Development of the Potential of Ecological Agriculture in the Village Ciresu, County of Braila

MARIANA CARMEN BURTEA[1], AUREL CIUREA[1], MARIAN BORDEI[2], GHEORGHE ROMANESCU[3], ANDREI VICTOR SANDU[4,5]*

[1] Dunarea de Jos University of Galati, Faculty of Engineering Braila, 111 Domneasca Str., 800001, Galati, Romania

[2] Dunarea de Jos University of Galati, Faculty of Engineering, 111 Domneasca Str., 800001, Galati, Romania

[3] Alexandru Ioan Cuza University of Iasi, ARHEOINVEST Interdisciplinary Platform, 11 Carol I, Corp G demisol, 700506, Iasi, Romania

[4] ,Gheorge Asahi Technical University of Iasi, Faculty of Materials Science and Engineering, Iasi, Romania

[5] Center of Excellence Geopolymer & Green Technology (CeGeoGTech), School of Materials Engineering, Universiti Malaysia Perlis (UniMAP), Kompleks Pusat Pengajian Jejawi 2, 02600 Arau, Perlis, Malaysia

Ecological agriculture is one of the alternatives to current intensified and harmful farming. It aims to obtain high crop yields and harvest without environmental pollution. The main objectives of this research were the following: establishing appropriate structures crop soil chemical attributes; establishing the possibilities of introducing salt - tolerant crops; establishment of technological particularities concerning land affected by salinity; implementing and expanding effective solutions in the influence area.

Keywords: ecological agriculture, salinity, environmental factors, soil improvement

After the researchers substantiated systems as: biodynamic agriculture [1], organic agriculture [1], biological agriculture [2], the ecological agriculture distinguishes itself by the fact that it is synonymous with the ever lasting agriculture, which ensures a balance between the ecosystems, the agriculture of the future which also ensures the biosphere integrity, the maximum reevaluation of the agro-ecosystems capacity of production and obtaining high quality products [3].

The scientific knowledge represents nowadays the main factor of agriculture development for the humanity benefit, on long term. The progress society expressed by the equation: ecological awareness - agriculture - food can be achieved only through the continuous and permanent development of agricultural sciences on genetically and physical-chemical basis. The soil science, as academician Constantin Chirita used to say will have to wear "coat of ecology" and to develop the discipline of organically binding the soil with the plants life and plant production [4].

The use of land fund in Romania presents three important problems:

- the land improved – leading to increase of the land productivity or stabilize the crops and increase the value of the land fund;
- the land use planning and ecological equilibrium which aims at conserving the land quality and rural landscape;
- the agricultural adaptation to the ecological, technical, economical and social background, under the conditions of different types of property [5].

The remarkable idea of the "European Charter for Rural Areas" concern the that the rural space of each country is meant to ensure the development and coexistence of whole population, agricultural and non- agricultural, in a perfect harmony of living and interest [6]. The environmental factors have an important role in the plants growth and develop unit. Plants use minerals, nutrients, water, heat from the soil and carbon dioxide, oxygen, light and heat from the atmosphere. The plants can benefit from the environment factors depending on the soil intrinsic properties.

The environmental factors which become ecological determinants in the agricultural systems are the following: the soil texture, the soil structure, the porosity, the capacity of retention and disposal of water, the soil drainage, the soil composition, the volume variation, the heat capacity, the cation exchange capacity, the buffering capacity, the salinity and/or alkalinity, the gleyzation and stagno - gleyzation, the nutrient content. The growth and development of plant, also, indirectly influence the environment, as ecological determinants [7-13].

Salty soils, found in different stages of improvement, those reevaluated without agro-pedo-ameliorative intervention, unusable soils from an agricultural point of view, have a strong influence on the ecosystems function. It reveals, therefore, the necessity of a profound ecological knowledge of soil as a medium for the plants life and its reasonably technological use, in order to achieve an ecological balance, or to avoid as much as possible a disturbance of the natural equilibrium.

Knowing the fact that in Romania, over 600 thousand hectares are occupied with salty soils [14] it is absolutely necessary to study "the ecologic complex of the soil" [5] as a whole functional unit of factors and determinants. Their knowledge leads to the maintenance of the ecological balance, both for the benefit of agro-ecosystem itself and for the social and economical one. The soil fertility is the future which raises the most important interest in the research domain and which has great economical, social and political importance. The fertility, as comprehensive feature of retaining, transforming and remitting mineral substances and water to the plants, it is related to the soil opening towards the outer energy flow. Kleinhempel, cited by Ionescu Al. [3] said that the fertility is the entropy variation in time, as its own feature.

The biomass production useful for man is considered only as an external determinant element. Thus, the fertility term is directly connected to the quality of energy from the

* *email: sav@tuiasi.ro*

soil. The permanent pedological problems are to maintain constant the soil fertility or to improve it where necessary and it can be solved through two highly efficient measures of soil revaluation affected by salinization:

- ameliorative fertilization, which represents an agro – pedo - ameliorative work which is done in order to restore, maintain and increase the production capacity of some soils which were submitted to the intense processes (natural or antropic processes) of fertility degradation [12]; the favorable influence on all the soil features, especially in humus rebuilding; all these determine the importance of using organic fertilizers, under the conditions of modern agriculture;
- the introduction of tolerant, protective, and improving crops on the salty soils the plants response to salt stress, with its two components (the osmotic stress and ion toxicity) is dependent on vegetative factors (vegetation phase, the plant variety and species), on soil (fertility, water and air content, climate), and also on the water management if agriculture, is practiced in an irrigated system [12]. Through their capacity of extracting large quantities of soluble soils, especially sodium chloride (NaCl), and of accumulating them in the leaves, the plants contribute to the ecological revaluation of the salty soils, provided the annual removal of the whole vegetative mass.

The amelioration effect of perennial crops is reflected through the enrichment of the upper horizons with organic substance, having beneficial effects over the physical and chemical properties of the soil.

Analysis of environmental factors in Ciresu, Braila County

The main objectives of this research were the following:

- establishing crops structures appropriate to the chemical features of the soil;
- establishment of the possibilities of introducing salt-tolerant crops;
- establishment of technological particularities concerning the exploitation of tolerant cultures affected by salinity;
- implementation and expanding effective solutions in the influence area.

Soils improving affected by salinization proved particularly difficult, complex, expensive and of long standing; thus, the approach of ameliorative works on such soils was avoided almost permanently but tolerant and minimal intervention and ameliorative works still remain available:

A. Agro - ameliorative works - they aim to achieve optimal growth and development of cultivated plants, due to hydro and pedo - ameliorative works.

In this category there can be included:

- basic works to mobilize soil root layer;
- organic fertilization works specific to salty soils;
- specific crop rotation differentiated on degrees of salinization;

B. Phytotechnical works

The salinity tolerance of agricultural plants allows their use both for ameliorative purposes and for efficient use of land affected by salinization. Among the protective and ameliorative crops we can mention:

- aromatic and medicinal plants;
- perennial grasses for seeds and green mass;
- fruit trees and vines;
- ornamental plants.

Climatic conditions in the study area

County oif Braila is holding one of the first places in the country in terms of land area planted with salty and affected by salinization soils. Thus, the 68,000 ha, representing 17.14% of the farmland and 18.77% of the arable land, Braila occupies the third place after Tulcea and Timis (figs. 1, 2) [12].

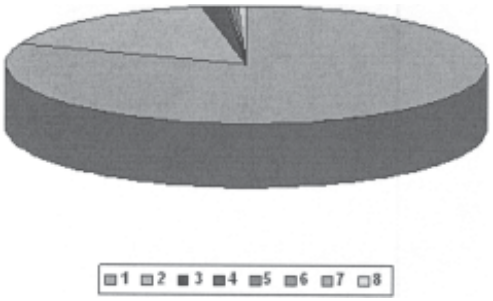

Fig. 1. Distribution of salty soils after the requirements for preventing and combating salinization: 1. unaffected; 2. risk of secondary salinization; 3. moderate salt; 4. strong solonetic with calcium carbonate (and gypsum), no soda; 5. strong solonetic without calcium carbonate and gypsum, no soda; 6. strong solonetic without soda; 7. high salinity; 8. residual salinization

From a geomorphological point of view, Braila County includes the north-eastern part of Baragan and the Big Island of Braila. As physical-geographical subunits we can distinguish: the terraces of Viziru and Braila, the digression plain Calmatui - Buzau (eastern side), inter - river Ialomita - Calmatui (northern-eastern side), Low Plain of Siret and middle and lower valleys of the rivers Siret, Buzau, Calmatui.

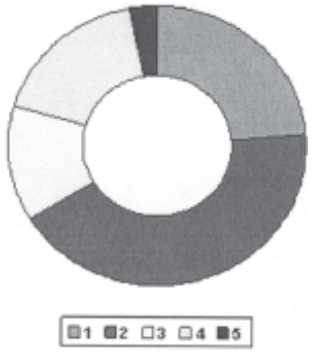

Fig. 2. Distribution of salty soils and of the soils affected by salinization in Braila: 1. chernozem including groundwater cambic wet; 2. Gleyed alluvial soils, saline and/or alcalizate; 3. alkalized solonceac; 4. saline solonetzs; 5. saline “lacovisti”

Large areas of accumulative relief: plains, alluvial plains, old valleys with endoreic feature and microdepressions (“crovuri”), interdunes, represent important natural conditions in the development of salinization process. From a climatic point of view, the space above mentioned is located in the steppe area, which is characterized by annual average temperatures and rainfall of 11.10°C, respectively 440 mm, evapo-transpiration 723 mm, and 250 mm water deficit. The climate is extremely favorable for the formation of salty soils and for the intensification and expansion of the salinization phenomena [14-20].

Soil properties in the studied area

The salty soils near Ciresu, Braila County, are located in a steppe climate with hot and excessively dry summers, fact that contribute to the extinction of the soil salinization process. The soil of alluvial vertic type, low - moderate salinated, which from a geo-morphological point of view is presented as a flat ground located in a lower part of the Călmăţui valley, is formed on loamy alluvial deposits under the influence of highly mineralized groundwater. On 0-40 cm depth, the soil presents high clayey and compaction

Nr. crt.	Depth	pH	Total soluble salt content	Humus	Assimilable P	Assimilable Kium
u.m.	[cm]		[mg/100 g sol]	[%]	[ppm]	
1	0-20	8,1	203	4,80	101	315
2	20-40	8,2	452	2,67	82	158

Table 1
SOIL CHEMICAL PROPERTIES IN THE AREA CIRESU, COUNTY OF BRAILA, AUTUMN 2010

Table 2
INDICATORS OF SOIL LOW-MODERATE SALINATED SOIL CIRESU, COUNTY OF BRAILA, AUTUMN 2010

Anions and cations content	Depth	
	0 - 20 cm	20 - 40 cm
Carbonates, mg/100g	0	0
Bicarbonates, mg/100g	49	40
Chlorides, mg/100g	21	58
Sulphates, mg/100g	77	210
Calcium, mg/100g	4	24
Magnesium, mg/100g	8	14
Sodium, mg/100g	46	98
Potassium, mg/100g	1.1	2.7
Cation exchange capacity, me/100g sol	33.40	38.06
PSA	2.79	3.27

Table 3
CHEMICAL PROPERTIES OF GROUNDWATER IN THE AREA CIRESU, COUNTY OF BRAILA

Chemical properties	Groundwater
pH	7.10
Electric conductivity 25° C, mS/cm	7.937
Mineral residue, mg/L	5318
Carbonates, mg/100g	0
Bicarbonates, mg/100g	488
Chlorides, mg/100g	1846
Sulphates, mg/100g	960
Calcium, mg/100g	360
Magnesium, mg/100g	168
Sodium, mg/100g	1020
Potassium, mg/100g	312
Total iron, mg/L	12.10
SAR Index	11.10
Priklonski Index	1.10

(over 50% inflatable clay, 20-30% degree of compaction), bulk density 1.30 to 1.45 g/cm^3, low permeability (V_{fi} = 5.30 mm/hour). Long and complex action of these natural factors, extremely favorable to produce salty phenomena, explains the current situation of soil degradation stage.

The important elements of the groundwater regime are: average depth (for the period of salts accumulation), the average annual supply sources (including salifere sources) seasonal fluctuations of the groundwater, the pressure gradient and flow rate, degree of mineralization and chemical composition, intake and exhaust front downward percolation of water and of salts in the parented soil material system. From a hydrological point of view, 19% of the land representing the cumulative relief, has the groundwater level located between 0.50 and 2 m and over 51%, representing terraces with relatively plain relief, sometimes largely deppressionares having the groundwater between 2 and 5 m. The mineralization degree of groundwater is high (more than 2 g/L) on an area of about 15% from the agricultural area [21].

The material and the working method

The soil and water samples were collected from the village pasture Ciresu. The chemical tests were performed according to current standards, namely:

- the total content of soluble salts by means of conductometric method,
- *p*H by the potentiometric method,
- Ca^{2+}, Mg^{2+}, CO_3^{2-}, HCO_3^-, Cl^-, SO_4^{2-} through volumetric method,
- Na^+, K^+ flam-photometric method,
- humus through Walkley Black, Gogoasa modification,
- phosphorus and mobile potassium through colorimetric method with molybdate ammonium Egner Riehm Domingo,
- the total capacity of cation exchange and exchangeable sodium through flam-photometric method from percolation of the soil.

Results and discussions

Carrying out chemical analysis of water and soil samples led to these results (tables 1, 2, 3):

- *p*H values show a weak alkaline soil, although the optimum values for the growth and the development of cultivated plants are between 6.0 to 6.5, even at a weak alkalinity, certain plant species may exploit the production potential of the soil;
- total soluble salt content - the obtained values fall into the category of low soil salinity in the layer 0 - 20 cm layer and moderate in salinity 20 – 40 cm. The vast majority of crops suffer from metabolic disorders and consequently, the crop in the presence of soluble salts in a concentration more than 100 - 150 mg/100 g soil decreases, the weak - moderate salinization allows the selection of some tolerant plants with the condition of irrigation and drainage facilities, especially because an increase in the concentration of soluble salts in the layer from 20 - 40 cm 0 - 20 cm layer can be noticed;
- exchangeable sodium content is less than 5%, which reveals that the soil is not affected by alkalization, fact confirmed by the soil reaction which does not exceed the value of 8.50;
- humus content of soil falls in the category of "well supplied" in the layer 0 - 20 and "middle stocked" in the layer 20 - 40;
- assimilable phosphorus content is in the category "well supplied";
- assimilable potassium content falls in the category "very well supplied".

The opportunity of organic fertilizer is estimated based on the state of soil nutrient supply and crop rotation choice:

- mineralization of groundwater is much more over the permissible values for irrigation water, even under the condition of irrigated and drainage soils and the use of salinity-tolerant crops;
- SAR index - reveals the moderate alkalization potential of the soil by using this water resource;
- Priklonski index reveals the unsatisfactory nature of water for irrigation.

The results obtained from chemical analysis of soil and water allows the recommendation of the following agro-ecological activities in order to capitalize low-moderate saline soils from Ciresu area.

-*Organic fertilization* - as an ecological measure in interventions necessary to improve soils fertility with low production potential, such as soils affected by salinization, because manure:

- contains all the elements necessary for the growth and development of plants;
- increases the buffering capacity of soils and exchangeable calcium content;
- improves the physical characteristics: structure, permeability;

High tolerance	Moderate tolerance	Low tolerance (sensitive)
500 mg/100 g soil	350 mg/100 g soil	180 mg/100 g soil
Puccinelia (*Puccinellia nuttalliana*)	White sulfina (*Melilotus albas*)	White clover (*Trifolium repens*)
Wholesale Pir (*Cynodon dactylon*)	Ryegrass (*Lolium Perenne*)	Red clover (*Trifolium pratense*)
Long Pir (*Agropyron pectiniforme*)	Sudan grass (*Sorghum sudanense*)	
Obsiga (*Bromus cathaticus*)	Lucerne (*Medicago sativa*)	
Perisor (*Elymus canadensis*)	Wheat (*Triticum aestivum*)	
Pir (*Agrophyron smithii*)	Rye (*Secale cereale*)	
Fescue (*Festuca arundinacea*)	Barley (*Avena sativa*)	
Barley (*Hordeus vulgare*)	Orchard grass (*Dactylis glomerata*)	
Ghizdei (*Lotus corniculatus*)	Firuta (*Bouteloua gracilis*)	

Table 4
SALINITY TOLERANCE OF THE MAIN FORAGE PLANTS [25]

Fruit Species	Tolerance range Total soluble salt content
	mg/100 g sol
Apple tree	105 - 325
Pear tree	110 - 400
Apricot tree	98 - 360
Quince tree	120 - 800
Plum tree	110 - 300
Sour cherry tree	88 - 200
Cherry tree	92 - 240

Table 5
SALINITY TOLERANCE OF FRUIT TREES [26]

High tolerance	Moderate tolerance	Low tolerance
Oleander (*Newrium oleander*)		
Calistemon veiminalis	Er (*Thuia orientalis*)	Calin (*Viburnum tinus robustum*)
	Juniper (*Juniperus Chinensis*)	Rose
		Feijoa sellowiana
		Privet (*Ligustrum lucidum*)

Table 6
SALINITY TOLERANCE OF ORNAMENTAL PLANTS [25]

Nr. crt.	Plantation type	Important representants
1	Stock	Fercal, Ruggieri 140Rn, Chasselas Berlandieri 41B, Salt Creek, Dog Ridge, Harmony
2	Varieties for white table grapes, not grafted	Augusta, Early from Cluj, Romanian Pink, Chasselas from Baneasa, Black horns
3	Varieties for white wines, not grafted	Gray Babeasca, Ottonel Muscat, Pinot gris
4	Varieties for red wines, not grafted	Black Babeasca, Pinot noir, Large Burgund
5	Varieties resistant to root their biological	Purple, Brumariu, Moldova, Pistruiatul
6	Variety of nobility, not grafted	Grandomah, White Kis Mis (sultanas), Gherhard, Muscat of Alexandria

Table 7
SALINITY TOLERANCE OF SOME VARIETIES OF VINE [25]

- enhances the microorganisms activity, produces energy and mineral dioxide carbon equivalent, and some are incorporated into the soil, gradually turning into humus.

The culture of salinity tolerant plants (tables 4, 5, 6, 7,)

Researches so far show that alfalfa is a medium species sensitive to salt with a relative agronomic tolerance, of about 350 mg/100 g soil (Richards, 1954, quoted by Măianu, 1984, [22]). From the experimental research on the soil undisturbed by salinization it has been found that alfalfa can achieve high cropss if the sap flow during the early flowering to seed formation is low. This can be achieved through the action of drought stress or soluble salts from the soil solution [13, 23]. From the experiments performed in the steppe zone of low saline soils, there have obtained good results for both trefoil green mass cultures as well for seeds [24].

Not being a halophila plant to be cultivated with real chances of longevity and productivity on affected soils it is necessary to achieve two conditions:

- the existence of the land improvements works;
- a selective choice of rootstock species and varieties of *Vitis vinifera* and successful combinations of graft / rootstock with optimal affinity [26].

Conclusions

The salty soil improvement and use represent a measure of protection and conservation of unaffected soil fertility, since most salty soils are found as small areas under the form of patches - islands embedded in the very fertile soil non-salty area, where they frequently form active nuclei or potentials of degradation by secondary salinization. The improving of salty soils requires the application of expensive technologies and therefore it is taken into consideration their valuation through the cultivation of tolerant plants which may exert a bio-ameliorator effect over its adverse features [27-31].

The importance of plants in role in the genesis and evolution of salty soils leads to the theory of their use in the reevaluation process of these degraded soils.Fertilization with organic fertilizers are applied to productive reuse of nutrients into new crops, the regeneration of organic substances in the layer and complex, chemical, physical and biological improvement of the soil, including the degraded ones. The mutual influence soil plant in the bio-geochemical cycle soil-water-salts-plant is the basic link of the research in order to enhance the soils affected, the fito-ameliorations being a perspective of efficient use of salty soils.

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Manuscript received: 22.01.2015