NJF-seminar NO346

Organic production of Fruit and Berris

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NJF SEMINAR NO 346

ORGANIC PRODUCTION OF FRUIT AND BERRIES

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Organizer: Section III: Horticulture -Working group: Fruit

BACKGROUND AND OBJECTIVES:

During the last 10 years organic production of fruit and berries has been given increased attention both in production and research in the Nordic countries. The objective of this seminar is to present scientific results and practical experience and to discuss challenges and targets inside organic production of fruit and berries.

TOPICS:

Among the topics to be presented at the seminar are

- Variety testing.
- Soil management.
- Manuring/fertilization.
- Production systems.
- Cultural techniques to prevent crops against pest and diseases.
- Economics.
- Marketing.

The effect of different mulches on yield, fruit quality and strawberry mite in organically grown strawberry

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Abstract

An organic strawberry field experiment was started in 2000 at MTT Agrifood Research Finland Ecological Production in Mikkeli to study the influence of mulching materials on the growth, yield, microbiological fruit quality and strawberry mite. Organically produced plants of *cv*. Jonsok were planted in June 2000 in double rows, 10 plants/plot 45 cm apart in four replicates. Mulching materials are black plastic, flax fibre mat, green mass, barley straw, buckwheat husk as well as pine and birch woodchips. In the first experimental year, mulches had a significant effect on the vegetative growth as measured by the numbers of runners. Strawberry plants grew most vigorously in buckwheat husk and in black plastic mulch. The vegetative growth remained low in woodchips mulches. In the first yielding year in 2001, plastic mulch gave the highest total and marketable yield. Birch mulch gave the lowest total and marketable yield. The percentage of berries infected by grey mould (*Botrytis cinerea*) of the total yield was highest in buckwheat husk mulch (36 %), while in other mulches it was 3-14%.

Berries from woodchips mulches had the longest shelf-life under the storage conditions studied. Buckwheat husk mulch seems to reduce the shelf-life of berries. In 2001, the highest numbers of strawberry mite, 10 mobile mites/leaf, were found in black plastic mulch, whereas the lowest numbers, less than 1 mite/leaf, were found in buckwheat husk and green mass. In all treatments, introduced predatory mites kept the mite numbers low.

Introduction

In Finland, plastic mulch is commonly used in conventional and organic strawberry cultivation. Plastic provides good weed control and increases the soil temperature compared to organic mulches or bare soil (Larsson 1997). In organic cultivation, plastic is not the most ecological mulch material; it is long-lasting waste and laborious to remove from the fields. In addition, plastic can promote the reproduction of strawberry mite, and heat on the plastic surface can damage berries (Båth 1990).

According to many studies, mulching with organic material has a beneficial effect on weed control and conservation of soil moisture (Skroch et al. 1992, Osterkamp 1993, Öberg 1999). Organic mulches can also affect the soil environment like nutrient content and biological activity of soil (Osterkamp 1993). Especially in organic strawberry cultivation interest in decomposable mulches is increasing and alternatives to plastic mulch need to be studied. We chose six organic mulch materials to investigate their effect on the vegetative growth and yield, microbiological quality of berries and strawberry mite biocontrol. The aim of the study is to find out materials to replace plastic mulch.

Material and methods

A field trial was established in June 2000 at MTT Mikkeli in the eastern part of Finland (61°28' N, 27°18' E, 107 m above sea level). The soil type is coarse mineral soil rich in humus. Five tons/ha of biotite and 500 kg/ha of organic fertilizer (4 % N) were added and tilled into the soil before planting. Organically produced plants of cv. Jonsok were planted on raised beds in double rows 2.20 m apart, 10 plants/plot 45 cm apart in four replicates. Mulching materials are black plastic, timothy-meadow fescue green mass (1.79% N), barley straw (0.61% N), buckwheat husk (2.29%

N), flax fibre mat (0.52% N, 6 mm thick), birch woodchips (0.26% N) and pine woodchips (0.08% N). A layer of 5-10 cm of green mass, straw, buckwheat husk or woodchips was added after planting. Green mass and straw were added once in June 2001. A mixture of red fescue-sheep fescue was sown between rows and cut with a lawn mover. Runners were removed in August. Plants were slightly infected by strawberry mite (Phytonemus pallidus), which was intended to be controlled with predatory mites in the yielding years.

Runners and runner plants were counted out of four plants/plot in August 2000. Strawberries were harvested twice a week during the fruiting season in 2001. Total yields, marketable yields (undamaged fruits larger than 22 mm in diameter) and berries infected by Botrytis fruit rot were weighed. The shelf-life of berries was tested three times during harvesting. The marketable berries were placed individually into separate wells of plastic minipots, 10 berries/plot. The minipots were placed on and covered with damp paper towels and put into black plastic bags to maintain high humidity and stored at room temperature (20-22°C). Each tray was examined daily and berries with visible rotting were discarded. The test method used is described by Woodford et al. (2002) who used it to predict the shelf-life of raspberries. The microbiological quality of harvested berries was evaluated twice in the first harvesting year. 100 g of marketable berries were smashed and 10 ml of smashed berries was mixed with 90 ml of distilled water. 10 ml of this mixture was diluted with another 90 ml of distilled water. 0.75 ml of the mixture was dropped into a Petri dish both on potato dextrose and malt extract agar, 10 Petri dishes/sample/ nutrient medium. The Petri dishes were kept at room temperature for 4 days and the numbers of fungal colonies were counted from the plates and the numbers of bacteria and yeast fungus colonies were evaluated on the following rating scale: 0=none, 1=few, 3=moderately, 4=abundantly. The Petri dishes were stored in a cold chamber at + 5 ºC. The fungi were identified from the plates after two months and the numbers ofBotrytis cinerea, Mucor spp., Hainesia lythri, Zythia fragariae were counted. Three species of predatory mites were introduced in May-June 2001: Amblyseius cucumeris (13.4/plant), Anthoseius rhenanus (4.5/plant) and Euseius finlandicus (2*4.5/plant). Unopened small leaves, 10/plot, were collected and inspected under binocular five times in May-September 2001. All stages of strawberry mite and predatory mites were counted and the predatory mites were prepared and identified.

Statistical analysis of the vegetative growth and mulching treatments were carried out using the GLM procedure of SAS (SAS Institute Inc., Gary, NC, USA). Comparisons of means were made using the Least Significant Difference (P = 0.05).

Results and discussion

Mulches affected significantly the vegetative growth as measured by the numbers of runners in the planting year. The vegetative growth was most vigorous in black plastic and buckwheat husk mulches. Especially in buckwheat husk mulch the foliage was very dense, probably due to the rather high nitrogen content of the mulch. The vegetative growth remained low in woodchips mulches. In several studies, mulching, especially plastic mulch, increased the number of leaves and runners (Solberg 1993, Osterkamp 1993, Winter 1996, Plekhanova & Petrova 2002).

In the first yielding year, black plastic gave the highest total and marketable yield. The marketable yield was significantly higher in black plastic than in other mulches and low in buckwheat husk mulch due to the significantly higher amount of berries infected by grey mould than in other mulches (Fig 1). The average percentage of diseased fruits was 36 % in buckwheat husk mulch, while in other mulches it varied from 3 to14% and was lowest in woodchips mulches. The decomposition of flax fibre mat started already in the planting year and after the winter, in the first harvesting year, there was practically no mulch left. Birkeland et al. (2002) also reported the highest mean yield over four years in plastic mulch compared to barley straw and fresh spruce bark.

Buckwheat husk mulch decreased the shelf-life most for marketable berries (Fig. 2). The investigation of microbiological quality showed that for marketable berries the total amount of fungi was highest in green mass and lowest in buckwheat husk mulch, but berries picked from buckwheat husk mulch plots had more grey mould colonies (colony-forming units (cfu)/g of berries) than other mulches at the end of the fruiting season (Fig. 3). In the beginning of flowering period weather was quite rainy, which favours grey mould incidence. And obviously due to the very dense foliage, buckwheat husk mulch increased the incidence of grey mould in the harvested berries. Generally, the cfu/g value was higher at the beginning of the fruiting season (harvesting date 12.7.) than at the end of the fruiting season (harvesting date 24.7.). During harvesting day in 12.7. weather was rainy, which may partly explain higher amounts of fungal colonies. In black plastic mulch and birch woodchips mulch the cfu/g value for the marketable berries was clearly higher in berries harvested in 12.7. (4535 and 4601, respectively) than in 24.7. (2234 and 2181, respectively). The mulch treatments had no clear effect on the amount of bacteria. There are no previous studies on the effect of different mulch materials on the microbiological quality of strawberry fruits.

At the end of August in the planting year, the numbers of strawberry mite varied from 3 (green mass) to 17 mobile mites/leaf (straw) due to the original infestation of the planting material. The following year, black plastic mulch favoured the reproduction of strawberry mite compared to other mulches. At peak population in plastic mulch, 10 mobile mites/leaf (15.8.), significant differences were noticed in comparison to buckwheat husk (0.5/leaf) and green mass (0.9/leaf). During the whole season, the highest numbers of predatory mites, mostly *A. cucumeris*, were noticed in black plastic mulch, coniferous chips and green mass (0.1, 0.08 and 0.07 mobile mites/leaf, respectively), whereas the lowest numbers, 0.03/leaf, were found in flax fibre mat and birch chips. Despite the infestation of the planting material, strawberry mite was kept under control during the whole season. This was obviously due to the early introduction (7.5.) of *A. cucumeris*. The two domestic species almost disappeared during the season, and one reason for this might have been the difficulties in maintaining healthy laboratory cultures. This concerns especially *A. rhenanus* which has earlier been found to be a potentially good predator of strawberry mite (Tuovinen 2000). Another explanation may be that *A. cucumeris* tends to force out other species if prey mites are not available in high numbers. This aspect will be studied more in future.

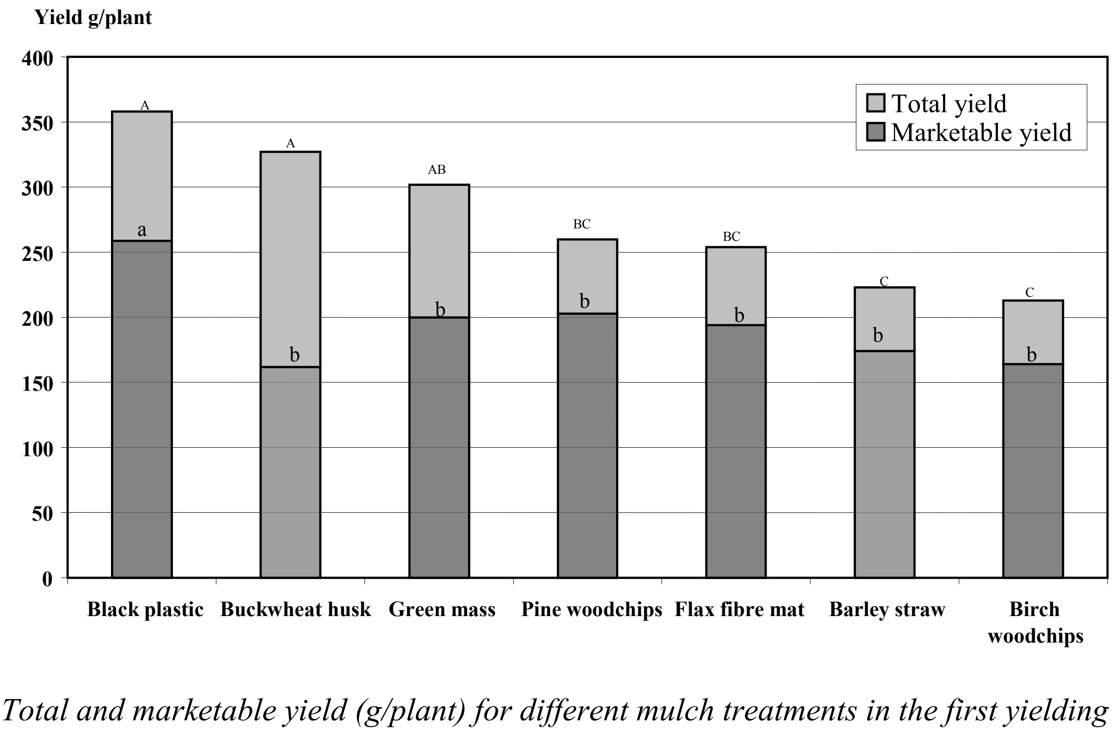

Fig. 1. Total and marketable yield (g/plant) for different mulch treatments in the first yielding year 2001.

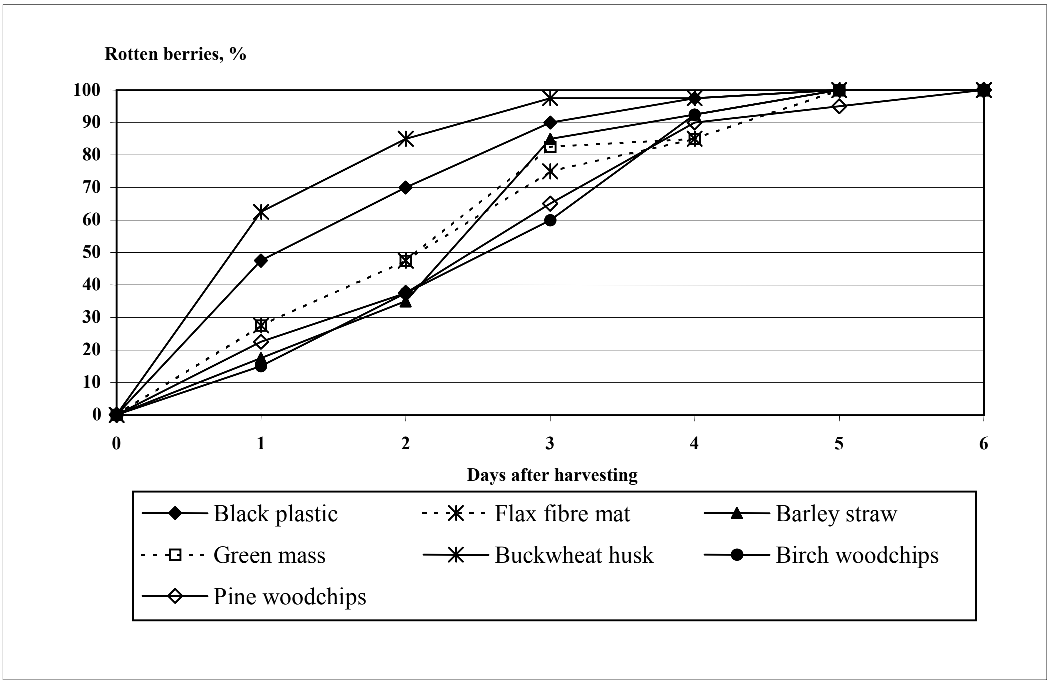

Fig. 2. Shelf life of berries for different mulch treatments. Harvesting date 16.7.2001.

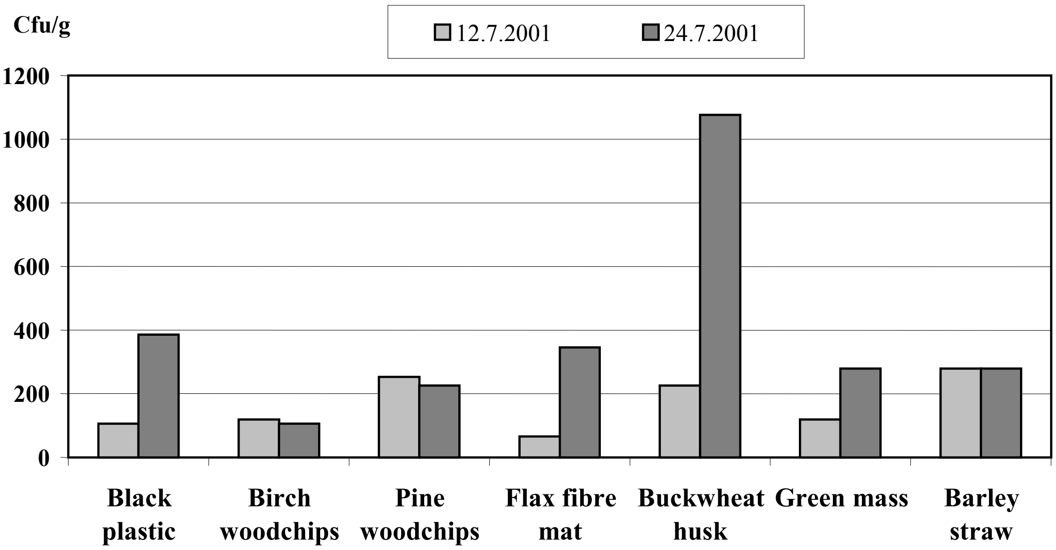

*Fig. 3. Incidence of grey mould (*Botrytis cinerea*) in harvested berries (colony-forming units/g marketable berries) for different mulch treatments. Harvesting dates 12.7. and 24.7.2001.*

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