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A Practical Guide to Virus Testing

A simple step-by-step approach….

Introduction

While it is true that viruses can have a major, detrimental impact on vine performance (in terms of both quantity and quality), it also is true that many other factors can similarly affect your vineyard and may be confused with symptoms of virus infection. Before you embark on a virus-testing programme, be sure to check other issues that may be affecting vine performance and appearance. The following examples may be problems in their own right, they may present symptoms similar to virus infection, or they may also be compounding a virus problem:

- Seasonality – frost, cold, wet and dry events can all affect vine performance and appearance.
- Vine nutrition – while nutrients may be present in the soil, they may be unavailable when they are required because of nutrient imbalances or cool conditions. Some nutritional imbalances can produce leaf symptoms that look very much like virus infection.
- Crop-load can have a huge impact, particularly on younger vines carrying too much crop. Vines may take a season or more to recover.
- Irrigation – vines that do not have access to enough water can easily become stressed, which will affect the quality and quantity of yield.
- Canopy management – poor canopy management can cause shading that will affect quality and, ultimately, quantity of yield.
- Soils – the structure, drainage and management of soils can also affect quality and quantity of yield.
- Pests and diseases - vines can also be affected by a variety of pests and diseases. Common pests that can cause symptoms similar to virus infection include black beetles, grass grubs and white fringed weevils.
- Physical damage to the vine trunk, as caused by under-vine weed removal machines, can cause symptoms similar to virus infection.
- String damage - if the tie-string is too tight and constricting the vine trunk, leaf symptoms that appear similar to symptoms of virus infection may be produced.

Vineyard Mapping

It is easier to view and understand the levels of virus within your vineyard (and to check for any spread of virus) if you make a vineyard "map". If you plan to investigate the virus status of your vineyard, making a map is the first step (see attached instructions and field recording sheet included in this document). After mapping your block using this format, you can send the information to Linnaeus, where the staff will use it to generate a statistically designed testing plan. The test plan is tailored to suit your specific requirements and is designed exclusively for your vineyard. The test plan will then be returned to you along with pre-printed labels attached. Once Linnaeus has carried out the testing, the results will be entered on your vineyard map.

How many vines do I sample?

The type of testing plan decided upon and the number of vines that need to be tested depend upon the following points:

- the reason you are testing,
- the size and layout of your vineyard, and
- the degree of accuracy you require in the results.

Here are a few scenarios we commonly encounter when people come to us foe virus testing of their vineyards. In each case, we have included one or more testing programmes that would typically be recommended. A more detailed description of each programme is provided in the next section.

1. The vineyard has no symptoms and suffers no loss of yield or quality, but you may require some assurance that you are not harbouring virus in you r vineyard which may spread to adjacent blocks.

In this instance, we would probably recommend a random 5% or 10% ELISA-based testing plan for Grapevine Leafroll-associated Virsuses, types 1 and 3 (GLRaV-3 and GLRaV-1). This testing programme will show if you have any virus present and give you a good indication of the level of infection in the vineyard.

2. You are thinking of buying an already established vineyard and you want to know the vineyard's virus status before you proceed with the purchase.

In this instance, we would again probably recommend a random 5% or 10% ELISA-based testing plan, depending upon the size and layout of the vineyard. This will show if there is any virus present and give you a good indication of the level of infection in the vineyard. If any virus is found, further examinations can be made to test for spread if required. We may also recommend some PCR testing to check for other important viruses.

3. The vineyard has visual symptoms of virus infection and may also be showing loss of yield or declining quality. You wish to confirm your visual observations to help you better spot virused vines and you also want to know if the virus is spreading.

In this instance, we would select a number of vines you think are showing virus symptoms and an equal number of vines that do not have those symptoms. In this way, when you compare the test results to your observations, you will be able to "train" your eye for virus symptoms. We will also then do "cluster" testing around any vines that are shown to be positive for virus, and this will determine if the virus is actively spreading. Vines adjacent to known and symptomatic virus-positive vines may have only very recently been infected and may not show symptoms.

4. You have decided to top-graft your vineyard and want to know the virus status to determine if this is safe to do so.

Here we would probably recommend an initial 5% or 10% random testing plan based on ELISA for GLRaV-1, 2, 3 and GVA (Grapevine Virus A). We would also recommend that any vines that are showing symptoms or that are performing poorly be sampled as well. If the results from this initial test are clear, then we would recommend some PCR testing for a wider range of viruses. It is very important to get good information before proceeding with top-working.

5. You are in the vine propagation business and you wish to take budwood from a vineyard.

Here we would recommend an initial 5% or 10% random testing plan based on ELISA for GLRaV-1, 2, 3 and GVA. Test results from this testing regime will show if it is worth proceeding to collect budwood from this vineyard. If you decide to proceed, we would recommend that you then test all the vines (100% testing programme) before taking further action. Testing can be done in composites (see below) to keep the costs commercially acceptable.

Single versus composite testing

Testing can be conducted either on a sample taken from a single vine or on a composite sample. A composite sample comprises individual samples from each of up to 6 vines, which are all tested together as a single test. A composite test will give a positive or negative result for those 6 vines: if the result is positive (that is, virus is present), then a further 6 tests will be required to determine which of the 6 vines is virused.

100% Testing

100% testing is usually in done in composite lots, and is the typical option chosen when a grower plans to collect budwood from the block. If the population is less than 1000 vines, it could be cheaper to do 100% composite testing than statistical random testing, depending on how many positive bays are identified with virus present (which will then need breaking down into single tests).

Random testing

Statistically designed random testing plans provide an accurate picture of the virus status of a vineyard without having to test every single vine, as in 100% testing.

The main reason for using statistically designed random testing plants is that it can be much cheaper than doing 100% testing – yet the results still provide a high degree of accuracy (approximately 95% - 99%). The number of vines that need to be tested in order to get good information depends upon the size and layout of the vineyard, and it also depends upon the level of confidence, or certainly, that you require in the accuracy of the results. The higher the level of confidence you require in the results from a random testing plan, the more vines you will need to test. Also, generally speaking, the bigger your vineyard, the more vines you will need to test, although it is a function of statistics that the actual percentage of vines required for testing declines as the vineyard size increases.

5% and 10% random probes

Statistical random tests targeting only a small percentage of the vines in a vineyard are usually quite an economical option. Typically, we recommend using a low percentage random test, such as a random 5% or 10% of the vines in a vineyard, as a "probe" to get a snapshot of the virus status of the vineyard. While 5% or 10% probe may not provide a high level of statistical confidence, it will provide an indication of the levels of virus present in a vineyard. This sort of probe is often used initially to determine if it is worth continuing the testing programme at a higher level in the vineyard.

If you are concerned that you may have virus-infected vines in your vineyard, please call us at the contact numbers listed below.

Vineyard Mapping Instructions (for the field recording sheet)

To map the vineyard, use copies of the attached field recording sheet:
Fill out the Block details, the date and the name of the person doing the mapping.
Also note on the sheet which end of the vineyard you have started from (for example, south end, road end, and so on).
Walk each row and record the row number.
Stop at each bay and record the number of vines in the bay (remember to count the end assembly vine in with the first bay).
Record the codes in the "comments" column (for example, if the second vine is dead and the fifth vine is missing, write 2D, 5M).
Move to the next bay and repeat procedure.
It is better to walk back to the same end of the block to start the new row; often blocks do not have rows of equal length and you are more likely to make a mistake working backwards.

MORE INFORMATION:

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Field Recording Sheet - Example

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Grower Name:	Block Name:
Scionwood Variety:	Rootstock Variety:
Scionwood clone:	Rootstock Clone:
Mapper:	Date:

U - untested	D - dead	M - missing
VV – visual virus	Y - young	R - rogue
NE – does not exist		
Direction of Row mapping:	Direction of Bay mapping:	
Remember to include the first strainer assembly in the first bay and the end strainer assembly in the last bay		

Row Number: 104			Row Number: 105			Row Number: 106		
Strainer to strainer: +/- metres			Strainer to strainer:+/- metres			Strainer to strainer:+/- metres		
Row to row: metres			Row to row: metres			Row to row: metres		
Plant to plant: metres			Plant to plant: metres			Plant to plant: metres		
Bay No.	No. of Vines	Comments	Bay No.	No.Of Vines	Comments	Bay No.	No.Of Vines	Comments
1	3		1	3	3Y, 4R	1	3	1M, 2DS
2	4	2M, 4VV	2	4	1DS	2	4	2DS
3	4		3	4	3D, 4M	3	4	2DS
4	4		4	4		4	4	
5	4	1D	5	4		5	4	
6	4		6	4		6	4	4R
7	4	3R, 2VV	7	4	2Y	7	4	2,3,4VV
8	4	1,2 and 3VV	8	4		8	4	
9	4		9	4		9	4	
10	3	3DS	10	3	2,3 and 4DS	10	3	
11			11			11		
12			12			12		
13			13			13		
14			14			14		
15			15			15		
16			16			16		
17			17			17		
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26			26			26		
27			27			27		
28			28			28		

Office Use Only

Mapper:	Form checked:	Data Entered: / /	Initials:

Field Recording Sheet - Actual

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Grower Name:	Block Name:
Scionwood Variety:	Rootstock Variety:
Scionwood clone:	Rootstock Clone:
Mapper:	Date:

U - untested	D - dead	M - missing
VV – visual virus	Y - young	R - rogue
NE – does not exist		
Direction of Row mapping:	Direction of Bay mapping:	
Remember to include the first strainer assembly in the first bay and the end strainer assembly in the last bay		

Row Number:			Row Number:			Row Number:		
Strainer to strainer: +/- metres			Strainer to strainer:+/- metres			Strainer to strainer:+/- metres		
Row to row: metres			Row to row: metres			Row to row: metres		
Plant to plant: metres			Plant to plant: metres			Plant to plant: metres		
Bay No.	No. of Vines	Comments	Bay No.	No.Of Vines	Comments	Bay No.	No.Of Vines	Comments
1			1			1		
2			2			2		
3			3			3		
4			4			4		
5			5			5		
6			6			6		
7			7			7		
8			8			8		
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Mapper:	Form checked:	Data Entered: / /	Initials:

Field Recording Sheet - Actual

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Row Number:			Row Number:			Row Number:		
Strainer to strainer: +/-		metres	Strainer to strainer:+/-		metres	Strainer to strainer:+/-		metres
Row to row:		metres	Row to row:		metres	Row to row:		metres
Plant to plant:		metres	Plant to plant:		metres	Plant to plant:		metres
Bay No.	No. of Vines	Comments	Bay No.	No.Of Vines	Comments	Bay No.	No.Of Vines	Comments
29			29			29		
30			30			30		
31			31			31		
32			32			32		
33			33			33		
34			34			34		
35			35			35		
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Mapper:	Form checked:	Data Entered: / /	Initials:

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