

Can potassium phosphite be integrated in late blight control strategies in starch potato?

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INTRODUCTION

Potato late blight is a serious disease that requires intensive and repeated fungicide treatments to avoid yield loss. We have earlier showed that potassium phosphite combined with reduced doses of fungicides provide good protection against both late blight and tuber blight. In more resistant starch potato cultivars potassium phosphite alone may provide sufficient protection (LiljerOTH et al., 2016). Despite a very low toxicity of phosphite there are concerns about residue levels in harvested tubers. Currently the MRL for phosphite in ware potato is 30 mg/kg (EU commission regulation). In this study we report continued field results from starch potato treated with phosphite and analysis of residue levels in the products, i.e. starch, fiber and protein, after processing the potato tubers.

MATERIALS AND METHODS

Field trials with traditional fungicide programs were compared with treatments with potassium phosphite alone or in combination with fungicides in a randomized block design with four blocks during two years. The first treatment was applied during the third week of June. In the standard fungicide program the treatments were applied 12 times (T1-T12) with 7-day interval at recommended dose. The fungicides Revus (T1, T3), Infinito (T4, T5, T6) and Ranman Top (T2, T10, T11, T12) were alternated. Phosphite (Proalexin) was applied at all treatment occasions and the full dose rate was 5 L/ha Proalexin. In the combination treatment with 7-day interval reduced doses of the fungicides (50 or 25% of full dose) was used in combination with 50% dose of phosphite. In the combination treatment at 14-day interval full or half doses of the fungicides were combined with full dose phosphite so that in total the same amounts were applied as in the 7-day interval treatment. The most commonly grown starch potato cultivar Kuras was used in the experiments. Each plot was five rows of 10 m length, from which the middle three rows were harvested. Late blight was visually scored weekly and early blight was scored at the end of the season. At harvest samples were taken for tuber blight assessment. Tubers were processed and the resulting starch, fiber and protein fractions were analyzed for presence of phosphite and phosphate with ion chromatography.

RESULTS AND DISCUSSION

We found that applying potassium phosphite provided almost as good protection against late blight as the conventional fungicide program. However, we found a tendency to lower starch content in tubers from plots treated with phosphite alone that needs to be investigated further. Applying combinations between fungicides and phosphite at half recommended dose or at full dose but applied at longer interval, 14 days instead of normally 7 days, gave as good or better protection than conventional fungicides at recommended dose with 7-day interval (Figure 1). These treatments also gave the highest average tuber yield and starch yield although not significantly different from the conventional treatment. The amount of tuber blight was very low and no differences between treatments could be detected. The infection rate of early blight was more than 25% lower in treatments involving phosphite compared to treatments with late blight fungicides only ($p=0.004$). In harvested tubers we found residues of phosphite ranging from 25-100 mg kg⁻¹ tuber depending on the rate of application. However, in the processed starch product the level of phosphite residues was below the detection limit of about 1 mg kg⁻¹ starch. In the protein and fiber fractions low amounts of phosphite were found. Preliminary calculations indicate that about 80% of the phosphite found in tubers at harvest will end up in the process water during processing.

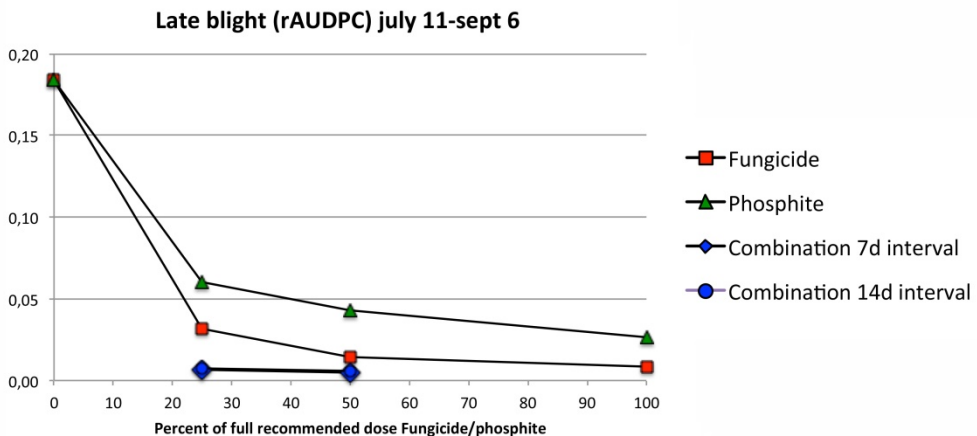


Figure 1. Late blight severity expressed as relative area under the disease progress curve (rAUDPC) in a field trial 2016 with the starch potato cultivar Kuras. Dose-response curves of phosphite applied alone at 7-day interval, a fungicide strategy where Revus, RanmanTop and Infinito was alternated at 7-day interval and two treatments where reduced doses of the fungicides were used in combination with potassium phosphite at 7 or 14-day interval.

In conclusion, potassium phosphite provided good control of late blight in starch potato in Sweden. Potassium phosphite used in combination with reduced doses of fungicides provided as good control as full dose fungicides with maintained yield. Also the combination applied at 14-day interval gave similar level of late blight control and yield compared to a traditional fungicide program with 7-day interval. While residues of phosphite were found in harvested tubers no residues were found in the starch fraction, and only low levels were found in fiber or

protein fractions after processing. Potassium phosphite may, provided that it can get approved, be considered as a low-toxicity alternative treatment against late blight in starch potato and it may also reduce the infection rate of early blight.

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REFERENCE

Liljeroth, E., Lankinen, Å., Wiik, L., Burra, D.D., Alexandersson, E., Andreasson, E. (2016). Potassium phosphite combined with reduced doses of fungicides provides efficient protection against late blight in large-scale field trials. *Crop Protection* 86, 42-55.

