



C  **Future-proofing berryfruit**
CLIMAFRUIT

ClimaFruit - Future proofing the North Sea berry fruit industry in times of climate change

FINAL Report to Political Reference Group Members*
December, 2013

*See Appendix 1 on page 11

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Background

Funded: 50% Interreg IVB North Sea Region (NSR) Programme & 50% National /private funds

Total funding: 6,118,045 Euro

Project life: 01/10/2009 - 30/09/2013

Project aim: ClimaFruit will secure, sustain & grow the economic value of the NSR berry fruit industry under changing climatic conditions by developing a world leading Berry Fruit Cluster in the NSR, ensuring investment, opportunities, sustainable use of resources & the production of healthy food.

Partners: Department of Food Science,
Faculty of Science and Technology,
Aarhus University, Denmark (AU)

Faculty of Landscape Planning,
Horticulture and Agriculture, Swedish
University of Agricultural Sciences,
Sweden (SLU)

Norwegian Institute for Agricultural and
Environmental Research, Norway
(Bioforsk)

Department of Plant & Environmental
Sciences, Norwegian University of Life Sciences, Norway (UMB)

James Hutton Institute, Scotland (JHI)

LWK Niedersachsen, Fruit Research Institute, Germany (OVA)



Risk

Climate change scenarios predict that in the NSR average temperature & rainfall will increase. However, the frequency of irregular & extreme weather events will also increase. These changing conditions provide both opportunities & risks to horticultural industries located in the NSR. Long-term climate changes will provide huge opportunities for the NSR to grow its horticultural sector given that food supplies from Southern European countries will no longer be sustainable due to a limited supply of water in those regions (European Environment Agency Report 2/2004). The NSR will need to produce food products that we currently import & food produced in the NSR will become more financially competitive within the EU market. To be positioned for these opportunities we must first overcome some of the current risks in the NSR. Current risks are linked to crops that

are specifically grown in northern EU countries due to their requirement for winter chilling (sustained period of cold), e.g. cherries & berry fruit. NSR fruit industries are currently based on cultivars planted many years ago & chosen because they coped with harsh winter conditions & required large amounts of winter chilling. As winters in the NSR have become milder these existing cultivars are no longer sustainable or as productive. In some years little or no fruit are produced from these plants. Countries across the NSR are currently faced with similar challenges & associated employment & financial deficits. This project will focus on blackcurrant, raspberries & blackberries with the intention of delivering innovative technologies that will add value to other fruit crops experiencing similar threats specifically related to changes in the NSR's climate.

Aim

By connecting the horticultural sector with EU, regional & national governments, we will strengthen the future sustainability of the NSR berry fruit industry during risk from climate change & add value to secure the long-term future of NSR fruit industries. A virtual 'NSR Centre of Expertise in Berry Fruit' will be formed by bringing together leading experts (plant breeders, physiologist, biochemists, health researchers, and modellers), commercial partners (Multinational, SMEs, industry stakeholders), consultants, industry boards & national & regional policy makers. We will ensure that public good outcomes are implemented to create lasting value throughout the NSR, specifically both in the short term to secure crops under threat & in the long term to position ourselves to capture future opportunities.

This project will secure the NSR as:

1) **A better place to live** by reducing chemical use & the carbon footprint of horticultural production systems, provide long term economically & ecologically sustainable solutions around optimal use of water, nutrients & chemicals. Increased plantings of berry fruit will have a positive effect on our environment & landscape. Secure the production of locally grown fruit, providing fresh healthy food products & natural ingredients for foods with reduced chemical residues & underpinning the health & wellbeing of society.

2) **A better place to work** by creating wealth via employment in local, often rural, communities due to increased job opportunities for a seasonal workforce over summer. New business opportunities will be created that contribute to local economies in the processed & food sector by developing new & improved food products for & from the region.

3) **A better place to invest in & export** from by overcoming existing risks & demonstrating the opportunity to grow the berry fruit industry in the NSR via increased production of both fresh & processed berry products. Developing a cluster of experts within the NSR will ensure the establishment of a world-leading berry fruit



hub focused on implementing sustainable & healthy solutions.

Transnational Benefits

Impact

By developing a NSR cluster of expertise we implement a common growth strategy for the NSR industry. Success will build on & extend national research initiatives to build synergies & accelerate value through multidisciplinary transnational team collaboration. Together we will identify solutions faster & with greater efficiency to secure the future of the NSR berry fruit industry in response to specific changes in the NSR climate. A single country cannot successfully deliver on this project as no single country has the necessary expertise or a sufficiently diverse climate.

We will develop a common set of tools & databases, exchange plant material, carry out trials across at different climatic sites, evaluate performance, exchange fruit samples for analysis, exchange data & knowledge as well as develop & share capability within the project via shared PhD students.



This approach will ensure our likelihood of success, increase the competitiveness of the NSR & accelerate our ability to add value & deliver outcomes that will have a lasting impact. Nationally based experts (with complementary skills), will connect with nationally based commercial partners (multinational, SMEs), industry boards & policy stakeholders & makers, ensuring outcomes are implemented equally across the NSR & deliver on national, NSR & EU policies.

Successful activities & outcomes will lead to an increased knowledge & the application of SMART technologies; this will lead to greater profitability by the industries, growth & increased investment into the NSR.

Partnership

A network will be formed by bringing together science experts from 5 nations within the NSR. No single country currently has all the expertise needed to address the current risks. No country experiences the diverse climatic conditions across the NSR from which we can learn & prepare ourselves for continuing change.

In the project, experts will network across the region & within their nation to maximize implementation & ensure delivery of innovation to the market (growers, industry bodies, consultants, food SME & multinational companies). To reduce any risk or barriers to adoption we will fully integrate industry partners & consultants directly into the activities. Regional trials will be carried out both at research sites, providing demonstrations sites, & at growers properties, this will

ensure rapid adoption of innovation & technologies & an increased likelihood of growth for the nationally based berry fruit industries.

This network will be strengthened by linking project outcomes with decision makers & end-users that will implement & take up outcomes beyond the life of the project. This will include members from our Political Reference Group (including political consultants & policymakers) & government ministers who will represent the outcomes & risks at a national & EU level. National Ministers have endorsed the project as being aligned to current national priorities & policies for environmental sustainability, reduced use of chemicals & the production of healthy food products.

Long Term Outcomes

Develop a coherent NSR cluster focused on berry fruit

By 2014 developed a virtual NSR 'Centre of Expertise in Berry Fruit', involving a strong & collaborative cluster of experts, industry & political stakeholders committed to securing berry fruit & horticulture in general in the NSR.

Provide climate change solutions & opportunities for the NSR soft fruit industry

By 2014 overcome regional & climatic risks to the NSR berry fruit industry by delivering superior plant material better suited to the current & future NSR climate.

Reduce the carbon footprint of the NSR soft fruit sector

By 2014 reduce the carbon footprint of the NSR soft fruit industry (via reducing use of water, chemicals & nutrients) & maximize fruit production & quality.

Climatic impacts on health

By 2014 quantify the impact of climate (water & temperature) on health attributes of fruit, enabling the prediction & mitigation of future impacts of climate change on fruit nutritional, health beneficial & quality

Balancing low input fruit with high impact health

By 2014 define the impact of low input production practices (chemical, water &, nutrients) on human health attributes of current & novel fruit cultivars with specific emphasis on compounds driving nutritional & quality parameters, leading to innovation techniques for manipulating these attributes.

Provide a climate change & value future map for the NSR soft fruit industry

By probabilistic modelling, determine the importance of climate, region & sustainable production on productivity & quality. Develop & implement web-based predictive & decision tools for use by industry to ensure smart decision making into the future.

Future proofing beyond 2014: adaptation strategies for a competitive future

Through simulation of climatic extremes, ensure strategies are in place to secure production of

berries into the future. Outcomes will deliver value beyond current NSR climates & beyond 2014.

Summary of Status and Outcomes (Years 1 – 4; 1 Oct. 2009 to 30 Sept. 2013)

Work Package 1 – Management

Project management established the transnational network of researchers. This required establishment of a project coordination group and a project steering group and identifying financial managers for each of the beneficiaries. A Beneficiary Agreement was established and signed. In addition a transnational Political Reference Group was established (with 2 members representing each participating nation).

Templates for reporting on national and transnational activities and for financial reporting were established. Reporting requirements and procedures were established.

Reporting is successfully completed for the first 6 mo report (March 2010), year one report (September 2010), 18 mo report (March 2011), year two report (September 2011), 30 month report (March 2012) and year three report (September 2012).

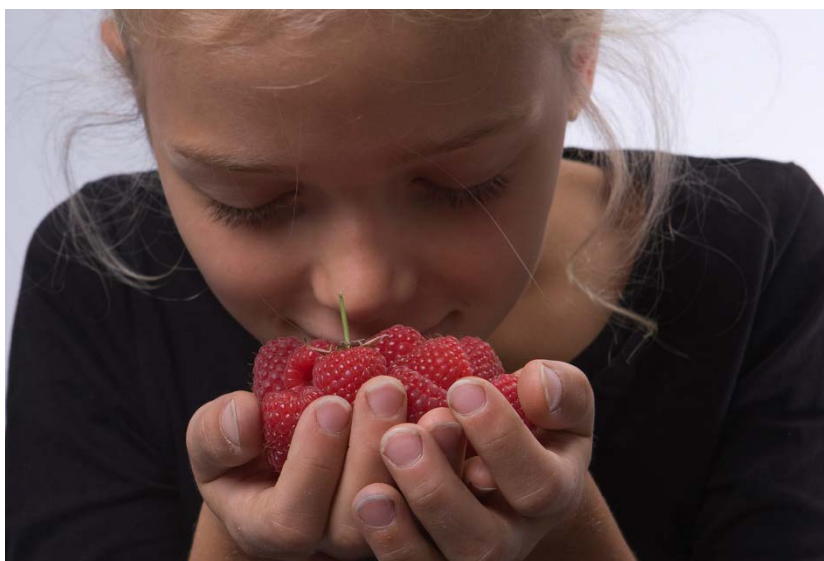
A 2 day **start up** meeting was held in Denmark (Sept, 2009), enabled the representatives of the beneficiaries to meet and to agree on national activities and on transnational initiatives. This meeting involved exchange of knowledge, approaches and activities occurring at national levels.

A **Year 1** Beneficiary meeting was held in Scotland (Sept, 2010) that focused on ways to improve our activity and financial reporting and how to strengthen the transnational aspect of the ClimaFruit project.

A **Year 2** Beneficiary meeting was held in Norway (Sept, 2011) that focused on exchange of scientific activity, novelty, knowledge exchange, addition possible collaboration and activities through holding a mini scientific symposium with 30 scientific presentations from project participants.

A **Year 3** Beneficiary meeting was held in Sweden (Sept, 2012) that focused on exchange of scientific results, novelty, knowledge exchange, addition possible collaboration and activities through holding a mini scientific symposium, including 3 presentations on the Swedish industry perspectives and activities plus 28 scientific presentations from project participants.

A **Year 4** Beneficiary meeting was held in Germany (Sept, 2013) that focused on exchange of scientific results, innovation, knowledge exchange, addition possible collaboration and activities to be continued and concluded after the end of the project through holding a mini scientific



symposium, including 4 presentations on the German industry perspectives and activities plus 21 scientific presentations from the project participants. In addition, a series of 31 project outcome videos were made by the project partners and these have subsequently been loaded on the project website.

Work Package 2 – Communication

A project website was established (www.climafruit.com).

Information on the project is also available on the NSR website:

(www.northsearegion.eu/ivb/projects/details/&tid=122).

In addition, an interactive website is available on the project website that has been developed to provide a virtual roadshow of the project activities; www.climafruit.com. This interactive website includes a start-up 'roadshow' including 13 introduction videos and a closing 'roadshow' including 31 project outcome videos.

The four year ClimaFruit project has resulted in a significant volume of promotional activities with public, industry, science and political sectors through a variety of formats; meeting presentations (industry board meetings, industry meetings, and science meetings), email and website releases, press releases and written releases (refer to summaries in Tables 1 -4).

Work Package 3 – Sustainable Practices

A transnational cultivar trial was carried out across the 5 partner countries, this included planning, and distribution of plant material, agreement on sampling, and analysis protocols. Significant data and volumes of fruit from the transnational trial sites have been sampled and exchanged between the project beneficiaries for analysis. In addition considerable national activities were carried out that focused on improving sustainability practices in growing berry fruit (organic production, spray technologies, UV light technologies, optimization of water and nutrients). Input has been made in pathogen resistance (aphids, vine weevil, viruses etc) with markers and sources of resistance under evaluation for including into future breeding programmes. This reporting period has also focused on the exploitation of segregating fruit populations (UK). Aligned with this research is the continued release of varieties and the trialing of these in different environments to ensure durability and fitness for purpose. Considerable activities at the national level are focused on evaluating superior germplasm suited to national conditions and to provide industry with the underpinning knowledge on cultivar and fruit performance so they are able to make informed decisions when choosing, establishing and investing into the berry fruit industry.

Work Package 4 – Health and Wellbeing

Transnational activities included agreement on, collection of and preparation of berry fruit samples from a range of national experiments on sustainability and climate impacts. Fruit samples and climate data were being coordinated and analyzed by JHI and UMB. The health benefits for soft fruit were explored and were shown to be beneficial in models of diabetes, cancer and cardiovascular disease. Significant effort was put into characterizing the health beneficial components in fruit grown under different sustainable systems; organic etc.

Work Package 5 – Adaptation Strategies

A transnational review on the impact of climate change of soft fruit has been initiated. The genetic factors involved in season extension in raspberry / blackberry are being determined. This work package also included research activities on climate change in relation to chilling requirements and dormancy to determine key drivers. Studies were carried out to determine the potential impact of climate change on fruit quality – these preliminary studies showed that minor temperature changes

can significantly altered fruit quality from what is currently considered ideal. The impact of pathogen challenge (duration, over wintering etc) during climate change is being modeled with a view to developing a predictive system for the NSR soft fruit industry. The impact of climate change on winter chilling in blackcurrant is being determined with the aim of developing varieties with a reduced requirement and/or plasticity to intermittent frost damage. A series of new activities focused on adaptation to temperature, including greenhouse, climate chamber and field evaluations were established. Specific activities, included pot based experiments targeting water/drought stress in blackcurrant and raspberry, took place in the UK and DK. Complementary studies were undertaken to identify the genetic responses to these stresses, to determine the impact of temperature increases on the NSR berry fruit industry.

Table 1: Summary of communication and project outputs delivered in **Year 1** (1 Oct. 2009 – 30 Sept. 2010).

Table 1: Summary of communication and project outputs delivered in Year 1 (1 Oct. 2009 – 30 Sept. 2010). Activity	Number delivered in Year 1
Transnational Partner meetings	2
Industry communication (meetings, presentations, open days & articles for end-users)	87
International scientific published papers	23
Press releases (radio / web/ newspapers)	34
Scientific presentations (oral /poster)	28
Capability development activities	12
Transnational demonstration projects	8
Nationally based feasibility studies in Year 1	25

Table 2: Summary of communication and project outputs delivered in **Year 2** (1 Oct. 2010 – 30 Sept. 2011).

Activity	Number delivered in Year 2
Transnational Partner meetings	1
Industry communication (meetings, presentations, open days & articles for end-users)	78
International scientific published papers	24
Press releases (radio / web/ newspapers)	11
Scientific presentations (oral /poster)	62
Capability development activities	8
Transnational demonstration projects	8
Nationally based feasibility studies	20
Capability development – Total number of PhD /postdocs	7

Table 3: Summary of communication and project outputs delivered in **Year 3** (1 Oct. 2011 – 30 Sept. 2012).

Activity	Number delivered in Year 3
Transnational Partner meetings	1
Industry communication (meetings, presentations, open days & articles for end-users)	43
International scientific published papers	34
Press releases (radio / web/ newspapers)	15
Scientific presentations (oral /poster)	55
Capability development activities	11
Transnational demonstration projects	8
Nationally based feasibility studies	40
Capability development – Total number of PhD /postdocs	7

Table 4: Summary of communication and project outputs delivered in **Year 4** (1 Oct. 2012 – 30 Sept. 2013).

Activity	Number delivered in Year 4
Transnational Partner meetings	1
Industry communication (meetings, presentations, open days & articles for end-users)	49
International scientific published papers	21
Press releases (radio / web/ newspapers)	30
Scientific presentations (oral /poster)	44
Capability development activities	12
Transnational demonstration projects	8
Nationally based feasibility studies	36
Capability development – Total number of PhD /postdocs	7

Footnotes:

It should be noted that the project has been completed as contracted on 30. Sept, 2013.

The Swedish Beneficiary (Swedish University of Agricultural Sciences) suffered an extreme and tragic loss on 3. October, 2013 where the entire Rånna Experimental Station was destroyed by an overnight fire.

It should also be noted that there is a considerable amount of activity planned to be continued in 2014; sample analysis, completion of data analysis, publications, completion of PhD studies / defenses, and further communication of the project outcomes to relevant scientific and industry audiences. These activities will continue beyond the life of the project.



Appendix 1: ClimaFruit Political Reference Group		Members
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