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EUFRIN Working Group on Fruit Thinning

New findings, techniques and products for apple thinning

At the beginning of this year, members of the EUFRIN Working Group on Flower and Fruit Thinning met in the Portuguese fruit-growing region of Alcobaça.
In this article, researchers Christian Andergassen and Magdalena Peterlin from the Laimburg Research Centre in South Tyrol discuss some of the experiments presented on thinning and fruit set in apples.

Professor Alessandro Botton from the University of Padua (Italy) kicked off the scientific part of the meeting. He presented his findings on signalling pathways triggered by ACC in falling fruit. 1-Aminocyclopropane-1-carboxylic acid (ACC) is one of five plant hormones, a natural precursor of ethylene, which improves ethylene biosynthesis and, when applied at fruit sizes of 15–20 mm, induces fruit drop as a thinning agent. For his experiment, the fruit was collected and examined before treatment with ACC (350 and 450 ppm at 14 mm) and 5 and 24 hours after treatment. In the untreated control, natural fruit drop occurs, with the fruit falling in regular waves. In comparison, 20% more fruit fell with ACC and there was a large wave of premature fruit drop.

Different sensitivity of central and lateral fruits

RNA fragments were extracted from seeds and pulp and analysed in more detail. When ACC is applied, central and lateral fruits are affected differently. Central fruits are already more advanced in their development and are therefore less sensitive to the ethylene produced by the applied ACC. In lateral fruits, on the other hand, genes are activated that stop the growth of the lateral fruits and draw all their energy to the stress-tolerant parts of the plant (central fruits), causing them to fall. A distinct hierarchy is important for the effect of ACC.

ACC and metamitron in Gala

Carla Fernandes, this year's host from Portugal, spoke about the one-year trial of thinning with ACC and metamitron on Gala apples. In recent years, they have had major problems with uniform flowering. Due to the mild winters, the apple trees' winter dormancy is too short and the lack of chilling hours leads to uneven flowering. In some cases, fruits up to 10 mm in size and newly opened flowers can be found on the same tree, which is a challenge for thinning. The

Central and lateral fruits react differently to ACC *VZ Laimburg*

Device for fruit fall prediction based on VIS/NIR scanning *VZ Laimburg*

Thinning trials with the fruit thinning machine

Magdalena Peterlin from the Laimburg Research Centre presented initial results on thinning with a fruit thinning machine developed for apple cultivation. The machine is mounted on the front linkage of the tractor and the fruit falls off due to the rotation of a spindle and the striking movement of rods. The three varieties examined, Braeburn, Gala and CR Brisset/Joya, were easy to thin and the fruit weight and diameter were positively influenced. However, not only individual fruits fell off, but also entire fruit clusters and shoots. As the machine penetrates deep into the tree and potentially reaches all apples, considerable fruit damage occurred, reminiscent of hail damage.

The Laimburg Research Centre presented the initial results of thinning with a fruit thinning machine. *VZ Laimburg*

active ingredients metamitron, ACC and 6-BA, ABA and the combination of 6-BA and NAA were compared for their efficacy in thinning. They were also tested for phytotoxicity. Phytotoxic reactions were observed on the trees of the ACC and ABA variants, but not on the metamitron variant. In the end, only metamitron differed from the control and the other thinning agents. Nika Hillmayr from the Institute of Slovenia discussed the results of her thinning trials with ACC on different varieties. Spring frost struck for four years in a row, but the trials were carried out nonetheless. ACC was identified as a good, sometimes strong fruit thinner, which depends heavily on its concentration. It was found that 400 ppm is too much for traditional varieties – 200 ppm is the upper limit. Return bloom and fruit growth are positively influenced. In the event of frost or low fruit set, it is better to use a low concentration or a milder active ingredient.

Thinning of CIV323/Isaaq®

In recent years, several new club varieties have been introduced in Trentino, Italy, including CIV323 Isaaq®, a so-called snack apple. Apples intended as snacks should have a diameter of 50–70 mm. Roberto Torresani from the Fondazione Edmund Mach has conducted detailed research into what needs to be considered when thinning. Untreated control trees were compared with the variants NAD, 6-BA, Metamitron and combinations of these three active ingredients. In general, this variety needs to be thinned. All active ingredients and combinations of active ingredients were able to achieve thinning. Metamitron was less effective than expected. The untreated control exceeded the target yield of 60 t/ha, while the treated variants were all slightly below this. NAD achieved good results, particularly with regard to return bloom. 6BA and the combination of NAD and 6BA had a positive effect on fruit size and quality.

Fruit drop forecast with VIS/NIR scanning

This year, the results of fruit drop prediction based on spectral VIS/NIR scanning at the KOB research sites and the Laimburg Research Centre were again presented. Sara Gruntmeir and Konni Biegert from KOB are continuing their work on predicting fruit drop using a non-destructive sensor. The experiment was carried out on Gala and Braeburn apples. Within each fruit cluster, the king fruit and the second lateral fruit were measured before thinning and every other day

after thinning. After treatment, fruit drop was monitored visually to check which fruits were falling. The spectrometer shows the development of the fruits on the tree after treatment. Before treatment and one day after, the wavelength reflected by the fruit is the same. In the case of the lateral fruits, it is immediately apparent which fruits may fall, while in the case of the king fruits, an initial trend can be seen from the 8th day after treatment. It was also possible to detect initial natural fruit drop when measurements were taken before the first treatment.

Kumar as a photosynthesis inhibitor

Michael Clever from the Esteburg Fruit Growing Centre in Jork (D) presented his trials with Kumar. Kumar contains 85% potassium hydrogen carbonate and is approved in the EU as a crop protection product against apple scab. It may be of interest for thinning in organic farming. According to Clever, Kumar is similar to a photosynthesis inhibitor, but its mode of action needs to be investigated further. His trials with Kumar on the Elstar variety have shown that there is a 10 to 30% reduction in the number of fruits with 5 kg/ha Kumar, applied at a fruit size of 12 to 16 mm. The highest thinning effect was achieved with double treatment, the lowest with application during flowering. Fruit weight was also increased by 5 to 15 g. Phytotoxicity, which is normally a problem, and russeting were not observed in the trials. Herman Welte from Agronaturalis also tried using Kumar as a thinning agent on Elstar at different dosages and at different times. It has a similar effect to ATS in flower thinning and to Brevis in fruit thinning. A thinning effect was achieved at a fruit size of 13 mm and an application rate of 10 kg/ha. Application at 10 mm appears to be too early, as contrary to expectations, no effect was achieved.

Apple production Alcobaça
In 2024, 56,300 tonnes were produced in Alcobaça, mainly Gala (60%), Fuji (20%) and Renette. The apples are mainly marketed in the region and the rest of Portugal, but also outside Portugal, for example in Brazil, other EU countries and in South and Central America.

EUFRIN Working Group on Flower and Fruit Thinning
EUFRIN, the European Fruit Research Institutes Network, is an organisation consisting of universities and research institutes throughout Europe and beyond, which have set themselves the task of researching and developing fruit growing and exchanging their knowledge. Divided into individual specialist areas, the members of the working groups meet regularly to share their findings. As on 26 previous occasions, scientists from the Flower and Fruit Thinning Working Group, led by Professor Guglielmo Costa, met again in 2025. Experiences were exchanged and scientific issues were discussed at European and international level. The conference took place in Alcobaça (Portugal).

In the land of the Alcobaça apple

Between the tranquillity of the mountains and the stormy Atlantic lies Alcobaça, the fruit-growing region in western Portugal. This is where the 'Alcobaça apple' originated and where the EUFRIN working group on blossom and fruit thinning held its three-day meeting.

Apple cultivation in Alcobaça

Alcobaça is located in inland Portugal, a few kilometres from the Atlantic coast and about 100 km north of Lisbon. Apple cultivation is practised in the region around Alcobaça, and the apples are marketed under the IGP Mãça de Alcobaça brand. The Associação dos Produtores de Mãça de Alcobaça (APMA), the association of Alcobaça apple producers, presented the fruit growing region at the start of the EUFRIN meeting. Founded in 2001, the brand promotes apples as a product of the region between the mountains and the Atlantic: "The influence of the sea on the climate, the sunshine and the soil properties give the apple its even colouring, balanced sweet-sour taste and refreshing aroma." The brand markets varieties such as Gala, Fuji, Granny Smith and Pink Lady, as well as the historic regional variety Casa Nova. All apples under the Mãça de Alcobaça brand are subject to integrated production guidelines. The sub-line '*Eco Pomares de Mãça de Alcobaça* IGP' aims to demonstrate sustainable apple cultivation and works with various approaches, for example to save water or attract beneficial insects.

Sustainable apple cultivation in Alcobaça *VZ Laimburg*