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BOOK OF ABSTRACTS

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How vineyard features and application time may affect the phosphonates residues in the bunches

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Highlights

- The good antifungal activity of phosphonates and their good tox and eco-tox profile increased their use in plant protection
- Time of application is the main factor that affects the level of residues of phosphonates in bunches at harvest, but the role of weather conditions and vineyard vigour cannot be underestimate

Introduction

Phosphonates are increasingly used against *Plasmopara viticola*. They are highly effective against Oomycetes and have a good tox and eco-tox profile. They have been often use as fertilizers, taking also advantage of their fungicide effect. In Europe the use of phosponates as fungicides is allowed only if registered according Reg. 1107/2009 and it si not allowed in organic agriculture..

The antifungal activity and the behavior of phosphonates inside the tissues was studied in some crops (Anil Kumar et al., 2009; Deliopoulos et al., 2010), but is not fully known in the grapevine. This inorganic salt, unlike phosphate, is not metabolised by the plant cells as phosphorus source with consequently progressive accumulation, especially in the bunches (Speiser et al., 2000; Kauer, 2010). As reported in literature, we found that the time of application is crucial on the residue amount at harvest time, but vineyard vigour and the agronomic practices are not highly relevant.

Material and methods

In 2015 and 2016, potassium phosphonate (Century®SL, BASF, Germany) was applied in two vineyards located in San Michele all'Adige (TN, Italy) with different characteristics (variety, vigour). The experimental set up included various application times (pre and/or post bloom) in combination with canopy management (hedging in 2015 and leaf removal in 2016).

The experimental set up was randomized complete block design. Blocks (33 m^2, 8-9 plants) were treated with Century®SL (12 l/ha per year) and compared with traditional fungicides and untreated control. Each treatment had four blocks (replicates). The treatments were applied with a motorised backpack mistblower (Solo 450®, Germany) using a spray volume of 550 l/ha. Some treatements were complemented with copper hydroxide. Timing was adjusted based on weather forecast and the experimental design. Plant material removed with the summer pruning was weighed and the vegetation weight estimated in three times (leaf removal, hedging and harvest).

In 2015 samples of bunches (1 kg) were collected in each replicate for phosphorous acid (PA) analysis (QuPPe method) at harvest. In 2016 the sampling was carried out four times, between last treatment and harvest, in order to draw a residue (expressed as fosethyl) trend, evaluating also the volume and weight growth of the berry. The disease efficacy was assessed on 60 leaves and 40 bunches for each replicate at the end of the season.

Results and discussion

In 2015 the disease was much less destructive than in 2016 with a disease severity on the untreated, respectively of 7 % and 50 % on leaves and 23 % and 80 % on bunches. In aggreement with previious literature, the efficacy of phosphonates was confirmed, both in 2015 and in 2016, with a better protection of leaves than bunches, respectively with an efficacy of 97 % - 88 % and 88 % - 71 %.

The main question was related to the residues of PA at harvest (expressed as fosetyl) and, in particular, on how it could be affected by application time, vineyard vigour and canopy management.

In 2015 the bunches collected in one vineyard, named SD (Pinot gris), showed higher content of PA than the other one, named FAC (Schiava). Moreover, the analysis highlighted the importance of the time of treatments. In the case of early harvest (vineyard SD), application before the blooming decreased the residue level (26 ppm) considerably more than application after blooming (77 ppm). Timely treatments, before and after the blooming, showed intermediate residue levels (44 ppm). In vineyard FAC, with late harvest, the PA values in the different treatments were similar (below 20 ppm). Hedging, used as the test factor of the canopy management, did not affect the PA residue. Another difference of vineyard FAC respect to SD was the vigour: higher in FAC than the SD. For this reason, in 2016, two areas of the same vineyards with high and low vigoury were selected to evaluate this aspect. The levels of PA in the two vineyards at harvest were all between 5 and 15 ppm, with the higher values always in correspondence of the late treatments. The effect of vineyard vigour was not significant in the PA accumulation in the bunches. Canopy management, in terms of leaf removal as test treatment, caused a slight reduction of the residues only in the SD vineyard. By analyzing the data of the four samplings over time, the PA concentration in the bunches decreased from the last treatment till the harvest, but in parallel with berry size increase. The contents of PA (µg) in the berry increased in the first three weeks, then they stabilised or slightly decreased.

An open question is ‘why the residual values of vineyard SD in 2015 were higher than in 2016?’. One factor was not considered: the weather conditions, and in particular the rains. Between the last treatment and the harvest, precipitations were 25 mm and 129.8 mm, respectively in 2015 and in 2016. Part of phosphonates, also if they are moved into the plant, remain probably outside and thus they are subjected to the weather conditions.

This work was done to understand the accumulation of phosphonates in the bunches, commonly used in vineyard against grapevine downy mildew. In light of the results, the main factor that affects the PA accumulation in the grape is the application moment of phosphonate. Vineyard vigour, variety and canopy management have only a slight effect on the residues. Further studies are desirable on how the weather conditions could affect the PA residues.

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