Impact of **Climate** on productivity and quality of

Raspberry

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Introduction

The changing climate affecting different fruit crops by plant architecture, productivity and fruit quality . Climate change challenges are clear; increased mean temperature, potentially longer growing seasons, more drought (summer) and water logging and changes in seasonal distribution, less frost and more extreme weather events. The changing conditions are the most limiting factors for sustainable raspberry industry in the North Sea Region (NSR). Cultivated raspberry varieties are typically poorly adapted to warm temperature and high humidity condition during summer and fluctuating temperatures in winters (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 insufficient. Heat tolerance is becoming an increasingly important trait with the advent of global climate change. High temperature stress or heat shock induces dramatic changes in gene expression in all plants. All organisms produce heat shock protein (HSPs) in response to elevated temperature. Heat stress inhibits chlorophyll accumulation and cause marked alteration in the chlorophyll a fluorescence (Efeoglu and Terzioglu, 2009). In the North Sea Region (NSR), the problem of fluctuating temperature and relative humidity is one of the constraints in raspberry industry. 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 all components of the arable environment and plant. This requires experimentation of raspberry genotypes under a range of similar climate change scenarios together with assistance of analytical modeling tools.

Hypotheses

- Moderate perturbation in temperature influences the photosynthetic response of raspberry plant
- 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 study photosynthetic responses of raspberry genotypes under high temperature
- To study up and down regulation of heat shock proteins under heat stress
- To evaluate the reference selections of raspberries for specific physiological traits across the North Sea Region (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

Materials and methods

Activity 1
Selection of heat tolerance primocane fruiting raspberry genotypes.

This activity will be carried out in a climate chamber at Department of Horticulture, AU, Denmark from February 2011. Five promising raspberry genotypes/lines will be screened under high temperature. Photosynthesis is one of the most heat sensitive processes. Heat stress can be determined by studying chlorophyll fluorescence as a physiological marker. Activities of PSII can be used to indicate the heat sensitive or resistance of the raspberry plant. The specific objective is to study photosynthetic responses of primocane raspberry cultivars to the fluctuating temperature condition.

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

This trial will allow the evaluation of elite raspberry cultivars for specific physiological traits including plant architecture, productivity and fruit quality across 6 transnational partners (BioForsk, Norwey; UMB, Norwey; SLU, Sweden; OVA, Germany; SCRI, Scotland; and AU, Denmark). Fruit will be produced under different climatic conditions , which are expected to lead into significant variation in pre and post harvest quality parameters of the reference cultivars. Plant data will be collected with respect to plant productivity and fruit quality. Climate data will be collected across the NSR trial sites focusing on genotype by environment (G x E) interaction.
Cultivars
Autumn: Autumn Bliss, Autumn Treasure, Fall Gold, Erica, Polka
Summer: Tulameen, Glen Ample, Glen Fyne, Octavia, Glen Doll, Glen Rosa

Activity 3
Postharvest evaluation of quality traits of raspberry fruits

Raspberry contains high amounts of phytochemicals and antioxidants. The impact of temperature, fertilizers, light and pests on these potential health beneficial components are not fully understood. Post harvest evaluation will be done across the NRS trial sites. Samples will be pooled from 2 harvesting period per season per site. Evaluation on TSS, TA, anthocyanin, total

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