

Necessary plant protection input in several scab resistant varieties

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Abstract

Over a period of three years, different fungicide strategies were tested on four scab-resistant apple varieties. The aim was, to evaluate the potential of fungicide reduction for each variety, while ensuring appropriate regulation regarding apple scab and sooty blotch disease.

Keywords: Apple scab, sooty blotch, resistant varieties, reduced plant protection input

Introduction

The use of scab-resistant apple varieties is an important component in the regulation of apple scab in organic fruit growing, especially in the Lake Constance region. Since 2013 at the latest, resistance of first-generation scab-resistant apple varieties like 'Topaz' and 'Santana' has been overcome in many parts of the Lake Constance region. In addition to apple scab, sooty blotch disease causes high annual losses, especially in late-ripening varieties and in orchards with reduced plant protection input. In our trials, we wanted to address the following questions: Do vf- (Rvi6) resistant varieties still have advantages compared to susceptible apple varieties after resistance breakthrough? What treatment intensity is required for these varieties after resistance breakthrough to successfully control apple scab? Which strategies reduce both apple scab and sooty blotch disease, and what potential do newer scab-resistant apple varieties offer for reducing fungicide treatment intensity?

Material and Methods

The trials were conducted on an organically managed orchard at Kompetenzzentrum Obstbau Bodensee using four scab-resistant varieties: 'Deljonca', 'Freya', 'Topaz' and 'Natyra®'. The trees of the individual varieties were planted in 2013 ('Topaz', 'Natyra®'), 2014 ('Freya') and 2018 ('Deljonca') with a planting distance of 1.0 x 3.5 m on M9 rootstock. In order to test the influence of different plant protection strategies based on standard practice, the trials were designed as large-scale block trials. This offered the opportunity for applying the plant protection treatments with a customary fan sprayer. For each variety, four rows with 30 trees each (120 trees in total) were available for each treatment. To avoid edge effects, all surveys were carried out in the two rows in the middle.

Infestation with apple scab and sooty blotch was recorded on a total of 500 fruits per treatment at the respective harvest time of each variety. Infestation with sooty blotch was classified on a scale from 0 (no symptoms) to 5 (>50% of the fruit surface infected). All fruits in classes 2-5 were defined as losses in accordance with market requirements. In addition, leaf scab infestation was recorded on all leaves of 50 long shoots per variety in August. The timing of the plant protection treatments was based on the recommendations of Beratungsdienst Ökologischer Obstbau e.V. and using the RimPro forecasting model. Different fungicidal plant protection strategies were applied annually throughout the season on all four varieties. However, necessary treatments with insecticides were carried out uniformly and in accordance with standard practice in all variants.

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- (1) The control treatment received no fungicide treatment at all.
- (2) The 'standard practice' treatment, received common plant protection with preventive and additionally curative treatments in case of high infection risk according to RimPro.
- (3) In the 'only curative' strategy, treatments were carried out exclusively curative in the respective infection. This strategy therefore remained copper-free throughout the entire season.
- (4) In the 'only preventive' strategy, on the other hand, only preventive treatments were carried out.

In two strategies, fungicide treatments were only carried out until the end of the first generation of codling moth. From around end of July, these strategies remained without further fungicide treatments:

- (5) 'standard practice + end of treatments end of July'
- (6) In treatment 'reduced in spring + end of treatments end of July', plant protection intensity was reduced during the primary scab season by focusing exclusively on phases with a high risk of infection.

Additionally, the strategy 'standard practice + summer only curative', was tested on the varieties 'Topaz' and 'Natyra®'. It was performed as standard practice during the primary season and exclusively curative from around mid-June till harvest. All treatments were carried out in accordance with the regulations for organic fruit growing. Copper and sulphur products were used for the preventive treatments, while lime sulphur and carbonate products 'Kumar' and 'Vitisan' in combination with sulphur were used for curative treatments during the infection. The individual strategies and varieties thus required different numbers of fungicide treatments each year. The respective number is shown above the year in the graphs illustrated below.

Results

In the variety 'Topaz', the untreated control showed high levels of sooty blotch infestation and a pronounced susceptibility to apple scab (Figure 1). The standard practice strategy completely suppressed scab infestation in all three years of the trial, while infestation with sooty blotch disease could not be completely prevented. The strategy with standard practice in spring and exclusively curative treatments in the summer months achieved comparable results in the two years this strategy was tested. This suggests that control of sooty blotch disease in summer can be successful even without additional preventive copper applications. In contrast to that, a reduction in treatment intensity during the primary infection phase led to a slight increase in apple scab infestation and a significant increase in losses due to sooty blotch disease. The only curative, copper-free strategy led to a result comparable to the intensively treated, standard practice strategy in the dry year 2025. In 2023 and 2024, the 'only curative' strategy did not achieve a reduction in infestation comparable to the standard practice for either pathogen. The strategy limited to preventive treatments showed higher failure rates than the standard treatment in all trial years and thus proved to be insufficient.

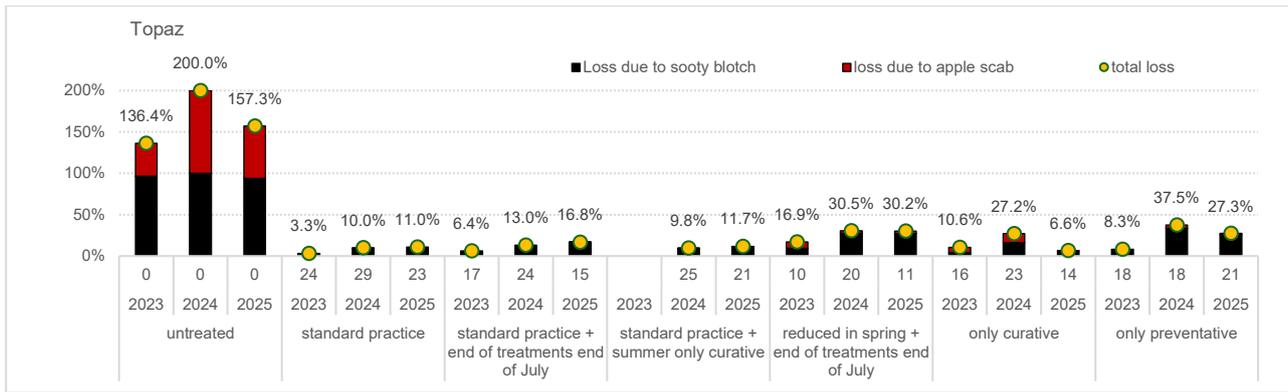


Figure 1: Annual losses due to apple scab and sooty blotch in several plant protection strategies for the variety Topaz.

As depicted in Figure 2, a moderate proportion of scab-infected fruit (15.7% and 22.6% respectively) was found in the untreated control of ‘Natyra®’ in two out of three years. In most of the strategies tested, scab infestation was generally very well controlled. Only in single years a slight fruit scab infestation occurred in the ‘reduced in spring + end of treatments end of July’ and ‘only curative’ strategies. However, the picture was different with regard to infections by sooty blotch disease. The untreated control showed a very high loss due to sooty blotch infestation, with values between 97.0% and 99.6% over the entire trial period. With the standard practice strategy, sooty blotch disease was almost completely controlled in two out of three years. Discontinuing fungicide treatments toward the end of July led to significantly higher losses due to sooty blotch infestation in the ‘Natyra®’ variety, which ripens in October. Similarly, the strategy with reduced treatment intensity in the primary season resulted in a significantly higher proportion of fruit affected by sooty blotch in all trial years. Ultimately, none of the variants with reduced treatment achieved a level of control comparable to that achieved with the standard practice strategy. Thus, despite its high resistance to apple scab, ‘Natyra®’ offers only limited potential for reducing treatment intensity, at least in the rainy Lake Constance region, due to its late ripening time and the associated high susceptibility to sooty blotch disease.

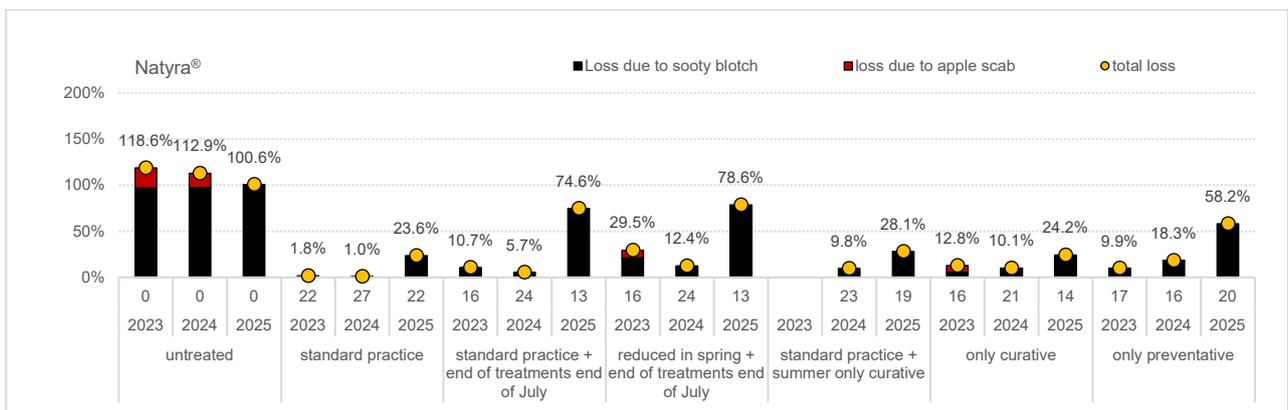


Figure 2: Annual losses due to apple scab and sooty blotch in several plant protection strategies for the variety Natyra®.

No apple scab was found on the variety ‘Deljonca’ throughout the entire trial period, even in the control treatment (Figure 3). This result underlines the variety's high resistance to apple scab. Accordingly, there was no loss due to apple scab in any of the tested strategies. The

variety also shows clear advantages compared to ‘Topaz’ and ‘Natyra®’ in terms of sooty blotch disease. Due to its early harvest time in mid- to late August, only a very low level of infestation occurred in the untreated control in two out of three years, with values of 0.6% and 0.7% of infested fruit. Accordingly, all strategies also showed no or only very low infestation by sooty blotch. The results suggest that the variety ‘Deljonca’ currently still has a high potential for reducing fungicide treatment intensity.

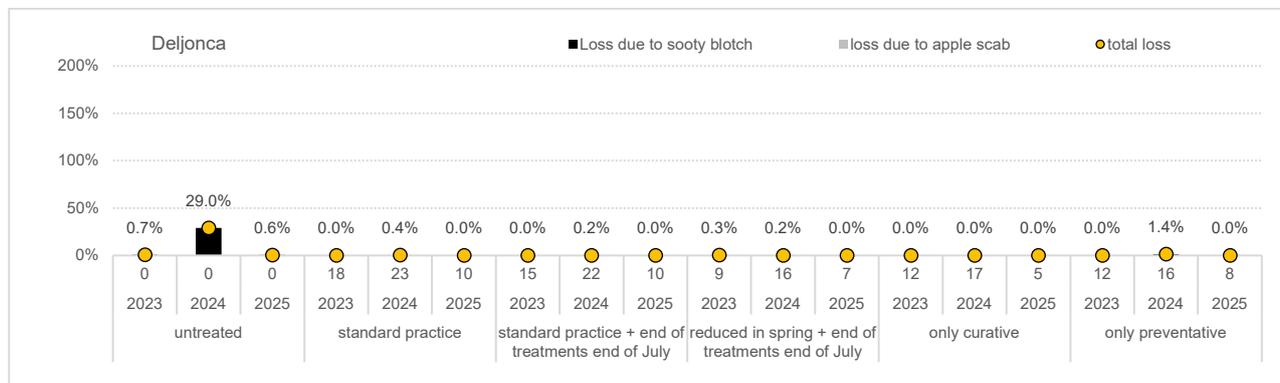


Figure 3: Annual losses due to apple scab and sooty blotch in several plant protection strategies for the variety Deljonca.

As shown in Figure 4, the variety ‘Freya’ confirmed a very high resistance to apple scab, with low proportions of fruit affected in the untreated control (0.0%, 0.4%, and 2.2%). Accordingly, even in the strategies with significantly reduced fungicide use, apple scab infestation was almost completely controlled. Despite the relatively early harvest date at the beginning of September, ‘Freya’ showed a high amount of fruit affected by sooty blotch, with values between 60.3% and 96.3% annually in the untreated control. In contrast to ‘Topaz’ and ‘Natyra®’, this could be controlled to a level comparable to the standard practice in several of the reduced strategies tested. Particularly the strategy limited to curative treatments showed very good results in all three years. Comparable with ‘Topaz’ and ‘Natyra®’, a reduction in treatment intensity in spring also resulted in a significantly increased proportion of fruit affected by sooty blotch in two of the three trial years.

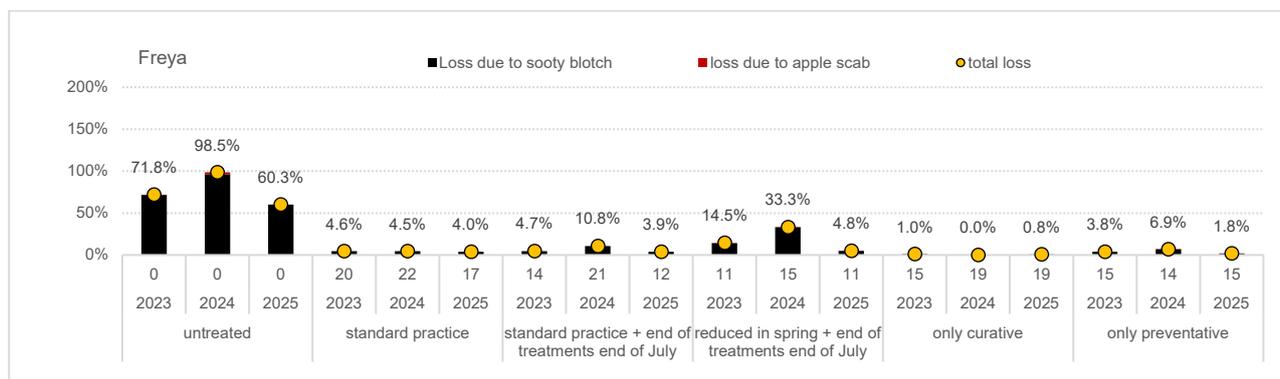


Figure 4: Annual losses due to apple scab and sooty blotch in several plant protection strategies for the variety Freya.

Discussion

Despite of partially identical resistance genes, the tested varieties showed obvious differences in susceptibility to apple scab. While 'Deljonca' (Rvi10) and 'Freya' (Rvi6) showed almost no fruit scab infestation in the untreated control, a high proportion of scab-infested fruit was found on the untreated trees of 'Topaz' (Rvi6) in all years. Without any fungicide treatments, 'Natyra®' (Rvi6) showed only moderate scab infestation in two of the three trial years. The results thus demonstrate that the newer scab-resistant varieties 'Deljonca' and 'Freya' in particular still have high potential for reducing the intensity of fungicide treatment in the control of apple scab. In the 'Topaz' variety with proven resistance breakthrough, apple scab was successfully controlled in all years using the standard treatment strategy, thus demonstrating advantages over susceptible varieties. However, this variety offers little potential for further reduction in treatment intensity. Furthermore, the results underline the high significance of sooty blotch disease for the rainy Lake Constance region. With regard to sooty blotch disease, 'Deljonca' also had the lowest loss rates of all tested varieties due to its early harvest time. Over the three year trial period, losses due to sooty blotch were significantly higher than losses caused by scab in the varieties 'Freya', 'Topaz' and 'Natyra®', both in the untreated control and in most strategies. The late-ripening variety 'Natyra®' in particular shows high susceptibility to sooty blotch and therefore offers little potential for reducing treatment intensity despite its scab resistance. For 'Freya' and 'Topaz', the copper-free strategy limited to curative treatments showed promising results for sooty blotch control. This indicates that successful control of sooty blotch disease can be achieved with exclusive treatments during infection and without the use of copper preparations. In this context, the Oekoapfelforward project is currently investigating the extent to which modern brushing machines for the mechanical removal of sooty blotch symptoms can contribute to a reduction in fungicide treatment intensity as an additional component in an overall strategy.

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