



# **Grower Summary**

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## **FV 420**

Carrot and parsnip; intervention studies to assess the effect of consumption on biomarkers of human health

Annual 2014

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HDC is a division of the Agriculture and Horticulture Development Board.

**Project Number:** FV 420

**Project Title:** Carrot and parsnip; intervention studies to assess the effect of consumption on biomarkers of human health

**Project Leader:** Dr Kirsten Brandt, Newcastle University

**Contractor:** Newcastle University

**Industry Representative:** Martin Evans, Freshgro

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**Previous report/(s):** None

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**End Date:** 30th November 2016

**Project Cost:** £74,415

# **GROWER SUMMARY**

## **Headline**

This Research will

- examine any association between carrot and parsnip consumption and cancer in people over 85 years old
- measure the effect of preparation and cooking on polyacetylenes,
- measure the bioavailability of polyacetylenes in different vegetables and
- measure the effect of a diet rich in polyacetylenes on biomarkers of cancer risk in humans.

## **Background**

Nutritional factors have been shown to affect the risk of cancer. It is well known that the intake of fruit and vegetables is inversely correlated to cancer risk and there is increasing evidence that certain fruit and vegetable groups have a protective effect against particular cancers. It is thought that the fibre, antioxidant, vitamin and mineral content of fruit and vegetables are the main factors that contribute to the anti-cancer effect, but current evidence has shown that these common constituents alone cannot explain the effect. Observational studies have found a negative correlation between carrot consumption and cancer (Boggs *et al.*, 2010; Larsson *et al.*, 2010) and there is *in vitro* evidence to suggest the polyacetylene (PA) class of compounds, first investigated in herbal medicines such as ginseng, but also found in root vegetables including carrots, have anti-cancer (Zidorn *et al.*, 2005) and anti-inflammatory properties (Alanko *et al.*, 1994). Animal studies have also shown reduced levels of intestinal cancer when diets are supplemented with carrot (Kobaek-Larsen *et al.*, 2005; Saleh *et al.*, 2013). However, so far there have been no studies on the health effects of polyacetylene intake in humans.

The objective of the present study is to determine if consumption of PA-rich vegetables can affect the biomarkers of cancer and inflammation in humans, by examining:

- (i) The effect of a vegetable intake rich in polyacetylenes on cancer incidence and inflammation in a group of older people;
- (ii) The effect of cooking techniques on polyacetylene concentration in carrots, when consumed,

- (iii) The bioavailability of polyacetylenes from various vegetables.
- (iv) The effect of a diet rich in polyacetylenes on biomarkers of cancer risk *in vivo* in humans (dietary intervention study).

## **Summary**

### ***The Newcastle 85+ study***

This is an observational trial that collected dietary data and other health and lifestyle information from a group of participants aged 85 years old at the start of the study in 2006. They were followed until death and their cause of death ascertained from medical records (Collerton *et al.*, 2007). The aim of this research will be to find out whether there is a link between PA-rich vegetable consumption and cancer mortality in this group of people.

There was a delay while a request for permission to access the 85+ study was considered. Although permission has now been granted, lack of staff to deal with data handling on the 85+ study has delayed progress.

### ***Vegetable preparation and polyacetylene availability***

Carrots will be artificially digested in the laboratory to determine the polyacetylene content when eaten raw (batons or diced), boiled or fried. Different cooking times will be compared.

### ***Bioavailability of polyacetylenes***

The polyacetylene content of different vegetables is unknown. MSc students will freeze dry a range of foods, extract the polyacetylenes with solvents and then use high powered liquid chromatography (HPLC) to measure the quantities. This data will inform the dietary intervention study, since the food given to the volunteers will be that highest in polyacetylenes. If time permits, the students will measure vegetables where the leaf is eaten, such as parsley and coriander, as well as other roots such as celeriac.

When the polyacetylene content has been determined, it is planned to publish the results. The hope is that other researchers will use it to re-evaluate their existing data from diet and health studies, to show if there is any correlation between polyacetylene consumption and outcome in terms of health or disease. (This is additional to the PhD work.)

### ***Dietary Intervention Study***

Biomarkers can be used to measure the risk of certain diseases. For cancer, it is possible to measure DNA lymphocyte damage from blood samples using the COMET assay, while inflammation can be measured by inflammatory biomarkers in the blood such as TNF- $\alpha$  and IL-6. This project will carry out a human intervention trial to test the effects of consumption of root vegetables on biomarkers for cancer and inflammatory disease, similar to a study on a dietary intervention with watercress and the effects on lymphocyte DNA damage and inflammatory markers carried out by Gill *et al.* in 2007.