Anykščiai
12th August 2020

ALGAE – ECONOMY BASED ECOLOGICAL SERVICE OF AQUATIC ECOSYSTEMS

FACTORS OPTIMIZING MACROALGAE DEVELOPMENT IN FRESH WATERS AND WAYS OF USING THE BIOMASS AS GREEN FERTILIZER

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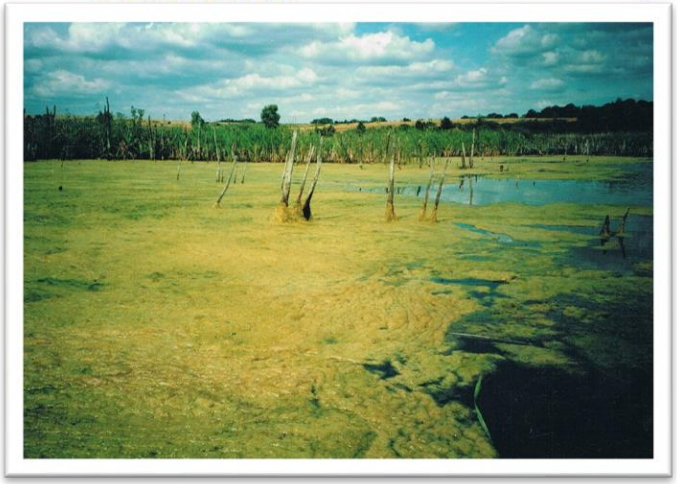

Shallow lake

River

Midfield pond

In summer time in eutrophic and warm water of aquatic ecosystems frequently develop massive population of filamentous green algae (FGA) forming a dense layer of algae biomass at the top of the water column.

Great potential of filamentous green algae to achieve the dominant position in the environment, including the ability to form large mats , is a main consequence of their high flexibility in adaptation to various external conditions.

Pikosz & Messyasz 2015. Oceanol. And Hydrob. Studies, 44(2): 273-281.

Ecological service

AlgaeService for LIFE

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LITHUANIA

Nature Research Centre · Baltic Environment · GPF · Spila

Life

POLAND

Universitas Studiorum Mickiewicziana Posnaniensis · UAM · Institute of Nature Conservation

Project objectives:

Demonstrate integrated efficient **management of nutrients** and algal nuisance blooms **by harvesting of cyanobacteria scums and macroalgae mats.**

To test and demonstrate the redesigning of waste biomass of cyanobacteria and **macroalgae into potential valuable products for recycling of environmental resources.**

To **raise awareness to environmental, water quality and health hazard issues** among the national governments, local authorities, the business community and society.

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AlgaeService for LIFE

Action 1. *Construction, testing and demonstration* ***two prototypes*** *for harvesting of cyanobacteria and macroalgae.*

Action 2. ***Distant methods*** *prepared for testing of cyanobacteria scums, macroalgae mats biomass agglomerations in situ.*

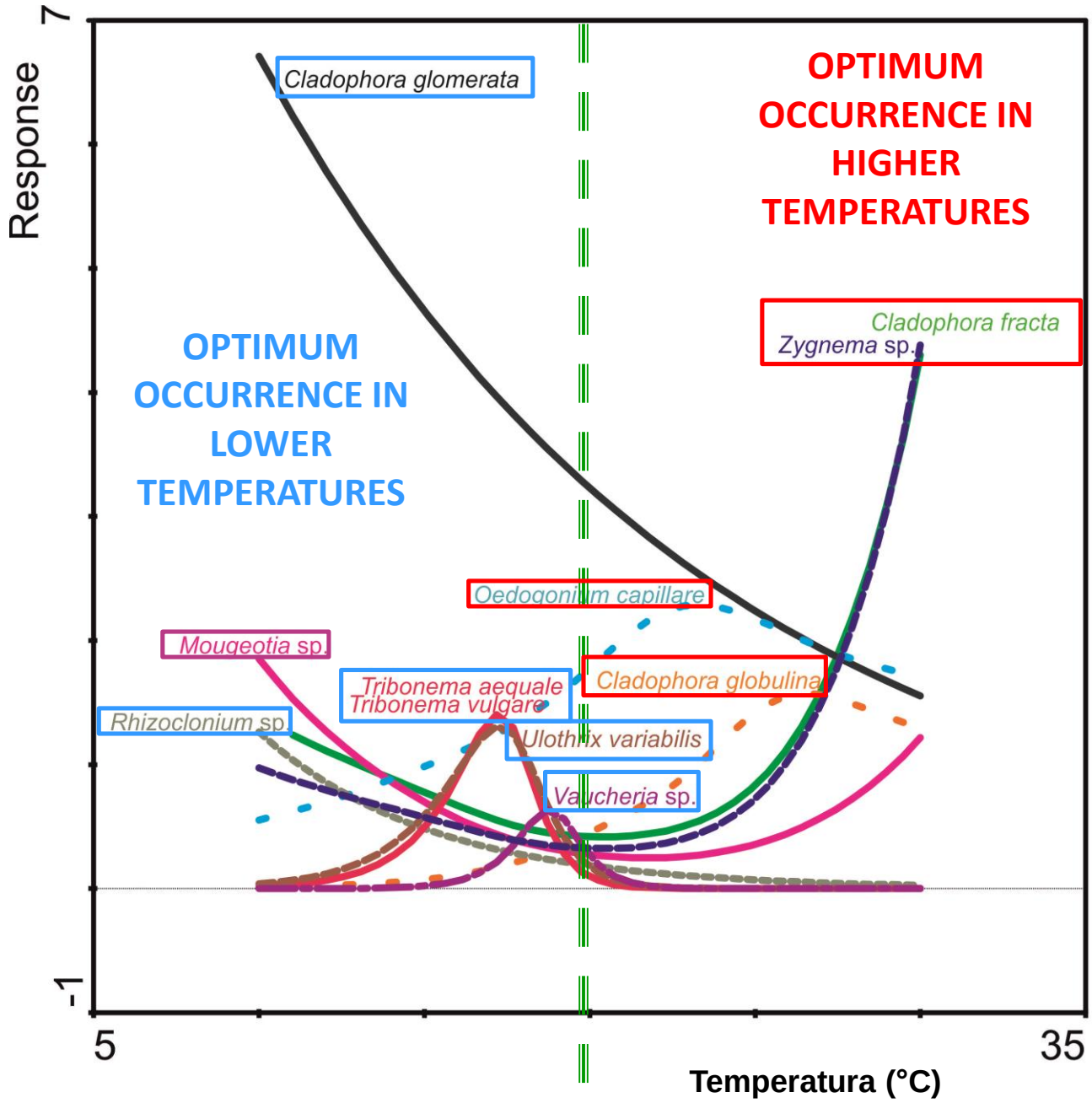
Action 3. ***Testing collected cyanobacteria and macroalgae biomass for potential application as low and high value bioproducts.***

Action 4. ***L****ife* ***C****ycle* ***A****ssessment: evaluation ecological and economical benefits.*

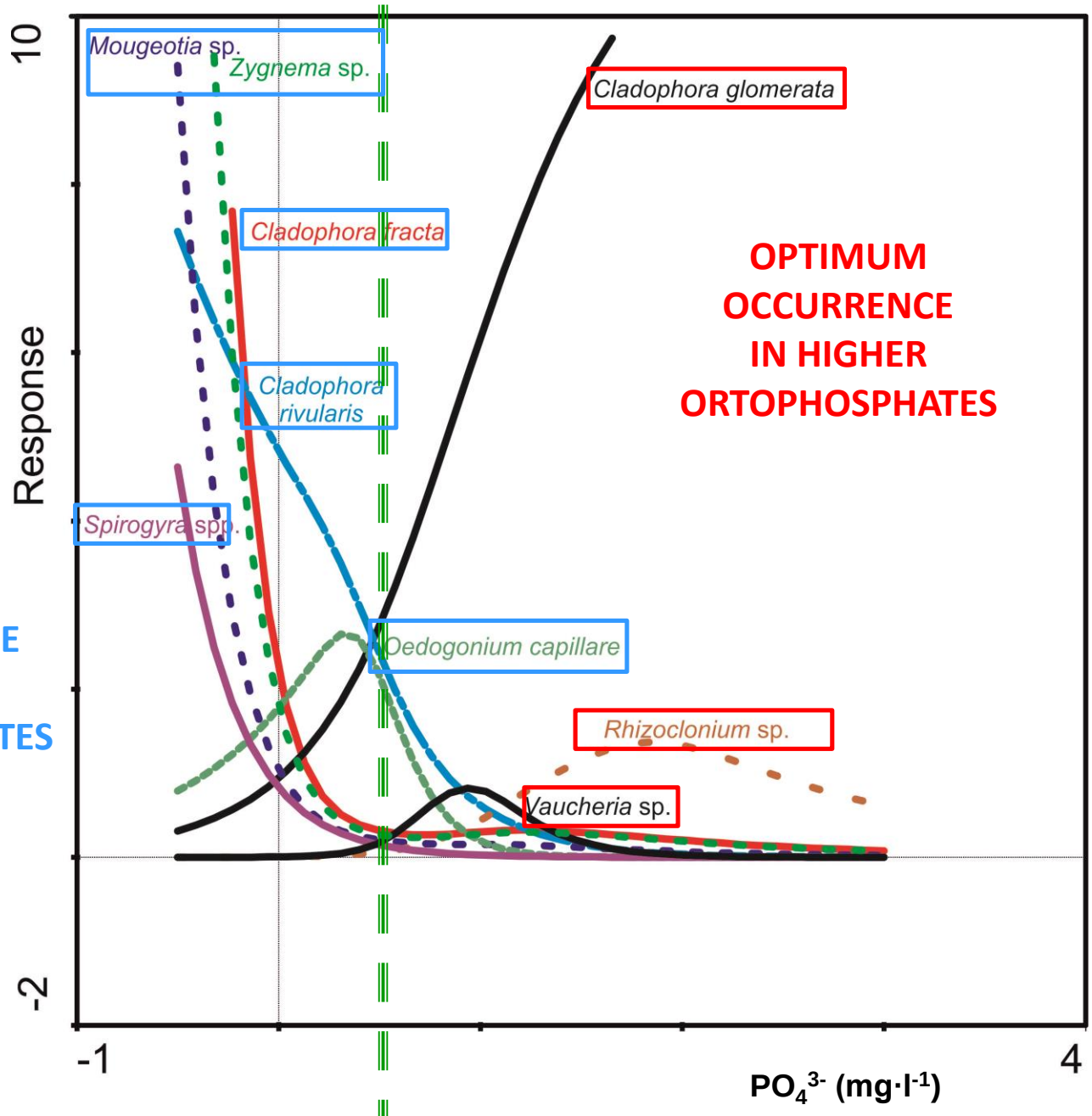
Action 5. ***Raising awareness*** *and dissemination of the project results.*

GROWTH PATTERNS OF FILAMENTOUS ALGAE

GAM PATTERN – TAXA ANSWER IN RESPECT TO TEMPERATURE CHANGES



GAM PATTERN– TAXA ANSWER IN RESPECT TO ORTOPHOSPHATES CHANGES

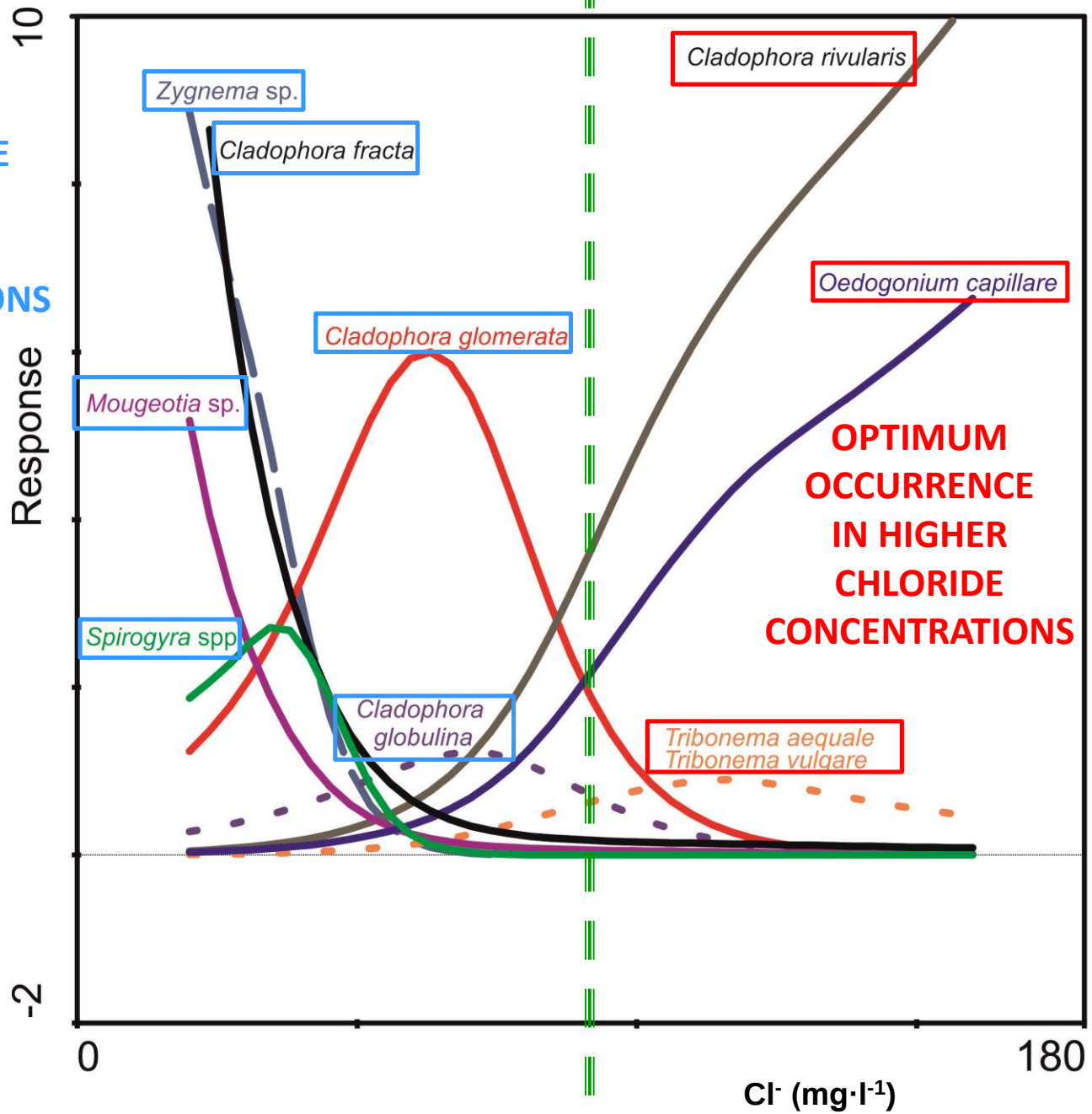


OPTIMUM OCCURRENCE IN HIGHER ORTOPHOSPHATES

OPTIMUM OCCURRENCE IN LOWER ORTOPHOSPHTES

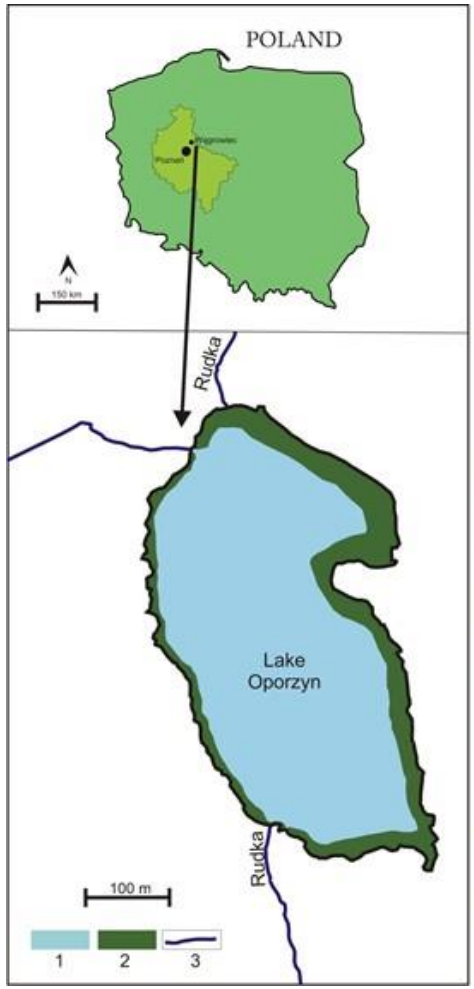
TAXA ANSWER IN RESPECT TO CHLORIDE CONCENTRATION CHANGES

OPTIMUM OCCURRENCE IN LOWER CHLORIDE CONCENTRATIONS



OPTIMUM OCCURRENCE IN HIGHER CHLORIDE CONCENTRATIONS

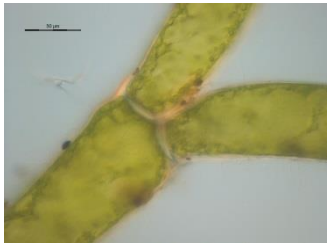
MACROALGAL BIOMASS – as low value bioproduct



Lake Oporzynskie

- **location**:
  Wielkopolska region
  near the town of Wągrowiec
- **area**: 17.5 ha (20.5 ha)
- average depth: 0.9 m
  maximum depth: 1.7 m
- **visibility**: 0.1 – 0.4 m
- **pH** 8.5 – 8.9
- flowing lake
- **Trophic state**: eutrophic

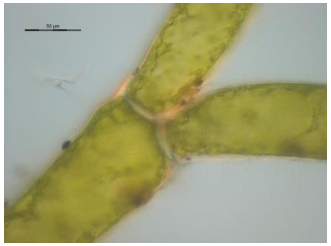
COMPOSITION OF CLADOPHORA GLOMERATA BIOMASS



CLADOPHORA GLOMERATA

FEATURE	%
DRY BIOMASS	**95.56**
ASH	**39.25**
PROTEINS	**14.45**
POLYSACCHARIDES	**15.60**
FATS	**0.78**

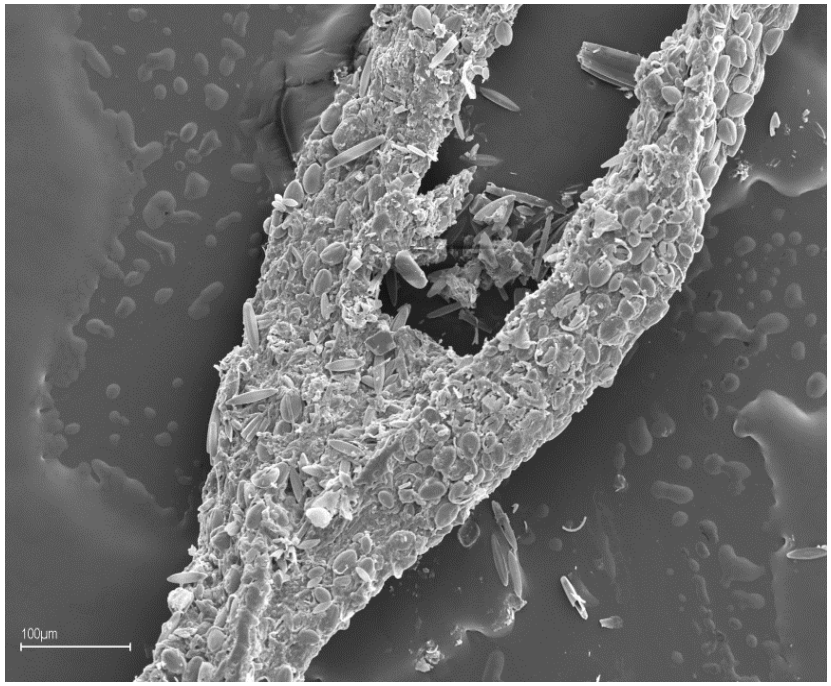
BIOMASS – ELEMENTAL COMPOSITION



CLADOPHORA GLOMERATA

ELEMENTAL COMPOSITION

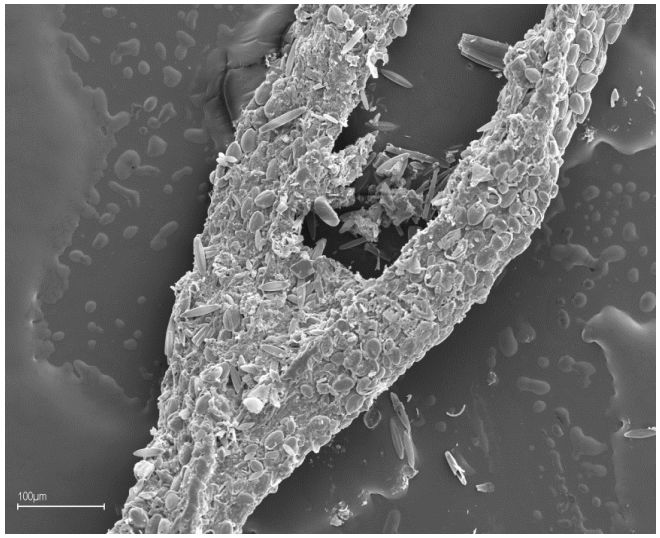
	[ug· g^{-1} s.m.]
Ca	146.2±3.4
Mg	3.63±0.02
Na	0.47±0.02
K	17.59±0.22
Fe	0.19±0.01
Zn	0.03±0.01
Cu	0.05+/-0.01

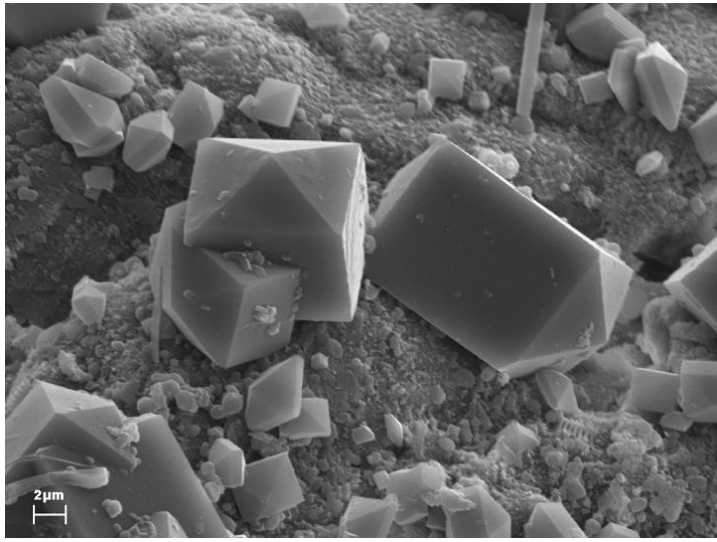


ACTION 3: TESTING COLLECTED BIOMASS

CHEMICAL COMPOSITION	MANURE* [%]	ALGAE** [%]
water	ok. 77	ok. 80
organic substances	20-27	20-30
Nitrogen	0,4-0,7	0,3-0,7
Phosphorus	0,2-0,9	0,3-0,8
Magnsium	0,1-0,3	0,2
Potassium	0,5-0,7	0,2-0,6
Sodium	0,1	0,1
Calcium	0,4-0,8	0,5-1,0
Silicon	0	0,3-1,0
pH	7,5	7,9

*Maćkowiak & Żebrowski 2000; ** Messyasz et al. data





Barley KWS Kosmos – 150 kg/ha – row spacing every 14 cm
the size of each plot – 0.25ha

Lubofoska fertilizer was applied before sowing – 30 kg/0,25ha

IX 2018 sowing

3 sprayings: Chwastox, Apyros, Propico (stalk and ear of grain)

Control	Manure 5 tons	Manure+ Algae 3 tons M+ 1 ton A	Mineral fertilizer 25 kg saletrosan	Mineral+ Algae 25 kg Saletrosan +1 ton Algae	Algae 3 tons

Faster and more even growth of barley in plots enriched with algae.

Control	Manure	Manure +Algae	Mineral fertilizer	Mineral+ Algae	Algae









Better yields, larger and heavier grain in plots enriched with algae.

Winter barley:

	Control	Manure	Manure +Algae	Mineral fertilizer	Mineral+ Algae	Algae
Yield [t]	0,9	1,2	1,5	1,0	1,4	1,5
Geramination [%]	86	98	99	93	98	96
Seed length [mm]	5,079-11,043	5,048-12,174	5,406-12,462	5,524-11,409	5,295-11,794	4,860-11,619
Seed width [mm]	2,453-5,386	2,423-4,693	2,778-6,904	2,901-5,718	2,689-6,271	2,601-6,108

Potatoes - Glada variant – each 30 cm– row spacing every 70 cm the size of each plot – 0.25ha

TarnogranR with boron fertilizer was applied before planting – 50 kg/0,25ha
Potassium salt 25 kg/0,25ha

IV 2019 planting

1 spraying on 1-leaf & 2-leaf weeds; 3 sprayings for potato blight every 14 days; 1 sparying after the occurrence of *Colorado beetle* (Calipso)

Control	Manure 10 tons	Manure-Algae 5 tons M+ 1 ton A	Mineral fertilizer 50 kg	Mineral +Algae 50 kg +1 ton A	Algae 3 tons

Faster, more even growth & greater resistance to drought in plots with algae.










The effect of using macroalgae as an additive to natural fertilizers - potatoes







	Control	Manure	Manure +Algae	Mineral fertilizer	Mineral+ Algae	Algae
Yield [t]	0,8	4,5	4,7	3,5	3,9	4,6
Starch	15,8	18,9	19,8	16,4	16,9	18,8

CONCLUSIONS

1. The use of macroalgae as an additive to natural fertilizers can play a major role in the effective implementation of EU water quality directives as well as for the sustainable development of the region.
2. Field experiments show clear effects in the ranks where macroalgae were added – a role in soil deacidification (Ca content).
3. Macroalgae mitigate the effects of drought – transport N and microelements from the roots to the steam.
4. Laboratory research is currently underway.

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Thank You
for your attention