Scanning report (EIP format for practice abstracts) - 2018

***Project title (native language):** **EUFRUIT: Europæisk frugtnet**

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

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Section A. Summary for EIP dissemination

***Keywords:** Non-destructive methods, volatile emission, hot water treatment, early detection of storage rot.

***Main geographical location:** DK031 Funen

Other geographical locations: DK011 (Copenhagen), DK012 (Copenhagen and its environs), DK013 (North Zealand), DK014 (Bornholm), DK021 (East Zealand), DK022 (West- and South Zealand), DK032 (South Jutland), DK041 (West Jutland), DK042 (East Jutland), DK050 (North Jutland).

***Summary (native language):**

Spild af økologisk kernefrugt afhænger af forskellige faktorer: sort, produktionssystem, ventetid mellem høst og lagring, forbehandling af frugten før og efter lagring, og opbevaringsmetode. Varmvandsbehandling før og efter lagring samt pakning og salg i detailhandlen er en miljøvenlig, sikker, pesticidfri og accepteret metode uden sundhedsrisici. Varmvandsbehandling har en dødelig eller væksthæmmende effekt på svampe. Der ud over kan vandbehandling rense frugternes overflade, smelte frugternes egen voks så eventuelle huller i overfladen lukkes, og øge koncentrationen af kemiske forsvarsstoffer i skrællen. Toogtyve fenolske stoffer blev identificeret i skrællen af 'Rød Ingrid Marie' og 'Pinova'. Den højeste koncentration of en ukendt fenol og fenolen epicatechin blev fundet i frugter behandlet ved 50 grader i 3 min, der også resulterede i en lavere forekomst af lagerråd. En bedre forståelse af svampepathogeners og vævets reaktion på varmvandsbehandling ville hjælpe til at udvikle denne miljøvenlige teknologi, som effektivt kan begrænse forekomsten af frugtråd at påvirke frugternes tekstur og sødhed. Der findes forskelligt udstyr på markedet, som har deres fordele og ulemper. Det er især vigtigt at udstyret kan behandle frugterne ensartet, og at temperatur og tid kan kontrolleret præcist.

Summary (english):

Losses and waste in organic pome fruit production depends on several factors: cultivar, production system, lag time between harvest and storage, pre-treatment before storage and supply, and storage method. Hot water treatment (HWT) before storage and before packaging is an eco-friendly, safe, residue-free, and accepted technology without human health risks. HWT has lethal or sub-lethal effects on fungi. Additionally, HWT may clean the fruit surface, melt fruit waxes closing any wounds on the surface, and increase the concentration of chemical defence compounds. Twenty-two phenolic compounds were identified in heat-treated peel of 'Red Ingrid Marie' and 'Pinova'. The highest concentration of an unknown phenolic compound and epicatechin was observed in fruits treated at 50 °C for 3 min, which also resulted in less storage rot. A better understanding of the pathogen / tissue response to HWT would help the further development of this eco-friendly technology, which efficiently can reduce rots in storage without compromising texture and sweetness of fruits. There are different equipment on the market, which have their pros and

cons. It is especially important that the machinery can treat fruits uniformly, and that temperature and time is precisely controlled.

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 (Waremme-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, Nl322 Alkmaar en omgeving, NL338 oost Zuid-Holland, NL33A zuidoost Zuid-Holland, NL341 Zeeuws-Vlaanderen, NL342 overig Zeeland, Nl411 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 Hamphshire, 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. Etablere et europæisk net indenfor frugtsektoren

2. Udvikle og implementere en systematisk tilgang til at indsamle og bearbejde eksisterende videnskabelig og praktisk viden
3. Etablere og videreføre en dialog med relevante EU, nationale og regionale myndigheder
4. Identificere og prioritere nye forskningsområder gennem en løbende monitorering og analyse af eksisterende og nye forsknings- og innovationsaktiviteter.

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) • Pcfruit
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)

Scanning report - 2018
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Country: Denmark

NUTS 3 region(s)[1]: 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).

WP no. and title: WP4 Fruit quality; improvement of fruit handling/storage

Date: 15.05.2018

Source materials and methodology

The source materials are based on discussion / interaction with industry through meetings in the two research projects: 'ProtectFruit' and 'Dafruss', interaction with industry / other scientists at two conference / symposium meetings - Danish organic conference November 2017 / FRUTIC symposium on 'Optimizing water use in the supply chain of fresh produce', Berlin February 2018, collaboration with Hinrich Holthusen from ESTEBURG Obstbauzentrum, Jork, Germany, and own research and dissemination activities.

Authors	Title	Source
Edelenbos, M., Bertelsen, M.G., Holthusen, H. 2017	Bedre udnyttelse af produktionen og mindre spild / Better utilization of pome fruit production and less food waste	Oral presentattion at Økologi kongres 2017, 29-30 November 2017, Kolding, Denmark.
Edelenbos, M. and Holthusen, H. 2018	Hot water treatment (HWT) of fresh produce to prolong shelf life and reduce losses and waste	Oral presentattion at the FRUTIC symposium, 6 February 2018, Berlin, Germany.
Edelenbos, M., Wang, A. and Bertelsen, M. G. 2018	Optimized hot water treatment (HWT) to reduce postharvest losses in pome fruits. HWT and quality, polyphenols and diseases.	Oral presentattion at a 'ProtectFruit' meeting 18 April, 2018, Copenhangen, Denmark.

Best practice findings - 2018

Losses and waste in apple production occur during harvest, storage and after shelf life (Edelenbos et al. 2017). Sorted out fruits can be used for juicing, drying, puree, or as parts of sweets depending on the quality of the rejected fruits. It

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

is, however, important to use the rejected fruits timely to prevent growth of *Penicillium expansum*, which is a secondary fungus that produces a mycotoxin called patulin. Losses and waste in organic production depends on several factors: cultivar, production system (unprotected, protected, or sprayed), lag time between harvest and storage, pre-treatment before storage and supply (hot water dipping), and storage method (air or controlled atmosphere). Losses and waste following storage may be limited and losses pushed forward in the supply chain to retailers and consumers due to increased storage temperature and senescence. Hot water treatment (HWT) before storage and before packaging is an eco-friendly, safe, residue-free, and accepted technology without human health risks (Edelenbos and Holthusen, 2018). The product is either dipped or rinsed with hot water. Higher efficacy is obtained with dipping than rinsing. Higher temperature and shorter times can replace treatments with lower temperature for longer times; however, it seems that some diseases are more efficiently controlled at lower temperatures for longer times. It has been shown that, HWT has lethal or sub-lethal effects on fungi. Additionally, HWT may clean the fruit surface, melt fruit waxes closing any wounds on the surface, and increase the concentration of chemical defence compounds by up- and or down regulation of the metabolism. Temperature increases shortly at the surface and at the underlying tissue at treatment and thereafter decreases and it initiates a response inside the fruit. Used correctly, less rot develop on HWT fruits in storage and shelf life. Twenty-two phenolic compounds were identified in heat-treated peel of 'Red Ingrid Marie' and 'Pinova' (Edelenbos et al. . The highest concentration of an unknown phenolic compound and epicatechin was observed in fruits treated at 50 °C for 3 min, which also resulted in less storage rots. A better understanding of the pathogen / tissue response to HWT would help the further development of this eco-friendly technology, which efficiently can reduce the number of rotten fruits without compromising the texture and sweetness of fruits. There are different equipment on the market for HWT, which have their pros and cons. It is especially important that the machinery can treat fruits uniformly, and that temperature and duration is precisely controlled during the treatment.