

Scanning report (EIP format for practice abstracts)

***Project title (native language):** Behangsregulierung bei Kern- und Steinobst

***Project title (English):** EUFRUIT: European Fruit Network

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Section A. Summary for EIP dissemination

***Keywords:** fruit thinning, chemical thinning, pear, apple, cherry, fruit quality, Brevis

***Main geographical location:** CH0

Other geographical locations:

***Summary (native language):**

Die Behangsregulierung ist entscheidend für die Sicherstellung regelmässiger Erträge (Verhinderung der Alternanz) und für die Fruchtqualität. Neben dem Preis sind der Ertrag und der Anteil Früchte der Klasse 1 die wichtigsten Schlüsselfaktoren für das Arbeitseinkommen. Mit einer optimalen Behangsregulierung werden zudem der Arbeitsaufwand für die Handausdünnung reduziert und die Ernteleistung erhöht. Die Ausdünnung ist daher ein wichtiger Faktor für die Wirtschaftlichkeit, vor allem in der Apfelproduktion.

In der Schweiz wird die Behangsregulierung vor allem mit chemischen Wachstumsregulatoren durchgeführt. Eine breite Palette an bewilligten Wirkstoffen ermöglichen verschiedene Strategien in Abhängigkeit der Sorte, dem Frostrisiko, der Witterung, dem Feuerbrandrisiko und den Erfahrungen des Betriebsleiters. Die meisten Wirkstoffe beeinflussen den Hormonhaushalt der Pflanze (NAAm, NAA, BA und Ethephon). Kaliumbicarbonat führt zu einer Verätzung der Blüte, während Metamitron durch die Hemmung der Photosynthese zu einem erhöhten Fruchtfall führt. Als Alternative können Produzenten ihre Obstbäume auch mechanisch ausdünnen. Hier kommt vor allem das System «Darwin» zur Anwendung. In einzelnen Betrieben wird zudem Ausdünngeräte der Typen «Bonn» und «Eclairvale» eingesetzt.

In den vergangenen Jahren hat Agroscope vor allem die Wirkung des neuen Ausdünnmittels Brevis (Wirkstoff Metamitron) getestet. Brevis ist seit 2015 für die chemische Behangsregulierung bei Äpfel und Birnen in der Schweiz zugelassen. Zusammen mit anderen Forschungsanstalten untersucht Agroscope, inwiefern die Wirkung von Brevis mit Wetterdaten vorausgesagt, respektive mit einem Photosynthesemessgerät kurz nach der Anwendung beurteilt werden kann. In der Praxis sollen diese Erfahrungen helfen, Brevis möglichst effizient einzusetzen. Damit kann einerseits die Wirkung vorgängig besser abgeschätzt werden, andererseits können diese Modelle helfen, den Einsatz von Pflanzenschutzmitteln zu reduzieren.

Neue Kirschenarten neigen teilweise zu einem starken Behang. Bei Produzenten besteht daher die Befürchtung, dass bei diesen Sorten ähnlich wie im Kernobst die Gefahr einer Alternanz besteht. Zudem erhoffen sie sich durch eine Behangsregulierung eine Steigerung der Fruchtgrösse. Da bei Kirschen in der Schweiz zurzeit kein chemisches Ausdünnmittel zugelassen ist, hat die Obstbaubranche angeregt, verschiedene chemische Wirkstoffe zur Behangsregulierung zu testen. In mehreren Versuchen wurden daher seit 2004 diverse Produkte zur Ausdünnung bei Kirschen getestet (ATS, BA, NAA, Metamitron).

Neben der Beantwortung dieser Forschungsfragen nimmt Agroscope auch Vollzugsaufgaben im Auftrag des Bundesamtes für Landwirtschaft wahr. Forscher von Agroscope beurteilen die Wirkung von neuen Produkten zur Behangsregulierung im Rahmen des Zulassungsprozesses.

Summary (english):

Fruit thinning is an important measure to guarantee a high fruit quality and a constant harvest over several years by avoiding biennial bearing. Apart from the market price, the amount of fruits and the percentage of first class fruits are key factors for the grower's income. Furthermore, labour costs for hand thinning and harvest will be reduced with an optimal crop load. Therefore, fruit thinning is essential for the economic profitability of an orchard, mainly in apple production.

In Switzerland, producers mainly use chemical growth regulators to reduce the crop load. Different registered thinning agents allow various strategies, depending on the variety, the weather, the experience of the farm manager and the risk of frost or fire blight. Most of the thinning agents influence the tree's hormones (NAA, NAD, BA, and Ethephon). Potassium Bicarbonate burns the flowers. Metamitron reduces the photosynthetic activity, which finally leads to fruit drop. Apart from chemical fruit thinning, growers can also thin their trees by using mechanical devices (e.g. Darwin).

Since 2008, Agroscope focused their research activity on the efficacy of the new thinning agent Brevis. Brevis is registered in Switzerland since 2015 to thin apple and pear. Together with other research institutions in Europe, Agroscope investigates how the efficacy of Brevis can be predicted by the use of weather data. A second approach to improve the use of Brevis is by quantifying the efficacy shortly after the application by measuring the photosynthetic activity. These measures can help to estimate the influence on the crop load, which finally saves the amount of pesticides used in orchards.

Some new sweet cherry varieties tend to have a high crop load. For that reason, fruit growers would like to thin cherry trees to reduce the risk of biennial bearing and to increase the cherry's fruit size. However, no chemical agents are registered in Switzerland to thin cherries now. Therefore, Agroscope evaluated different chemical products since 2004 to reduce the crop load of sweet cherries (ATS, BA NAA, Metamitron).

Agroscope has also executing functions on behalf of the Swiss Federal Office for Agriculture. Researchers of Agroscope write expertises on the efficacy of new thinning products.

Section B. Project information

***Project coordinator:** Michelle H. Williams; Aarhus University, Department of Food, Kirstinebjergvej 10, 5792 Aarslev, Denmark; mw@food.au.dk; +45 25170049

***Project period:** 2016 - 2019

***Project status:** Ongoing

***Funded by:** Horizon 2020

***Total budget:** €1.8m

***Geographical regions:** DK011 Copenhagen, DK012 Copenhagen and its environs, DK013 North Zealand, DK014 Bornholm, DK021 East Zealand, DK022 West- and South Zealand, DK031 Funen, DK032 South Jutland, DK041 West Jutland, DK042 East Jutland, DK050 North Jutland, BE211 (Arrondissement. Antwerpen), BE212 (Mechelen), BE213 (Turnhout), BE221 (Hasselt), BE222 (Arr. Maaseik), BE223 (Tongeren), BE231 (Aalst), BE232 (Dendermonde), BE233 (Eeklo), BE234 (Gent), BE235 (Oudenaarde), BE236 (Sint-Niklaas), BE241 (Halle-Vilvoorde), BE242 (Leuven), BE251 (Brugge), BE253 (Ieper), BE254 (Kortrijk), BE255 (Arr. Oostende), BE256 (Arr. Roeselare), BE257 (Tielt), BE258 (Veurne), BE310 (Nivelles-Nijvel), BE331 (Huy-Hoei), BE332 (Liège- Luik), BE334 (Waremmе-Borgworm), BE335 (Verviers), FR8 Méditerranée; FR81 Languedoc-Roussillon, FR6 SUD-OUEST, FR512 Maine et Loire, FR611 Dordogne, FR812 Gard, DE6 (Hamburg), DE8 (Mecklenburg-Vorpommern), DE9 (Niedersachsen), DEF0 (Schleswig-Holstein), DEE0 (Sachsen-Anhalt), DEA (Nordrhein-Westfalen), DE111, DE112, DE113, DE114, DE115, DE116, DE117, DE118, DE119, E11A, DE11B, DE11C, DE11D, DE121, DE122, DE123, DE124, DE125, DE126, DE127, DE 128, DE129, DE12A, DE12B, DE12C, DE131, DE132, DE133, DE134, DE135, DE136, DE137, DE138, DE139, DE13A, DE141, DE142, DE143, DE144, DE145, DE146, DE147, DE148, DE149, DE600 Hamburg, DE932 Cuxhaven, DE933 Harburg, DE939 Stade, DEF09 Pinneberg, NL1-NL4 + NLZ Holland; NL 224 zuidwest Gelderland, NL 226 Arnhem/Nijmegen, NL230 Flevoland, NL310 Utrecht, NL321 Kop van Noord-Holland, NI322 Alkmaar en omgeving, NL338 oost Zuid-Holland, NL33A zuidoost Zuid-Holland, NL341 Zeeuws-Vlaanderen, NL342 overig Zeeland, NI411 west Noord-Brabant, NL413 noordoost Noord-Brabant, NL414 zuidoost Noord-Brabant, NL421 noord Limburg, NL422 Midden-Limburg, NL423 zuid Limburg, ES620 Murcia, UKG11 Herefordshire, UKG12, Worcestershire, UKH12 Cambridgeshire, UKH16 North and West Norfolk, UKH17 Breckland and South Norfolk, UKJ22 East Sussex, UKJ35 South Hampshire, UKJ36 Central Hampshire, UKJ37 North Hampshire, UKJ41 Medway, UKJ42 Kent, UKJ43 Kent Thames Gateway, UKJ44 East Kent, UKJ45 Mid Kent, UKJ46 West Kent, ES618 Sevilla, ES511 Barcelona, ES512 Gerona, ES513 Lérida, ES514 Tarragona, CH0 Schweiz/Suisse/Svizzera, ITH51-59 Emilia Romagna region, ITH10 Bolzano-Bozen, HU101 Budapest, HU102 Pest, RO111, RO112, RO113, RO114, RO115, RO121, RO122, RO123, RO124, RO125, RO126, RO211, RO212, RO213, RO214, RO215, RO216, RO221, RO222, RO223, RO224, RO225, RO226, RO311, RO312, RO313, RO314, RO315, RO316, RO317, RO321, RO322 RO411, RO412, RO413, RO414, RO415, RO421, RO422, RO423, RO424. HU101, HU102, LT001 Alytaus apskritis, LT002 Kauno apskritis, LT003 Klaipėdos apskritis,

LT004 Marijampolės apskritis, LT005 Panevėžio apskritis, LT006 Šiaulių apskritis, LT007 Tauragės apskritis, LT008 Telšių apskritis, LT009 Utenos apskritis, LT00A Vilniaus apskritis.

Project web page: <http://www.eufrin.org/index.php?id=55>

***Project Objectives (native language):**

1. Gründung eines europäischen Netzwerks im Bereich des Fruchtsektors.
2. Entwicklung und Implementierung eines systematischen Ansatzes um bestehendes wissenschaftliches und praktisches Wissen abzufragen und zusammenzufassen.
3. Aufbau eines fortlaufenden Dialogs mit relevanten EU, nationalen und regionalen Interessensvertretern
4. Identifizierung und Unterstützung neuer Prioritätsbereiche durch kontinuierliches Monitoring und Analysieren bestehender und künftiger Forschungs- und Innovationsaktivitäten.

Project Objectives (English):

1. Establish a European network focused on the fruit sector.
2. Develop and implement a systematic approach for scanning and synthesizing existing scientific and practical knowledge.
3. Establish an ongoing dialogue with relevant EU, national and regional policy bodies.
4. Identify and support new priority areas of research by continually monitoring and analysing existing and upcoming research and innovation activities.

***Project partners:**

1. Aarhus University, Department of Food Science (Denmark) • AU
2. Research Station for Fruit npo (Belgium) • Pcfuit
3. Centre Technique Interprofessionnel des Fruits et Légumes (France) • CTIFL
4. Obstbauversuchsanstalt Jork (Germany) • OVA
5. Stichting Wageningen Research (Netherlands) • WR
6. ~~East Malling Research (United Kingdom) • EMR (terminated 08-02-2016)~~
7. Institut de Recerca i Tecnologia Agroalimentàries (Spain) • IRTA
8. Federal Department of Economic Affairs, Education and Research (EAER), acting through Agroscope Institute of Plant Sciences (Switzerland) • Agroscope
9. Laimburg Research Centre for Agriculture and Forestry (Italy) • Laimburg
10. University of Agronomic Sciences and Veterinary Medicine of Bucharest (Romania) • USAMV
11. National Agricultural Research and Innovation Centre Fruitculture Research Institute (Hungary) • NARIC
12. Lithuanian Research Centre for Agriculture and Forestry (Lithuania) • LRCAF
13. Assemblée des Régions Européennes Fruitières, Légumières et Horticoles (France) • AREFHL
14. Variety Innovation Consortium South Tyrol (Italy) • SKST
15. Freshfel Europe (Belgium) • FRESHFEL
16. Elbe-Obst Erzeugerorganisation r.V. (Germany) • EO
17. Fruitconsult BV (Netherlands) • FC
18. University of Greenwich (United Kingdom) • UoG
19. University of Hohenheim (Germany) • UHOH
20. Università di Bologna (Italy) • UNIBO
21. Institut National de la Recherche Agronomique (France) • INRA
22. NIAB EMR (new 09-02-2016)

Section C. Annex: Scanning report¹

Scanning report (Fruit thinning)

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Country: Switzerland

NUTS 3 region(s)²: CH0

WP no. and title: WP5 secure sustainable fruit production

Date: Y2 report 16/05/2018

Source materials and methodology

Out of the various subjects of WP5, thinning of pome and stone fruits is the most important field in which Agroscope is doing research. Thereby, the focus lies on the evaluation of new thinning agents and strategies for Swiss orchards. As like other research institutes in Europe, we concentrated our activities on predicting the efficacy of the new thinning product Brevis. Agroscope is also part of an international Brevis-group, which studies the effects of temperature and global radiation on the efficacy of Brevis. In stone fruits, we investigate the possibilities to chemically thin plums as well as sweet cherry varieties with a high crop load. To answer these questions, we use experimental plots at Güttingen (pome and stone fruit), Wädenswil (pome fruit), Breitenhof (stone fruit) and Conthey (stone fruit and pome fruit). Randomised trials with several treatments within a given row are conducted with a specially-designed experimental sprayer.

In 2017, Agroscope conducted two Brevis trials in Wädenswil. First, a time sequence trial was performed in Golden in which Brevis was sprayed every 3 to 4 days (about 2 mm increase in fruit size between two spraying dates) at a given dosage (1.65 kg/ha) to evaluate the new BreviSmart model and to improve its quality. Second, Brevis and Maxcel (6-Benzyladenine) were applied to Ladina to gain experience on how to thin this new variety. In both trials, number of flower clusters, number of fruits at harvest as well as fruit quality were evaluated. A thinning trial using the pear varieties Williams and Conférence was cancelled due to frost damage.

For cherries, experiments carried out in the recent years indicate that fruit quality cannot be promoted by fruit thinning. Therefore, Agroscope is taking a new approach by evaluating factors which promote fruit quality in sweet cherries. Researchers measured various branch and tree parameters (e.g. slope of branches, exposition or shoot growth) and compared these values with fruit quality parameters such as fruit size, sugar content or firmness.

Agroscope has also executing functions on behalf of the Swiss Federal Office for Agriculture. Researchers of Agroscope elaborate expertises on the efficacy of new thinning products.

Best practice findings

Agroscope has evaluated several agents to thin apples over the last years, including the recently launched product Brevis. Pros and cons of the tested products and thinning strategies have been described for different varieties in various publications and presentations to both scientists and producers. Brevis was found to be a promising thinning agent also in Switzerland. However when comparing apple trials since 2008 using different varieties (Golden, Gala, Braeburn, Ladina), the thinning efficacy was very variable. Mainly in wet and cold years, the thinning efficacy was not satisfying.

In 2017, weather conditions with high night temperatures before and after the application of Brevis were promising and therefore, a high thinning efficacy could be expected. Consistent with this expectation, the model BreviSmart predicted a moderate to high thinning efficacy. However, a severe frost event in late April biased the thinning trial. In all treatments, including the untreated control, crop load at harvest was lower than the target yield, most likely due to frost damage. Therefore, thinning efficacy of Brevis on Golden in 2017 was, once more, rather weak. Only a late application of two times Brevis significantly reduced the crop load

¹ Equivalent to 'final report' in EIP-AGRI format.

² Please see ec.europa.eu/eurostat/ramon/nomenclatures/ for details on NUTS regions, level 3

compared to the untreated control. In 2018, BreviSmart will be evaluated once more by applying Brevis either once or twice in a given dosage according to BreviSmart.

The cherry trial revealed that shoot growth positively influences fruit size. Therewith, generative growth doesn't seem to be in competition with shoot growth as observed in pome fruit. The slope of a branch neither correlated with its growth, nor with fruit quality or crop load. These findings motivate Agroscope to carry out further experiments on how orchard management, e.g. pruning or tree training, can improve fruit quality.