

Functional foods and seaweed aquaculture

By Stefan Kraan

If one mentions the word aquaculture in Ireland, the first thing that comes to mind is most probably salmon, or perhaps shellfish such as mussels. However, if we look at Asian countries, it is a different story altogether. In Asia, the cultivation of *seaweed* is far more important in terms of output and value than any other form of aquaculture.

Looking at it on a global scale, the value of cultivated, managed and wild harvested seaweeds exceeds €6 billion, with 87% of this value derived from aquaculture.

The most valued of the cultivated seaweeds is the red alga *Porphyra*, or 'Nori.' It is a major source of food for humans throughout the world, although it is almost exclusively cultivated in Japan, South Korea and China. Its worldwide production has an annual value of over €1.8 billion.

In addition to *Porphyra*, other edible seaweeds include *Gracilaria*, *Undaria*, *Laminaria* and *Caulerpa*, with their collective value exceeding €3 billion.

New applications of seaweeds and specific seaweed compounds in different sectors, such as food supplements, cosmetics, biomedicine and biotechnology, are constantly under development. Recent trends in life-style towards natural, healthy products are favourable for advancing seaweed aquaculture in Ireland. The most suitable seaweed species for cultivation in Ireland for the near future are those, which are already used in trials or

commercial cultivation operations in Ireland and other western countries, or species that have high levels of desired molecules. For these specific species, a real market demand exists. These include seaweeds for human consumption, functional food ingredients, nutraceuticals and cosmetics.

Seaweeds are also the industrial sources of carrageenans (*Chondrus*, *Eucheuma* and *Kappaphycus*), alginates (*Ascophyllum*, *Laminaria*, *Macrocystis*) and agars (*Gelidium*, *Gracilaria*) and have a global value of approximately €580 million. These important sources of polysaccharides are used in the food, textile, paint, biotechnological and biomedical industries and have recently come under the spotlight as functional food ingredients.

The increasing demand for safe, healthy, and minimally processed foods is creating an opportunity for seaweed products to be marketed as functional foods. Many studies have indicated the potential of brown seaweed polysaccharides, such as with Laminarins, Fucoidans and alginates as immuno-stimulant, anti-viral and anti-cancer agents. Several

research centres around the world are exploring the possibilities of brown seaweed extracts as functional food beverages. Other functional ingredients from seaweeds may be natural colorants, anti-oxidants and fibre.

MRI Carna, in County Galway, Ireland, is exploring the use of several seaweeds for these purposes. Nevertheless, seaweeds are a natural, sustainable resource and levels of desired compounds fluctuate with seasonality and location. Therefore, we try to establish cultivation methods of species of interest in order to produce consistent quality and traceability.

With funding from Taighde Mhara Teoranta and BIM, we have established a pilot scale *Porphyra* cultivation unit and a seed bank for kelp cultivation at MRI Carna. It is planned in the near future, at MRI Carna, to develop this further into a larger seaweed cultivation programme for a myriad of species, with applications for functional foods and biodiscovery. Development of these techniques will help to enable seaweed aquaculture to become a mainstream aquaculture activity.

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