Testing of strawberry-varieties (with/without biodegradable mulch film) for organic cultivation

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Abstract

Different strawberry varieties, available from organic propagation at that time were, planted in August 2004 and proofed about their suitability for organic cultivation, each variety was tested with and without biodegradable mulch film. Within the early ripening strawberry varieties 'Clery' had a middle yield and was susceptible for infections with leaf spot, losses of plants by Verticillium were seldom. This variety should be planted early to reach enough vigor in autumn. 'Clery' has an interesting potential in the phase of higher prices at the beginning strawberry season. 'Darselect' ripened shortly before 'Elsanta', the yield was lower, but the fruit-size bigger, so the picking could be done more quickly. 'Elsanta' showed in this trial under organic conditions not too bad results, but on this area no strawberries had been cultivated for many years before, so the potential of soil-borne diseases was only low to middle.

In the group of middle ripening varieties 'Korona' suffered under the hot weather in June 2006 and reacted with heavy wilting symptoms, first of all caused by Verticillium, and with more leathery and small fruits. 'Florence' and 'Peco' had often sunburst (by intensive sunbeams). 'St. Pierre' had a vigor plant, middle yield and less sunburst, but should be picked well ripened. The late variety 'Yamaska' was robust, but tasted only middle good.

The biodegradable mulch film increased in the first year the yield of the early ripening varieties, in the second year with a hot summer this effect disappeared. Partly snails used the mulch film as refuge, damages of the film also were caused by birds. The natural decomposition was sufficient, when the film was tilled into the soil after the second harvest.

Keywords: Strawberry, variety testing, soil-borne diseases, biodegradable mulch film, organic cultivation

Introduction

Main problems in organic cultivation of strawberries are losses by fungal attacks (dying of the whole plants, smaller fruits because of disturbed nutrition from the roots, infections of the fruits by *Botrytis cinerea*). The choose of suitable varieties is very important for the success of organic strawberry-cultivation. From 1998 to 2004 trials about suitability of different strawberry varieties were carried out on the organically managed experimental orchard Katzental of the LVWO Weinsberg, where the soil had a high content of silt and clay. Often many losses were caused by soil-borne diseases like *Phytophthora sp*. or *Verticillium sp*. Based on the results from Katzental further trials about variety-testing were initiated 2004 in the new organic part of the experimental station Obstversuchsgut Heuchlingen of the LVWO Weinsberg, while the orchard Katzental changed to another department. The use of biodegradable mulch film and its influence on ripening and yield was an important aspect of that trial.

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Material and Methods

The experiment had two main themes:

- comparison of two origins of potted plants ('Honeoye' and 'Korona')
- influence of biodegradable mulch film on healthy and yield of different varieties ('Honoeye', 'Clery', 'Elsanta', 'Darselect', 'Korona', 'Kent', 'Florence', 'Yamaska')

In August 2004 potted plants, which were all propagated in organic nurseries, were planted with 1,0 m x 0,3 m distance. The advance culture was self seeding of rye, water was given by drip hoses. Per variety 25 plants were planted **without repetitions**, each variety was proofed with and without biodegradable mulch film (Materbi-film, produced by NOVAMONT from maize starch, black colour, 20 μ). Altogether the trial had 20 regular parcels, additional the varieties 'St. Pierre' and 'Peco' were planted, which were propagated conventionally. During the whole duration of the experiment the vigor, infections by leaf-diseases (four classes: weak / weak to middle / middle / heavy infections), losses by soil-borne diseases and striking details during blossom were evaluated. The yield was registered in the years 2005 and 2006 and divided in these classes:

- damages like deformations by low temperatures, infections by *Botrytis cinerea*, leathery berries, other losses (sunburst, snails, birds, beetles)
- size of healthy fruits: < 22 mm, 22-25 mm, 25-30 mm, > 30 mm

As marketable yield the weight of all fruits > 25 mm were summarized. In 2006 additionally the average fruit weight was evaluated from the classes 25-30 mm and > 30 mm.

On April 25th 2005 a light frost caused damages at the blossoms, although they were covered with fleece, and as a result of that some more deformations were seen at harvest. Beginning with the first weak of June the maximum temperature was below 20 °C for 10 days, afterwards it was warm, at the end of the harvest season very hot (maximum often higher than 30 °C). Rain was seldom during harvest season of strawberries in 2005. One year later more rain fell at the beginning of harvest, so some more infections of the fruits by *Botrytis cinerea* were assessed. At the end of June 2006 during ripening of late varieties it rained nearly every day, so the fruit quality was reduced.

Results

Table 1 summarizes evaluations of leaf spot during the whole running of the trial. The intensity of attack depended from the weather conditions in summer and autumn. Plants with heavily infected plants nevertheless could bear a sufficient yield. The stands of 'Honeoye', 'Elsanta', 'Korona' and 'Kent' were a little bit uneven, some plants died. Typically for 'Darselect' were light green leaves with suboptimal contents of Mg and Fe. 'Clery', 'St. Pierre', 'Yamaska' and 'Florence' had a vigorous stand.

Table 1: Sensibility of the tested varieties for leaf spot (*Mycosphaerella fragariae*)

Infections	varieties
weak	Kent, St. Pierre, Peco, Yamaska
weak-middle	Darselect, Florence
middle	Honeoye, Elsanta
heavy	Clery

In table 2 some data from the comparison of the two origins of 'Honeoye' and 'Korona' were listed, based on the plots without mulch film. Both varieties lost only < 1% by *Botrytis cinerea* in 2005 and nearly 2 % in 2006. Deformations (3-9 %) and feeding damages by snails, birds or beetles (10-15 %) were more important.

Table 2: Comparison of two origins of 'Honeoye' and 'Korona', marketable yield (g/plant) from plots without mulch film

Variety/origin	2005		2006		Sum 2005+2006 t/ha *
	25-30 mm	> 30 mm	25-30 mm	> 30 mm	
'Honeoye' origin 1	84	349	310	384	32,1
'Honeoye' origin 2	75	276	259	532	32,5
'Korona' origin 1	75	194	187	186	18,3
'Korona' origin 2	111	213	232	243	22,7

* only 28 500 plants/ha, assumption of 5 % losses of the plants

In 2006 (second yield) more smaller fruit were harvested, because the plants had many inflorescences. 'Korona' from origin 1 had less marketable yield because of damages like sunburst and leathery berries. For organic cultivation the yields were sufficient.

An important effect of the biodegradable mulch film in the year 2005 was an increasing of the yield of the most early and middle ripening varieties ('Clery' + 13 %, 'Elsanta' + 8 %, 'Darselect' + 39 %), in 2006 the opposite happened ('Clery' - 8 %, 'Elsanta' – 39 %, 'Darselect' – 18 %) .

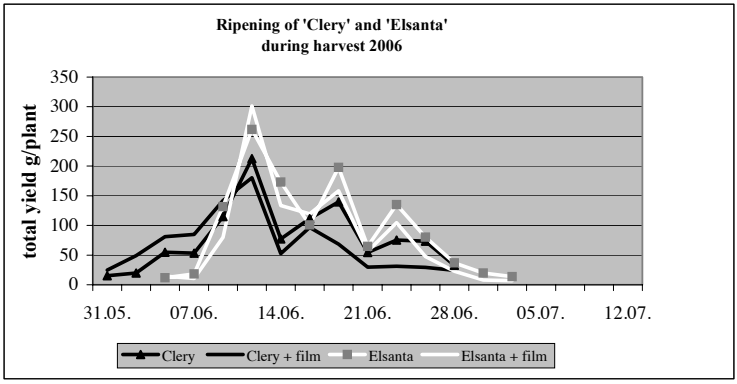

Figure 1: Ripening 2006 of the early varieties 'Clery' and 'Elsanta' (total yield, g/plant)

In figure 1 the influence of using biodegradable mulch film is shown for the early ripening variety 'Clery' in comparison to 'Elsanta'. 'Clery' reacted with an earlier beginning of the picking season, 'Honeoye', too. At the middle and late ripening varieties this effect couldn't be watched so clearly.

In figure 2 the marketable yield (Sum 2005+2006) is described for different varieties, cultivated without biodegradable mulch film. Summarizing both years 'Clery' and 'Darselect' had a lower marketable yield, but 'Clery' ripened earlier, so the fruit can be sold with higher prices. At the harvest 'Darselect' started only 2-3 days before 'Elsanta', during the whole harvest season the yield was lower, but the weight of the fruits was higher, so the picking efficiency was higher. St. Pierre showed in the earlier trials in Katzental healthy and vigorous plants. In this experiment the vigor was comparable, the colour of the fruits is light red, so only well coloured strawberries should be harvested.

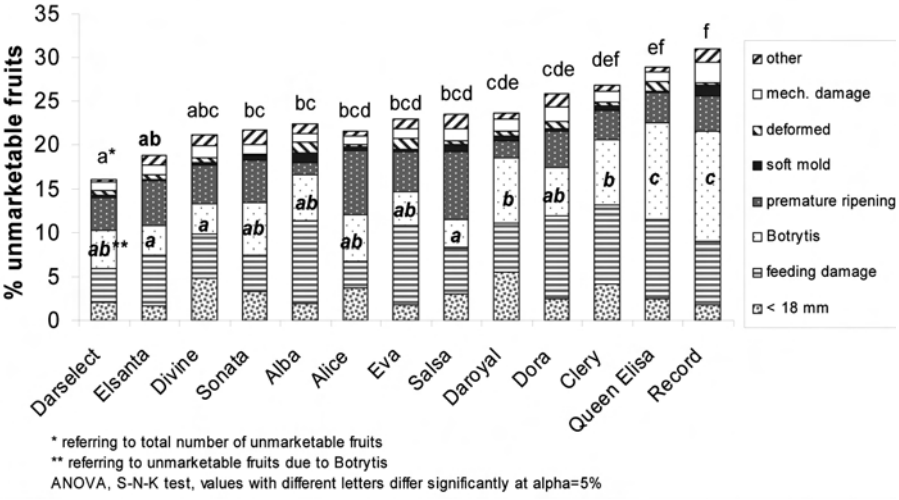

Figure 2: Marketable yield (sum 2005+2006, g/plant), plots without mulch film

'Korona' tasted well, but had problems with plant healthy in the second harvest season, because the plants started to wilt by *Verticillium sp.* In combination with mulch film one of the origins was less healthy, the film seemed to increase wilting. 'Kent' is an older middle ripening variety, with yield similar to 'Elsanta' and less hard fruits, but sensibility for *Botrytis cinerea* was a little bit higher. 'Peco' was planted late in August 2004 because of delivering difficulties, so the marketable yield was low. Besides the dark red fruits were often damaged by the sun in the hot summer 2006.

In 2006 the percentage of deformations was lower than the year before ('Darselect' 42 % in 2005!), but more botrytis-infections were found, especially at the early ripening variety 'Clery' (3,4 % in 2006). Worth mentioning were losses by leathery berries at the varieties 'Elsanta', 'Korona' and 'Kent'.

Both late ripening varieties 'Florence' and 'Yamaska' had high total yields. Altogether fruits often were sorted out because of sunburst or feeding by snails, carabids or birds, partly the loss of yield was very high (between 85 and 463 g/plant, see figure 3). 'Florence' had high losses by damages like sunburst, stained fruits or feeding. The snails seemed to prefer the varieties 'Darselect' and 'Florence', they spurned the less sweet varieties 'Honeoye' and 'Yamaska'. Some factors like sunburst are difficult to influence in organic cultivation, especially in times of extremely changeable weather conditions.

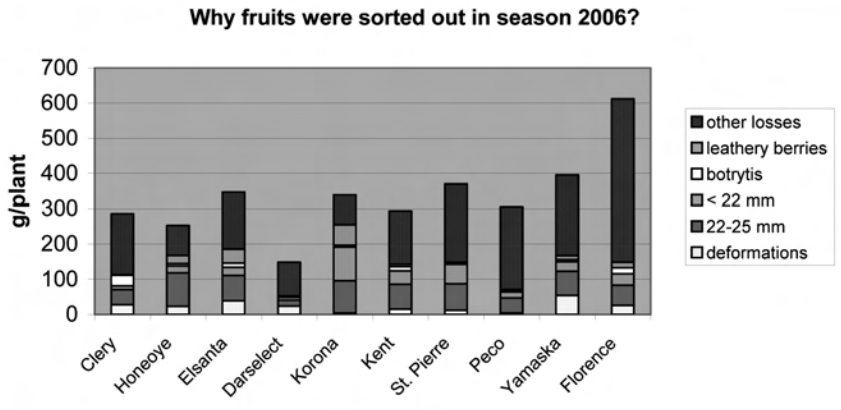

Figure 3: Fruit losses (g/plant) in summer 2006

About handling of the biodegradable mulch film (originally used in the short cultivation of cucumbers) the following points must be mentioned: After the first harvest season the mulch film was damaged at some points, because during hot weather craws tried to reach the drip hoses. If bindweeds grew under the mulch film and were drawn out by hand, the film broke. On sites where bindweeds or thistles are a problem the mulch film should not be used. The film perished first at the places, where an intensive contact to the soil existed. There also was a small area, where weeding could not be done with the rotary tiller.

Discussion

The biodegradable mulch film had some advantages (less weeds in the row). Temperature above the black mulch film can be very high during sunny days, this was a result of a trial in organic cultivation of vegetables, where black, green, red and brown biodegradable mulch films were compared (Postweiler, 2006). Using mulch film must be combined with drip hoses under the film, the moisture of soil under the film should be controlled regularly, even if natural rainfall seems to be sufficient. In both years the yield of the most tested varieties was high enough for organic cultivation conditions, but in other evaluations on organic fields lower yields per plant were found (Eis & Pfeiffer, 2007).

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