



GENIALG

e-Learning course
SUSTAINABLE SEAWEED FARMING PRACTICES

Module 3 - Breeding Seaweed

LESSON 1

Breeding as a tool for optimization of seaweed cultivation

©Atlantic Sea Farms



This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement no. 727892 (GENIALG). This output reflects the views of the author, and the Research Executive Agency (REA) cannot be held responsible for any use which might be made of the information contained therein

www.genialproject.eu

Module 3 - Breeding Seaweed

LESSON 1 – Breeding as a tool for optimization of seaweed cultivation

Main purpose of seaweed breeding



- In the last century, increased understanding of life histories of several economic seaweeds changed seaweed production from the simple collection of natural resources into a farming industry, a process that is under technical control throughout, just as its terrestrial counterparts (Hwang et al 2019);
- Currently, farming of marine seaweeds involves selection of parental plants (cultivars), seedling production, open sea cultivation, harvesting and processing. These different stages are inter-connected, mutually influence each other, and have a great impact on the quality and quantity of final products (Hwang et al 2019).



Module 3 - Breeding Seaweed

LESSON 1 – Breeding as a tool for optimization of seaweed cultivation

Main purpose of seaweed breeding



- There is a great genetic variability in seaweeds, for this reason, it is important to select the best strain using previously defined criteria;
- If we know the best genomic sequence that gives the most optimized growth, we can say that we want seaweed with that genomic features for cultivation.



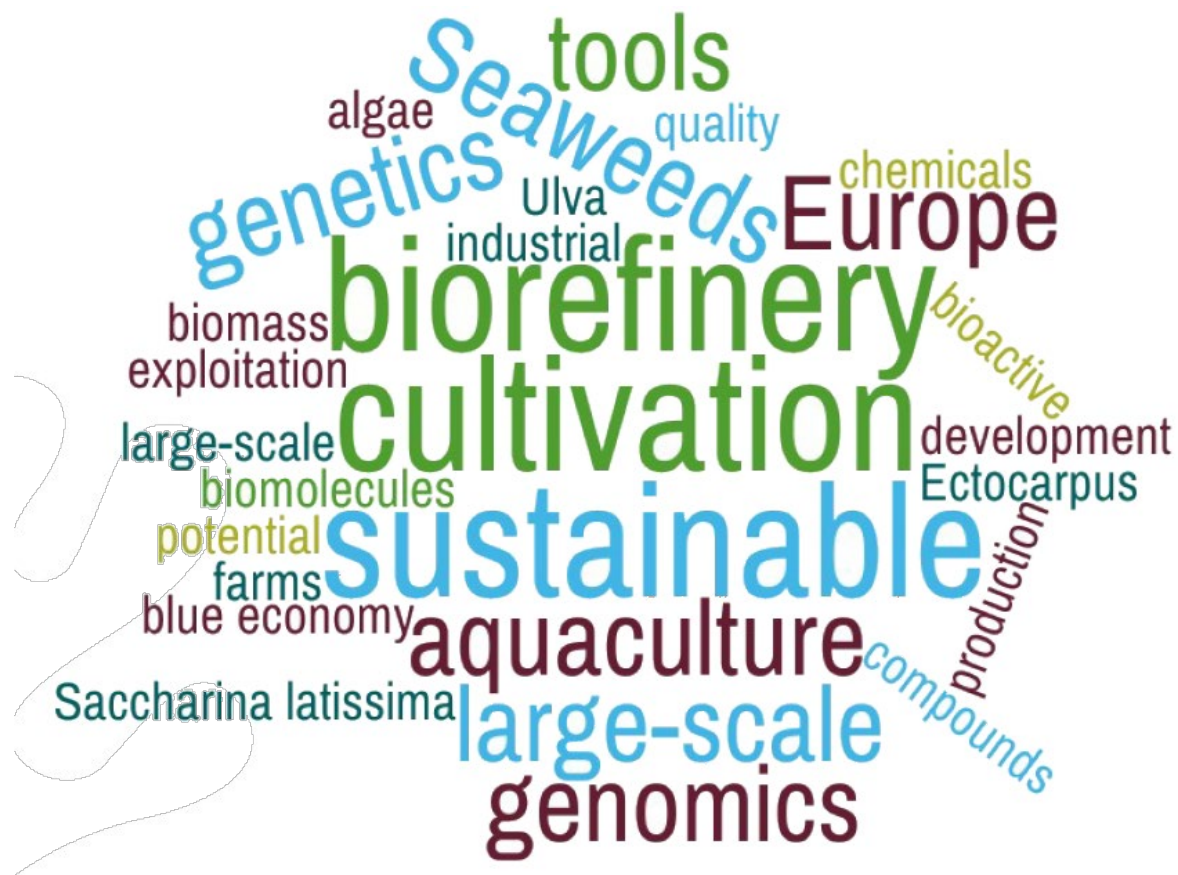
Module 3 - Breeding Seaweed

LESSON 1 – Breeding as a tool for optimization of seaweed cultivation

Main purpose of seaweed breeding



DEVELOPMENT OF THE BLUE ECONOMY



This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement no. 727892 (GENIALG). This output reflects the views of the author, and the Research Executive Agency (REA) cannot be held responsible for any use which might be made of the information contained therein

www.genialproject.eu

Module 3 - Breeding Seaweed

LESSON 1 – Breeding as a tool for optimization of seaweed cultivation

Seaweed breeding process



1. NEED FOR TOOLS FOR TRAITS SELECTION

Cultivate seaweed with desirable traits

Identify and select parents



Select seedlings for ropes sowing

“Agronomic” traits:

- Productivity: growth, size
- Stress tolerance
- Ease of harvest: stipe length

Quality traits:

- High value molecule content
- Iodine content



Need of genetic markers associated with desirable traits



Seaweed breeding process



2. ASSOCIATE GENOTYPE/PHENOTYPE

Two Methods:

1 Linkage mapping

A map of the genes on a chromosome based on linkage analysis. A linkage map does not show the physical distances between genes but rather their relative positions, as determined by how often two gene loci are inherited together.

2 Association mapping

Genome-wide association study (GWAS)

Identifies genetic variants (genotype) that associated with specific traits (phenotype). Investigates genetic markers cross whole genome of large number of individuals and predicts genotype-phenotype associations by statistical analysis at population level.



Seaweed breeding process



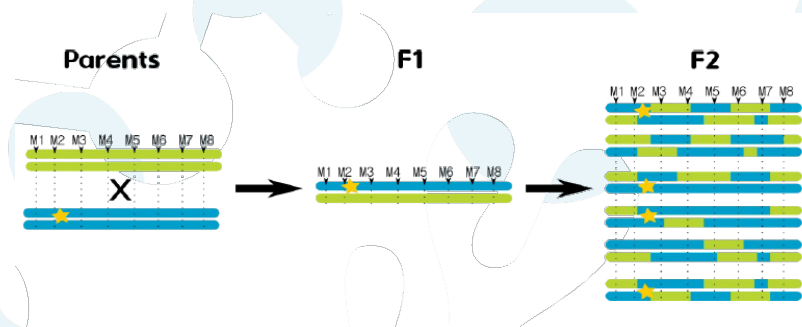
2. ASSOCIATE GENOTYPE/PHENOTYPE

Two Methods:

1

Linkage mapping

- A bi-parental progeny from genetically different parents;
- Parental genotypes and progeny's genotypes;
- Parental and progeny's phenotype for the traits we want to map (usually desirable traits).



Detection limited to loci segregating in the family



Seaweed breeding process



1 LINKAGE MAPPING – The other mapping family

Objectives

- Compare maps between sporophytes and gametophytes
- Phenotyping: are the sporophyte traits the same in gametophytes?
- Can we predict sporophytes phenotype by phenotyping gametophytes?



Seaweed breeding process

2. ASSOCIATE GENOTYPE/PHENOTYPE

Two Methods:

2 Association mapping

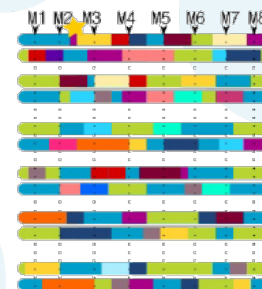
Genome-wide association study (GWAS)

- Natural populations sampling and genotyping
- Phenotyping
- Phenotype association with genotype
- But: strong effect of genetic structure



Mapping population

= wide sampling of natural populations



Large diversity but unknown evolutionary history



Module 3 - Breeding Seaweed

LESSON 1 – Breeding as a tool for optimization of seaweed cultivation

Saccharina latissima culture



Harvest of fertile individuals or induce sporogenesis



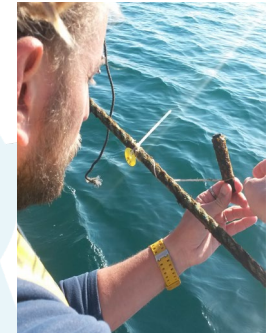
Spores release and gametophytes culture



Sowing on small ropes



Growth



Transplantation



This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement no. 727892 (GENIALG). This output reflects the views of the author, and the Research Executive Agency (REA) cannot be held responsible for any use which might be made of the information contained therein

www.genialproject.eu



**LESSON 1 OF
MODULE 3
FINISHED**

Find out more
www.genialgproject.eu

Follow Us
 [@GENIALG_EU](https://twitter.com/GENIALG_EU)
 [@GENIALGproject](https://facebook.com/GENIALGproject)

Contact us



This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement no. 727892 (GENIALG). This output reflects the views of the author, and the Research Executive Agency (REA) cannot be held responsible for any use which might be made of the information contained therein