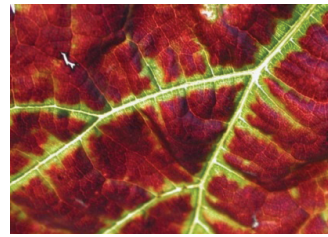




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## LEAFROLL CONTROL STRATEGY

### 5. SPREAD OF LEAFROLL DISEASE IN SOUTH AFRICA

Leafroll can only be spread by two general means; 1) either through planting infected planting material, or 2) via its vector (a mealybug or scale insect). In South Africa it is mainly due to the vine mealybug (*Planococcus ficus*).

The patterns in which infected plants occur within vineyards give clues about where the disease came from and how it got there and this helps with preventing this kind of spread from occurring further.

Common spread patterns observed are: 1) clumps of leafroll infected grapevines, 2) leafroll along the edges of vineyards, and 3) random occurrence of leafroll in young vineyards.

#### 5.1 Clumps of leafroll infected grapevines

The most common pattern observed is the occurrence of two or more leafroll infected grapevines directly adjacent to each other in rows (Fig. 1).



Figure 1: "Runs" of two or three adjacent leafroll infected grapevines, indicative of infection from a single infected grapevine to adjacent plants in the row. (Image: G. Pietersen, ARC-PPRI)

Newly infected grapevines typically spread from these grapevines along the rows in either direction, before spreading to adjacent plants across rows to create roughly spherical foci of infection (Figs. 2 & 3).

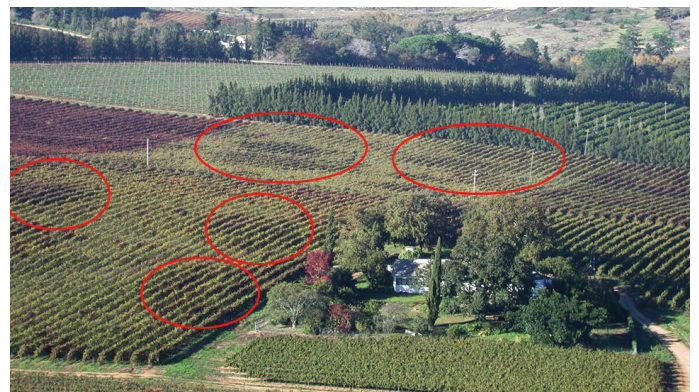


Figure 2: Foci or clumps of leafroll infected grapevines (red circles), indicative of secondary spread (spread from one grapevine in the vineyards to others, normally closest neighbors in the same vineyard). (Image: G. Pietersen, ARC-PPRI).

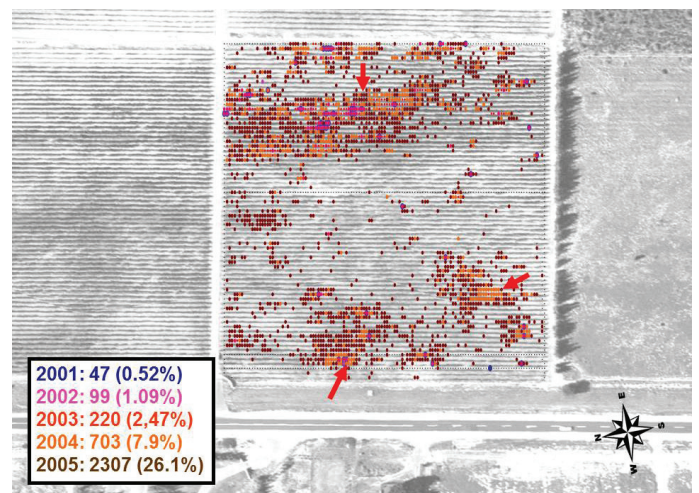


Figure 3: Aerial view of leafroll infected plants showing symptoms for the first time as indicated in the legend. Note the foci or clumps of infected plants indicated by arrows, each having arisen from only one or two infected plants initially. (Image: G. Pietersen, ARC-PPRI).



This means of spread from an infection focus in a vineyard, is termed secondary spread by epidemiologists as it takes place from plant-to-plant within a vineyard.

It is caused by the movement of the virus-carrying (viruliferous) mealybug crawlers 1) on their own, 2) on implements, 3) on laborers moving along rows, or 4) by various combinations of these.

The spread from these foci is relatively slow (in plant pathology terms) and is clearly the consequence of having an initial infected plant at a specific position in the vineyard.

Removal of infected grapevines (roguing) is a successful means of controlling secondary spread, irrespective of the mechanism of spread as this removes the source of the virus.

## 5.2 Leafroll along the edges of vineyards

A second common spatial distribution pattern observed is a large number of leafroll infected grapevines at the edges of a vineyard with a smaller number of infected plants towards the middle or opposite side of the vineyard (i.e. a gradient) (Figs. 4a-4d).

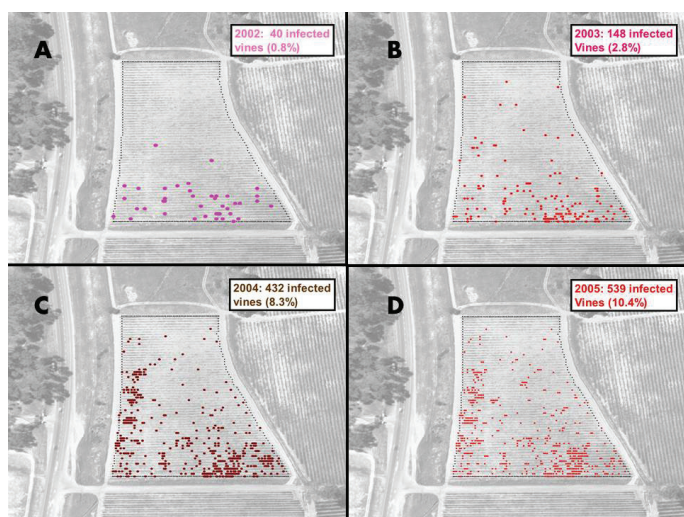


Figure 4: Aerial image displaying position of leafroll infected grapevines showing symptoms for the first time in the seasons indicated. Note the large number of infected grapevines at the bottom edge of the vineyard and lower numbers of infected grapevines towards the top and the progressive movement of the disease upwards, showing the spread of the disease from an origin outside this vineyard. Note also the formation of disease "clumps" from 2004 on, showing the occurrence of secondary spread. (Image: G. Pietersen, ARC-PPRI).

This spatial pattern indicates that the leafroll has been introduced into the vineyard from a source external to it (primary spread) and from a specific direction.

This pattern is mainly due to leafroll being acquired by mealybugs from a source external to the vineyard and being introduced by virus-carrying mealybugs by their own motility, by wind, by laborers or implements, or by various combinations of these.

In most instances the number of infected grapevines in these gradients is greatest in the direction from where the disease is introduced into the vineyards (often older proximal vineyards).

In vineyards where this disease spread pattern occurs, the disease gradient is along the grapevine rows, indicating spread of mealybugs on implements or laborers moving along the rows. However, on some occasions the gradient is across rows, suggesting that the mealybug is spread by a means which can cross grapevine rows (e.g. wind) (Figs. 4a-4d)

Sometimes a number of infected grapevines on the edge have no obvious source from where the disease originates (Fig. 5), but are close to a gate or a corner of the vineyard. This is indicative of viruliferous mealybugs being carried on implements or laborers from an origin some distance from the vineyard.



Figure 5: Image of leafroll infection occurring at a corner of a vineyard, with no obvious leafroll infected source next to it. This is due to the introduction of the disease from an origin outside of this vineyard possibly by viruliferous mealybugs on farming implements or laborers. (Image: G. Pietersen, ARC-PPRI)

Various strategies can be employed to reduce this, so-called, primary spread from an external source.

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