



# Grower Summary

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**FV 420**

**Carrot and Parsnip:  
Intervention study to assess  
the effect of consumption on  
biomarkers of human health**

**Annual Report 2015**

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Only officially approved pesticides may be used in the UK. Approvals are normally granted only in relation to individual products and for specified uses. It is an offence to use non-approved products or to use approved products in a manner that does not comply with the statutory conditions of use, except where the crop or situation is the subject of an off-label extension of use.

Before using all pesticides check the approval status and conditions of use.

Read the label before use: use pesticides safely.

## **Further information**

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**Project Number:** FV 420

**Project Title:** Carrot and Parsnip: Intervention study to assess the effect of consumption on biomarkers of human health

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

**Industry Representative:** Martin Evans, Freshgro

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**Start Date:** 30<sup>th</sup> November 2013

**End Date:** 30<sup>th</sup> November 2016

**Project Cost:** £74,415

## **GROWER SUMMARY**

### **Headline**

This research will:

- Produce a database of foods and their corresponding polyacetylene concentrations using foods commonly eaten by older people. Using data on cancer incidence from the 85+ study, investigate if there is any association between intake and cancer risk;
- Measure the effect of preparation and cooking on polyacetylenes;
- Measure the bioavailability of polyacetylenes in humans;
- Measure the effect of a diet supplemented with polyacetylene containing foods 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 a higher intake of fruit and vegetables leads to a lower 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 carrot consumption can lead to a lower incidence of cancer ([Boggs et al., 2010](#); [Larsson et al., 2010](#)) and there is evidence from studies with isolated cells that suggests 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 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 into the health effects of PA intake in humans. The objective of the present study is to determine if consuming a portion of carrots can affect the biomarkers of cancer and inflammation in humans by examining:

1. The PA content of commonly eaten foods in a population from the North East of England and if there is any association between eating polyacetylene-rich foods and cancer incidence in people over 85 years old.
2. The effect of cooking techniques on PA concentration in carrots
3. The bioavailability (how much is digested and absorbed) of PA from cooked carrots and how much PA can be detected in the blood, urine and faeces after consumption by humans
4. The effect of a diet supplemented with carrots on biomarkers of cancer risk in humans (dietary intervention study)

### **Summary**

#### **Database of polyacetylene-containing foods**

The database of foods will compile a list of foods commonly eaten in a population in North East England and list their PA content. This will allow the public to make choices about how they consume vegetables (fresh, cooked) and in what form (fresh, frozen, as part of a mixed ready meal, as part of a mixed home-made dish) to give them the greatest intake

of PA. To date, 32 foods have been analysed (with replicates from different supermarkets) and the results are being entered into software for calculation of intake.

The data for cancer incidence from the 85 year olds have been received on 30th September 2015, and will be compiled and analysed to see if there are any associations between polyacetylene-rich food consumption and risk of cancer.

### **Preparation and cooking of carrots**

Carrots have been prepared as either disks, quarters or whole then boiled and fried for different amounts of time.

At present we are unable to report the full results of the study as the PhD student aims to publish these first but the overall results are summarised below:

- boiling carrots retains more PA than frying them
- PA are more stable in oil than in water
- carrots cooked whole retain more PA than those cut into disks or quarters

The recommendation would be to cook the carrots whole rather than in disks or quarters for the best retention of PA. These results will be shown at the HDC student conference and the Onion and Carrot Conference in November 2015.

In vitro digestion, used to make an estimation of how much polyacetylene was available during digestion, has proved difficult to get useful results due to large variabilities in polyacetylene content in the digested matter. This experiment may be revisited in the 3<sup>rd</sup> year of the PhD if time permits.

### **Bioavailability of Polyacetylenes**

It is not known how much PA from whole vegetables is digested and absorbed by the body. An experiment has been designed to determine the path of polyacetylenes in the body after consumption. It will assess how much PA is absorbed into the blood, how much remains in the gut and whether they are passed out in the urine. Two different 'doses' of carrot (100 and 250g) will be consumed by human volunteers to determine if there is an effect of dose on the absorption. Due to delays in the process of ethical approval, this study is still currently undergoing ethical review and is now expected to start in October/November 2015

### **Dietary Intervention Study**

Biomarkers can be used to measure the risk of certain diseases. For cancer it is possible to measure DNA damage in lymphocytes (white blood cells) and mitochondria. Inflammation can be measured by inflammatory markers such as IL-6, TNF- $\alpha$  and CRP as well as prostaglandin metabolites in urine. This project will carry out a human intervention trial to compare the effects of consumption of either white carrots or oat biscuits for 6 weeks (to see the effect of polyacetylenes but exclude the effects of carotenoids and fibre) on the biomarkers of cancer and inflammation. This study has obtained ethical approval on 7<sup>th</sup> September 2015 and is currently recruiting.

### **Financial Benefits**

The promotion of the health benefits of carrots, parsnips and other Apiaceae vegetable consumption could lead to a significant and sustained sales increase. Peer-reviewed scientific publications are required by EFSA (European Food Standards Agency) to substantiate the health claims of a food. This study aims to generate such publications.

#### **Action Points**

The dietary intervention will require sources of white carrots from October 2015 until approximately May 2016. If growers are able to provide white carrots during this period they are encouraged to get in touch with the researcher.