viti-notes

[Effective chemical use]

Research to Practice

Equipment adjustment and evaluation to maximise spray coverage

Viti-note Summary

- Calibration
- Adjusting air output
- Optimising air volume
- Optimising air speed
- Optimising air direction
- Travel speed
- Evaluating spray coverage
- Fluorescent dyes sprayed onto vines
- Water sensitive cards placed in the canopy

Other topics in this Viti-Notes series include:

- Targeting sprays for vineyard pests and diseases
- Maintaining product performance in spray mixes
- Selecting and using spray adjuvants
- Understanding chemical 'modes of action'
- Managing chemical resistance in the vineyard
- *Equipment adjustment and evaluation to maximise spray coverage*
- A single rate per hectare – why it shouldn't be used
- Determining chemical rates for dilute and concentrate spraying
- Determining dilute water volumes for spraying
- Calculating chemical rates for vines

Spray equipment has to be setup so that sufficient spray solution is delivered in a manner that achieves even coverage throughout the vine canopy while minimising off-target impacts and excessive run off.

Sprayer setup and evaluation should be carried out at least three or four times during the season for each trellising system used in the vineyard. Sprayer adjustment will be necessary each time the vine canopy or target changes, e.g. at budburst, 20 cm shoot length, flowering, pre-bunch closure and veraison. Evaluation of spray coverage is particularly important for late season applications to bunches.

Calibration

The speed of the tractor and rate of output from the sprayer enable calculation of the volume applied per 100 metres of vine row or per hectare. Sprayer setup must pay attention not only to the rate per area but also to:

- Different types of canopy architecture, and changes to the canopy size over the season;
- The specific requirements for managing each pest or disease;
- Weather conditions on the day of spraying.

The three main factors to consider during sprayer setup are:

- Vine canopy - Identify the target and any challenges to achieving effective coverage throughout the canopy;
- Air quality - The characteristics of the vine canopy and target determine the air quality – volume, speed, direction - required from the sprayer;
- Application volume - The vine canopy, air quality and application target determine the volume of liquid and the amount of chemical needed.

Adjusting air output

Air movement largely controls spray penetration into a canopy and evenness of chemical distribution across target surfaces.

- Air setup considers the target, growth stage, and canopy architecture.
- Air quality is the right combination of air volume, direction and speed for a specific target.
- Air volume, air speed, air convergence / mixing and air direction may be adjustable depending on the sprayer being used.
- Air should be used to move droplets to the target - not through the canopy to the next row.
- The spray plume should penetrate and settle out within a canopy so that an occasional puffing of droplet-laden air can be seen emerging from the other side of the vine.
- If it is windy, the spray cloud should emerge from the upwind canopy, which may mean considerable movement beyond the downwind canopy.

Optimising air volume

Sprayers usually produce too much air for the vine canopy during most of the season. To reduce air volume at the canopy, tractor speed can be reduced, fan speed through the sprayer gearbox or tractor PTO can be reduced, the blade pitch can be adjusted, or air can be bled from spray heads.

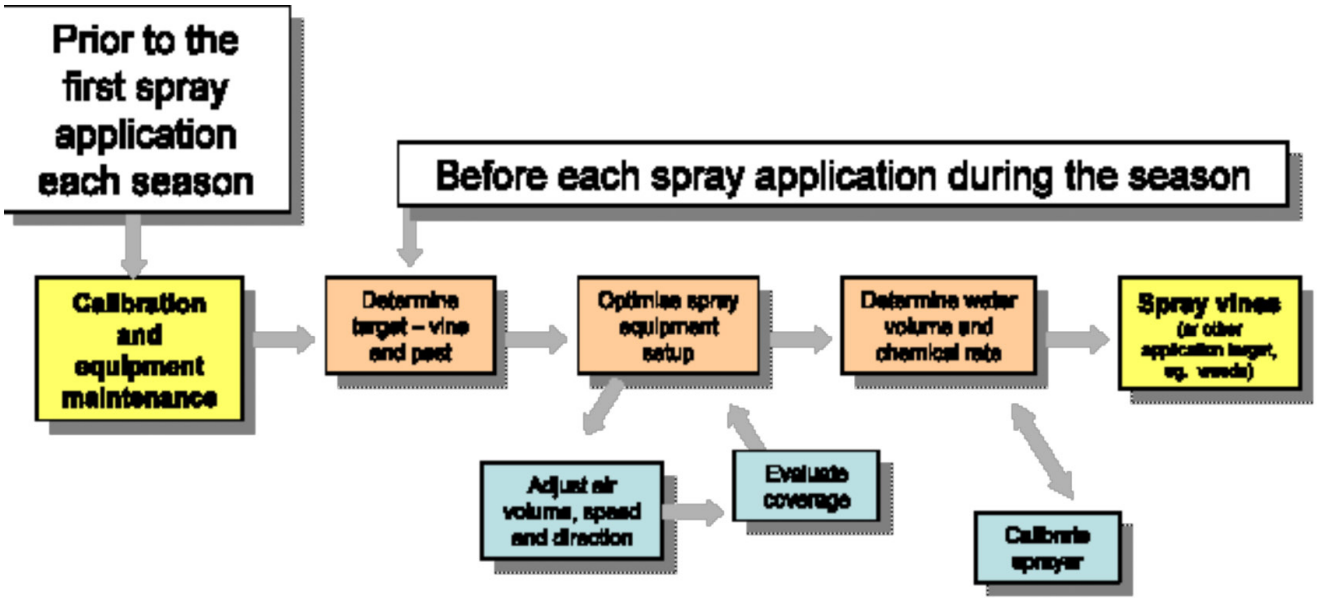

Figure 1. Spray application checklist.

Optimising air speed

Air velocity produced by some sprayers can easily push the spray plume through and beyond the canopy. High velocity air can also cause 'shingling' where leaves overlap and 'wall off' the inner canopy so that sprays do not penetrate.

To reduce air speed at the canopy:

- Reduce fan speed through the sprayer gearbox or tractor PTO;
- Increase distance of outlet from canopy by angling nozzles back or forwards (ducted and air shear sprayers);
- Enlarge the size of the air outlet (where adjustable use the largest opening or head possible to produce lower velocity, higher volume air).

Low speed and high volume air delivery result in the best canopy penetration for axial fan sprayers only (air shear machinery works in the opposite way).

Optimising air direction

Accurate targeting of air from fans, nozzles, heads or ducts is required to achieve even coverage and minimise off-target impacts. Achieving accurate targeting of air flow can be achieved in a number of ways:

- Using deflectors, towers or ducting which enable changes in head / nozzle angles and distance from the canopy;
- Arranging head placement usually 10 -15° back or forwards, and directed at canopy for multi-head fan sprayers - sequence of forwards, backwards, forwards etc. may be more effective when using multiple heads;
- Using canons with air shear equipment;
- Using angled air outlets or heads which lengthen the travel path of air and reduce potential for shingling of the vine canopy.

When directing air from a sprayer make sure that the spray swath covers the entire canopy and remember that converging air may, or may not, improve the evenness of deposits.

Travel speed

Travel speed should, within realistic limits, be selected to enable good penetration and coverage of the vine canopy:

- Slower travel delivers more air and spray volume per metre of row;
- Faster travel delivers less per metre of row, therefore drive faster if air output from sprayer is too high for the vine canopy.

Evaluating spray coverage

A number of techniques are available that can test the effectiveness of spray coverage. This evaluation has the potential to reduce chemical use and environmental contamination by identifying overdosing or where spray is missing the target. Water sensitive cards and fluorescent dyes can be used to evaluate the effectiveness of sprayer adjustments and operation, and to determine appropriate spray volumes.

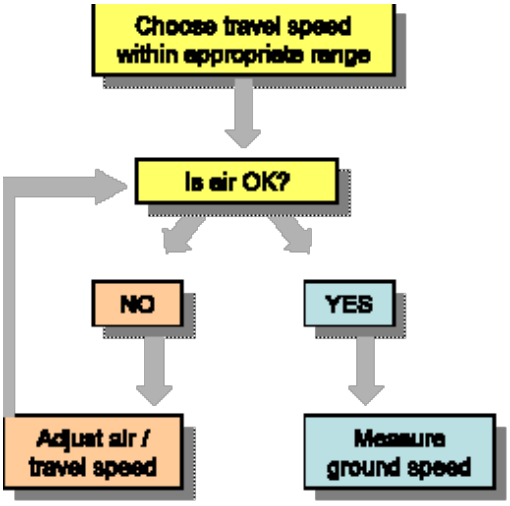

Figure 2. Evaluate spray coverage.

Fluorescent dyes sprayed onto vines

Dyes provide a means to measure spray coverage and are ideal for showing the distribution of sprays inside the canopy. Applied at night (the darker the better), a strong UV light highlights the dye and spray coverage. A high output black light has recently become available, enabling deposits to be assessed in the shade during the day.

A limitation with dye or pigment particles is that the process is too time consuming for adjusting and optimising sprayer setup. Also, dye does not necessarily behave in the same way as pesticides and should only be used as a guide as to where the liquid has deposited. A fluorescent dye assessment should be conducted at least once in the life of a sprayer. The major limitation to the use of fluorescent dye as a spray management tool is that in most cases the process it is too time-consuming to use for adjusting and optimising sprayer setup.

Water sensitive cards placed in the canopy

Water sensitive cards (WSC) have a yellow surface that is stained blue by water droplets. Coverage is assessed from the staining pattern and sprayers can be adjusted until the desired coverage pattern is achieved. Larger droplets (>100 µm) can be clearly seen on water sensitive cards while smaller droplets (< 100 µm) are carried in the air currents above and around the very smooth surface of a card. Use water sensitive cards only to compare equipment producing similar sized droplets.

Cards showing spray deposits should be kept as a permanent reference to assist with sprayer adjustments in the future.

NOTE: THE RESULTS OBTAINED FOR AIR SHEAR APPLICATIONS SHOULD NOT BE COMPARED DIRECTLY WITH PRESSURE NOZZLE APPLICATIONS

WSC can be placed in different locations in the canopy at each test run or attached at set heights to poles in fixed positions within the canopy. Using poles in this fashion is more effective as this spray target position remains fixed. Results are therefore repeatable and comparable, and any observed improvements made to coverage will be due to sprayer adjustments and not to where the cards are positioned within a canopy. The spray poles should be placed in the centre of the most 'difficult to spray' canopy in the vineyard.

Regardless of which method is used, during sprayer setup record equipment adjustments, climatic conditions, and vine growth stages.

When using WSC look for:

- Any major gaps in spray coverage within or around the vine canopy - where cards remain completely yellow;
- When runoff has occurred - where cards are completely blue;
- Uneven coverage - indicated when some cards turn blue while others are mostly yellow;
- Droplet size and distribution. (During sprayer setup it is generally too time consuming and unnecessary to do an actual droplet count to determine distribution, i.e. drops per cm2.)

When using WSC it is important to remember that:

- They give a true relative indication of droplet size from different nozzles (this is not the case with fluorescent dye results).
- They under-estimate coverage of fine droplets of less than 100µm.
- It is a water stain and not the dose which is shown.
- Drops spread and appear twice as large as they actually are.
- WSC deposits can be regarded as a 'worst case' - results will be better on actual vine foliage.

Acknowledgement

The Australian Wine Research Institute would like to acknowledge:

- Cooperative Research Centre for Viticulture (CRCV) and all involved in the VitiNotes series (1996 - 2006).

Further information

Innovator network factsheets

Spray application by Alison MacGregor

http://www.gwrdc.com.au/webdata/resources/files/GWR_070_Spray_Application_Fact_Sheet_FINAL_WEB.pdf

Training

For regional specific training in pest and disease control, the AWRI is running Research to Practice: Integrated Pest Management for changing viticultural environments.

Contact

Marcel Essling: rtp@awri.com.au for more information.

Agrochemical information

Agrochemicals registered for use in Australian Viticulture - updated annually.

Visit www.awri.com.au for the latest version.

Useful references

Nicholas, P., Magarey, P.A. and Wachtel, M. (Eds.) 1994 Diseases and pests, Grape Production Series 1, Hyde Park Press, Adelaide (a glove box edition of this book is also available).

For images of grapevine symptoms visit www.winetitles.com/diagnosis/index.asp

Product or service information is provided to inform the viticulture sector about available resources and should not be interpreted as an endorsement.

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