

Macroalgae for an increasing organic market



Organic food consumption and production has steadily increased since 1985. It has been given political priority in several Nordic countries. Today, macroalgae play an innovative role in The New Nordic Cuisine: contents of the macroalgae make them attractive for consumers concerned about food origin and content. Often these attentive consumers also relate to the organic market.

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A growing market

The organic market and agriculture has been growing since its start in the middle of the 1980's and has political priority in the Nordic countries. In Sweden, the organic area shares 14 % of the total agricultural area. The Danish market shares of organic products are at 7 % placing Denmark in the second place on the top ten-list in Europe: Danish consumers spend 142 EUR per capita per year buying organic. The data from Norway are lower respectively 6 % organic area off all agricultural land and consumption is only 1 % of market shares (Røsnes 2010). The goal for the Norwegian Department of Food and Agriculture is to reach 15 % shares of both production and consumption in 2020.

A macroalgae definition

The term "macroalgae" includes macroscopic and multicellular red, green and brown algae. These algal populations are very important as habitat and food for many other marine species as for the entire ecosystem (e.g. fish nurseries, CO₂ sink). Macroalgae are found in diverse habitats from arctic shores to tropical coral reefs. Large brown macroalgae associated with smaller red and green algae dominate along the Norwegian coast. Kelp associations are divided into Laminariales (e.g. *Laminaria hyperborea*) and Fucales (e.g. *Ascophyllum nodosum*). The removal of one species affects the composition and structure of the overall association.

Historical role

In addition to its great environmental significance, macroalgae have also been very important to the Norwegian communities living along the coast. The harvesting of kelp in household has traditions back to the last ice age. Kelp was probably used as compost and feed for animals and humans because of the composting properties and nutrients and minerals content. *Palmaria palmata* was used as human food already in the Viking age (800-1000 A.D). In the middle age, macroalgae were harvested at low tide in the spring and used as animal feed, food additive and for soil improvement. For centuries, macroalgae have been an important source of income for many coastal communities and Norwegian companies founded early in the 20th century are now leading companies in harvesting and processing of macroalgae for uses in agriculture food and industry (Meland & Rebours 2012). The last few years have seen an increase in the interest for cultivation of macroalgae as done in Asia for many years. Experimental work is going on along the Norwegian coastline. Macroalgae as fodder and fertilizer are commonly applied in organic farms in Norway.

A rich ingredient for human food

Macroalgae of high quality are sold directly for human food. These products with a natural origin are recognized as a very healthy component to include in the

diet. A large variety of antioxidant compounds have been identified in macroalgae species. The antioxidant activity is correlated to the content in phenolic acid and α -tocopherol. Macroalgae contain proteins varying from between 3 -15 % of dry weight in brown algae and 47 % of dry weight in green and red algae. In general, macroalgae contain only between 2 -4 % lipids off dry weight, with high proportions of polyunsaturated fatty acids, including omega 3 and omega 6 (Matanjun *et al.* 2008). Some species, as the seasalad (*Ulva lactuca*), are especially rich in iron. Another species, *Porphyra* sp., is especially rich in vitamin B₁₂ (Mouritsen 2010).

Macroalgae in the New Nordic Cuisine are commonly used without processing or extraction as a vegetable from the sea. Macroalgae also have natural properties for coloring and enhancement of the taste of the food. These products are therefore chosen to lower the addition of salt and artificial colours and flavours. Alginates are extracted from macroalgae and are also used largely as additives in organic processed food for example in stabilizing cheese or ice cream. Many products containing seaweed or seaweed extracts are available in the grocery stores, health shops and chemists. However most of these products are produced abroad and are imported to meet national demands. Organic certified products containing macroalgae for human food are imported to Norway from France, Spain and Ireland. Few Nordic companies are trading local organic macroalgae products for human food: ice cream stabilized with algae (Skarø is) and flour made of Norwegian *Laminaria* (Taremel).

How to go organic?

Macroalgae as raw biomass either harvested from wild origin or cultivated can be certified as organic product (Mattilsynet 2005). If the macroalgae are used for human or animal food, one has to report to the Norwegian Food Safety Authority. Import of certified organic macroalgae follows the same rules as for other organic products. The organic certification body in Norway, Debio, defines rules for organic aquaculture for fish and shellfish, however, macroalgae are not yet included. For cultivation of kelp, there are no special procedures, but one has to apply to the *Directory of Fisheries* in the same way as for aquaculture of other species. Restrictions mainly concern the use of area and the activity should be correlated with the local area plans. More information can be found on www.debio.no.

In addition, the European Union has outlined some indicators for the culture of organic macroalgae: Regulation No 710/2009, No 889/2008 and No 834/2007. Organic standards from the European Union require the following: 1/ sustainable updated management plan must be provided; 2/ renewable energy sources and recycled material should be preferred; 3/ harvesting should be carried out in such a way that it does not have a significant impact on the aquatic environment; 4/ cultivation must utilize naturally occurring nutrients in the environment or from organic animal production and must be part of polycultural system; 5/ organic and non-organic macroalgae should be kept separately and distance are decided by national rules; 6/ the conversion period is 6 months or a life cycle and decided by national rules; 7/ under circumstances where member states faces shortage of organic protein the conversion period can be shorter; 8/ drying must not be done in direct contact with flames.

EU indicators for the culture of organic macroalgae: Regulation No 710/2009, No 889/2008 and No 834/2007.

<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:204:0015:0034:EN:PDF>

<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:250:0001:0084:EN:PDF>

<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2007:189:0001:0023:EN:PDF>

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References

- Matanjun, P., Suhaila, M., Noordin, M.M. & Kharidah, M. 2008. Nutrient content of tropical edible seaweeds, *Eucheuma cottonii*, *Caulerpa lentillifera* and *Sargassum polycystum*. *J Appl Phycol*. DOI 10.1007/s10811-008-9326-4.
- Mattilsynet. 2005. Veileder A. Felles veileder for produksjon, foredling, lagring, import og omsetning av økologiske landbruksprodukter, næringsmidler og fôrvarer.
- Meland, M. & Rebours, C. 2012. Short description of the Norwegian seaweed industry. *Bioforsk FOKUS* 7(2):278-279.
- Mouritsen, O.G. 2010. Tang. Grønsager fra havet. *Nyt Nordisk Forlag Arnold Busck*. ISBN 978-87-17-04055-7. Pp 261-269.
- Røsnes, E. 2010. Produksjon og omsetning av økologiske landbruksvarer. Statens Landbruksforvaltning, Norwegian Agricultural Authority SLF. Rapport for 2010. Pp 8-13.