

New products for scab regulation in organic fruit growing?

C. Casera¹, M. Kelderer¹, A. Mora Vargas¹, Discipulus Incognitus

Abstract

Scab (Venturia inaequalis) is the most important disease in apple growing. Even in organic cultivation, apple orchards must be treated intensively, and this also applies to scab-resistant varieties. Most resistance has now been broken through. For preventive treatments, mainly copper preparations are used. According to the European registration, copper should be replaced as soon as possible with other preparations, because copper accumulates in the soil and harms various organisms in the soil. Lime sulphur can be used as a preventive measure or to target wet foliage in the infection. Sulphur lime is also feared to be subject to more and more restrictive conditions. In the last few years, various experimental stations have tested new alternative preparations for scab control. In the research Center Laimburg (RCL) trials, a preparation based on pelargonic acid from the company Neudorff has also shown an interesting effect both as a preventive measure and specifically against scab.

Keywords: *Venturia inaequalis*, apple scab, organic apple orchard, copper replacement, pelargonic acid

Introduction

For many years, alternatives to copper have been tested at the RCL for the regulation of fungal diseases in fruit growing and viticulture. In recent decades, the lime sulphur and various hydrogen carbonates (Kelderer 20) have been successfully tested and introduced. For copper and sulphur lime, there is a risk that further requirements could restrict their use. Trials were also carried out in 2021 with the preparation (Neu-1143 F) based on pelargonic acid from the Neudorff company and other preparations in comparison with copper and sulphur lime.

Material and Methods

The field trial was carried out in 2021 at the Laimburg Research Centre, Vadena, South Tyrol in Italy. The products were tested in an orchard with the variety 'Golden Delicious', which is ideally suited as a test cultivar due to its high susceptibility to scab, leaf burning and russetting on the fruits. In Table 1 the different experimental plant protection products and plant strengthners are given. The spray scheduling was set according to the meteorological data of the Laimburg Research Centre site. The treatment timing were directed either preventive or scab stop on wet leaves after 300 or 500 degree-hours, (number of hours multiplied by the mean temperature in degrees Celsius between the onset of rain and the time of treatments. The experimental treatments started on the April the 21st, 2021, and ended on May on the 23th, 2021. There were carried out 9 preventive treatments, 10 scab stop treatments on 300 degree-hours and 7 scab treatments on 500 degree-hours.

The treatments were carried at a speed of 3.5 km/h with blue air-injector flat spray nozzles CVI with a spray pressure of 8.5 bar and with a water volume of 1500 l/ha. While using experimental product Neu-1143 F (Neudorff) problems occurred during the application. Before the applications started, the orchard was divided into 44 randomized plots. The

¹ RC Laimburg, 39040 Post Auer, South Tyrol, Italy; markus.kelderer@laimburg.it, corresponding author

experiment included 10 trial products and the untreated control, which were all repeated 4 times. One plot had 10 trees (with 1 border tree on each side), from which 25 shoots (west and east side) were collected. The primary scab infestation on leaves was divided into classes: 0: 0 spots, 1: 1-5 spots, 2: 5-15 spots, 3: more than 15 spots. All leaves per shoot were counted. The primary scab on fruits was divided in two classes: affected or not affected. Per plot 200 fruits were counted. An assessment on russeting on the fruits was carried out on harvest in September. The intensity was estimated in percentage of affected surface on the fruit.

Table 1: Applied experimental products and application time

nr.	trial products	active ingredient	application time	dose gr - ml/hl	notes
1	Neu-1143 F	pelargonic acid	preventive	2 l	to repeat after 20-25 mm precipitation and/or after 2-3 days
2	Neu-1143 F	pelargonic acid	scab stop 300 GS	2 l	to repeat after 300 GS
3	Neu-1143 F	pelargonic acid	scab stop 500 GS	2 l	to repeat after 500 GS
4	Polisenio	lime sulphur	preventive	1,6 - 1,2 kg	to repeat after 20-25 mm precipitation and/or after 2-3 days
5	Polisenio	lime sulphur	scab stop 300 GS	1,6 - 1,2 kg	to repeat after 300 GS
6	Polisenio	lime sulphur	scab stop 500 GS	1,6 - 1,2 kg	to repeat after 500 GS
7	Poltiglia disperss	cupper	preventive	50 g / hl	to repeat after 20-25 mm precipitation and/or after 2-3 days
8	Bordoflow	cupper	preventive	80 ml / hl	to repeat after 20-25 mm precipitation and/or after 2-3 days
9	experimental product	botanic extract	preventive	333 ml / hl	to repeat after 20-25 mm precipitation and/or after 2-3 days
10	experimental product + Poltiglia disp.	botanic extract + Cupper	preventive	333 ml + 16,5 g / hl	to repeat after 20-25 mm precipitation and/or after 2-3 days
11	untreated		-	-	-

Statistic

The data collected were statistically evaluated by one-way ANOVA and the analysis of variance and differences was determined by Games-Howell test. All analyses were performed using the software IBM SPSS Statistics 24.

Results

Figure 1: Intensity of scab infections on leaves.

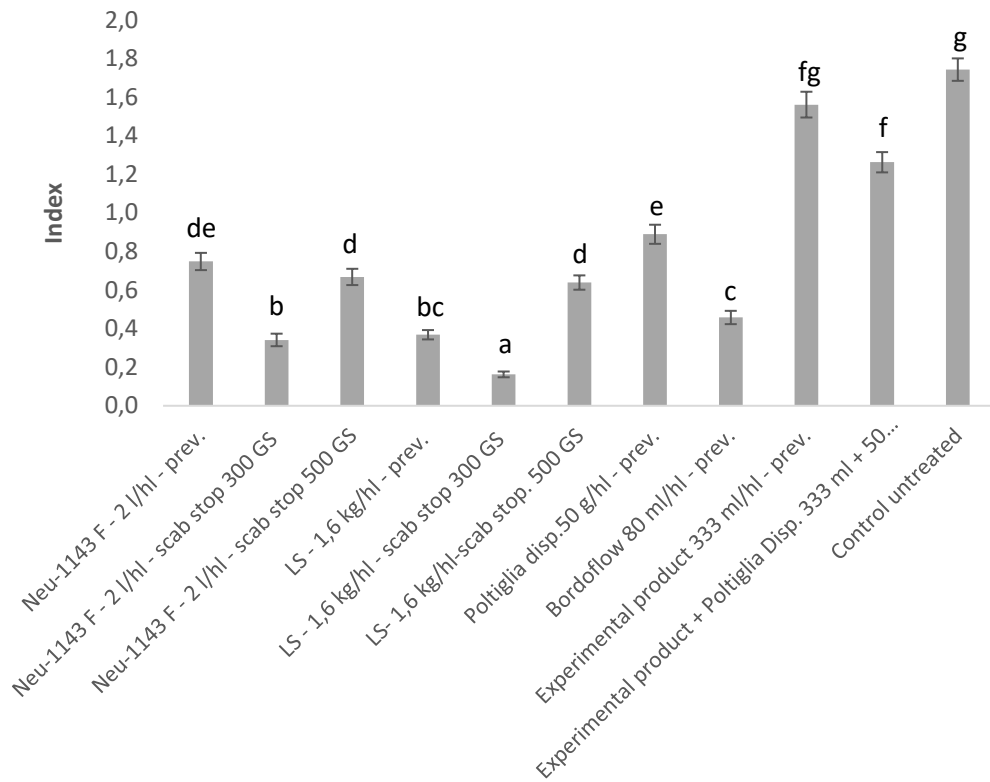


Figure 2: Percentage of fruits with scab spots

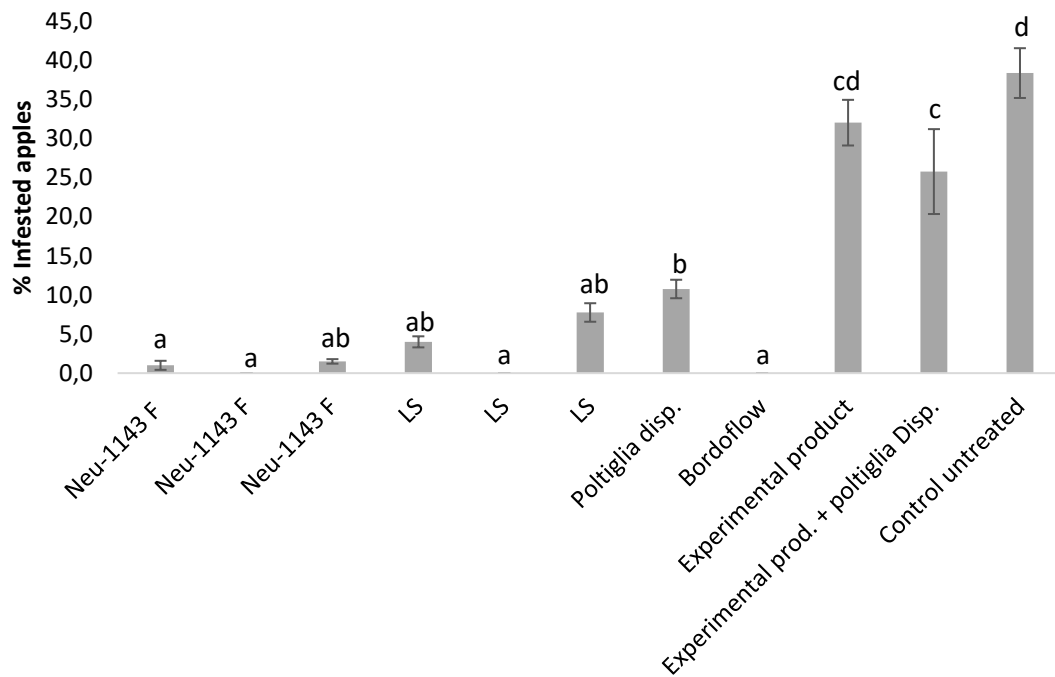
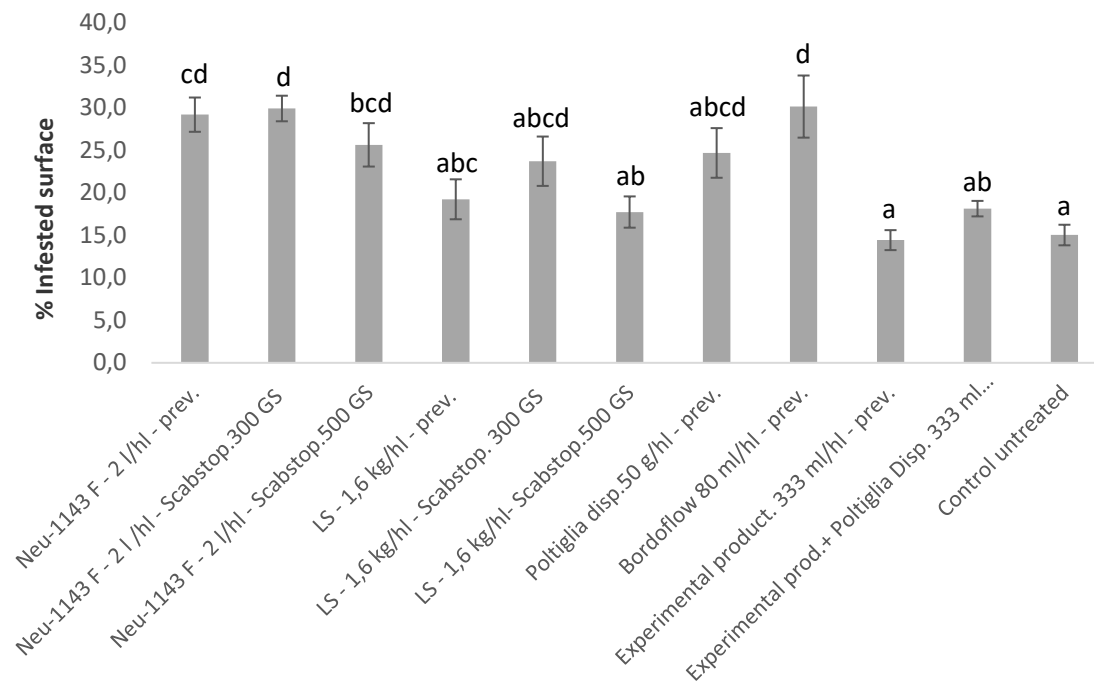


Figure 3: Intensity of russeting on the fruits



The scab infestation in the untreated control plots shows us the scab pressure in the trial plot. On average, every leaf had at least one scab spot (fig.1). Of the fruits, 47 % were infested with scab (fig.2). Of the trial variants, the sulphur lime broth applied specifically 300-degree hours after the start of rain brought the best results on both the leaves and the fruit. Similarly good results were obtained with Neu-1143 targeted after 300-degree hours. The preventive application of Neu-1143, the application of Neu-1143 targeted after 500-degree hours and the application of Bordoflow also gave good results on the fruit. The use of Poltiglia Disperss, a standard copper product in South Tyrolean organic fruit growing, was surprisingly weak. The botanical experimental product showed no useful effect neither if combined with a low dose of copper. As far as russeting is concerned, the copper preparations have been known to cause russeting on the fruit, but the preparation Neu-1143 also showed russeting on the fruit both when used preventively and, when used as scab stop treatment. (fig.3).

Experimental product 1 and experimental product 2 proved to be very effective against *Venturia inaequalis*. Especially experimental product 1 was able to reduce the infestation intensity on the leaves to 13%. However, the leaf burn caused by experimental product 1 should be considered in future trials. The copper product Poltiglia Disperss achieved the expected effects of a copper-based product. It is evident that, when added to Gowan-10320 and Plantonic, it increased the efficacy of the individual agents. The product Neudorff did not perform as expected. The infestation intensity could be reduced to only 28%. The use of the product resulted in sticky residues in the spray filter and consequently in clogging. However, in publications on Neudorff against *Venturia inaequalis*, the agent behaved effective and provided promising results (Benduhn et al., 2020). Therefore, it can be assumed that the foam-stopping agent negatively affected the efficacy of the product Neudorff. The products Romeo and Auralis, both registered against powdery mildew, did not

have a high efficacy. With an infestation rate of 37% the product Romeo was at the bottom of the range compared to the other trial products. With a percentage of 46.5%, the trial product Auralis performed the worst, and is only very slightly ahead of the untreated control. This means that Auralis cannot be considered effective against primary scab. The infestation of the untreated control had the highest rate with 46.6%. In the fruit scab evaluations, where only a small number of infected fruits were found, the arithmetic mean was about 5%. For russetting, the major differences were up to 11%. The highest rate had the trial product Romeo (27.8%) followed by trial product 8 (25.5%). The best results achieved trial product 9 (16.2%) and Poltiglia Disperss (16.7%).

References

- Benduhn, B., Zimmer, J., Buchleither, S., Rank, H. and Kunz. (2020). NEU 1143F, a possible new agent to reduce the use of copper in organic pome fruit growing, results from a joint research project. 19th International Conference on Organic Fruit Growing 17-19 February 2020, Hohenheim, Germany.
- Kelderer M. Casera C. und Lardschneider E. (2006). First results of the use of potassium bicarbonate against scab in South Tyrol. Ecofruit - 12th International Conference on Cultivation First results of the use of potassium bicarbonate against scab in South Tyrol. Ecofruit - 12th International Conference on Cultivation Technique and Phytopathological Problems in Organic Fruit-Growing Weinsberg/Germany, S. 93-97
- Zemmer, F. Marschall, K. Kelderer, Markus und Zelger R. (2002). Mode of action of lime sulphur against apple-scab (*Venturia inaequalis*). Ecofruit - 10th International Conference on Cultivation Technique and Phytopathological Problems in Organic Fruit-Growing Weinsberg/Germany, S. 94-95