

# Development of high value food grade sugar-kelp production in Northern Norway

Christian Bruckner, Malte Ricke, Hanne Mæhre

contact: [christian@polaralge.no](mailto:christian@polaralge.no)



**Salten Algae AS**



**NIBIO**

**Universität  
Rostock**



Traditio et Innovatio



**NORD**  
University

# Why are new, highly efficient sugar-kelp seedlings needed?

- Asian sugar-kelp (*Saccharina japonica*) of high quality is 3 - 4 m long and more than 1 m wide
- Sugar kelp cultivated in Norway (*S. latissima*) on the contrary rarely exceeds 1 m in length



Rongcheng,  
China



Gildeskål,  
Norway

# Why are new, highly efficient sugar-kelp seedlings needed?

- Asian sugar-kelp production accounts for more than 12 million tons per year (Cai et al. 2021)
- Such large quantities can be only produced in Asia today because the production methods of *S. japonica* were fundamentally innovated in the late 1950s (Tseng et al. 1955, Hu et al. 2021).
- The introduction of the so-called 'summer sporeling' method in the late 1950s has boosted the sugar kelp production in Asia tremendously ever since (Su et al. 2017).
- **The current cultivation methods used for sugar kelp in Norway is outdated in Asia since more than 70 years!**
- In fact, despite the projected production potential of 4 million tons by 2030, the Norwegian macroalgae aquaculture so far only produces 400-800 tons (Olafsen et al. 2011, Fiskeridirektoratet 2025).
- Our current sugar kelp cultivation procedures originate from practical applicability of research activities, but do they really meet the actual global standards for large-scale production, harvest, shelf-life and post-harvest processing?

# What are the differences between Asian and Norwegian cultivation methods?

The following cultivation procedures for *S. latissima* are today standard in Norway (see e.g. Forbord et al. 2020)

- spores and gametophytes are seeded onto twine and ropes and reared into 0.5-1 cm long juvenile sporophytes in the hatchery (4-6 weeks) before being deployed at sea
- Sea based on-growth cultivation is performed for 4-6 months until harvest .
- Since the ropes are seeded with billions of spores and gametophytes in the beginning of the production process, the ropes are densely over-grown and carry hundreds of macroalgae per meter at harvest.
- Consequently, the harvested algae are generally small, pale and thin due to the constant competition for light, nutrients and space on ropes at sea.

# What are the differences between Asian and Norwegian cultivation methods?

The following cultivation procedures for *S. japonica* are today standard in Asia (see e.g. Tseng et al. 1955, Hu et al. 2021)

- Sporelings are reared in hatcheries (3-6 months) until they reach a size of several centimetres
- Elder and larger sporelings are transferred to cultivation ropes at densities of few individuals per meter
- Consequently deployed at sea, they grow at least 3-4 m in length during a 7-8 month cultivation period.

# Will a procedure developed for an Asian species also function for a Norwegian species?

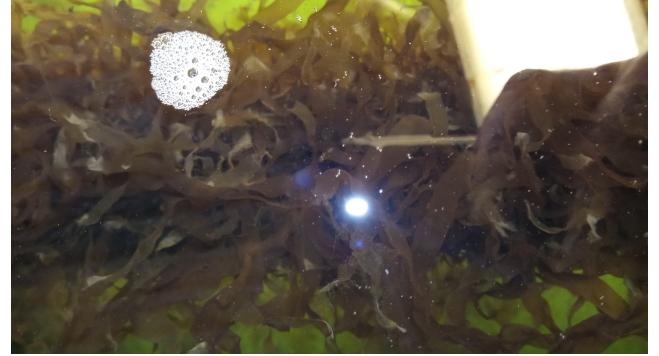
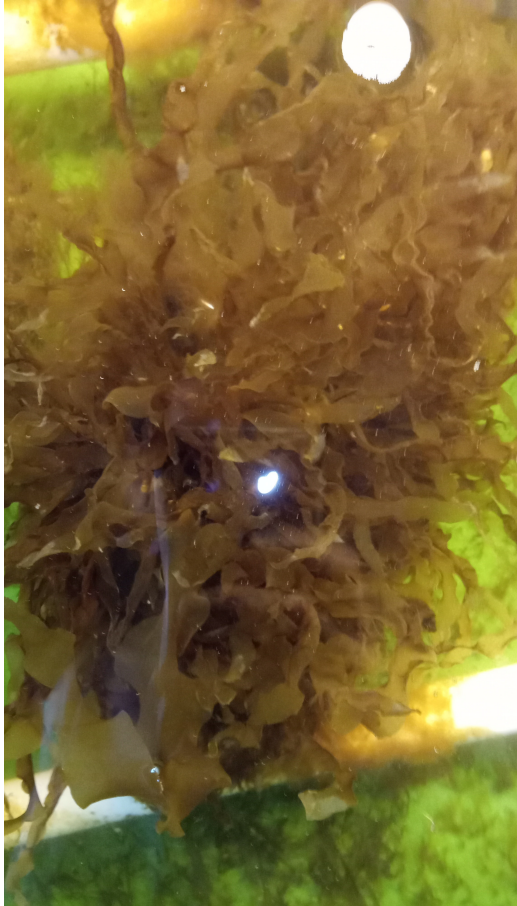


cultivated

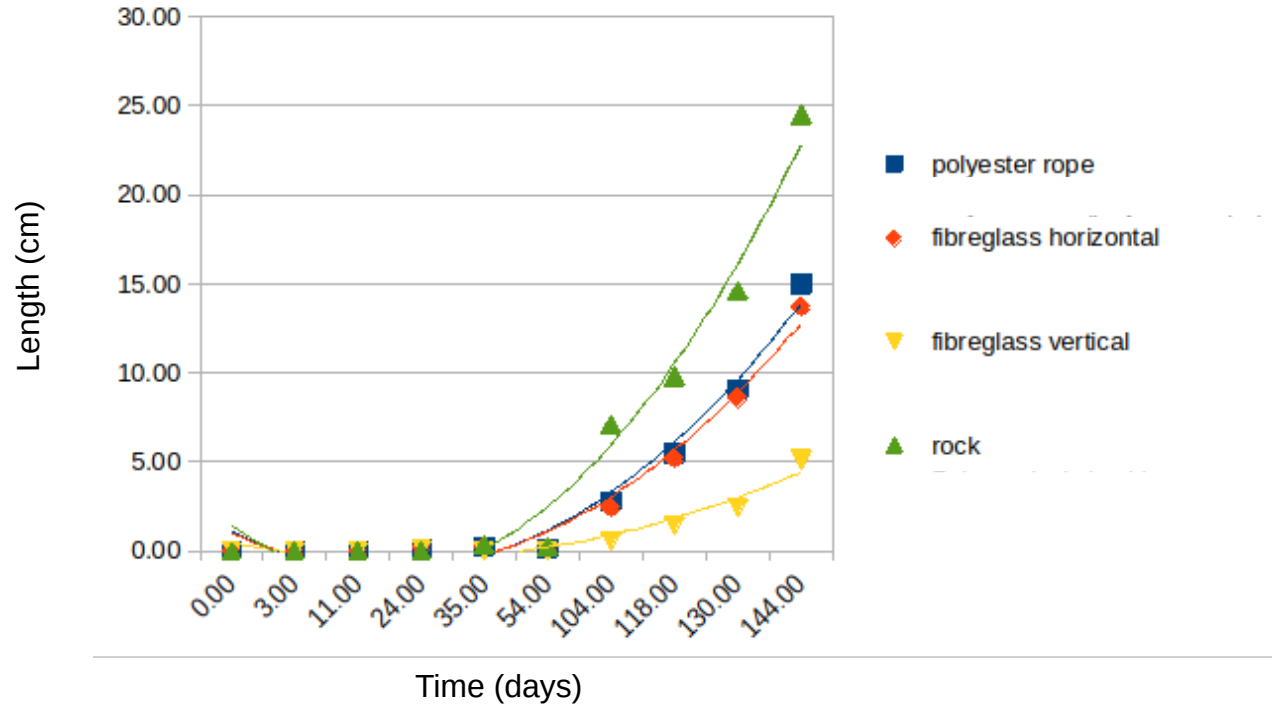


wild

# *S. latissima* seedlings in the hatchery

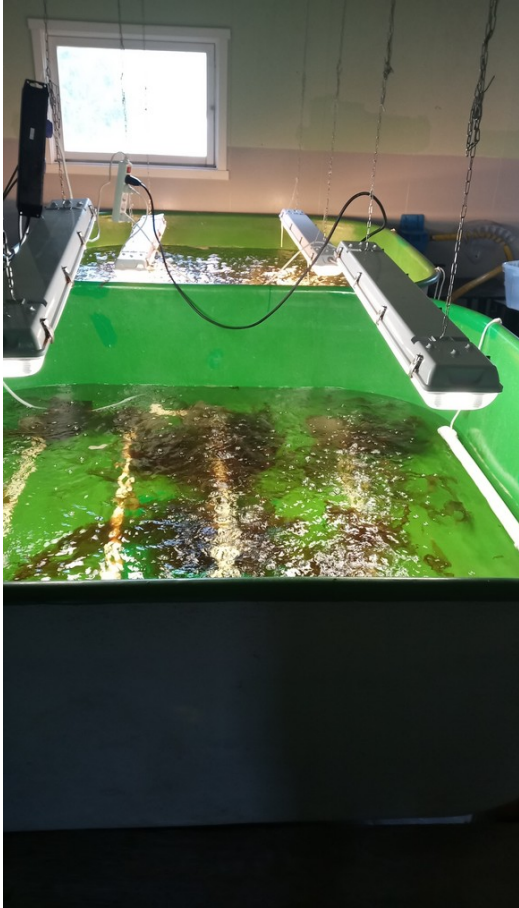


# *S. latissima* seedlings in the hatchery



The sporelings are ready for transfer to the cultivation rope after 120 – 150 days

# *S. latissima* seedlings in the hatchery



After 200 – 300 days  
they exceed 60 cm.

# Seeded ropes



# Seeded ropes

2024:

- Seedling size: (A)  $9.6 \pm 1.9$  cm (B)  $77.2 \pm 8.2$  cm
- Seedling distance: (A) 50 cm (B) 100 cm
- Reference: 6 mm polyester rope seeded by standard techniques
- Deployment at Pursea AS

# Seeded ropes

2025:

- Seedling size:  $30.4 \pm 1.3$  cm
- Seedling distance: (A) 10 cm (B) 20 cm (C) 50 cm
- Reference: 6 mm polyester rope seeded by standard techniques
- Deployment at Salten Algae AS, Kelpinor AS

# Cultivation



# Length and weight

2024:

- Harvest size: (A)  $128.6 \pm 4.4$  cm (B)  $176.8 \pm 9.4$  cm
- Harvest weight: (A)  $335.6 \pm 67.5$  g (B)  $790.7 \pm 66$  g
- Reference: length  $57.8 \pm 5$  cm; weight  $8.9 \pm 1.6$  g;

# Length and weight

2025:

- Harvest size: (A)  $124.6 \pm 2.8$  cm (B)  $120.7 \pm 3.6$  cm (C)  $111.9 \pm 2.4$
- Harvest weight: (A)  $375 \pm 15.4$  g (B)  $368.2 \pm 19.4$  g (C)  $329.6 \pm 12.5$  g
- Reference: length  $55.3 \pm 1.5$  cm; weight:  $11.5 \pm 0.8$  g;

# Length and weight



**Heaviest: 1712 g (240 cm); Longest: 328 cm (1425 g)**

# Asian sugar kelp classification

## **Class 1:**

Length greater than 100 cm, flat-thick blade part greater than 70 cm; width greater than 12.5 cm; flat-thick blade area is dark brown in colour; yellowish patches less than 25% of the frond surface excluding the flat blade area;

## **Class 2:**

Length greater than 80 cm, flat-thick blade part greater than 50 cm; width greater than 9.5 cm; flat-thick blade area is dark brown in colour; yellowish patches less than 50% of the frond surface excluding the flat blade area;

## **Class 3:**

Length greater than 60 cm, flat-thick blade part greater than 40 cm; width greater than 6 cm; flat-thick blade area is brown or yellowish brown;

## **No Class: Substandard:**

Broken blades less than 40 cm long, with flat part of the blade narrower than 15 cm.

# Asian sugar kelp classification

- *Saccharina latissima* cultivated by “Asian” principles results in class 1 and 2 qualities
- *Saccharina latissima* cultivated by standard principles results in substandard qualities

# Chemical composition

- Dry matter (DM) and ash content, lipids, protein, carbohydrates, fibre, minerals, heavy metals and amino acid content were analysed
- DM content was higher in "Asian kelp" compared to "control kelp"
- ash content was lower in "Asian kelp"
- Lipid content was generally low, however, slightly higher in "control kelp" than in "Asian kelp"
- Lipids consisted mainly of poly- and mono-unsaturated fatty acids.
- Protein content was also generally low and comparable in all samples, as well as amino acid content and composition
- Content of both, fibre and carbohydrates were much higher in "Asian kelp" samples compared to "control" samples
- Iodine was less concentrated in "Asian kelp" samples compared to "control kelp"
- The trace element Fe was much higher concentrated in "Asian kelp" samples. Other minerals and heavy metals were similar in all samples.

# Comparison

- Large
- Heavy
- Dark colour
- Less iodine
- High food quality



- Small
- Light
- Pale colour
- More iodine
- Food?

# Future plans

- Establishment of commercial “Asian” sugar-kelp cultivation in cooperation with farmers
- Optimization of seedling production
- Automatization of production of seeded ropes

# Acknowledgments

## Funding



contact:  
[christian@polaralge.no](mailto:christian@polaralge.no)

## Cooperation



**Salten Algae AS**



**Universität  
Rostock**



Traditio et Innovatio

