

Potential reduction of sooty blotch on apples using specialized brushing technique after harvest

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Abstract

In years with high precipitation, sooty blotch is infesting a high share of apple fruit showing superficial discoloration or blemish after harvest. Therefore, a high amount of fruit cannot be sold as fresh fruit. The area covered by the fungal layer on the fruit surface can be reduced by using specialized brushing technique and the share of marketable fruit can be enhanced, consequently. In 2022 and 2023 this approach was examined by Kompetenzzentrum Obstbau Bodensee (KOB), Germany, in cooperation with the organic fruit growing business of Nikolaus Glocker, Germany. Within this trial, four apple cultivars susceptible to sooty blotch were assessed and divided in four classes dependent on the area affected. Afterwards apples were brushed by class and reduction of sooty blotch was calculated by repeating the classification process and comparison to the former state of sooty blotch symptoms. It is shown that apples with up to 25% fruit surface showing symptoms of sooty blotch can be cleaned to a degree that is almost unblemished and therefore can be sold as first class fruit. However, the most crucial point for successful removal of sooty blotch is the accessibility of the area surrounding the apples stem pit, if spots are located there.

Keywords: sooty blotch, fly speck, fruit blemish, brushing, brushing technique

Introduction

Sooty blotch and fly speck occur on several fruit, e.g. apple, and are caused by fungi which settle on the fruit surface but do not penetrate the cuticula. *Peltaster cercophilus* is proven to be the most popular organism causing sooty blotch in Southern Germany (Weber et al., 2016). In general, symptoms of sooty blotch are grey or brownish marks which can be easily rubbed off. If these marks cover a high share of fruit surface and are not eliminated, fruit growers can suffer high economic losses. Tolerance of sooty blotch symptoms depends on the market channel and market situation in the specific year. Therefore, it might happen that fruit of otherwise high quality has to be sold to industry e.g. for juice production only due to sooty blotch symptoms.

As sooty blotch is only superficial, it can be removed easily. To increase the packout of apples marketable as fresh fruit there is an approach to develop and incorporate a specialized brushing system into the already existing work flows during sorting apples before marketing. Within this approach there are several questions occurring; How are grade of infestation and possible success of brushing connected? Does fruit shape, time of harvest or sensitivity to external pressure have a significant impact on success of brushing?

Material and Methods

In both years, 2022 and 2023, examination started after storage in beginning of April. In 2022 experiments were performed using the cultivar of 'Topaz' and the number of tested cultivars was increased to four, namely 'Topaz', 'Natyra', 'Braeburn' and 'Pinova', in 2023. In both years, infested fruit were collected during harvest and stored under controlled atmosphere (CA). All tests were performed using a brushing machine of the Dutch company 'Burg' containing 24 cylindrical brushes arranged in an horizontal level rotating around its

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axis for brushing apples from the lower side and making them move forward. Additionally, there are six rows of three brushes each, which intend to brush the apples from top by rotating around a vertical axis. This arrangement leads to slight external pressure on the fruit during the brushing process. Depending on the settings used apples remain approximately 50 to 60 seconds within the brushing system. Beforehand, apples were floating in water (6°C to 8°C) for a few minutes due to water dumping. To evaluate the success of removing sooty blotch, all apples were classified according to the concept shown in Table 1, before and after running through the brushing system. Each class was brushed separately. Apples showing < 5% of fruit surface infested by sooty blotch were classified as category 1 and can be sold without reservation. If 5-10% of fruit surface was infested, they were classified as category 2. Here subtle distinction was needed, hence the area surrounding the apple stem pit is often infected the most with sooty blotch but might be less accessible for the brushes than the rest of the fruit. Whether the apple can be sold as first class or not parts at this point and depends much on the fruit growers' concept of distribution. To analyse success of brushing especially in the apple stem pit surrounding area category 2a, 2b and 2ab were used. Category 3 to 5 describe infestation of > 10% of fruit surface. These apples cannot be sold as first class, generally.

Table 1: Categories for classification of sooty blotch. ✖: not suitable as first class fruit, ✔: suitable as first class fruit.

Category	infested fruit surface in %	First class fruit
0	0	✔
1	< 5	✔
2a	5-10, only area surrounding apple stem pit	✖/✔
2b	5-10, spread only area not surrounding apple stem pit	✖/✔
2ab	5-10, on whole fruit	✖/✔
3	11-25	✖
4	26-50	✖
5	> 50	✖

Results

Exemplary for all cultivars examined the last two years, figure 1 shows results from the cultivar 'Topaz' in 2023. X-axis refers to categories of infestation before brushing, whereas y-axis indicates the percentage of fruit in each category after brushing. More than 80% of category 1 fruit were cleaned to an extend that no sooty blotch was indicated anymore. Also, in category 2b sooty blotch was reduced to a sufficient degree as more than 90% could have been sold as fresh fruit. Category 2a and 2ab were identified as more challenging in reduction of infested area. Here, only about 60% were identified as marketable as fresh fruit after brushing. The more of fruit surface area was infested the more challenging it was to reach the goal of decreasing sooty blotch to a level of first class fruit. In category 3, 30% of apples showed < 5% of infested fruit surface and in category 4 only 5%, respectively. In 2022, brushing of 'Topaz' achieved overall better results than 2023, using same settings and timing. 90.3% of category 2 apples and 60.8% of category 3 apples were cleaned to a degree of category 0 or 1 apples and therefore marketable as fresh fruit.

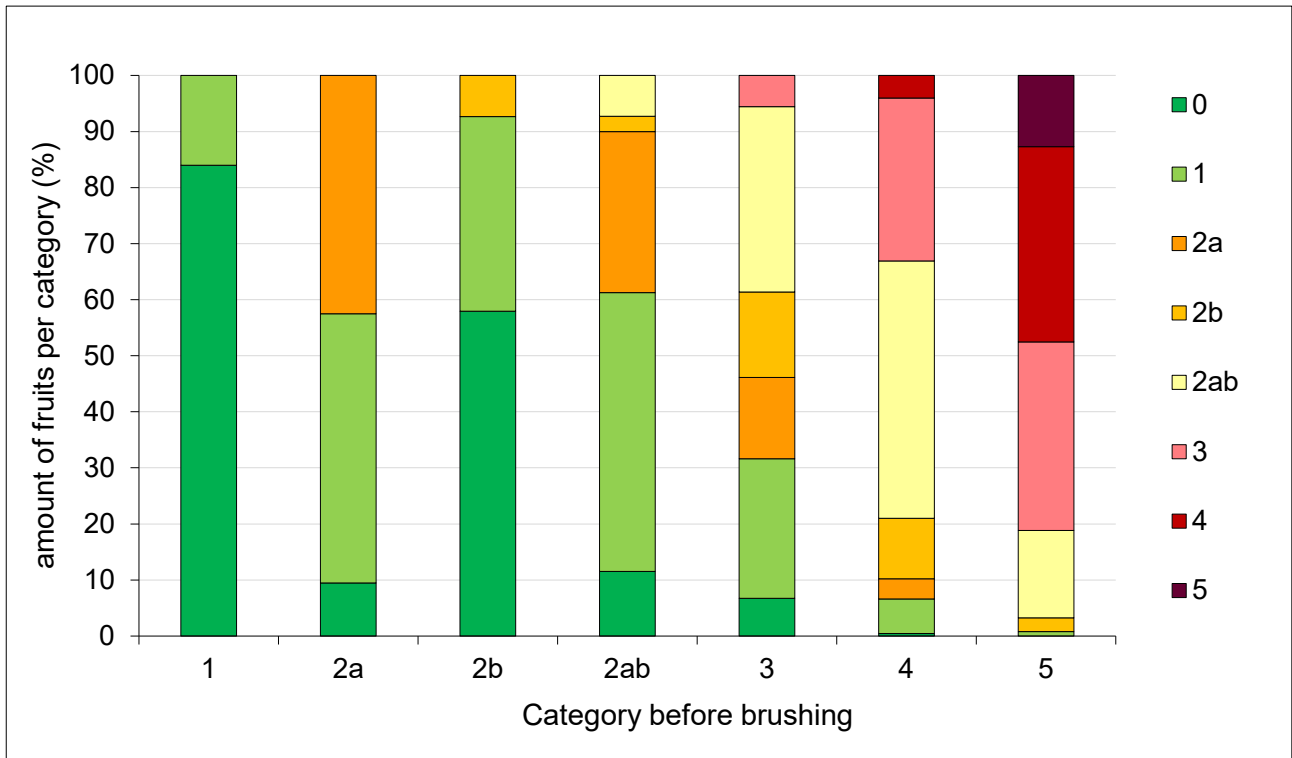


Figure 1: Sooty blotch on apple of cultivar 'Topaz' after brushing by category, 2023. N=2919 fruit. Category 0: no infestation of fruit, category 1: < 5% infested fruit surface, category 2a: 5-10% infested fruit surface only in the area surrounding apple stem pit, category 2b: 5-10% infested fruit surface only in the area not surrounding apple stem pit, category 2ab: 5-10% infested fruit surface spread on whole fruit, category 3: 11-25% infested fruit surface, category 4: 26-50% infested fruit surface, category 5: > 50% infested fruit surface.

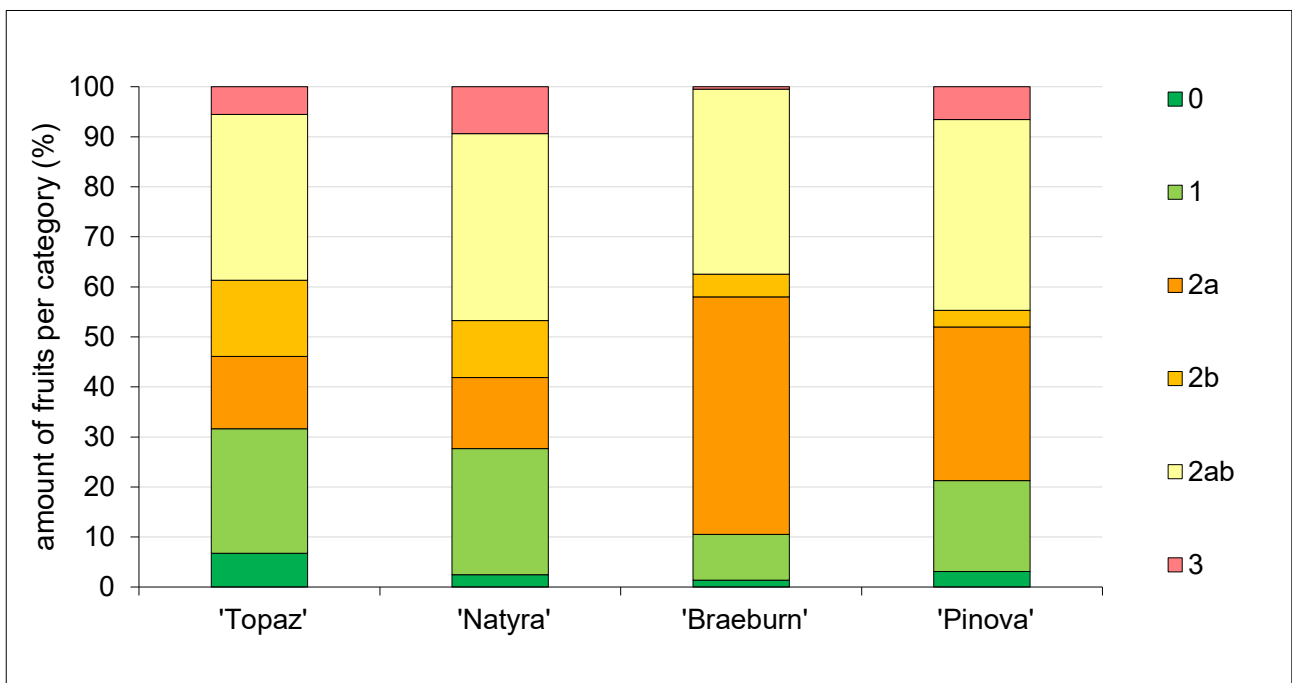


Figure 2: Sooty blotch on category 3 apples of four cultivars after brushing, 2023. Category 0: no infestation of fruit, category 1: < 5% infested fruit surface, category 2a: 5-10% infested fruit surface only in the area surrounding apple stem pit, category 2b: 5-10% infested fruit surface only in the area not surrounding apple stem pit, category 2ab: 5-10% infested fruit surface spread on whole fruit, category 3: 11-25% infested fruit surface.

Figure 2 shows brushing results for category 3 fruit from all tested cultivars in 2023. This represents all fruit with 11% to 25% infested fruit surface. After brushing 90% of all apples were classified better. However, distinction between cultivars can be made. 'Natyra' and 'Topaz' reached the highest percentage of apples in category 0 and 1, which are marketable fruit. Cultivars 'Braeburn' and 'Pinova' showed a high amount of fruit in category 2a with affected area surrounding the stem pit.

Discussion

Results of this study indicate that using specialized brushing technique led to reduction of sooty blotch on apples of all tested cultivars in all categories of infestation. Especially good results were shown if sooty blotch infestation was located on fruit surface not close to the apple stem pit. This shows that the most crucial point for successful removal of sooty blotch is the accessibility of the area surrounding the apples stem pit. In particular, cultivars with narrow or deep dents in the stem pit area were brushed less successfully since brushes could not reach this area. In cultivars showing more flat and less conical shape, this problem occurred less frequent. If apples with some remaining sooty blotch in this area are accepted as fresh fruit is decided by the markets. Considering these first results, cut-off point for sufficient brushing results seems to be category 3, meaning no more than 25% of infested fruit surface. Within this range a great share of fruit was rescued from not marketable to marketable in the first years of trials. For category 4 and 5 - apples showing more than 25% of infested fruit surface - only a marginal share of apples could comply with the quality demands of the markets after brushing. Further investigation in the field of specialized brushing technique is needed, e.g. to evaluate if brushing before storage can help to reduce losses due to fruit decay or to find out if there are differences between cultivars in sensitivity to external pressure which occurs during the process of brushing.

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References

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