Mechanical pruning in organic apple production - especially with regard to pathogens and pests -

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Abstract

In organic growing the technique of mechanical pruning is not used despite the cost and time saving, because the expected undesirable side effects on the pest population have not been researched sufficiently. We want to test this technique of mechanical pruning on growth behaviour, the yield potential, the fruit quality and pest populations in organic apple growing within the BÖLN project "Examination of possible treatments of mechanical pruning in organic apple production - especially with regard to pathogens and pests". We also want to test the mechanical pruning in combination with mechanical thinning with the Darwin Mechanical Blossom Thinning Machine. The trials are carried out in Klein-Altendorf and on an organic fruit farm near Klein-Altendorf. After one year tendency effects of the used machines can be identified.

Keywords: apple, mechanical pruning, mechanical thinning

Introduction

The usually practiced manual pruning in winter needs with 50-75 h/ha a lot of time and high personnel costs (Wicke & Baab, 2011). The mechanical pruning can reduce the necessary time to up 3-5 h/ha (Baab, 2011). But an additional manual correction cut is necessary. Therefore the required time is about 10-20 h/ha and year (Baab, 2011).

The mechanical pruning system creates a two-dimensional fruit wall. This is an optimal basis for the mechanical thinning with the Darwin Mechanical Blossom Thinning Machine. The mechanical thinning is more profitable than only manual thinning (Zimmer *et al*., 2010/2011).

The optimal point in time for mechanical pruning is between the phenological stages green bud (BBCH 56) and red bud (BBCH 57) (Baab, 2011). The optimal point in time for mechanical thinning is the ballon stage (BBCH 59) and the open central flower (BBCH 61). Both mechanical systems destroy much leaf mass; the effect of this on the yield and quality is to examine.

In the conventional fruit production, there are used different types of machines. They vary in there cutting tools. The cutter bar causes smooth interfaces and the circular saw blade causes frayed interfaces. The frayed interfaces could be attractive for pests and pathogens.

S far these new technique is not used in organic growing despite the cost and time saving, because the expected undesirable side effects on the pest population, especially the woolly apple aphid (*Eriosoma lanigerum*), have not been researched sufficiently.

Furthermore, there is still no experience with the growth behavior, the yield potential and the fruit quality in organic apple growing.

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Material and Methods

The investigations are carried out on six varieties. The variety ‘Topaz’ is particularly vulnerable to green apple aphid (*Dysaphis plantaginea*). The variety ‘Elstar’ is suitable for testing the effect of mechanical pruning and thinning on biannual bearing. The variety ‘Gala’ is particulary vulnerable to apple scab (*Venturia inaequalis*) and nectria cancer (*Nectria galligena*). The variety ‘Pinova’ is particulary vulnerable to Gloeosporium-fruit rot und powdery mildew (*Podosphaera leucotricha*). The variety ‘Jonagold’ is particulary vulnerable to woolly apple aphid (*Eriosoma lanigerum*) and the variety ‘Natyra’ is interesting for this project because it´s a new apple scab resistant variety in organic apple growing.

For determining the yield, fruit quality, the emergence of pests and pathogens and the time saving for manual thinning different measurements are carried out, like: number of blossom clusters, number of apple before thinning by hand, yield, colour sorting and size sorting, pathogens and pests.

The table below shows the six treatments that are tested in all listed varieties.

Table 1: Tested treatments.

Nr.	Variants
1	manual pruning in winter
2	manual pruning in winter + Darwin rope thinner
3	mechanical pruning cutter bar (green to red bud)
4	mechanical pruning cutter bar (green to red bud) + Darwin rope thinner
5	mechanical pruning circular saw blade (green to red bud)
6	mechanical pruning circular saw blade (green to red bud) + Darwin rope thinner

Results

In the following, the first results of this year are presented using the example of the variety Pinova. This is a young orchard, which was planted in 2013.

The time for manual pruning is shown in figure 1. The required time for manual pruning is on average 37,2 hours per hectare. The required time for the additional hand correction cut in the mechanical cutted variants is 8,3 hours per hectare. That means that the manual pruning time is reduced by 77,72 percent in the mechanical cutted variants. However, in the mechanical cutted variants the time for mechanical pruning with the machines have to be added. This is, dependent on the used machine, about 3-5 hours per hectare.

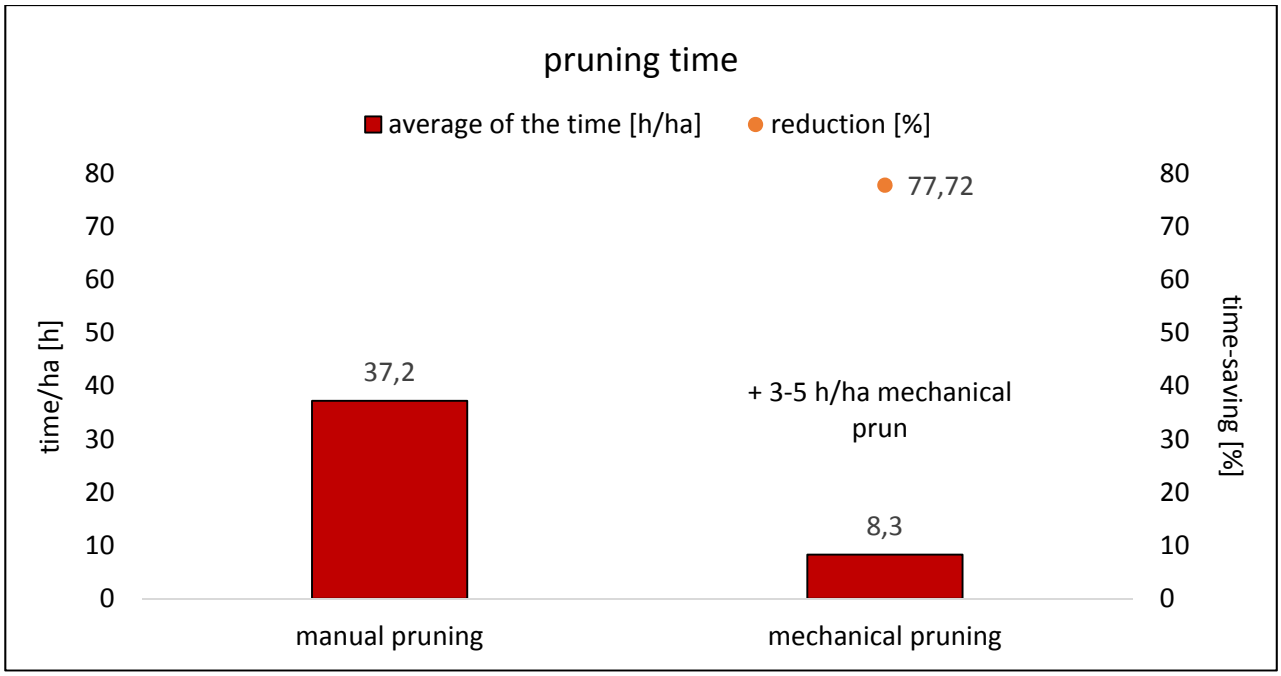

Figure 1: Required time for pruning in manual cutted and mechanical cutted variants.

In figure 2 the thinning results are shown. Before manual thinning, we counted the fruits on the trees. Then we removed a quantity of fruits required to leave a total of 100 fruits per plant. In all variants where the Darwin Mechanical Blossom Thinning Machine was used, the number of manual removed fruits was clearly lower. This means that the required time for manual thinning is reduced. This is especially clear in the mechanical cutted variants.

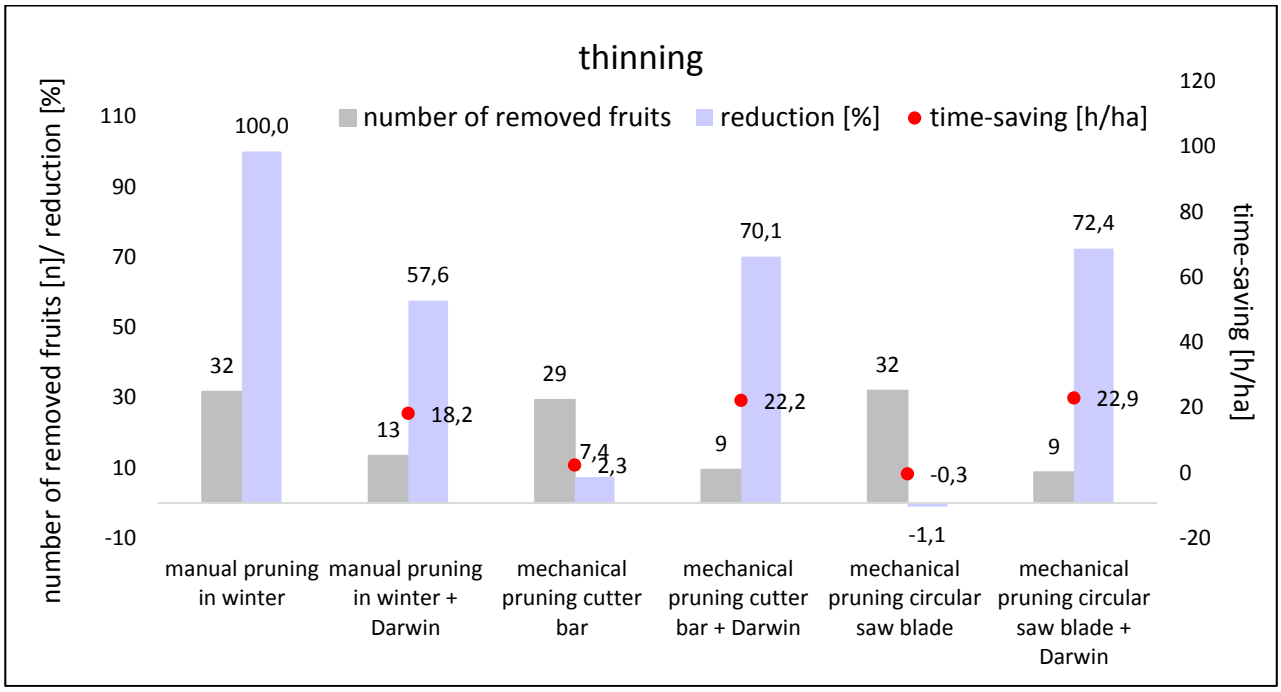

Figure 2: Effects of the Darwin Mechanical Blossom Thinning Machine in the manual cutted and mechanical cutted variants.

In figure 3 the average yield per tree and the average weight per fruit is shown. The average weight per tree shows no remarkable differences between the tested treatments. Only the last variant has lower weights per tree. The result of the average weight per apple shows remarkable differences between the tested variants. The trees treated with the Darwin Mechanical Blossom Thinning Machine tend to have a higher average weight per fruit.

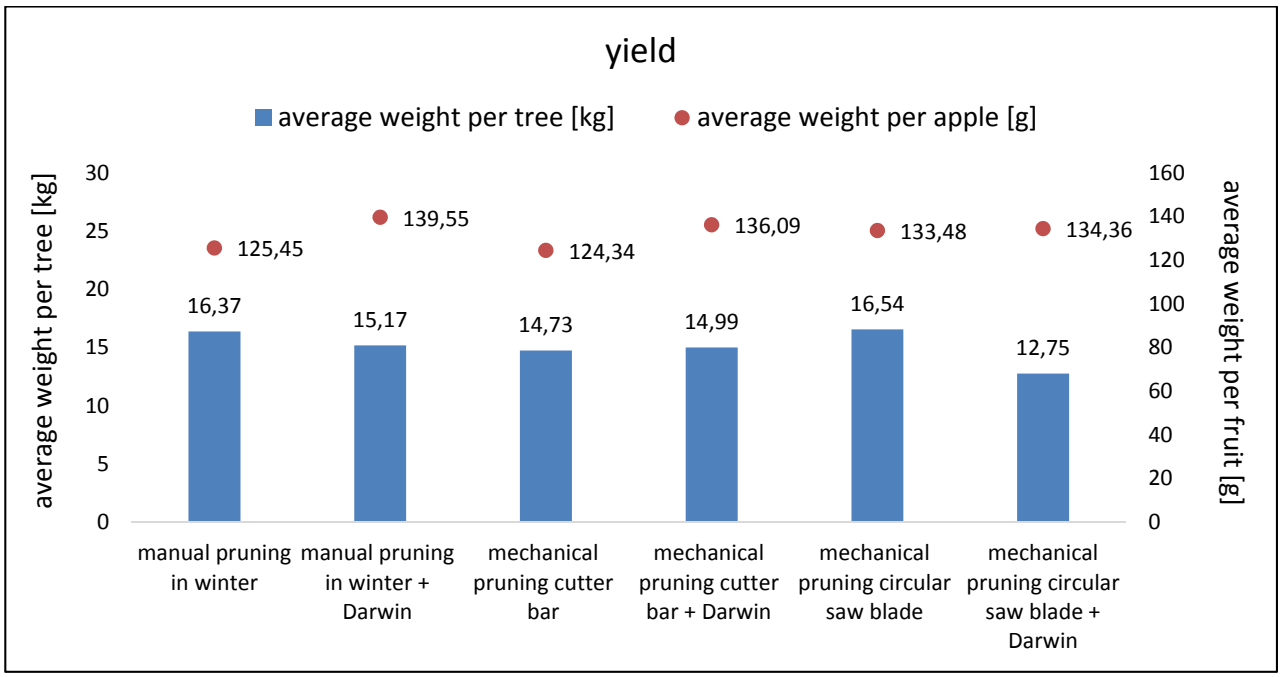

Figure 3: Effect of the treatments on the average weight per tree and the average weight per fruit.

Conclusion

In order to offer a clear conclusion about the effects of mechanical pruning and mechanical thinning on growth behavior, the yield potential, the fruit quality and on pest populations in organic apple growing, it is necessary to consider results over multiple years. However, you can already see initial tendencies after one year. By the use of mechanical pruning you can save time in relation to manual pruning. The Darwin Mechanical Blossom Thinning Machine has a more pronounced effect on mechanical cutted trees than on manual cutted trees. The average weight per apple is higher on trees that were treated with the Darwin Mechanical Blossom Thinning Machine. The cutter bar and the circular saw blade showed not yet any differences with regard to pests and pathogens.

References

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