driedfruits australia

Horticulture Innovation Australia

Dried Grape Best Practice Guide

Part 3

Spring to pre-harvest

2015

Sultana bunch flowering

CONTENTS

INTRODUCTION

The awakening of vines after their winter dormancy marks the beginning of one of the most active phases in vineyard growth and fruit development.

Consequently this period is also one of the busiest for growers and vineyard managers and one of the most critical in terms of establishing and monitoring vineyard health and fruit development.

Producing quality fresh grapes is the first step to producing a quality dried grape product. Diligent management practice and good strategic decisions during the development of the canopy and fruit focus on three major development stages:

- Budburst and Leaf Emergence
- Flowering and Fruit set
- Fruit Development

This guide is the third in a series of Best Practice Guides published by Dried Fruits Australia, and completes the annual cycle for dried grape production. It outlines the current recommended best practice in relation to key decision-making in the period from budburst to veraison, and the lead up to harvest.

This guide is intended for use in conjunction with the more detailed *Dried Grape Production Manual*, available from Dried Fruits Australia.

The information is based largely on industry knowledge and experience, as well as a review by former senior research scientist in horticulture at DEPI Mildura Dr Karl Sommer of published research. It has been compiled with the assistance of a grower-based advisory committee.

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BUDBURST AND LEAF EMERGENCE

In spring, the buds and protective scales along grapevine canes swell to reveal brown, woolly hairs ("woolly buds"). As the bud further swells, the tips of young green shoots emerge. In Sunraysia, this is usually around the second week of September. When 60 percent of the nodes have progressed to this stage the phase is known as budburst. Green shoots become clear and the leaves are completely free about two weeks after budburst; this is referred to as leaf emergence. Careful management is required throughout this spring and early summer period to ensure good shoot growth and cluster and berry development.

Frost Prevention

Frost damage on vines

Although the weather is warming in early September, the risk of frost remains high, with the potential for significant damage to the emerging and tender leaves and fruit buds. The ambient temperature increases by about 1°C for every 30 centimetres above ground level.

Although Swingarm trellis is considered a tall trellis, canes rolled onto the bottom wire may, in fact, be lower than the traditional Tee trellises - hence there is risk for considerable damage if growers are not attentive to frost mitigation management practices during the spring period (roughly from early September until early November).

The soil conditions that most suit the uptake of heat during the day and aid its release at night are:

- A clean inter-row area free of weeds or cover crops (vegetation shades the soils and reduces available moisture, thereby limiting heat uptake during the day)
- Moist soils (which have a greater heating capacity than dry soils)
- Compact, rather than aerated soils (compact soils have a greater mass and are quicker to heat and store heat better. The air in recently-cultivated soils acts as an insulting layer which limits warming during the day and the release of heat at night.)
- A clean undervine space prepared by killing weeds with herbicides and sweeping debris off the undervine area.

Cultivated soils therefore need to be rolled immediately after cultivation and then irrigated. Any cover crop or weed cover on uncultivated soils should be slashed as close as possible to the soil surface in August.

Best Practice

Remember to be a good neighbour - your vineyard management practices in spring not only affect your property, but also, potentially, your neighbours'. So do not undertake management practices that will induce frost. Cold air (and thus frost) wherever it is induced, will move to the lowest spot, and this may be your neighbours'. For example, premature working up of the soil may cause pockets of cold air to form on your property, and these may flow on to your neighbours' land.

A frost-path in a vineyard

Soil Moisture

Even though the vines are dormant in winter, it is important to maintain adequate soil moisture. If the winter has been dry, it may be necessary to apply an irrigation during pruning. An irrigation before leaves begin emerging is critical, because it sets up the vines for a strong budburst. But remember that vines use less water during the spring than during the height of summer when they have a full canopy of leaves, so take care not to over-irrigate.

Sultana fruitfulness

Too much irrigation can cause an excessive 'grand flush' of cane and leaf development especially in Sultanas. The excessive flush of growth creates long internodes on replacement canes, which will eventually shade developing canes and result in less fruitful buds – ultimately it reduces crop and causes a downward spiral in production.

Best Practice

Soil moisture should be monitored through visual inspection of the vineyard and with the use of soil moisture monitoring equipment. Irrigations should be controlled to provide adequate, but not excessive water, until pre-flowering. Establishing and maintaining the correct balance can be difficult. The States' Primary Industry departments offer appropriate irrigation training in their regular farming skills workshops and training courses.

Note when the last buds burst at the end of the fruiting canes to calculate correct timings for sprays for chemical cincturing.

Sunmuscat Shatter

Shatter of Sunmuscat berries, especially the second shatter, can at times be devastating and significantly reduce crop potential. Research has found that excessive berry shatter in Sunmuscats is caused by a shortage of carbohydrate supply to bunches following fruit set. The practice of hand cincturing can overcome the problem, but is not practical. The chemical Cycocel® has been developed to 'chemically cincture' the vines, however the timing of its application is critical. Where there has been a history of excessive second shatter, spraying with the setting spray Cycocel needs to be considered to improve berry set, thus crop size.

Best Practice

It is important to monitor budburst and note when the buds at the end of fruiting canes burst. The most success is achieved when Cycocel®77a is applied from 36 days after budburst through to flowering.

Rate

- **20 mL Cycocel®77a/100 L spray mix**
- **100 mL non-ionic wetter /100 L spray mix**
- **1,400 L spray/ha**
- **applied to the whole canopy**

It is important to maintain adequate soil moisture levels to prevent moisture stress in the vines when they are setting, especially in Sunmuscats when berry set is occurring.

If moisture stress occurs at this time, the results can be disastrous with the vines aborting nearly all of the berries on the bunches.

It is a fine balancing act to maintain enough moisture not to cause stress but also to prevent the 'grand flush' of overgrowth and the problems associated with it can cause.

Excessive shatter in Sunmuscats

FLOWERING AND BERRY SET

The period of flowering and berry set establishes the maximum number of berries on each vine. The number of bunches, along the canes, was determined by conditions during the previous November and by how many canes were retained on the vine during pruning. The number of bunches and the number of berries per bunch are important components of yield at harvest. Approximately eight weeks after budburst, the fused petals covering the developing flowers separate, and "capfall" occurs, with the five pollen-bearing stamens and the pistil then exposed. Flowering occurs at the point of the most rapid rate of shoot growth, usually about mid-November. The critical phase in determining the number of berries per bunch, namely fruit set, then follows.

Vineyard Management During Spring

Flowering grape bunches

It is important to be active in assessing the needs of the vine during the spring – its most vigorous phase of growth and development. Growers should monitor shoots closely, taking into consideration previous cropping performance, cover cropping history and the current and previous irrigation and fertiliser management regimes.

Consideration should be given to altering irrigation and fertiliser programs if:

- Vines are cropping poorly
- Shoots are showing low or excessive vigour
- Nutrient deficiency or toxicity symptoms are obvious

Irrigation

Sultana bunch after berries have set

Shoots, leaves and flowers develop rapidly after budburst, more so as the weather warms. It is important to have plenty of soil moisture available during the period leading up to flowering and berry set to try to make the best of the potential crop size. Avoiding stress during the period of bud initiation is also important for the subsequent season's crop size potential.

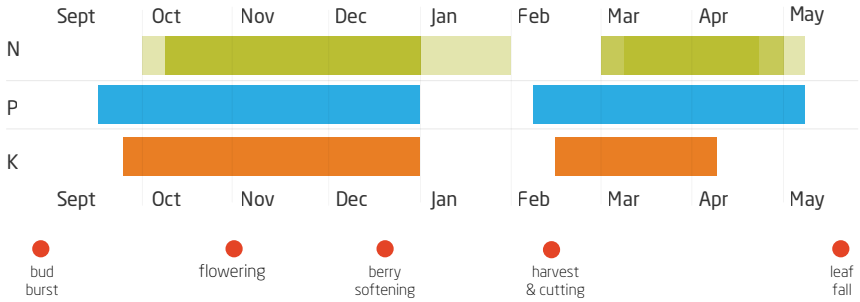
Best Practice
Monitor weather forecasts around berry set looking for heat wave conditions and irrigate accordingly. If the vines are dry and stressed during flowering and berry set, developing berries will drop off. This "excessive berry shatter" will result in far fewer berries left on bunches to develop into a crop.

Vine nutrition

There are no hard and fast recommendations for annual application rates of nutrients to vineyards. As a starting point, for each hectare of vineyard, just to replace removals, the requirements are up to 70kg of nitrogen (N), 10kg of phosphorous (P) and 100kg of potassium (K). The table below indicates when vine roots are taking up the largest amounts of N, P and K (for N, the different shades of green indicate the relative strength of the uptake - dark green for strong, light green for weaker take-up).

Best Practice
Petiole sampling at flowering is the most objective method of assessing vine nutrient status. Petioles from opposite the basal bunches should be sampled at 50% cap fall and analysed by an independent analytical laboratory. The concentrations can then be compared to the industry standards. Annual assessment using this method will allow growers to modify vineyard fertiliser programs to ensure vine nutrition is not a factor limiting yields and that fertiliser is not being wasted. Production records should also be maintained to assess fertiliser programs over the longer term.

The following table indicates when vine roots are taking up the largest amounts of N, P and K.
Different shades of green for N refer to the relative strength of uptake (i.e. dark green = strong, light green = weak)



If you are uncertain of what fertiliser or how much you should be using, consult a knowledgeable and experience agronomist.

Irrigation

Leaves and flowers continue to develop rapidly on the vine after budburst. It is essential to have plenty of available soil moisture during the period leading up to and during flowering and berry set to try to make the best of the potential crop size. Avoiding stress during the period of bud initiation is also important for the subsequent season's crop size potential.

Best Practice
Monitor weather forecasts around berry set looking for heat wave conditions and irrigate accordingly. If the vines are dry and stressed during flowering and berry set, the vine will physiologically react and abort the developing berries. This "excessive berry shatter" will result in very few berries left on bunches to develop into a crop.

PEST AND DISEASE CONTROL

Producing clean and high-quality dried fruit depends heavily on the pest and disease control regime implemented during the spring. Monitoring at least every two weeks for pests and diseases in the vineyard should begin at least four weeks before budburst. Growers should consult the Dried Fruits Australia Industry Spray Diary or other industry guidelines for currently registered fungicides and pesticides for use in pest and disease control. Whenever a spray application is applied, enter this into the DFA Spray Diary.

Weeks from budburst:	Vine growth stage:	Monitor for:
Minus 4.	Late winter.	Black spot; Phomopsis.
0.	50% budburst.	Record date
2.	Shoots 10-15 cm.	Downy mildew (if weather data indicates a need); Powdery mildew; Black spot; Phomopsis. Light Brown Apple Moth (LBAM) caterpillars; Mites.
4.	Shoots 20-30 cm.	Downy mildew; Powdery mildew; Black spot; Phomopsis. LBAM caterpillars; Mites.
6-7.	Pre-flowering.	Downy mildew; Powdery mildew; Back spot; Phomopsis. LBAM caterpillars; Mites.
8.	Early flowering (1-5% capfall).	Downy mildew; Powdery mildew.
9.	Late flowering (80% capfall).	Downy mildew; Powdery mildew. LBAM eggs and caterpillars.
10.	Berry set.	Downy mildew; Powdery mildew; Black spot; Phomopsis. Mealybugs; LBAM caterpillars; Bunch mites.
12.	Berries pea-size.	Downy mildew; Powdery mildew. LBAM eggs.
13.	Berries pea-size.	LBAM eggs
15.	Pre-bunch closure.	Downy mildew; Powdery mildew. LBAM eggs; Mites.
16-17.	Berry softening.	Downy mildew; Powdery mildew. Mealybugs; LBAM caterpillars; Mites;
20-22.	2 weeks before harvest.	Downy mildew; Botrytis. LBAM caterpillars.
22-24.	Harvest.	Botrytis (sample to check for chemical resistance). Crop damage assessments for all diseases and pests.
25-40.	Post harvest.	Downy mildew; Powdery mildew. Mites.

Pests

Insects

Although many different insects and mites can be found in the vineyard, relatively few are serious pests in Australia. The main pests damaging grapes being grown for drying are: light brown apple moth; long tailed mealybug; grapevine scale and bunch mite, also in some cases, earwigs. Natural predators including wasps, parasites, lacewings or ladybirds, as well as climate extremes, can assist in reducing numbers without the need for chemical control. Monitor insect activity in the vineyard and consider protection of vines at susceptible stages, such as flowering. Pest and disease identification charts are available from the States' Primary Industries agencies.

Brown Lacewing

Best Practice
The best pest management programs combine cultural techniques and biological control agents as the primary method of control, with selected chemicals used only as necessary to prevent pest populations reaching damaging levels. Wettable sulphur is less toxic to pest predators than broad spectrum insecticides. Consult an experienced agronomist if you require advice about whether to implement chemical control programs.

Snails

It is easiest to kill snails while they are still on the ground. So it is important to be monitoring the vineyard floor during early spring and bait where needed. This provides the best opportunity to prevent snails moving up into the developing vine canopy and contaminating fruit at harvest.

There are two types of chemical baits available -

- Methaldehyde (either grain bran or Durham) – (Green)
- Methiocarb – (Blue)

Best Practice
Although more expensive, the Durham, wheat-based pellets are longer-lasting because they are moisture resistant and do not disintegrate when wet.

Powdery mildew flag shoot.
(Photograph courtesy of Bob Emmett)

Diseases

The main diseases of dried grape varieties are downy mildew, powdery mildew, botrytis, black spot, bunch rots and phomopsis. Most spread rapidly in favourable conditions. Their ability to cause crop losses varies from season to season, depending on weather conditions and the stage of canopy development. Vine cultural techniques that discourage diseases should be adopted where possible. Open canopies, advanced irrigation systems and use of rain tolerant and disease resistant varieties will all contribute to producing high quality fruit. However, effective fungal disease management also depends on preventative sprays being applied on a routine basis and curative sprays being applied if needed.

Powdery Mildew

Powdery mildew is a widespread and persistent disease, with potential for high losses in vineyards where there was an infection the previous season. Powdery mildew overwinters in bark and buds and does not require moisture for an infection to occur. Preventative fungicide sprays, using a chemical such as sulphur, should commence within two weeks of budburst and then occur routinely at 14 day intervals through to flowering.

Powdery mildew is considered a fine weather disease and does not require a rain event to cause its spread and infection of vines.

Best Practice
The 'rule of thumb' strategy for powdery mildew preventative spraying is 2-4-6 weekly intervals from budburst. Then, in the period to flowering, monitor for disease and spray only if evidence of disease is found.

Downy Mildew

Down spots from a Downy mildew infection on the underside of a vine leaf

All dried grape varieties are susceptible to downy mildew, but it is a rain-triggered infection. It requires the occurrence of specific conditions, known as "10:10:24" – that is, at least 10 mm of rainfall while the temperature is 10°C or more over a 24 hour period. Rain splash of spores must occur towards the end of the 24 hour period and that the foliage remains wet for the rest of the 24 hour period. Preventative sprays for downy mildew can be applied in conjunction with sulphur sprays (being used for control of powdery mildew). Downy mildew preventative chemicals such as copper or mancozeb can be tank mixed with wettable sulphur.

Best Practice
Spraying for downy mildew may not be necessary in fine (no rain) weather. If not applying downy mildew preventative sprays regularly, it is wise to have sufficient phosphorus acid fungicide to apply at short notice as a post-infection control method.

Botrytis

Botrytis infection

Botrytis has become a problem for dried grape growers in recent years, especially for Sunmuscats. However, it must be remembered that Sultana is also susceptible before harvest if the conditions are right at flowering (to cause a latent infection) and if rain occurs before the fruit-bearing shoots are cut for trellis drying. Commence a botrytis preventative management program at flowering (80% or better capfall), followed by preventative sprays at pre bunch closure and at veraison. Further information on suitable chemicals is available on the Dried Fruits Australia botrytis fact sheet.

Best Practice

It is important to remember that certain chemical groups should only be used no more than two to three times in a season (depending on the chemical) in order to prevent the fungus building up resistance to the chemical. Apply a preventative spray ahead of forecast rain just before harvest. Due to its short withholding period of seven days, a strategy of holding a spare application of the chemical iprodione (product names such as Aquaflow or Rovral) should be considered in the overall botrytis management plan.

Weed Control

Caltrop plant

Weed seed is the most common contaminant of fruit, and incurs penalties at the packing shed, or may result in rejection of fruit. Be vigilant with spiked weed control throughout late winter and spring, particularly with the major problem weeds, three-cornered Jack, Caltrop and Gentle Annie. If there are only small 'hotspots', plants can be manually removed. However, chemical or mechanical control may be needed if the weed is more widespread. Other weeds that should be looked for are Khaki weed and Bathurst burr. Asparagus, when turned to seed, can also cause contamination in fruit and be difficult to remove, thus incurring a penalty.

Best Practice
Keep a keen look out for germinating weeds after rainfall and especially after thunderstorms. Caltrop will germinate readily with the onset of warmer weather and even more so as irrigations commence. Extra vigilance after rain for germinating Caltrop is recommended because they will flower and start to produce seeds within 10 days of germinating. They will go on to produce hundreds of seeds if conditions are right. Control in the field is the preferred method of keeping the seeds out of fruit and bins. It is far more costly to remove weed seeds present in harvested dried vine fruit.

VINE HEALTH AND FRUIT DEVELOPMENT

Managing vine health and fruit development to optimise productivity and fruit quality requires attention to many factors during the period from late winter through to early summer. Achieving best results depends on optimising the water, nutrition, pest and disease management regime in any given season for the specific soil type, variety and rootstock. Managing all these inputs is challenging, but adherence to basic principles will contribute to achieving consistently higher yields, even when environmental conditions are not favourable.

Fruit Development

Cordon bunch removal

Applying chemical cordon bunch removal spray

Chemical cordon bunch removal sprays are used to eliminate unwanted cordon bunches on all varieties but especially in varieties such as Sunmuscat and Carinas which have fruitful buds back to the base bud at the cordon. Cordon bunches should be removed before the bunches have grown too large and developed sufficiently to survive contact with the calcium nitrate spray.

It has been estimated that the cost of picking cordon bunches at harvest is about equal to the value of the fruit making this practice revenue neutral. However the cordon bunches will be slower drying draped over the wire which will delay the harvest date and potentially expose all of the crop to rain.

The ideal time to spray is when the bunches are approximately 40-50 mm in length (usually early to mid-October) but seek advice regarding suitability for use. (An alternative method is advised for Sunglo as buds that reshoot will usually be fruitful and produce a second crop.)

It is absolutely critical that the crop is protected from run-off and overspray and does not become wet below the cordon. Spraying with extra-large droplets to reduce spray drift will assist, as well as fitting a shroud to the sprayer on the opposite side of the spray nozzles to prevent drift onto the vines in the adjacent row.

Suitable equipment to prevent run-off and overspray

Preventing run-off can be achieved by constructing and fitting suitable protective equipment onto an air blast sprayer and fitting an 'air knife' that will blow any run-off away from the crop.

Best Practice
If using calcium nitrate spray, the recommended rate is:
25 kg technical grade calcium nitrate/1,000 L water, plus
- **1L/1,000L non-ionic wetter (such as Agral)**
- **Applied at a rate of 2,500 L/Ha (1,000 L/acre), and**

Whenever there is a spray application applied, enter this into the Dried Fruits Australia Industry Spray Diary.

Vineyard Management

Vineyard floor

When the risk of frost has passed, there is advantage to be gained by mulching any remaining cover crops, natural vegetation or weeds. The mat of decomposing plant material helps keep the vineyard floor cool as the weather warms up, thereby assisting with avoiding sunburn on susceptible varieties.

Best Practice
Avoid cultivation from late spring as bare soil reflects heat and increases the chances of sunburn on developing grapes.

Vine and canopy management

Maintaining adequate soil moisture is critical around the berry setting period. The amount of water applied to vines Swingarm trellis may need to be higher compared to conventional Tee-trellised vines because of the larger canopy and higher crop loads. Sunmuscat vines shed berries readily, and this may be attributed to moisture stress at berry set, as well as being on a rootstock with a higher density of roots at the top of the soil profile.

Best Practice
The canopy size should also be reduced in early summer. Promote good air flow through the vineyard by topping the vines growing down over the top of the non-fruiting side, as well as skirting just below the crop on the fruiting side of the trellis. This will assist with disease control if adverse weather conditions occur, improve access for wetting and harvest operations and assist with drying.

Heat damage

Sunburn damage on Sunmuscats

Try to keep the vines in a stress free condition otherwise the leaves will 'shut down' and stop producing sugar. Leaves will also slow down when the temperature reaches 36°C. As veraison approaches, berries begin to soften and may be more vulnerable to sunburn, particularly on rows with fruit on the north to north-westerly side of the trellis. Maintaining soil moisture levels will help maintain leaf function during hot conditions and also reduce the likelihood of sunburn.

The application of sun screen products based on Kaolin such as Surround® could be applied to vines to keep them cool and help protect them from sunburn prior to heat wave conditions should be considered.

Best Practice

From veraison (usually around the Christmas /New Year period) through to cutting, carefully monitor weather forecasts for predictions of heat waves. When hot weather is forecast, where possible, apply an irrigation to ensure the vines are well watered going into the heat event, and make sure water is ordered to keep the soil topped up during the heat event.

Early harvest preparation

Prepare equipment for harvest early – it's easy to get caught not having the parts that are required to service machinery or not having equipment ready at all by the time fruit is ripe and it's time to summer prune. As the fruit is maturing and you have some feel for the size of your crop, communicate with your processor regarding the estimated crop size. Some supply contracts may include tonnage clauses – if there is a large crop, early communication with the processor regarding crop size may enable the processor to receive the whole of the crop without applying price penalties to your over-quota fruit.

Best Practice

Avoid frustration and disappointment during harvest by regular communication with processors and contractors. Advance notice will allow the processor to allocate adequate bins for your harvest and avoid the frustration and disappointment of being short of bins. If you require harvest contractors, book in dates early for work to occur and, as harvest approaches, discuss any required changes. This will provide you the best opportunity of getting contractors on site when needed.

Notes

Healthy vines on Swingarm trellis

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Further information:

This booklet offers guidelines for decision-making at critical points in the pre-harvest and harvest phases of dried grape production. It offers suggestions for management practices that can help improve the quality of dried grapes produced.

This guide is to be read and used in conjunction with the Dried Grape Production Manual and the Spray Diary, both of which are available from Dried Fruits Australia.

More specific and detailed information and guidance on management procedures and current research is available by contacting the Industry Development Officer at Dried Fruits Australia. Growers should also seek specific information and advice from their preferred processor.