Impact of **climate** on **productivity** and **quality** of **raspberry** fruit

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Introduction

The changing climate is impacting on different fruit crops by altering plant architecture, productivity and fruit quality. Changing conditions are the most limiting factors for sustainable production of raspberries in the North Sea Region (NSR). Cultivated raspberry varieties are typically poorly adapted to warm temperature and high humidity during summer and fluctuating temperatures as experienced during the winter (Ballington and Fernandez, 2008). Moreover, the timing and severity of abiotic stress, particularly temperature, on productivity and quality in segregating raspberry populations across NSR is not still understood. Heat tolerance is becoming an increasingly important trait due to global climate change. High temperature stress induces dramatic changes in gene expression in plants. All organisms produce heat shock protein (HSPs) in response to elevated temperature. Heat stress inhibits chlorophyll accumulation and causes marked alteration in the chlorophyll fluorescence. Cultivars adapted to the NSR need to tolerate warm summers, and winters with wide temperature fluctuations. Prediction of the specific threats to raspberry can only be made when we adequately understand the complex interaction between environment and plant factors. This requires selection of raspberry genotypes under a range of similar climate scenarios together with assistance of analytical modeling tools.

Hypotheses

- Moderate perturbation in temperature influences the photosynthetic efficiency of raspberry plants
- There is an interaction between raspberry genotypes and environment with respect to productivity and fruit quality
- It is possible to establish production prediction models for raspberry genotypes with climate perturbation (G x E).

Objectives

- To select heat resistant primocane fruiting raspberry genotypes
- To evaluate reference selections of raspberries for specific physiological traits across NSR
- To identify relationships between climate and raspberry productivity and quality across the NSR
- To develop predictive tools (models) enabling smart decision making on raspberry productivity under conditions of changing climate

Material and methods

Activity 1: Selection of heat tolerant primocane fruiting raspberry genotype

This activity will be carried out in a climate chamber at the Department of Horticulture, AU, Denmark from January 2011. Five promising raspberry genotypes will be exposed to one of six temperature regimes (15°C, 20°C, 25°C, 30°C, 35°C, and 40°C). Photosynthesis is one of the most heat sensitive processes; therefore heat tolerence is determined by chlorophyll fluorescence measurement as a physiological marker. Activities of photosystem II (PSII) will be used to indicate the heat sensitive or resistant of the raspberry plants. The specific objective is to study photosynthetic responses of primocane raspberry cultivars to fluctuating temperature.

Activity 2: Evaluation of internationally sourced germplasm under protected field condition across 6 transnational sites

This trial is established to select raspberry cultivars that are cultivated in three replicated randomized complete block design (RCBD) in open field conditions. Elite raspberry cultivars with specific physiological traits will be evaluated for productivity and fruit quality across 6 transnational partners (Bio-Forsk, Norway; UMB, Norway; SLU, Sweden; OVA, Germany; SCRI, Scotland; and AU, Denmark). Primocane and floricane raspberries are expected to show significant variation in pre and postharvest quality parameters compared to the reference cultivars. Climate data will be collected across the NSR trial sites enabling genotype by environment interactions to be identified.

Cultivars

Primocane: Autumn Bliss, Autumn Treasure, Fall Gold, Erica and Polka

Floricane: Tulameen, Glen Ample, Glen Fyne, Octavia, Glen Doll and Glen Rosa

Activity 3: Postharvest evaluation of quality traits of raspberry fruits

Raspberries contain high levels of phytochemicals and antioxidants. The impact of temperature, fertilizers, light and pests on these compounds have not yet fully understood. Therefore postharvest evaluation will be carried out across the NRS trial sites. Samples will be pooled from two harvest periods per season per site. Evaluations will be done on total soluble solid, titratable acidity, anthocyanin and total phenolics.

References:

Ballington, J.R. and G.E. Fernandez. 2008. Proceeding of the Ninth International Rubus and Ribes Symposium. Acta Horticulture. 777:87-90.

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