Progress in pest management in organic strawberry production

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**Implications**

For tuning up sustainable organic strawberry production new measures in pest management need to be developed. Both pest insects and pathogenic fungi reduce fruit yields and quality. The present study shows that mass trapping of strawberry blossom weevils by using plant volatile and insect pheromone baited traps is not an efficient measure in an established field. However, in a new study traps will be combined with fencing of the field with an insect net. There will also be a study on the effect of using ozonated water as a measure to prevent the fungus related disease grey mould to develop.

### Background and objectives

In strawberry production, several pests have negative impacts on plant health and fruit yields.

One of the major pest insect is the strawberry blossom weevil (*Anthonomus rubi*). This weevil deposits eggs into flower buds and then severs the stems of the buds. Because of this weevil, some farmers have more than 70% yield loss. To manage this pest insect, several studies on using traps baited with volatiles have been conducted. It has been shown that a mixture of a plant volatile and insect pheromones attract strawberry blossom weevils to traps (Wibe et al 2014). In 2016 we carried out a mass trapping study, where the objective was to investigate if it was possible to reduce weevil damage by using traps baited with this volatile mixture (Wibe and Sjøberg 2016). To strengthen the management of this pest insect, a new project in 2017 will combine traps and fencing with insect net to exclude weevils from a strawberry field.

Another challenge for strawberry production is the disease grey mould caused by the pathogenic fungus Botrytis *cinerea.*This fungusinfects both the flowers and fruits, and can greatly reduce yields. It is considered as one of the most damaging diseases of strawberry. In viticulture, there are also challenges with pathogenic fungi. However, at some vineyards they had success with spraying the vines with ozonated water (Bhadra 2015, Wood 2014). The ozone kills the fungi without having any negative impact on the plants or the grapes. Therefore, in a new project in 2017, a strawberry test field will be given the same treatment as the vineyards, to study the effect of ozonated water on grey mould on the strawberry plants.

### Key results and discussion

In the mass trapping study of strawberry blossom weevils, altogether 5361 weevils were trapped. In the first four weeks, 159 weevils were caught by the traps. The number of weevils caught the next four weeks was 985 and for the last four weeks 3913. The weevils caught in the first period had been overwintering and were among those who performed damage on the strawberry plants. The weevils caught later were among the new generation of weevils that would breed the next year, thus not doing any damage on the strawberry plants the present year. When comparing damage caused by the weevil (number of cut buds on each plant) in the test field with a control field, no significant differences were found. There was neither found any difference in the yields between the test and control fields. This led to the conclusion that it was not possible to reduce the damage caused by the strawberry blossom weevil in a two-year-old strawberry field using this method, since too few weevils were caught in the beginning of the season. By fencing a new established strawberry field with insect net, the strawberry blossom weevil will be excluded from the field. If this is combined with insect traps on the outside of the fence, weevils attracted to the field will be stopped by the fence and can be caught by the traps. Combining these measures will reduce the risk for weevils entering the field and less damage is expected.

Treatment of a strawberry field with ozonated water will hopefully reduce the disease outbreaks caused by the pathogen *B.* *cinerea* and increase the strawberry yields without having negative impacts on the fruit quality or the environment. Ozonated water for pest management is still not organically certified. However, since the half time of ozone in water is short (20-30 min) and it will not provide any residues (only O2), the use of this treatment has a potential to become a new measure in organic plant protection.

### How work was carried out?

In the mass trapping study of strawberry blossom weevils, 200 funnel traps were mounted in a two-year-old strawberry field (0.32 ha). The traps were mounted in ten rows (20 traps in each row) at a distance of five meters. Each trap was baited with a lure containing a specific plant volatile and the aggregation pheromones of the weevil. The lures were exchanged in the middle of the growing season. All traps were controlled and emptied every four weeks. In addition to the number of caught weevils, also insect damage and yields were recorded.

In the new project, combining traps and fencing with insect net, the measures will be mounted in a new established strawberry field of 0.8-1 ha. The fence will be about 2.5 m high, sealed closely to the ground and having a short fold on the top, pointing outwards. Outside the fence, traps will be mounted every 5 m to catch weevils stopped by the fence. The effect of these combined measures will be followed in the same field during three years.

For treating strawberry in a test field with ozonated water, an ozone generator will be mounted on a tractor. On this tractor there will also be a mounted a regular field sprayer with a water tank. Ozon gas will be lead from the generator into the water and sprayed onto the strawberry plants. The effect of the treatment will be compared with areas which have been treated with just water and areas with regular conventional pest management with fungicides.

**References**

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