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Leaf by Leaf: An improved method of describing apple scab infections in field trials using MS Excel

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Abstract

An improved method for the evaluation of *Venturia inaequalis* infections of apple trees in field trials is proposed. The method takes into account the position of infected leaves on long shoots. A MS Excel worksheet was developed to facilitate the processing of these data. This can be downloaded at <http://www.oeon.de/downloads/venturia.zip>. We use this worksheet in our field trials and also for our consultancy service to compare different on-farm control strategies.

Keywords: *Venturia inaequalis*, apple, evaluation, MS Excel

Introduction

Apple scab, caused by *Venturia inaequalis* (Cooke) G. Wint., is one of the most serious diseases of apple worldwide (MacHardy, 1996). In the past five years we have conducted a number of trials aimed at improving methods for apple scab control in organic farming situations. Scab lesions were recorded on leaves from long shoots as well as basal rosettes. We found out that valuable additional information was provided by recording the position of infected leaves along the long shoot. In order to process these data more easily, an MS Excel sheet was developed, and this is described here.

Material and methods

For every scab control treatment, 25 long shoots were collected from each of four replicates. Only long shoots arising from vegetative buds, but not from blossom buds, were chosen for analysis. Collected shoots were stored in a plastic bag in a cold room at -4 to 2 °C for less than 7 days before analysis. Beginning from the two tablespoon leaves, each shoot was examined from bottom to top, and apple scab lesions were recorded for each leaf according to the following index: leaf without symptoms (0), leaf with one scab lesion (1), 2-3 lesions (2), and >3 lesions (3). To ensure that the correct positions were assigned, missing leaves were scored as 0. These data were initially recorded onto paper, and then transferred into the MS Excel worksheet. To give an example, a typical shoot would be recorded as 0 0 0 0 1 2 1 3 0 0 0 0 0 0 0 1 3 3 0 0 0.

A blank worksheet as well as an example of a completed worksheet may be downloaded from <http://www.oeon.de/downloads/venturia.zip>. Since this sheet uses only direct formulae (rather than the visual basic editor), it can be easily adapted to other uses. Following input of the data, Excel transforms each recorded shoot into an 'ideal shoot' with an average number of leaves, whereby each actual leaf is placed on its corresponding position along the ideal shoot. Both diagrams of the worksheet show the distribution of infections along the ideal shoot, Diagram1 as the number of infected leaves at each position, Diagram2 as the average infection index at each position. The entire model is based on the assumption that growth of all shoots begins at the same time in spring, different shoot lengths being due to different growth rates.

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For the same reason, only actively growing shoots should be analysed with this model. To determine leaf age, it is estimated that 1000 degree hours elapse between the initiation of two successive leaves.

Results and Discussion

The use of the MS Excel worksheet in the evaluation of field trials for control of *Venturia inaequalis* has enabled us to extract additional information from the recorded data. If successive infection periods of *V. inaequalis* are separated by more than 10 days, the efficacy of individual sprays can be evaluated. Further, information on their ‘control dynamics’ may be obtained; thus, sulphur (Fig. 1) and copper (Fig. 2) treatments can be demonstrated to react differently to rainfall during their crop protection periods (Maxin 2007). Further, by treating the leaf number as a time-scale (the highest number representing the youngest leaf), it is possible to estimate the time-point during the growing season at which infections occurred in individual orchards. In order to compare different farms, 100 shoots of the same apple variety are collected from each farm. An assessment and comparison of the results is then carried out during a consultancy meeting at the beginning of the new growing season.

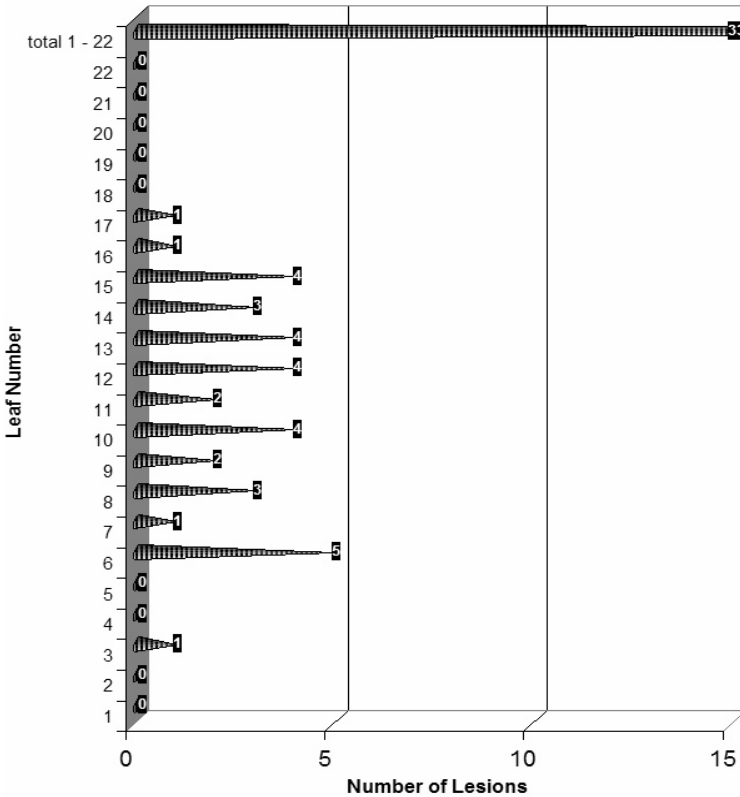


Figure 1: Number of infected leaves on the “ideal shoot” from a direct sulphur application during the infection period (from Maxin *et al.*, 2007).

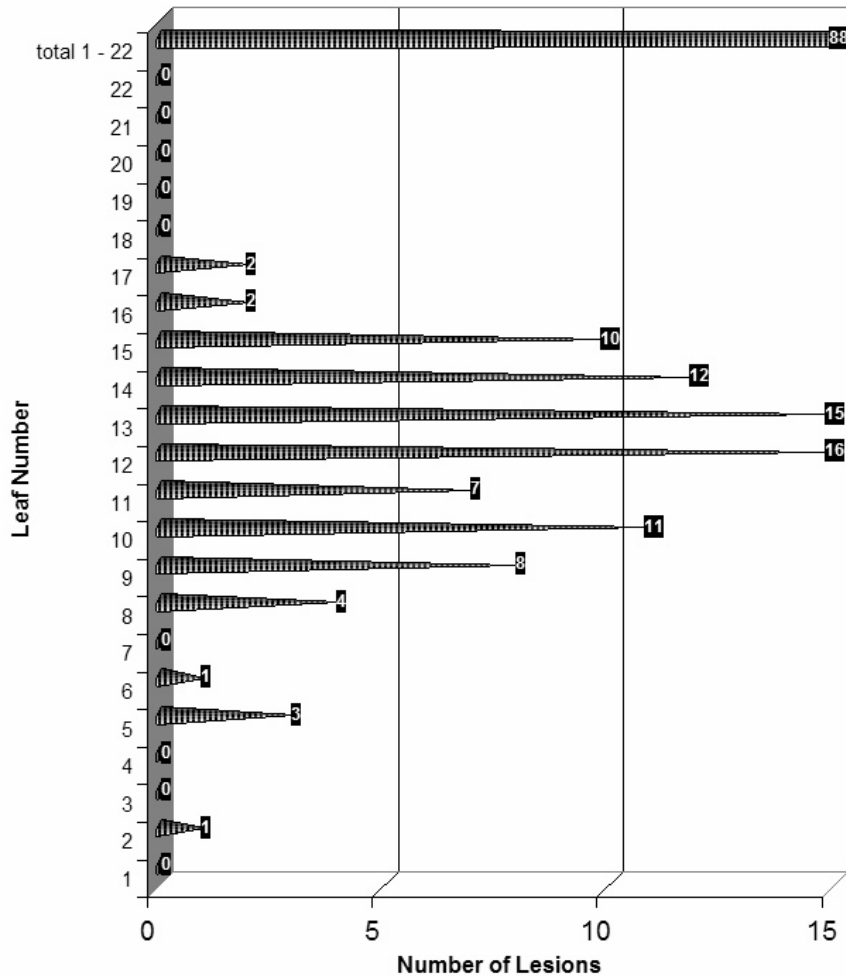


Figure 2: Number of infected leaves on the “ideal shoot” from a copper application (from Maxin *et al.*, 2007).

References

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