Preliminary results show rain roofs to have remarkable effect on diseases of apples

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Abstract

In the spring of 2012 narrow plastic covered roofs (2 m wide and 3 m tall) were erected over 6 x 8 trees in rows of Red Elstar and Rubens apples (planted 2009) at the experimental orchard in Aarslev, Denmark. Three of the eight trees were sprayed with sulphur and potassium bicarbonate in case of rain, the other 5 remained unsprayed. The roofed treatments were compared to unsprayed trees, and trees sprayed intensively with sulphur and potassium bicarbonate. The aim of the experiment was to investigate if reduced leaf wetness caused by the protection of the roofs could substitute the use of fungicides. The results were very promising; in 2012 the rain roofs reduced all major diseases on apples. Severe apple scab (>1 cm^2) under unsprayed conditions was reduced from 72 % in Red Elstar and 95 % in Rubens under open sky to 3-11 % under the roofs. This compared favourably with the 0-3 % severe scab found in the intensively sprayed plots. Even more significant was the effect on rots. Both sprayed and unsprayed plots of the two cultivars had between 18-40 % rots after storage and shelf life. In comparison, fruits grown under the roofs had an average of 2 % rots regardless of whether they had been sprayed or not. The occurrence of soothy blotch was significantly reduced under the roofs. While more seasons with different weather conditions are needed for a full evaluation of the roofs' effect on diseases, the initial results are remarkable, showing effect on all encountered diseases. The challenge will be to develop a durable and cheap roof construction that can help its implementation in modern organic apple production.

Keywords: rain covers, covered protection, apple scab, *Kumulus Potassium* bicarbonate

Introduction

In Denmark the pressure to find alternatives to spraying in Organic apple production is high. One such alternative may be protected production. It is known from the sweet cherry production that rain covers can reduce rots at harvest (Børve & Stensvand 2003). Whether similar effects can be obtained in apples, and what effects can be achieved in regard to diseases like apple scab that has multiple infections cycles during the season, is a research area that up to now has largely been unexplored. The aim of the present experiment was to investigate if reduced leaf wetness caused by year-round plastic cover (roof) over field grown apple can reduce diseases of apple and substitute the use of fungicides.

Material and Methods

The experiment was conducted in the experimental orchard of Aarhus University located in Aarslev, Denmark. The rain roofs were constructed in the spring of 2012 in two neighbour rows of the cv. Red Elstar and Rubens (M9) planted at 1.0 x 3.3 m in 2009. The roofs were compared to both an *unsprayed* and a *sprayed* treatment where sulphur and potassium bicarbonate were applied. A total of six roofs (three true replicates) were constructed, each spanning eight trees and located where unsprayed and sprayed plots adjoined. Three of the eight trees were sprayed, the other 5 remained unsprayed. For

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each treatment and plot three trees were assigned as experimental trees. The roofs were made of 3 parallel galvanized steel pipes spanning the length of the roof. For every 2 m the 3 steel pipes were attached to 4'' x 4'' wooden columns by means of 1" galvanized steel rafters in a 30 degree angle and stabilized by ¾'' flat diagonal steel pipes. From ground to ridge the roof was 3 m high and it spanned a width of 2 m and a length of 10 m. The roof itself was constructed of plastic (polyethylene) that was rolled around the two outer steel pipes and held in place by clamps. The roof was installed before bud break and remained in place for the entire season.

Results and Discussion

In 2012, eight infection periods were recorded in the primary season, but only three resulted in moderate to severe scab warnings. June and July were very wet and warnings against secondary scab totalled 7 moderate to severe warnings according to the RIMpro model. As a consequence a total of 15 sulphur and 10 potassium bicarbonate sprays were used in the sprayed parts of the experiment. Unsprayed apples of both cultivars were severely attacked by scab; causing 72 % Red Elstar and 95 % Rubens to be discarded (>1cm^2 scab). Under the roof only 2 % of Elstar fruit showed severe scab infections after remaining unsprayed for the entire season. The corresponding result for Rubens was 11 % discarded fruit, which remains impressive considering the cultivar's susceptibility towards scab. This result was comparable to the sprayed treatments were 0% Red Elstar and 3 % Rubens fruits were severely scabbed. Similar positive effects of the roof could be achieved for rot diseases where less than 3 % of fruits rotted after storage and shelf-life. The corresponding open-air treatments had a ten-fold higher rot occurrence. Spraying with sulphur and potassium bicarbonate had no effect on rots. In Rubens, 26 % of the fruits had soothy blotch on more than 10 % of the surface area in the unsprayed treatment, while this was significantly reduced to 0 % by both spraying and roof treatments. Fruit yield was reduced in the unsprayed treatment, but no significant yield differences were found between roofed and sprayed treatments.

The present study is still in its initial phase and more years of experiments are of course needed for a full assessment of the effects of the rain roof. However, the results obtained against scab in the first year warrants interest since they were obtained under heavy infection conditions, using cultivars that are highly susceptible towards scab. The effect of the roof on rots was even more convincing, and in case of Red Elstar, it is at level with what is achieved in the conventionally sprayed parts of the experimental orchard, and similar to, or even below, what is found to be normal for the cultivar in other countries (Maxin 2012).

Citation of the full publication

The citation of the full publication will be found on Ecofruit website as soon as available.

Acknowledgments

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References

Børve J, Stensvand A 2003. Use of plastic rain shield reduces fruit decay and need for fungicides in Sweet cherry*. Plant Disease* 87: 523-28.

Maxin P 2012*. Improving apple quality by hot water treatment.* PhD thesis. Aarhus University, Denmark