



Seagreens Research

Seagreens® has a leading role in the field of research in seaweed for food and health, developing and implementing the standards for human food seaweed™ with its partners and the independent Seaweed Health Foundation.

Human food seaweed is different and distinct from seaweed for use in horticulture or animal feed. It is the product of particular methods (Patent Pending*) to ensure the selection, harvesting, processing and international regulatory compliance of particular species whose quality and provenance can be certified.

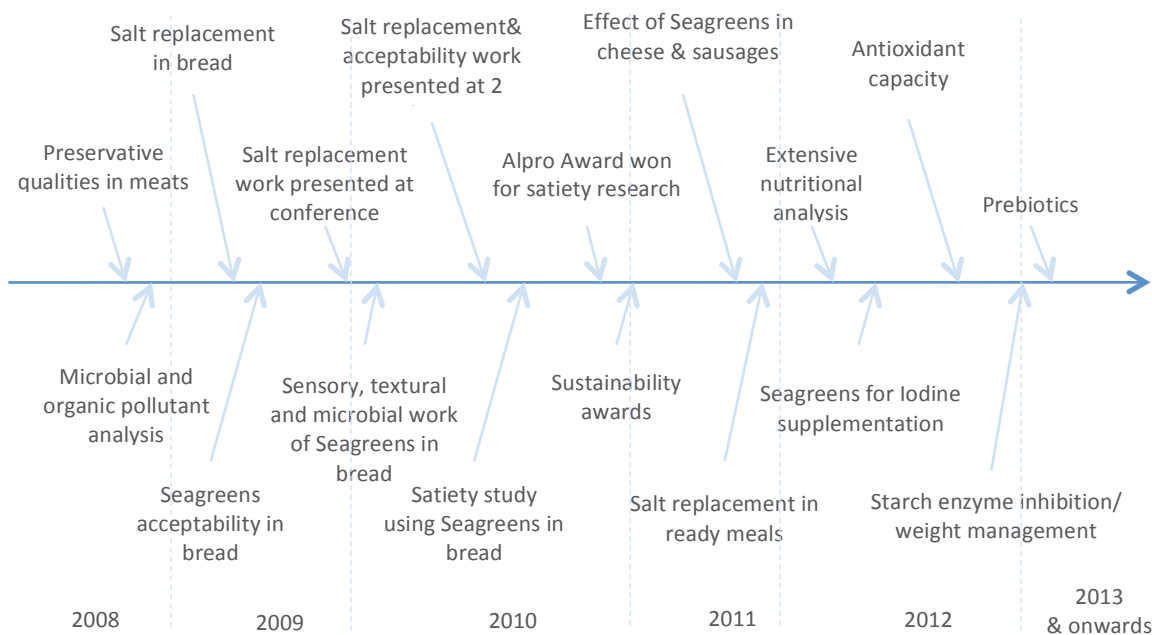
The distinctive attributes which will continue to distinguish the Seagreens brand apply equally to the selection, harvesting, processing and delivery of Seagreens Certified Ingredients:

- Species selection
- Consistency - quality, nutritional profile, particle size, identity, etc.
- International accreditation, utility and availability
- Research and innovation

Seagreens’ research projects that have been undertaken, and are on-going include:

- Nutritional Analysis
- Iodine Supplementation
- Antioxidant Capacity
- Weight Management
- Salt Replacement / Taste Acceptability
- Preservative Qualities and Shelf-life Extension
- Prebiotic
- Sustainability

More detail on each area is described below in Annex 1, with a timeline of activity:



Seagreens Research Agenda

Building on this research the aspiration for the agenda over the next 1-3 years is, for Seagreens and with partners, to:

- Strengthen the distinction of seaweed produced to HFS standards
 - Annual/periodic extensive nutritional analysis (as per Sheffield Hallam University research in 2011)
 - Refine quality markers
 - Demonstrate impact of HFS standards on existing and new quality markers
 - Improve consistency of key markers with HFS
 - Better understand variables of HFS, e.g. by season, location etc
- Demonstrate successful applications of Seagreens to prove concept to the market
 - Prebiotic / gut health further demonstrated, mechanism understood, and application in human trials
 - Further weight management and anti-diabetic research – understanding mechanisms and refining amount of Seagreens require for impact
 - Detoxification research to start on Seagreens
- Develop research activity on distinct Seagreens blends in the areas already researched
 - Nutritional content of key blends – applying to specific applications
 - Developing unique blends for unique applications (e.g. weight management) and demonstrating viability

Annex 1: Seagreens Research Projects

(as of September 2013)

- **Nutritional Analysis**

Rationale and Outcomes: The widest nutritional analysis ever undertaken by a seaweed brand to determine the broad nutritional profile within Seagreens species, and make comparisons with other sources of seaweeds. This work has provided Seagreens and our partners with an incredibly in-depth understanding of our products, and provided the evidence on the benefits of human food quality seaweed.

Partners: Centre for Food Innovation, Sheffield Hallam University

Dates: November 2010 – on-going

Approximate total investment: £45,000

- **Iodine Supplementation**

Rationale and Outcomes: With the majority of women in the UK iodine deficient, which is a statistic reflected around the world, Seagreens was used in a project to ascertain its effectiveness as an iodine supplement, and also start to understand how it works within the body, especially as compared to artificial sources of iodine supplementation. Results were very positive, and are expected to be submitted for publication in 2013.

Partners: Napiers Remedies and Glasgow University

Dates: January 2012 – October 2012

Approximate Total Investment: £31,000

Publication and Awards: In preparation

- **Anti-oxidant capacity**

Rationale and Outcomes: As part of Seagreens nutritional analysis, as well as work with University partners, the antioxidant capacity of Seagreens was measured using various techniques to gauge a full picture of what is present within Seagreens. It is clear that all Seagreens species are rich and concentrated source of antioxidants that could be more effective radical scavengers than green teas, are a comparable source of polyphenols to other polyphenol rich sources, and that the antioxidant capacity of Seagreens remains high through digestion in the initial stages of gastro-intestinal digestion. This suggests that a high concentration of antioxidants will be released from Seagreens within the gut lumen where it can provide protection from oxidative damage.

Partners: Sheffield Hallam University, Glasgow University, Newcastle University

Dates: November 2010 – March 2012

Approximate Total Investment: £5,000 and as part of Nutritional Analysis above

Publication and Awards: In preparation

- **Weight Management**

Rationale and Outcomes: As certain extracts from seaweeds are known to increase

the feeling of fullness (satiety), so Seagreens investigated if the whole food seaweed would have a similar effect. Results have demonstrated that it did, and resulted in reduced calorie intake of 179Kcals a day in overweight but otherwise healthy males, and with no impact of nutrient uptake; now published in the Journal of Appetite. Furthermore, results have indicated that Seagreens has an inhibitory effect on starch enzymes, likely due to specific phenols with Seagreens species. This effect slows the release of sugars into the blood, and could reduce the glycaemic index of food, making you fuller for longer.

Partners: Centre for Food Innovation, Sheffield Hallam University, and Newcastle University

Dates: March 2010 – on-going

Approximate Total Investment: £9,000

Publication and Awards:

- Hall, A.C., Fairclough, A.C., Mahadevan, K., & Paxman, J.R. (2012). *Ascophyllum nodosum* enriched bread reduces subsequent energy intake with no effect on post-prandial glucose and cholesterol in healthy, overweight males. A pilot study. *Appetite*, 58, 379-386.
- Alpro Foundation Award 2011
- Wheater, H. (2012) Release of polyphenols from brown seaweeds following an in vitro enzymatic digestion predicts antioxidant capacity and potential to inhibit the digestive enzymes α -amylase, α -glucosidase and lipase. MSc Thesis, Newcastle University

• **Salt Replacement and Taste Acceptability**

Rationale and Outcomes: With the sodium within salt being targeted as a significant cause to hypertension and heart conditions, there has been sustained effort to find suitable salt-replacers. Seagreens has been trialled in various products, including baked goods, cheeses, meats and sauces/ready meals, with great effect. The flavour profile of Seagreens works extremely well in foods, and in the trials has been as acceptable or preferred to the control foods. This is likely due to the 'mineral' flavours of Seagreens relating to the presence of all the minerals, and the umami flavour Seagreens can provide as a food ingredient linked to glutamates present with Seagreens.

In addition to positive flavour profiles, Seagreens has worked well in industrial scale processes, without impacting on factors such as the rise of bread.

Partners: Centre for Food Innovation, Sheffield Hallam University, Teesside University, Gee Lawson

Dates: 2009 – October 2012

Approximate Total Investment: £27,000

Publication and Awards:

- Fairclough, A. and Mahadevan, K. (2011) Wild Wrack (*Ascophyllum nodosum*) – A replacement for salt (as sodium chloride) in bread products. Sheffield Hallam University
- Big Ideas for the Future (2011) Report by Research Councils UK
- More in preparation

• **Preservative Qualities and Shelf-life Extension**

Rationale and Outcomes: The natural anti-microbial attributes of Seagreens were investigated through the use of Seagreens as a food ingredient to enhance the shelf-life of foods, particularly in the absence of salt.

Results demonstrated that, compared to control foods, there was a significant reduction in the levels of TVC, coliform numbers and lactic acid bacteria when Seagreens was used within foods. Furthermore, within bread, no mould growth appeared after 9 days on breads with Seagreens included with the absence of salt, when it was present on control breads with salt but no Seagreens.

Partners: Centre for Food Innovation, Sheffield Hallam University

Dates: 2008 – on-going

Approximate Total Investment: £9000

Publication and Awards:

- Brownlee, I., Fairclough, A., Hall, A. and Paxman, J. (2012) The potential health benefits of seaweed and seaweed extract. Sheffield Hallam University Research Archive
- More in preparation

- **Prebiotic**

Rationale and Outcomes: Research is underway to investigate the prebiotic benefits of Seagreens, building on research literature that demonstrates the polysaccharides present in Seagreens seaweed are effect prebiotics. This means they are able to pass through the stomach undigested, to help provide material beneficial for the good bacteria in the lower intestine.

Partners: Teesside University

Dates: May 2012 – on-going

Approximate Total Investment: £6000

Publication and Awards:

- Lyons, V. (2012) Seagreens® as a potential prebiotic and the role of probiotic bacteria in the production of nitric oxide in macrophages. MSc Thesis Teesside University

- **Sustainable Harvesting**

Rationale and Outcomes: Seagreens is sustainably harvested in Scottish Outer Hebrides, with the factory winning awards and being highlighted for sustainable good practice and environmental excellence by the likes of the Crown Estate, Scottish Environmental Protection Agency and Scottish Natural Heritage. Seagreens was also a finalist in the environmental excellence category at the Nutraceutical Business and Technology awards 2012.

Dr Craig Rose, Deputy Managing Director at Seagreens, was part of the wider team that investigated the sustainable levels of harvesting of Seagreens species in the Outer Hebrides to ensure sustainable harvesting can continue and upper levels are in place.

Partners: Hebridean Seaweed Company, Scottish Association for Marine Science

Dates: November 2009 – October 2010 (mapping)

Approximate Total Investment: £70,000 for mapping and on-going investment

Publication and Awards:

- Burrows, M.T., Macleod, M. and Orr, K. (2011) Mapping the intertidal seaweed

resources of the Outer Hebrides. Scottish Association for Marine Science Internal Report No. 269

- Crown Estate Marine Business Award 2010 (Hebridean Seaweed Company)
- The Scottish Environmental Protection Agency (SEPA) & Scottish Natural Heritage (SNH) Award for Excellence in Environmental Sustainability (Hebridean Seaweed Company)
- Environmental Excellence (finalist) Nutraceutical Business and Technology Awards 2012 (Seagreens)