the compost is delivered for spreading.

*Compost must meet the Australian Standard AS 4454-2003 to minimise risks with contaminants, plant-propagules, pathogens, nitrogen draw-down, and excessive heat at spreading.*

**4. Marketing has relied on research**

Successful marketing of recycled organic products has been based on data that demonstrates performance in the field. Growers appreciate seeing results on "their patch". Field trials have identified optimal grades and rates of composts, and assisted in alleviating grower concerns about effects on crops.

*Trials to demonstrate the performance of composts should be established and monitored in close collaboration with growers.*

**5. Research specific**

Research has targeted higher value crops. It is difficult to justify importing organic matter for crops with low margin. Field trials have addressed issues identified by the growers – these can vary between regions and crops; even within a vineyard, different soil conditions may require different management.

*Field trials should address the specific issues and conditions faced by growers.*

**6. Demonstrated responses**

There has been a change in at least one plant growth or soil property on every experimental site established by EcoResearch – currently around 50 across southern Australia. Some responses have been recorded within six weeks and benefits are still being recorded six years after application.
*Monitoring of plant growth, yield and soil properties can demonstrate benefits from use of recycled organic products.*

**7. Research wide ranging**

Research has demonstrated that the principles for use of compost are relevant for a wide range of horticultural crops and varieties over contrasting soils, geographical and climatic regions.

*Results from trials in specific regions can be supported with evidence from trials across Australia.*

**8. Collaborative research**

A key to the success of market development has been working with growers who are leaders in their industry and local community. These growers are the most likely to identify a possible benefit to their horticultural management, and try something new.

*Market development has been most successful where leading growers have been involved.*

**9. Communications**

Results of measurements have been reported back to the growers and grower-groups involved within 48hrs of monitoring. Research outcomes have been communicated through popular industry journals such as The Australian and New Zealand Grapegrower and Winemaker and Australian Viticulture.

*Research outcomes can be reported through popular industry journals.*

**10. Presentations**

Presentations give growers the chance to challenge processors and researchers with their concerns, and to hear a more in-depth discussion of details relevant to their industry. Presentations are also more informative and interactive than print media. A presentation is most effective where it can be incorporated into a meeting or event that growers would be attending anyway. Growers already have many demands on their time. Attendance can be poor where a presentation/seminar is organized as a stand-alone event.

*Growers appreciate presentations and are more likely to attend where these are incorporated into regular grower meetings.*

**11. Spreader availability and spreading demonstration**

Adoption of compost has been dependent on the development of suitable spreading machinery. Experience suggests that demand for compost may not increase unless appropriate spreading machinery can be supplied with the compost. With a spreading demonstration, concerns over difficulties with spreading can be addressed. A demonstration is best performed by someone experienced with the machinery and compost spreading.

*Market development will rely on growers having access to appropriate spreading machinery.*

**12. Compare with choices and common practice**

Field experiments have compared compost with common practice and the local alternatives more commonly used by growers. This provides a "benchmark" for growers to compare performance.

*Trials should offer growers the chance to compare compost with common practice and local alternatives.*

**13. Understand the industry**

Increased yield and berry-size are considered to be positives by table-grape growers, but may be seen as negatives by wine-grape growers. Each horticultural industry has specific management and quality requirements. Publicity and communication materials should be checked for industry relevance before circulation. Efforts to promote compost

as a serious alternative have been hindered by circulation of information that demonstrates a lack of understanding for horticultural industries.

*Each horticultural industry has specific management and quality issues and marketing must demonstrate an appreciation of these issues.*

**14. Marketing**

Processors have found that promoting their product to grower groups has been more successful than approaches to individuals. Promotion through displays at field days, spreading demonstrations and local seminars has provided a low-key way for growers to access information. Repeat exposure is required; growers often hear a presentation on results two or three times before they finally decide to buy.

*Promotion of compost to grower groups at field days, seminars and demonstrations has been a successful approach to marketing. Repeated exposure has been necessary.*

**15. Problems**

Effective marketing of compost has been limited by problems with the product quality – contamination and inconsistency have negative impacts for the customers. The lack of a complete package of compost and spreading has also hindered uptake. Compost should be marketed as a product package, which includes spreading and follow-up.

*Problems with compost contamination and lack of consistency need to be monitored, prevented and addressed.*

**16. Questions on quality**

Growers are most likely to question the quality of compost when it is visually contaminated (plastics, stones, soil, glass etc.) or not completely composted. Quality viticulture production requires quality inputs. Growers expect that compost is “sweet smelling, not stinky with stones and plastic bags”. Serious marketing of garden organics compost-mulch should take customer concerns seriously.

*Growers are most likely to question compost quality if it is contaminated or inadequately processed. Only clean, stabilized compost-mulch should be supplied to growers.*

# Appendices

## Seminar Questionnaire

## References

## Glossary

# Viticulture and Composting Seminar

Thank you for attending this seminar on composts and use of composts in wine and table grape production. A two part questionnaire has been developed to enable the industry to better comprehend your requirements and understanding of composts in grape production.

The first part of the questionnaire, that is the BLUE pages should be completed BEFORE the seminar; and the second part, that is the GREEN page should be completed AFTER the seminar before you leave. If you have any questions about the questionnaire please ask Katie Webster and she will assist you to complete it.

Thank you for taking the time to attend and complete the questionnaire; and as you can see there is nothing on the questionnaire to identify you so it will be treated in complete confidence.

***************************

Please complete questions 1-22 on the BLUE page BEFORE the seminar.

1. Which markets do you grow grapes for.

   ☐ Wine ☐ Table ☐ Dried Fruit

2. What is the approximate area you have under grape production. Please specify hectares (H) or acres (A).

   Wine **…….** Table **…….** Dried Fruit **…….**

3. Which best describes you.

   ☐ Uncontracted grower ☐ Contracted grower
   ☐ Grow for own winery

4. How do you rate your knowledge of composts and use of composts for grape production. Please give a rating out of 10 where 1 = little knowledge and 10 = excellent knowledge.

   | | | | | | | | | | | |
   |---|---|---|---|---|---|---|---|---|---|---|
   | Compost quality | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** |
   | Compost as mulch | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** |
   | Compost as soil conditioner | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** |
   | V'yard establishment | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** |

5. How do you describe your role.

   ☐ Vineyard owner
   ☐ Vineyard Manager
   ☐ Consultant/Technical Expert
   ☐ Other (Specify) **……..**

6. How do you prefer to gain information about grape production and the grape industry.

   ☐ Trade magazines ☐ Grower associations
   ☐ Seminars ☐ Technical Experts
   ☐ Wine companies
   ☐ Own research/experience
   ☐ Other (Specify) **……**

7. Does your vineyard have a quality assurance program.
   ☐ Yes ☐ No

8. Do you manage your vineyard organically.

   ☐ Yes ☐ No

9. Does your vineyard have an environmental management system.

   ☐ Yes ☐ No

10. Do you have a vineyard quarantine program.

    ☐ Yes ☐ No

11. Do you have problems with water management in your vineyard.

    ☐ No (Go to Q 12)
    ☐ Yes (Please mark boxes below – you can mark more than one box)

    ☐ Water availability ☐ Water quality
    ☐ Water costs ☐ Irrigation capacity

12. Do you have problems with soil management in your vineyard.

    ☐ No (Go to Q 13)
    ☐ Yes (Please mark boxes below – you can mark more than one box)

    ☐ Poor structure ☐ Low biological activity
    ☐ Poor drainage ☐ Low organic carbon
    ☐ Erosion ☐ Salinity/sodicity
    ☐ Air and moisture permeability
    ☐ Other (Specify) **……..**

13. Do you currently use composts in grape production for.

    Wine ☐ No (Go to Q14) ☐ Yes (Go to Q17)
    Table ☐ No (Go to Q15) ☐ Yes (Go to Q17)
    Dried ☐ No (Go to Q16) ☐ Yes (Go to Q17)

If you answered Yes in Q 13, please go to Q 17.

14. WINE grapes - Why don't you use composts on wine grapes. (You can mark more than one box)

- ☐ Not enough information about composts
- ☐ Composts not available locally
- ☐ Concerns about compost quality
- ☐ Cost of compost
- ☐ Cost of spreading compost
- ☐ Accessibility of spreading compost
- ☐ Risk of disease
- ☐ Excess vigour/late budburst/frost damage
- ☐ Winery does not permit use of composts
- ☐ Other organic products available
- ☐ No direct benefits
- ☐ Tried before
- ☐ Other (Specify) ……

15. TABLE grapes - Why don't you use composts on table grapes. (You can mark more than one box)

- ☐ Not enough information about composts
- ☐ Composts not available locally
- ☐ Concerns about compost quality
- ☐ Cost of compost
- ☐ Cost of spreading compost
- ☐ Accessibility of spreading compost
- ☐ Risk of disease
- ☐ Excess vigour/late budburst/frost damage
- ☐ Buyer does not permit use of composts
- ☐ Other organic products available
- ☐ No direct benefits
- ☐ Tried before
- ☐ Other (Specify) ……

16. DRIED FRUIT grapes - Why don't you use composts on dried fruit grapes. (You can mark more than one box)

- ☐ Not enough information about composts
- ☐ Composts not available locally
- ☐ Concerns about compost quality
- ☐ Cost of compost
- ☐ Cost of spreading compost
- ☐ Accessibility of spreading compost
- ☐ Risk of disease
- ☐ Excess vigour/late budburst/frost damage
- ☐ Buyer does not permit use of composts
- ☐ Other organic products available
- ☐ No direct benefits
- ☐ Tried before
- ☐ Other (Specify) ……

If you answered Q 14, and Q 15 and Q 16 you do not need to answer any more questions on the BLUE pages.

17. Why do you use composts in your vineyard. (You can mark more than one box)

- ☐ Water retention
- ☐ Soil improver
- ☐ Weed control
- ☐ Increase organic carbon
- ☐ Improve soil in vineyard establishment
- ☐ Reduce use of other chemicals
- ☐ Encouraged by grape buyers to compost
- ☐ Other (Specify) ……...

18. Do you use compost as a supplement to other products or as an alternative to other products.

- ☐ Supplement
- ☐ Alternative (Specify products replaced)

……
……
……
……

19. How do you spread composts in your vineyard

- ☐ Use own machinery
- ☐ Use a contract spreader
- ☐ Use spreader supplied by compost processor

20. What benefits does composting provide to you. (You can mark more than one box)

- ☐ Reduce water use
- ☐ Reduce evaporation
- ☐ Better weed control
- ☐ Improve establishment of young vines
- ☐ Increased grape yields
- ☐ Increased quality of grapes
- ☐ Other (Specify) ……...

21. Are there any disadvantages or problems in using composts.

- ☐ No
- ☐ Yes (Specify) ……...

……
……
……

22. Will you continue to use composts.

- ☐ Yes
- ☐ Undecided
- ☐ No (Specify) ……..…

……
……
……
……

Thank you; that is all you need to complete at the moment.

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## Viticulture and Composting Seminar

This is the second part of the questionnaire that is to be completed AFTER the seminar and before you leave. If you have any questions about the questionnaire please ask Katie Webster and she will assist you to complete it.

Again, thank you for taking the time to attend the seminar and complete the questionnaire and we assure you of maintaining your privacy and analysing the information in complete confidentiality.

**********

23. Are you likely to use composts in your vineyard in the next 1-2 years.

    1 ☐ Very Unlikely (Go to Q28)
    2 ☐ Unlikely (Go to Q28)
    3 ☐ Undecided (Go to Q28)
    4 ☐ Likely (Go to Q24)
    5 ☐ Very Likely (Go to Q24)

If you marked box 4 (Likely) or box 5 (Very Likely) in 23, please answer Q 24, 25, 26, 27 and 30.

24. Why would/do you use composts in your vineyard. (You can mark more than one box)

    ☐ Water retention
    ☐ Soil improver
    ☐ Reduce evaporation
    ☐ Weed control
    ☐ Increase organic carbon
    ☐ Improve soil in vineyard establishment
    ☐ Increased yields
    ☐ Increased quality
    ☐ Reduce use of other chemicals
    ☐ Encouraged by grape buyers to compost
    ☐ Other (Specify) ……...

25. Which 3 factors do you think contribute to the quality of compost. (Please mark 3 boxes)

    ☐ Comply with Australian standard AS 4454
    ☐ Organic certification (NASA or BFA)
    ☐ Macro-nutrient analysis (N, P, K)
    ☐ Full analysis (including contaminants)
    ☐ Compost smell
    ☐ Compost texture
    ☐ Compost appearance
    ☐ Other (Specify) ……...

26. What are the 3 best benefits of why you would/do use compost.

    1. ……
    2. ……
    3. ……

27. What are 3 disadvantages or problems you could/do have in using compost.

    1. ……
    2. ……
    3. ……

Go to Q 30.

In Q 23, if you marked box 1 (Very Unlikely) or box 2 (Unlikely) or box 3 (Undecided), please answer Q, 28, 29, and 30.

28. What further information do you require to make a decision to use compost.

    ☐ Type of composts
    ☐ Grades of compost
    ☐ Rate of application of compost
    ☐ Cost of compost
    ☐ Cost of spreading compost
    ☐ Quality assurance of compost
    ☐ Risk of disease
    ☐ Benefits of composting
    ☐ Other (Specify) …….

29. What 3 problems or disadvantages prevent you using composts in your vineyard.

    1. ……
    2. ……
    3. ……

30. What would encourage you to use compost in your vineyard.

    ……..
    ……..
    ……..
    ……..
    ……..
    ……..
    ……..

**Thank you for completing this questionnaire**

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## Glossary

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|---|---|
| Aggregate stability | Description or measure of the degree to which groups of soil particles clump together to form soil "crumbs" which remain aggregated when wetted. A higher degree of aggregate stability is desirable and indicates good soil structure. |
| Agitator | Used in compost spreaders to agitate or "stir" compost, to reduce bridging or clumping of compost in the hopper; usually a belt-driven rotating bar with spikes mounted transversely in the spreader near the gate (outlet). |
| Air filled porosity | The volume percentage of a medium (soil, organic matter) filled with air when 'just-drained' |
| Amendment | A substance applied to the soil to remedy problems and change soil properties. Common examples are addition of organic matter to increase low soil organic carbon, addition of gypsum to remedy soil sodicity, and addition of lime to increase soil pH. |
| Application rate | The amount of compost applied to the soil. This can be expressed by its dimensions (eg. depth and width), volume (eg. cubic metres per hectare), weight (eg. tonnes per hectare), or concentration (eg. a percentage in a depth of soil). |
| Auger | A mechanical device for moving loose materials; used in compost spreaders to aid the flow of compost to the spreading belt. |
| Banding | Application of compost in a strip under the vine row. |
| BFA | Biological Farmers of Australia - undertakes certification of organic production systems. |
| Bridging | When compost fails to flow continuously through the compost spreader, and forms a "bridge" over the moving floor, preventing further agitation and movement to the spreading belt. |
| Broadcasting | Application/scattering of compost and other agricultural amendments across a broad area. |
| Canopy | The leaf and shoot system of the vine. |
| Compliance Agreement (CA-05) | Issued by the Department of Primary Industries to accredited compost facilities to enable them to supply compost to vineyards phylloxera exclusion zones (PEZ) and phylloxera risk zones (PRZ). |
| Compost | Organic material which has been microbiologically transformed under controlled, aerobic, thermophilic conditions to form a stabilized humus. |
| Compost contamination | Substances considered undesirable in compost - heavy metals, organic contaminants, pathogens and visual contaminants. |
| Compost maturity | Numerous definitions, but generally used to describe the degree to which compost has stabilised and decomposition has slowed. Mature compost will usually be free of phytotoxins and suitable for use directly around plant roots. |
| Compost processor | Commercial manufacturer of compost. |

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| Compost quality | The extent to which a compost has a range of desirable and undesirable properties affecting the fitness of the compost for its intended use. The properties used to define quality may vary depending on the intended use. The Australian Standard for Composts, Soil Conditioners and Mulches (AS-4454 2003) defines a range of properties and acceptable limits. |
| Compost spreader | A piece of machinery usually hitched to a tractor which is capable of carrying a quantity of compost and applying it in a band of desired depth and width under the vine row, or broadcasting. |
| Composting | A method of speeding up the breakdown of organic materials by micro-organisms under controlled conditions to produce a stabilized compost or humus. |
| Compost-mulch | Coarse compost applied to the soil surface as a mulch. |
| Excess vigour | Rapid growth of vine shoots and development of a large canopy which can lead to problems managing grape yield and quality. |
| Exclusion zone | Phylloxera-free areas of New South Wales into which it is prohibited to move soil and vine materials; accredited processors holding a Compliance Agreement (CA-05) can move compost into these areas. |
| Frost damage | Rupturing and death of plant cells due to freezing either within or outside the cell under frost conditions. Often appears as browning and death of leaves and young shoots. |
| Garden organics | Compost made from organic matter sourced from suburban council collections of garden trimmings, prunings, clippings and leaves. |
| Grade | The range of particle sizes within a compost. A coarse grade has a higher proportion of larger particles and a fine grade has a higher proportion of small particles |
| Grape quality | The degree to which the properties of the grape and its juice will produce quality wine. Largely subjective, but a range of measures including juice sugar, acid content, pH and grape colour are also used |
| Heavy metals | Metallic elements which may cause harm to plants, soils and microbes - arsenic, cadmium, chromium, copper, lead, mercury and zinc. |
| Hopper | Part of a compost spreader which carries/contains the compost. |
| Infiltration rate | The rate at which water moves into the surface of the soil. Higher infiltration rate is considered desirable in most situations. |
| Irrigation capacity | The area to which an irrigation system can supply a volume of water within a timeframe. Higher irrigation capacity allows growers to water and protect more of the vineyard during a hot/dry spell. |
| Late bud burst | When the first growth of vine shoots in spring is delayed, often due to cold soil temperatures. |
| Macro nutrients | Elements essential to plant growth . The elements found in highest concentration in plant tissues - nitrogen, phosphorous and potassium and also calcium, magnesium and sulphur.. |

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|---|---|
| Micro nutrients | Elements essential to plant growth which are found in low concentration in plant tissues - iron, manganese, molybdenum, copper, zinc and boron. |
| Moving floor | A conveyor belt running the length of the compost-spreader floor which moves compost through the hopper to the gate (outlet). |
| Mulch | An organic or inorganic layer of material (or cultivated layer of soil) applied to the soil-surface which interrupts the capillary withdrawal and evaporation (by direct sunlight or air movement) of moisture from the soil. |
| NASAA | National Association for Sustainable Agriculture Australia - undertakes certification of organic production systems. |
| Organic carbon | Carbon which occurs in compounds bound with hydrogen. Organic compounds form the basis of all living matter. |
| Organic certification | Official recognition awarded to growers who have achieved an organic production system. |
| Organic matter | The residue of plants, animals and microbes, including their excreta and secretions. |
| Organic production system | Where agricultural and horticultural products are certified as grown without the use of manufactured/synthetic chemicals and fertilizers. An organic production system may also specify other practices thought to enhance sustainability. |
| Organically managed | Where a vineyard is managed according to the principles of an organic production system, but is not necessarily certified. |
| Phylloxera | An aphid like insect native to North America which is a pest in some regions of Australia and is capable of causing severe disease in vines leading to stunting and death. |
| Phytotoxicity | Adverse reaction caused in plants by the presence of toxic compounds - these can be present in poorly composted materials. |
| Plant pathogen | An organism capable of causing a disease or infection in a plant. |
| Plant propagules | A seed or plant-part which is capable of initiating a new plant. |
| Pore volume | Similar to air filled porosity. |
| Processor | See compost processor. |
| Quality assurance | A specified program encompassing all aspects of agricultural production to which growers must comply to be able to supply their product to buyers demanding quality assured produce. |
| Quarantine program | Systems and procedures for minimising the risk of introduction of disease, plant-propagules and contaminants to the vineyard. |
| Recycled organic products | Horticultural products made from organic wastes. |
| Rotivator | Farm machinery which intensively cultivates the top 20-30cm of soil with a rotary action. |
| Salinity | A concentration of salt in the soil which causes harm to plants. |

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| Sodicity | A soil condition where high levels of sodium ions in irrigation waters replace other ions bound to soil particles, causing loss of soil structure. Sodic soils are difficult to manage, being sticky and slippery when wet, and hardsetting as they dry. Treated with application of gypsum. |
| Soil amendment | A substance applied to the soil to remedy problems and change soil properties. Common examples are addition of organic matter to increase low soil organic carbon, addition of gypsum to remedy soil sodicity, and addition of lime to increase soil pH. |
| Soil compaction | The compression of soil such that it loses structure and porosity. Commonly caused by the weight of farm machinery moving over the soil. |
| Soil conditioner | Organic matter or soil amendment applied to improve the soil. |
| Soil improvement | Improvement in a range of soil factors - usually used to refer to improvement in soil organic carbon, soil structure and nutrient cycling properties. |
| Soil moisture | Water held within the soil. |
| Soil organic carbon | A mix of living, dead and decomposing organic compounds derived from plant, animal and microbial tissues. |
| Soil strength | A measure of the effort required (pressure exerted) to push through soil. Gives an indication of the difficulty experienced by growing plant roots in finding a path through the soil. |
| Soil structure | The arrangement, size and stability of soil particles, soil aggregates and air spaces within a soil. |
| Spinner | An attachment to spreading machinery with spinning pick-ups which broadcast materials over a broad area. |
| Spreading belt | A transverse conveyor attached beneath the gate on the outside of a compost spreader, which delivers compost under the vine row. |
| Spreading machinery | Machinery used to band or broadcast agricultural amendments including composts. |
| Standards | The Australian Standard for Composts, Soil Conditioners and Mulches (AS-4454 2003). Outlines a range of compost properties and production methods which are considered to indicate acceptable quality. Can be used as a system to achieve accreditation. |
| Vine stress | Low soil moisture or high evapotranspiration conditions leading to a slowed rate of photosynthesis and leaf transpiration. Growers may consider a controlled level of stress as desirable at certain stages of seasonal growth. |
| Vine vigour | The rate of growth of vine shoots. |
| Vineyard establishment | Early growth of young vines and the tasks undertaken to achieve a viable vineyard; soil preparation, trellis and irrigation installation, vine planting, training and pruning. |
| Vineyard quarantine | See quarantine program. |

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| Visual contamination | Contaminants such as gravel, soil clods, plastics, metals and glass which are visibly obvious in compost. |
| Water holding capacity | An estimate of the soils water store; a useful indicator of the amount of water that can be stored in a soil and extracted by plants. |
| Water quality | A range of properties of water which indicate its fitness for application to plants. Agricultural producers usually rate water quality in terms of salt content, which is expressed either as electrical conductivity (EC) or total dissolved solids (TDS). |