Scanning report (EIP format for practice abstracts)

*Project title (native language): EUFRUIT: European Fruit Network

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

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Section A. Summary for EIP dissemination

*Keywords: soft fruit, irrigation, UK, precision, DSS, decision support system]

*Main geographical location: 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,

Other geographical locations:

*Summary (native language):

Summary (english):

The soft fruit industry within the UK mainly consists of strawberry and raspberry production in a variety of growing systems, for example protected, un-protected, soil grown and substrate. Irrigation to these crops, especially in protected and substrate grown systems is fundamental to crop survival and productivity. Grower interviews conducted by NIAB-EMR has shown that growers rank efficient irrigation as key to their crop performance but there is a wide variation in the amount of water that is applied to a particular crop. Research trials/experiments at NIAB-EMR for both soil and substrate grown crops has shown that precision irrigation tools and techniques results in significant savings in the amount of water and fertilizer applied to the crop, with improvements in yield and fruit quality also being achieved.

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):

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)

Section C. Annex: Scanning report[1]

Scanning report
Eleftheria Stavridou, NIAB-EMR

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Country: UK

NUTS 3 region(s)[2]: 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,

WP no. and title: WP5 secure sustainable fruit production

Date: 11-05-2017

Source materials and methodology

This scanning document will be restricted to soft fruit precision irrigation management projects conducted in the UK over the last 10 years in the first instance. The best practice discussed is principally sourced from two major funding streams in the UK; Agriculture Horticulture Development Board and Innovate UK.

Agriculture Horticulture Development Board (AHDB) are a major funder of research, development and knowledge transfer in the UK's horticulture sector. AHDB is funded through levy collected annually from the growers as a proportion of farm gate value. AHDB Horticulture looks after the different crop interests across all sectors, of which soft fruit and tree fruit sectors are relevant to the remit of EUFRUIT.

Innovate UK is a UK government funding body that focuses on projects that support commercial innovation. The projects are business lead and a proportion of the project costs are funded by the commercial companies. The Agritech Catalyst has become a major funder of projects in the horticulture sector since its inception 5 years ago replacing it's forerunner, DEFRA HORT-LINK. Both have funded numerous projects on soft fruit and tree fruit projects relevant to the remit of EUFRUIT.

Irrigation businesses reviews were carried out by the 'Water Advisory Team for Efficient Resource Recovery' (WATERR) project, which was parlyt funded by the European Regional Development Fund (ERDF) as part of the South East ERDF competiveness programme 2007-2013. More information can be found at http://www.emr.ac.uk/projects/waterr-water-advisory-team-efficient-resource-recovery/

Access to information: AHDB publishes reports on funded research on its website (www.horticulture.ahdb.org.uk) mostly freely available across the EU however some factsheets, wall charts, DVDs and publications may need to be paid for. Innovate UK projects are partly commercially funded and as such their outputs can be commercially confidential. The gateway to research is an online database which enables the searching of funded projects (http://gtr.rcuk.ac.uk/). HORT-LINK project summaries are available through http://randd.defra.gov.uk/

Best practice findings

The soft fruit sector within the UK mainly consists of strawberries (both everbearers and June bearers varieties), and raspberries (primocane and floricane). There are many growing systems, protected, un-protected, soil grown and substrate grown, all of which has helped extend the season of UK soft fruit which is now available from March through to November.

[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

The irrigation Business Reviews (IBRs), in depth interviews, that were conducted during 2014-2015 with irrigators as part of 'Water Advisory Team for Efficient Resource Recovery' (WATERR) project identified current irrigation water use efficiency, the impact of irrigation on financial returns, and opportunities for improvement. In brief, the IBRs reveal:

- field strawberry growers use 79 cubic meters of irrigation water per tonne of crop produced. However, there was on average a 2 fold difference in water use productivity between growers, ranging from 48 up to 102 cubic meters per tonne produced.
- substrate strawberry growers used 82 cubic metres of water per tonne of crop produced. But there was a 3 fold difference in water use productivity between growers, ranging on average from 35 up to 115 cubic metres per tonne.
- field raspberries required a higher volume of water per tonne of crop produced than any of the other crops reviewed, using on average 114 cubic metres per tonne, however, as with substrate grown raspberries, there was nearly a 2 fold difference in irrigation water productivity on average between growers, ranging from 74 up to 140 cubic metres per tonne produced
- substrate raspberry growers used 111 cubic meters per tonne of crop produced, however, there was a 2 fold difference in water use productivity between growers, ranging on average from 80 up to 178 cubic metres per tonne.

In substrate grown strawberries and raspberries irrigation is fundamental to crop survival, and is also the primary source of fertiliser and crop nutrients. Growers therefore indicated that for these crops irrigation accounts for 100% of production i.e without irrigation there would be no crop, or in value terms between 93% and 97% of Gross Proceeds after deducting the cost of irrigation.

Work carried out by EMR in a HortLINK project demonstrated in scientific experiments of field-grown 'Elsanta' that irrigation scheduling strategies developed during the project delivered water savings of 85% without reducing Class 1 yields and improved aspects of fruit quality. In this system soil matric potential sensors were connected to loggers and soil matric potential recorded continiously.Irrigation being applied when the matric potential reached the irrigation setting point and with only enough water being applied to bring the soil in the rooting zone back to field. The irrigation scheduling strategy was tested in 5 commercial farms and on the majority of the trials an increase in Class 1 yield (up to 8%) and a reduction in water use (up to 40% saving) when compared to the commercial regimes was found.

In the UK in recent years there has been a shift from the traditional soil grown systems to substrate (particularly coir) growing systems, increasing the need for well designed irrigation systems for the delivery of water evenely across the cropping area. In the IBR interviews, growers were asked to identify and rank those 'Best Practices' which are most important in optimising irrigation performance and financial returns. Monitoring substrate moisture content in order to optimise irrigation scheduling was ranked as the most important activity by over 90% of growers interviewed. There is, therefore, extensive use of probes and computerised tools to optimise irrigation frequency and duration, but growers also highlighted the need for better integration of these technologies with other scheduling and application systems. The need to regularly check irrigation equipment condition was also ranked as 'important' or 'very Important' by over 80% of growers. Substrate growers stated that equipment malfunction can be extremely costly emphasising the importance of using the latest systems and undertaking regular monitoring and servicing In addition to improving on–farm water and fertiliser use efficiencies, effective irrigation scheduling will also deliver savings in fertiliser and energy costs. Scientific research and on-farm trials have shown that precision irrigation can increase marketable yields due to a reduction in fruit waste during production, and aspects of berry quality including %BRIX, flavour, firmness and shelf-life can also be improved. Many soft fruit growers have high employee costs and so the rise in the minimum wage announced in the post-election budget will impact greatly on profit margins unless remedial steps are taken to improve the efficiency of production and harvesting. Research at EMR has shown that strawberry canopy areas can be manipulated using precision irrigation and that plant leaf area can be reduced by 40% without affecting Class 1 yields or quality. In addition to reducing disease pressure and improving light penetration, the reduced canopy is also likely to make fruit more visible and therefore, facilitate speedier picking and reduce time spent harvesting.

At NIAB EMR, therefore, developed a precision automated irrigation system for substrate-grown soft fruit, based on continuous measurements of coir moisture content. In experiments, the precision irrigation system delivered water and fertiliser savings of 14-45% in different growing raspberry systems and improved marketable yields by 25%, compared to commercial values. In scientific experiments on substrate grown strawberries, water and fertiliser savings of 15-45% were achieved without reducing Class 1 yield whilst aspects of fruit quality were improved when compared to a commercial regime where run-off averaged 20% over the season. The decision support system for irrigation management is a system of precision irrigation for use in substrate grown soft fruit crops. The key features of the system are: 1) Data logger, which is able to trigger irrigation events automatically

2) soil moisture sensors (up to 12) and 3) remote access. A number of moisture sensors (6-12) are inserted into different pots/bags within an irrigation block, readings are logged frequently (e.g. every 5 minutes) and an average volumetric moisture content (VMC) value is calculated. As the plants use the water within the substrate the VMC declines until it eventually reaches the irrigation trigger threshold, upon which an irrigation event is then automatically triggered via the farm irrigation rig. Remote access to the control loggers within each irrigation block gives real time information on coir moisture contents and irrigation timings. The benefits of the system are: water is only given to plants as and when they require it; coir moisture content is maintained within precise limits; close control of amount of run-off; reduces the amount of fertiliser and water required to grow the crop; reduces the risks associated with over or under watering; maximises crop yield and fruit quality; real time information accessible remotely; savings in time and costs compared to manually monitoring and adjusting irrigation programmes.

More information about irrigation management in soft fruit production in the UK can been found at:

http://www.emr.ac.uk/projects/waterr-water-advisory-team-efficient-resource-recovery/

https://horticulture.ahdb.org.uk/sites/default/files/research_papers/SF%20107%20Final%20Report%202012.pdf

https://horticulture.ahdb.org.uk/sites/default/files/research_papers/SF%20118_Report%20Final_2013.pdf

https://horticulture.ahdb.org.uk/sites/default/files/research_papers/SF%20136_Report_Final_2013.pdf

https://horticulture.ahdb.org.uk/publication/water-harvesting-and-recycling-soft-fruit

https://horticulture.ahdb.org.uk/news-item/water-survey-starts-build-picture-abstraction

https://horticulture.ahdb.org.uk/sites/default/files/research_papers/Cranfield%20HDC%20Water%20Strategy_Final_13May2014.pdf

https://horticulture.ahdb.org.uk/sites/default/files/research_papers/SF%20152_Report_Annual_2015_0.pdf