Testing of pear trees on their own roots in comparison with important used rootstocks under organic farming conditions with special regard to fire blight (*E. amylovora*)

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Abstract

Pear trees on their own roots are tested in comparison to grafted trees in growth and yield characteristics and with special regard to the tolerance to diseases, above all fire blight (Erwinia amylovora). In spring 2004 15 randomized trees of the cultivar 'Williams' from three variants (self rooted in vitro, self rooted long cuttings, grafted on Quince A) were planted in a pear orchard, which was heavily infected with fire blight (Erwinia amylovora) the previous years. The trees were left untreated. Growth and yield characteristics, plant diseases and tree losses were observed. After four years the in vitro self rooted trees were significantly more vigorous in growth than those grafted on quince A. The self rooted long cuttings were comparable in growth with grafts on quince, but showed high tree losses probably due to frost damages in the first winter one year after planting. However no infections with Erwinia amylovora could be observed so far. In a field trial with more cultivars and rootstock variants planted in 2006 at two organically managed sites more significant effects are expected in the next years.

Keywords: pear, rootstock, self rooting, *Erwinia amylovora*, fire blight

Introduction

In several publications the positive effect of self rooted pear trees on fruit quality parameters are described (Carrera, M. and Gomez-Aparisi, 2000, Stanica et al., 2000). It is also known that trees on their own roots are more tolerant to abiotic stress factors (Kriscovic and Abramovic, 1972). The aim of the still running research project (2004-2008) funded by the Austrian ministry of Agriculture is to test if pear trees on their own roots could be an alternative for growers in comparison to grafted trees, with special regard to the tolerance to diseases, above all fire blight (*Erwinia amylovora*).

Material and Methods

In spring 2004 15 randomized trees of Williams Christ from three variants (self rooted in vitro, self rooted long cuttings [propagated from the Institute of Floriculture and Woody Plant Science in Hannover], grafted on Quince A) were planted in a pear orchard (a loamy soil with a low calcium content, proper for quince), which was heavily infected with fire blight (*Erwinia amylovora*) the previous years. The trees were left untreated. Growth and yield characteristics, plant diseases and tree losses were observed. Lost trees were replanted, if adequate plant material was available; however in the statistical analyze with SPSS 15.0 (Anova with post hoc S-N-K-test, α=5%) only the trees planted at the beginning (in 2004) were evaluated.

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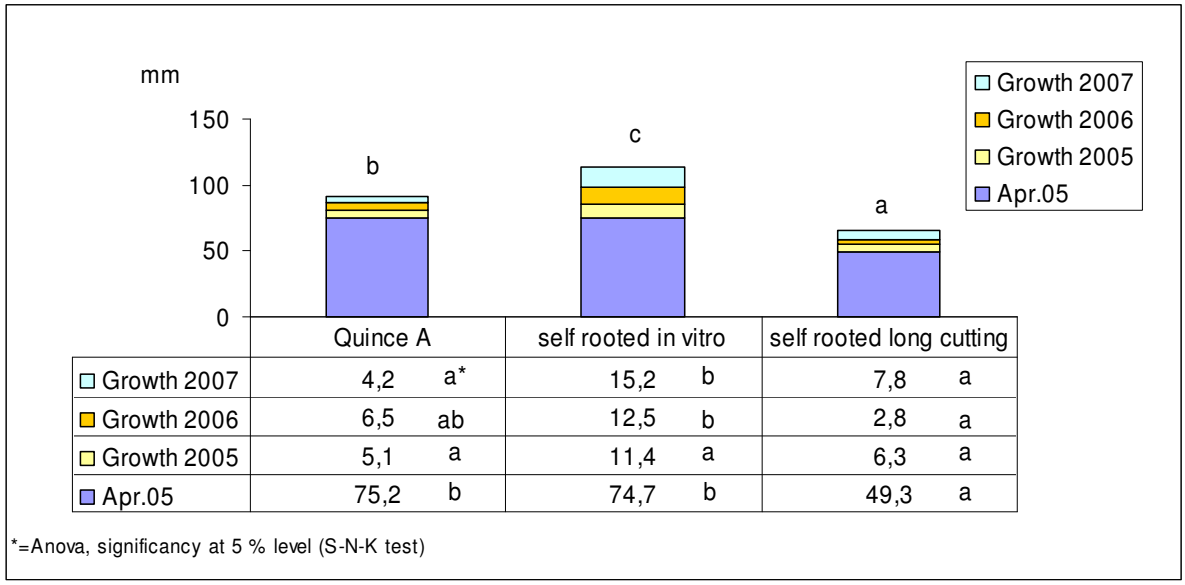
Another field trial with three cultivars grafted on four rootstock variants (quince Adams, pear seedling Kirchensaller, Farold 69 and Pyrodwarf) plus each cultivar self rooted in vitro, with 5 x 5 trees for each cultivar-rootstock combination was established in 2006 in two organically managed orchards, one on farm in Vorarlberg (cv. 'Uta', 'Williams', 'Subira') with fire blight (*Erwinia amylovora*) infestations in the orchard and one in the experimental station of the Department in Vienna (cv. 'Uta', 'Williams', 'Bosc`s'). In this part of the project also the vegetative and generative characteristics and the suitability of self rooted pear trees for organic production are studied. First significant results of this trial are expected in the next years.

Thus in 2004, 2005 and 2006 in cooperation with university of Ljubljana propagation experiments with green long cuttings of pear cultivars ('Bosc`s', 'Uta', 'Williams', 'Subira') during summer were made.

Results and discussion

In the trial with the pear cultivar 'Williams' in the orchard with high natural infection potential with fire blight in Lustenau after four years the in vitro self rooted trees were significantly more vigorous in growth than those grafted on quince, whereas the self rooted long cuttings were comparable to those on quince (figure 1). These results are corresponding to similar observations of Spethmann (2007).



	Quince A		self rooted in vitro		self rooted long cutting	
Growth 2007	4,2	a*	15,2	b	7,8	a
Growth 2006	6,5	ab	12,5	b	2,8	a
Growth 2005	5,1	a	11,4	a	6,3	a
Apr.05	75,2	b	74,7	b	49,3	a

*=Anova, significancy at 5 % level (S-N-K test)

Figure 1: Stem circumference in the period from 1-4 years after planting of trees of the pear cultivar 'Williams' self rooted and grafted on quince A in the trial in Lustenau.

Since the second year after planting the trees on quince flowered more intensely than the self rooted ones, however yields were low also on this rootstock so far and not significantly higher. After the winter 2004/05 the self rooted long cuttings showed heavy tree losses probably caused by winter frost (figure 2). Other tree losses during summer 2005 could be observed one on Quince A and one on in vitro self rooted. During winter 2005/06 another tree grafted on Quince A died. However, in 2006 and 2007 neither further tree losses, nor infections with *Erwinia amylovora* could be observed so far.

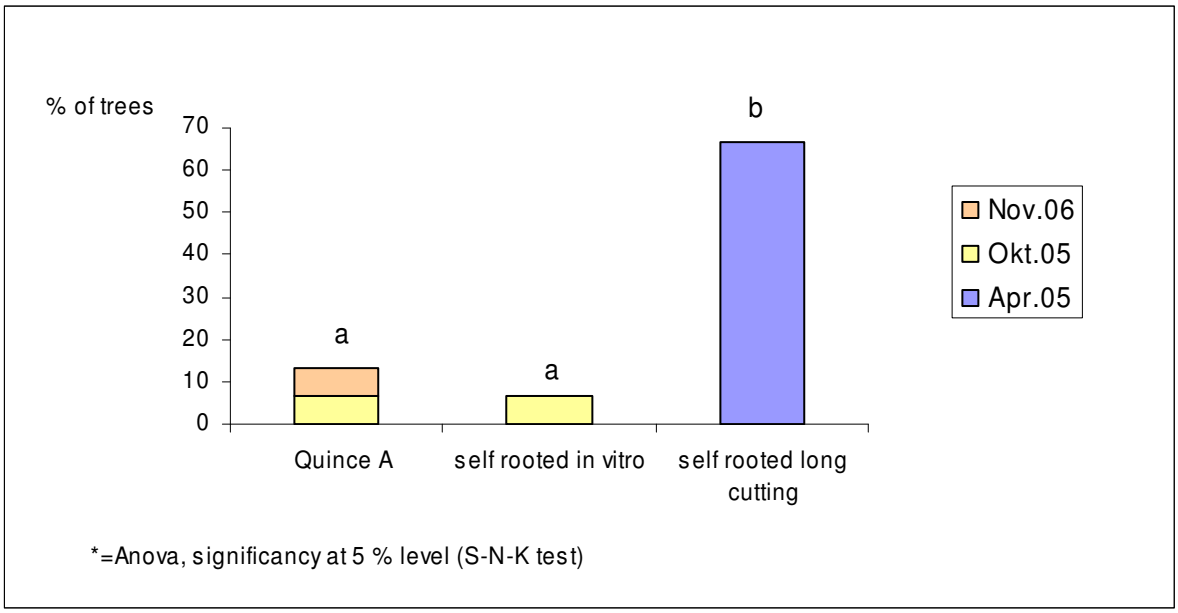


Figure 2: Tree losses in the period from 1-4 years after planting of the pear cultivar 'Williams' self rooted and grafted on quince A in the trial in Lustenau.

In spring 2007 some significant differences in pest incidence between variants could be observed. On Quince and on in vitro trees more damages by *Operophthera ssp.* could be observed in comparison to the self rooted long cuttings. *Janus compressus* could not be found on quince (figure 3), maybe the lower growth of trees on quince in this year as showed in figure 1 could give an explanation.

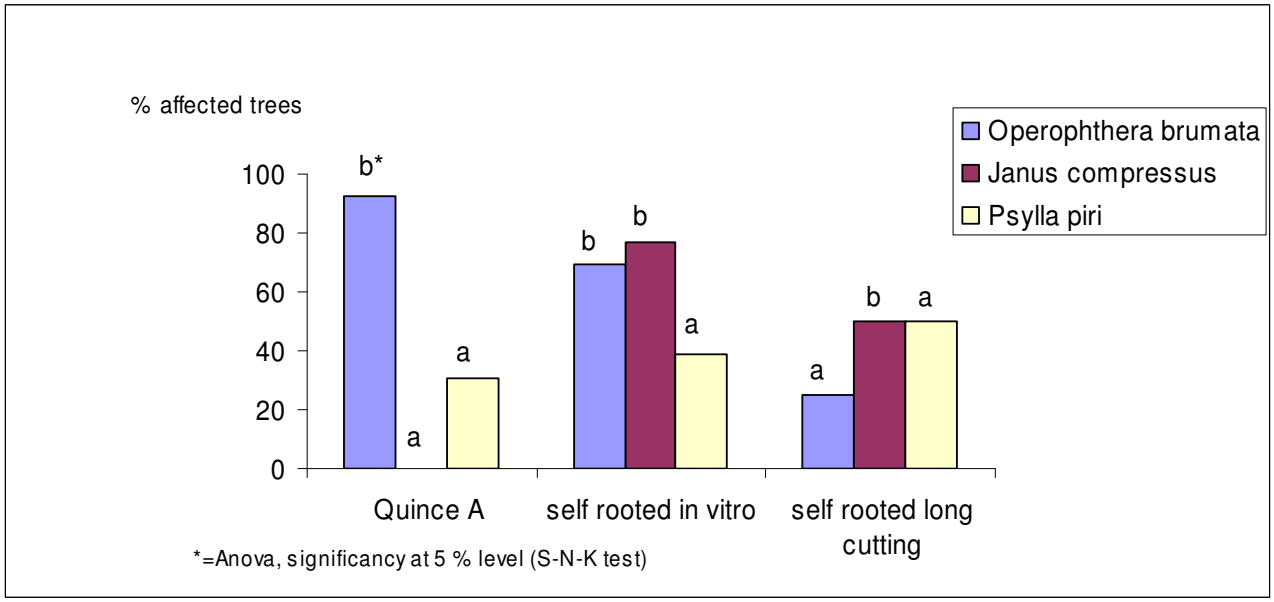


Figure 3: Frequency of insect damages by pests in 2007 (24th may) in the trial in Lustenau.

The propagation trials showed rooting rates from 0 to over 50 % dependent on cultivars and year (figure 4). Spethmann (2007) obtained a higher percentage (from 0-70 %) of self rooted long green cuttings with different fruit cultivars. However, the obtained rooting plants had many problems when planted in the following spring in the soil. Therefore the rooted plants from summer 2006 were cultivated in pots in 2007, where they grew well.

These trees are going to be planted now in open land in an organic managed field trial in the research orchard of the Department in Vienna and on farm in Vorarlberg.

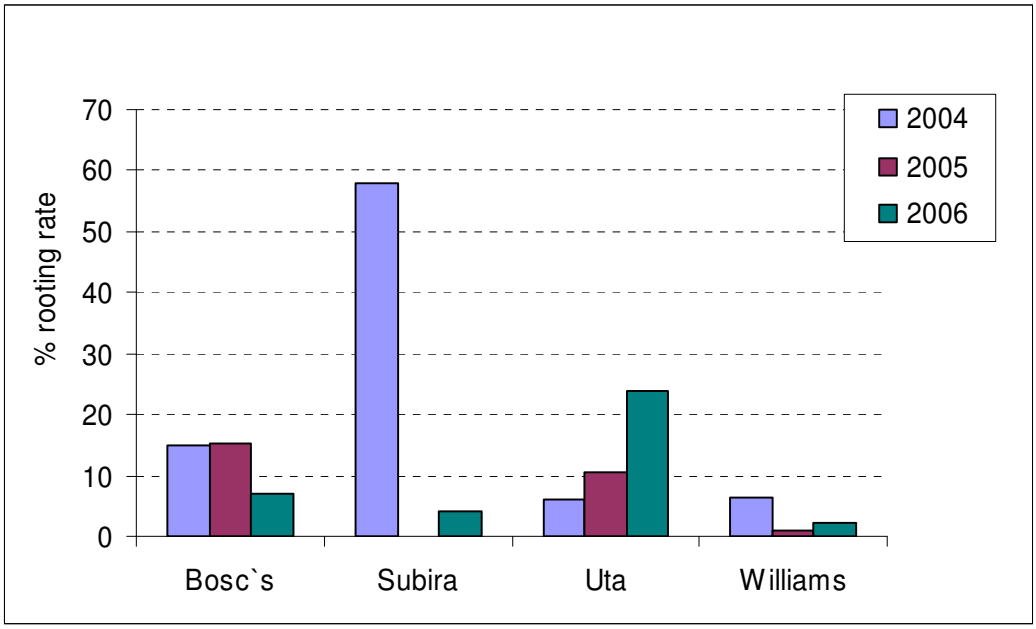


Figure 4: Rooting rate of long cuttings of pear cultivars from 2004 to 2006.

Conclusion

At this stage of the project it can not clearly answered the question, if it makes sense to use self rooted pear trees in an organic farming system. However, we expect more significant results in the next years from our field trial with three pear cultivars and more rootstock variants planted in 2006 at two organically managed sites in Austria. Furthermore, the propagation with self rooted long cuttings of cultivars has to be adapted to organic nurseries.

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