POTENTIAL UTILIZATION OF STRANDED MACROALGAE ON THE ROMANIAN BLACK SEA COAST IN ECOLOGICAL AGRICULTURE

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ABSTRACT

Strong waves, winds and storms are forming macroalgae deposits on shore, thus affecting aesthetics and health of the potentially tourist's beaches. This material is usually collected and wasted at the town cesspit. In stead, it could be used as crop fertilizer, especially in ecologic agriculture were utilization of synthetic nutrients is forbidden. Analysis of presence, quantity and quality of the stranded macroalgae deposits in May-October 2004, concludes that Eforie Sud and Neptun-Mangalia are suitable sites for collection. Biomass mean value was 6 kg/m^2, green and red macroalgae being the dominant species (*Enteromorpha, Cladophora, Ceramium, Polysiphonia*). The research was financed by B.EN.A. - Tomini Trading.

KEY WORDS: macroalgae deposits, ecological agriculture

INTRODUCTION

The algae world is very rich, varied, and well represented, especially in cold and temperate seas. Data show that coastal human population use of marine algae in household goes several thousand years ago: crop fertilizer, food for both human and animals.

In many regions of the world, nowadays, marine benthic algae are an important raw material source for nourishment, industry branches (pharmacy, cosmetics, food industry), agriculture (compost, pest disproof extracts) and zootechny (algae supplemented fodder, algae flour, poultry food) (BOLOGA, 1980).

Marine algae with fertile values are used for their chemical composition (sodium, potassium, calcium, magnesium and iodine) which play

a decisive role in seed germination, resistance to frost temperature, crop growth. Subcarpathian hills of Davidesti, Arges, were fertilized with dehydrated and well-chopped green algae in 1976. Fertilization of soil with marine algae enhanced the productivity of hay, row protein and iodine quantities also (TEODORU *et al.*, 1978). These effects were being present even couple of years after algae treatment of the soil (TEODORU *et al.*, 1980).

Because of the low number of edible marine algae and lack of unexposed areas to wave destructive force, and therefore unsuitable for algae cultivation, their use along the Romanian shore is not taken into consideration. As macroalgae exploitation from the natural environment is difficult, we propose the utilization of stranded macroalgae. Previous expeditions to Constanta South point out important stranded macroalgae stocks that are wasted at city cesspit.

MATERIAL AND METHOD

Weekly expeditions at South of Constanta City were carried out between May and October 2004, after stormy days that produce important deposits of stranded macroalgae. Beach sectors with stranded macroalgae were identified and 10 cm/10 cm samples were collected from three points of the same deposit for correct macroalgae composition evaluation. The samples collected from these stations and brought in the laboratory, washed from fouling, sorted by species, rested on filter paper to reduce humidity in order to weight them. These proceedings provide a macroalgae species list at the Romanian coast and fresh biomass data expressed in g/m^2.

For macroalgae nutritive properties determination, nine samples of vegetal material (green, red and brown algae) were analyzed by biochemical methods. In order to determine the biochemical quality of algal material, samples are suffering preliminary stages of preparation such as: cleaning of fouling, washing of mineral suspensions with distilled water, wiping with filter paper to reduce humidity excess. Organic substance total content (MANESCU, 1978) and main biochemical compounds (protein, glucides, lipids) (RAZET *et al., 1996*) were determined according to standard methods. Mineral substance total compound was analyzed also (percent basis from biomass).

RESULTS AND DISCUSSION

Studied area of the Romanian Black Sea coast, between Mamaia and Vama Veche, is composed by natural rocky substrate (bivalve shells, rubble and limestone) and artificial substrate (harbor dams and beach protection dams) favourable to marine benthic algae development. Under adequate weather conditions, important macroalgae stocks are formed.

As expected, macroalgae were deposited on wave-exposed beaches (Cazino, Costinesti, Venus, Vama Veche stations) and on dam protected beaches as well.

Short stations description:

- Mamaia with green algae predominant deposits that were moved away at city cesspit every morning during the summer season;
- Eforie Sud was the only station with constant deposits during the entire study period. Green algae were the predominant group also. Capul Turcului sampling point is not a tourist's beach and was not cleaned regularly. The presence of a wastewater discharge is responsible for opportunistic green algae development (*Enteromorpha*);
- Neptun is a regularly cleaned tourist beach with quantitatively low deposits. Predominance of red algae should be noted.
- Mangalia with one high value deposit end June followed by usual deposits for the entire study period. Red algae were the predominant group;
-Vama Veche with small deposits spread up to 2 Mai village.

The most important feature of present marine algal flora is the low number of species with high productivity.

Qualitative samples analysis pointed out predominance of the green and red algae, brown algae being less represented. Macroalgae samples study revealed 20 species: 9 green algae, 9 red algae and 2 brown algae (Table 1). All three phyla of marine algae (green, red, brown) were present during entire May-October, 2004 period, except two spring specific genera (*Punctaria, Porphyra*).

Table 1

Stranded macroalgae species at the Romanian coast in May-October, 2004

CHLOROPHYTA	RHODOPHYTA	PHAEOPHYTA
Bryopsis plumosa	*Porphyra leucosticta*	*Cystoseira barbata*
Cladophora sericea	*Calithamnion corimbosum*	*Punctaria latifolia*
Cladophora albida	*Ceramium rubrum*	
Cladophora vagabunda	*Ceramium elegans*	
Cladophora sp.	*Ceramium diaphanum*	
Enteromorpha flexuosa	*Lomentaria sp.*	
Enteromorpha prolifera	*Polysiphonia elongata*	
Ulva rigida	*Phyllophora brodiaei*	
Chaetomorpha sp	*Phyllophora crispa*	

Green (*Cladophora*, *Enteromorpha* and *Bryopsis*) and red algae (*Ceramium* and *Polysiphonia*) were quantitatively well represented. Proportion of green algae was higher at Mamaia – Eforie shore, red algae predominating towards the south of the Romanian coast. Brown algae were encountered with low quantities at Eforie Sud (*Punctaria*) and Mangalia (*Cystoseira*) (Fig. 1).

As a rule, macroalgae deposits formed on the shore had mean biomass values lower than 6 kg/m^2. Important mean biomass quantities of stranded macroalgae were encountered at Eforie Sud and Mangalia (Fig. 2). It should be mentioned that Eforie Sud deposits were constant as presence, quantity and quality. By confrontation, one Mangalia rich deposit end June added to the following deposits gave the high mean value in the diagram.

The studied period (May-October 2004) has been characterized as weather conditions by low water temperatures and S S-W winds that brought deep clear waters, rich in nutrients, suitable for macroalgae development.

The biochemical parameters and biomass structure have been analyzed for potential utilization of stranded macroalgae for ecological agriculture purposes.

According to the literature search, both common and specific polysacharides (cellulose, alginic acid, laminarin, fucoidin, agar, carrageen) are present in marine algae. Vitamins are quantitatively comparable with those from fruits and vegetables (B2, C, D, PP, H, and A). Peptides and proteins are present also (SIMIONESCU *et al*., 1974).

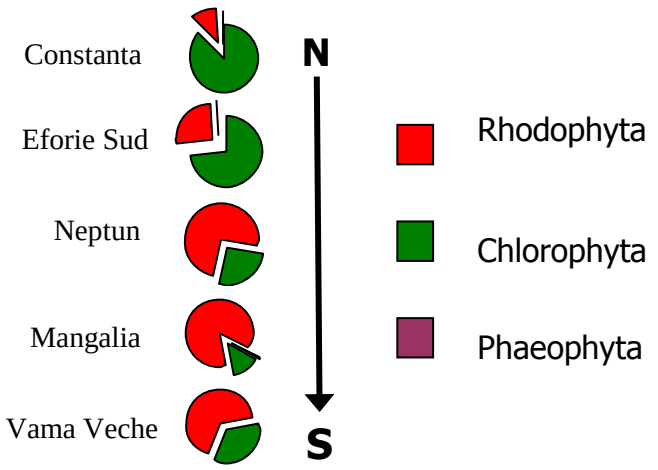

Fig. 1 - Quantitative proportions of stranded macroalgae in deposits formed along the Romanian coast (May-October, 2004)

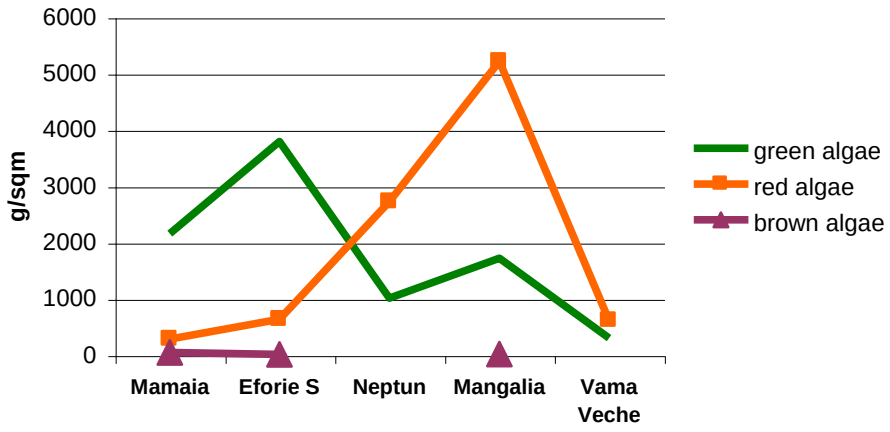

Fig. 2 - Mean quantities variation of stranded macroalgae at the Romanian Black Sea coast (May-October, 2004)

Studies of organic and mineral proportions in stranded macroalgae at the Romanian coast (May-October 2004) do not show large variations of the parameters (Fig.3). Compared with the other algal groups, green algae have a readily low mean value of organic substance. Slight differences of organic

content between algae groups are an advantage for agriculture utilization as fertilizer. The total biochemical composition will be little affected by any of the algal groups that will hold the dominance along the time.

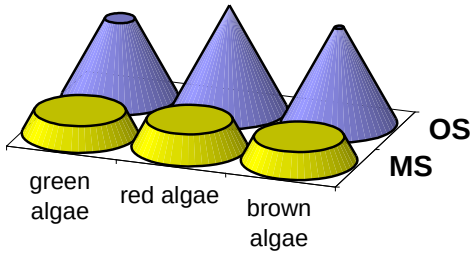

Fig. 3 - Organic substance (OS) and mineral substance (MS) ratio in stranded algae composition at the Romanian coast (May –October, 2004)

The shore segment between Neptun and Mangalia is important from the macroalgae collecting point of view, knowing that red algae are quantitatively predominant at the southern coast (Fig. 1) and that they contain high organic substance quantities (Fig. 3).

The macroalgae groups have different contents of biochemical compounds (protein, glucides and lipids). Green algae are rich in protein and lipids, red algae in glucides and lipids, brown algae in proteins and glucides (Fig. 4). Concluding, the mixture of all three algal groups (green, red and brown) is suitable for macroalgae utilization in ecological agriculture.

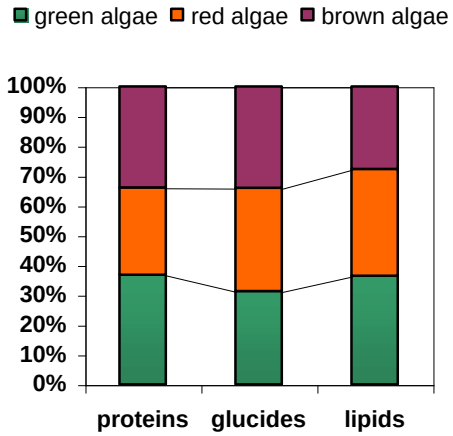

Fig. 4 - Percentage of macroalgae biochemical compounds at the Romanian Black Sea coast (May – October, 2004)

CONCLUSIONS

Macroalgae deposits were formed at the Romanian Black Sea shore on wave-exposed beaches, and on dam protected beaches as well, for the entire May - October 2004 study period. These are easy accessible areas in order to collect this biological resource.

Three algae groups (Chlorophyta -green algae, Phaeophyta -brown algae, Rodophyta -red algae) were revealed by analysis of stranded macroalgae deposits present during the mentioned period.

Enteromorpha, Cladophora (green algae), *Polysiphonia* and *Ceramium* (red algae) were the sample dominants, all with noticeable size of thalus and high content of dry substance (obtained by algae dehydration) compared with the other species present in coastal deposits, quite an advantage in ecological agriculture use as row material.

Macroalgae deposits formed on shore had mean biomass values lower than 6 kg/m^2. Important mean biomass quantities of stranded macroalgae were encountered at Eforie Sud and Mangalia stations.

Slight differences of organic content between algae groups are an advantage for agriculture utilization as fertilizer. The total biochemical composition will be little affected by any of the algal groups that will hold the dominance with time.

The shore segment between Neptun and Mangalia is important from the macroalgae collecting point of view, knowing that red algae are quantitatively predominant at the southern coast and they have high content of organic substance.

Main macroalgae organic compounds analysis revealed that green algae are rich in proteins and lipids, red algae in glucides and lipids, brown algae in proteins and glucides. The mixture of all three algal groups (green, red and brown) is suitable for macroalgae utilization in ecological agriculture.

Algae deserve to be taken into consideration as fertilizer especially because the only expense for the coastal community is algae transportation. *In situ* dehydration of marine algae makes them light and suitable for large quantities transportation.

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