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SUMMARY

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CURRENT AND FUTURE STATUS OF STANDS' REGENERATION THROUGH AFFORESTATION

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Abstract

The stands' regeneration through afforestation does not represent the main modality for insuring the stands' regeneration, but it is used where the natural regeneration cannot be assured, and when the forests are extend or reintroduced. It may be appreciated that nowadays, the stand's status is mainly influenced by the climatic, pedo-hydrological and anthropical factors .In this context, we may witness the process of devitalization and trees' abnormal drying, especially in the arid areas of the country, respectively in the steppe and forest steppe regions, also in Danube meadow regions, in plane and other hilly territories, mainly during dry and extremely dry years. Statistics regarding the beating-up works and rehabilitation of affected plantations within the plantations realized between 2001-2010 by RNP-Romsilva reveal that there were established on a total surface ranged between 5621 and 9239 ha, and 18-25% were damaged and had to be remade. Concerning the supplying of forest reproductive materials, it may be mentioned that during 2001-2011 the seed stand and the seed orchard surfaces decreased, but the seed stands surface for the main scattered and other noble hard wood species increased. The ecological rehabilitation of the degraded forest is necessary and should be realized by promoting species more resistant to more and more dryer site conditions from forest steppe the plane forest and by extension of surfaces covered by Norway spruce in sub alpine region, Stone pine and Mountain pine in the alpine region. Related to the afforestation realized within the state owned forests, it may be noted that they were made in accordance with technical guidelines using the best genetically improved forest reproductive materials, with adapted provenances/ species in different site conditions. We consider that it is mandatory to update the technical guidelines in order to include a more intensive afforestation and forest management processes, conditions that are necessary for obtaining more stable and higher quality stands.

Key words: *afforestation, climate change, site condition, forest species*

INTRODUCTION

The stands' regeneration through afforestation does not represent the main modality for insuring the stands regeneration nor the guaranty of forests existence continuity. The afforestation is used where the natural regeneration cannot be assured, where the forest's frontiers extend or the forest is reintroduced.

Marin Drăcea [5], the initiator of Romanian research on silvicultural matters, mention very suggestively the importance of this domain "The forest is not a temporarily improvisation, but the result of hard and long battles between the blind forces of the nature which continuously corrode the earth's crust until the wooden vegetation, with strong patience and brilliant tactics, manages to conquer the soil, to calm down these blind forces and to give to the man kind peace, the safety of tomorrow and thus the will to live."

It may be appreciated that in the current days, the stand's status is mainly influenced by the climatic, pedo-hydrological and anthropic factors.

Taking into account the evaluations made by the Intergovernmental Panel on Climate Change [22] on global and regional level, we may acknowledge that the mean global air

temperature has increased by approximately 0.74°C in the period 1906-2005, and in Europe, during the same period, the mean temperature increased by 1° C; the precipitations volume has increased in North but decreased in South. I our country, in the period 1961-2007, the increase of the mean temperature was almost 1°C [2], [17]. It turns out that the rapid rhythm of the climatic changes surpasses the ecosystems' adaptability capacity (I.P/10 207/ European Commission Brussels, March 2010- [19]).

In this context, nowadays we may witness the process of devitalization and trees' abnormal drying, especially in the arid areas of the country, respectively in the steppe and forest steppe regions, Danube meadow regions, in plane and other hilly territories, mainly during dry and extremely dry years. This process is highlighted by the wood volume harvested through sanitary cuttings and as well by the results of the trees' health status monitoring evaluated through defoliation degree method [10], [11].

MATERIAL AND METHOD

The study materials for the present paper are "Forest reproductive materials" used in afforestation during the last decade (2001-2010). There are also tackled aspects concerning the update of the national catalogue of Basic Materials for Forest reproductive materials, in accordance with national and international regulations, and taking into account the climatic changes.

The methods used are represented by statistical analysis concerning the current status of stands' regeneration through afforestation and the assessment of climatic changes' impact on site conditions of the forest ecosystems. In order to realize the stands' regeneration through afforestation in the present changes of environmental conditions, the main activities that must be done were mentioned for each vegetation zone.

RESULTS AND DISCUSSIONS

Current status of stands' regeneration through afforestation

The general considerations are reflected by the degree of success of the afforestation works and by the status of natural regenerations (which appear mainly in the extra Carpathian regions form south, east and south-east of the country) and also by the high volume of works that must be done in order to consolidate the plantations until the establishment of close crop status.

Statistics [20] regarding the beating-up works and rehabilitation of affected plantations within the plantations realized between 2001-2010 in forest managed by RNP-Romsilva reveals that there were established on a total surface ranged between 5621 and 9239 ha, and 18-25% were damaged and had to be remade (Table 1).

The climatic changes specific to the current days in Romania are reflected also by the characteristics of the hydrological regime and the frequent floods, due to more and more frequent alternations of minimum and maximum hydrological values [8]. These phenomenons imply severe consequences especially in the Danube Delta and Danube Meadow regions. These types of situations impose the use of the most adequate afforestation technologies [9] and the establishment of an afforestation composition capable to resist these conditions.

The overflowed meadow region located along the Danube, the rivers and in the Danube Delta represents a distinguish silvicultural zone [6], where a limited number of forest tree species grow and the poplars and willows are the widest spread species.

The ecosystems established in steppe or forest steppe clime conditions are considered to be among the most unstable but productive ecosystems. The establishment and development of the forest vegetation through afforestation is difficult, expensive and completely different to the afforestation of any other forest zone from the country and is characterized by the following particularities: (i) the microclimate changes in short time intervals; (ii) the hydrological regime is unpredictable; (iii) the accessibility is hindered bay many little rivers; (iv) the floods produce heavy loses to the plantations.

Starting with the '60ies and until 1989, in the Danube Meadow and Delta regions, there were realized several land improvement works to many natural poplars and willows open woods,

levees and levees covered by palustrian vegetation; swamps and lakes were improved by damming in, draining and levelling; the new areas became silvicultural or agricultural lands.

Table 1. Situation of beating-up works and rehabilitation of damaged plantations

Specification / year	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Current beating up works (ha)	5729	5211	6833	6486	5813	5868	4545	7022	6881	5177
Rehabilitation of plantations (ha)	1799	1344	2006	1589	544	112	1026	2217	1808	1047
Total (ha)	7528	6555	8838	8075	6357	6990	5621	9239	8689	6224

Table 2. Distribution of poplars and willows in natural or cultivated stands

Stand composition	**Natural stands**		**Cultivated stands**		**Total**	
	ha	%	ha	%	ha	%
Poplars stands	24.317	51,0	55.251	71,3	79.568	63,6
Willow stands	15.249	32,0	20.371	26,3	65.620	28,5
Mixed poplars and willow stands	8.074	16,9	1.823	2,4	9.897	7,9
Total	47.640	100	77.445	100	125.085	100

After the damming in, the Danube floodable land considerably decreased, especially in the meadow zone, but in the same time the interest for the Danube like ecosystems amplified from the economical point of view and especially from ecological point of view. Furthermore, taking into account he perspective when the available water becomes more and more limited, the sustainable management of all ecosystems, including the forest ones located in zones transited by many water flows (especially in the fluvial zones, including the Danube zone) will be a more and more important issue, offering new valences to the forest tree species.

After the damming in of the Danube, we can note the following distribution of different land categories: (i) the dam-margin zone; holms and the Small Brăila Pond (over 14 000 ha): (iii) impounded zones (over 10 000 ha, 7764 ha with silvicultural purpose).

The afforestation of these areas involves many difficulties like: (i) significant modification of site conditions and deterioration of the soil's humidity and trophicity; (ii) the bad condition of dams: the crest of wave was weatherworn and it even ceased to the water pressure in 2006 and 2010; (iii) poor development of the infrastructure the roadways being represented by the boundary dams and interior earth roads; (iv) the abusive pasturing of no owner animals which shelter in the silvicultural buildings; (v) the sustainable management manner or rehabilitation of natural habitats.

The modification of ownership heavily influenced the forest general condition but especially the stands' regeneration manner. During the forests' restitution process we may acknowledge that the regeneration process went on normally only within the state owned forests. The state owned forest surface decreased from 6. 341 million hectares in 1990 to 3.339 million hectares at the and of 2010, when 52.2% of the national forested was state owned forest, 19 % was natural persons owned forests, 11.5% legal persons owned forests, 2.2% forest owned by religious entities (churches, monasteries etc.), and 15.1% forests owned by town halls. In 1991 the forest regeneration was realized on a total surface of 23097 ha, 15 560 of those through afforestation, while in 2009 regeneration works were realized on a total surface of 22853 ha (10962 ha through afforestation).

In 1991 the afforestation works were realized completely in the state owned forests. In 2009, 77.2% of the total amount of the afforestation

works was realized in state owned forests, although the state owned forests represent only 53% of the total national forested area.

The increase of the national forested area through afforestation of 25551 degraded lands (the majority of planted lands are located in Oltenia and Dobrogea, according to (*** Law Nb. 46/2008 – Forest Code [22] and National strategy for Romanian sustainable development [21]) during 1990-2010 period varied according to the possibility of transfer of this type of land from the National State Domain Agency to RNP-ROMSILVA.

Lately, outside the national forested area, an afforestation campaign is in place, contributing this way to the increase of forested area by planting of trees on the lands unable to be used for agricultural purpose.

The creation of shelter-belt action doesn't occupy the necessary status, due to the difficulties generated by the convincing the land owners to agree to with the plantation of some their lands.

Related to the afforestation realized within the state owned forests, it may be noted that they were made in accordance with technical guidelines using the best genetically improved forest reproductive materials adapted species in different site conditions. The most suitable work technology and regeneration composition were used when special site conditions were encountered.

The future of stands' regeneration through afforestation

Concerning the insurance of forest reproductive materials, it may be mentioned that during 2001-2012 the seed stands' surface decreased from 58098 hectares to 46697 hectares and the seed orchard's surface also decreased from 828 hectares to 619 hectares.

Table 3. Dinamics of seed stands and seed orchards surfaces (ha)

Year	**Conifers**		**Broadleaves**		**TOTAL**	
	Seed stands	Seed orchards	Seed stands	Seed orchards	Seed stands	Seed orchards
1979	34 374		30915		65289	
1986	32891	576	37669	428	70561	1004
2001	25303	528	32795	300	58098 (44548*)	828
2011	17813		28884		46697	619

*) Initial surface was reduced by Ministerial Order Nb. 481/2002

If we analyze the evolution of seed stands and seed orchards surfaces we may notice that, during the last 30 years, it has decreased. In 2009-2010 National Forest Administration – ROMSILVA financed a project [15] meant to revise and update the National Catalogue [25] (approved by Ministerial Order Nb. 269/2001 [26]) and elaboration of the National Catalogue of Basic Materials, in accordance to national (***O.U.G. nr. 11/2004 [24], replaced by the Law 107/2011 [18]) and international regulations (***EU Directive 1999/105 [27]). The basic materials sources proposed within the National Catalogue of Basic Materials (which will finalize in 2012) are sufficient in order to cover the forest reproductive materials needs, for all important forest tree species.

In order to ensure necessary for the more increasing demand for scattered and noble hard wood species (Wild cherry, Ash, Sycamore maple, Black alder, Chestnut, Beam tree, Black walnut) there were established 167 seed stands on a total surface of 788 ha.

A novelty approach of the new National Catalogue is the introduction of 63 seed stands and 2 seed orchards included in the "Tested" category. These basic materials sources were approved by the national authority responsible for silvicultural matters taking into account the results of researches made by ICAS [14].

There were also proposed [15] source units for stands adaptation capacity to extreme site conditions, on species and regions of provenances [16], as it follows:

- superior altitude Norway spruce stands (ecological sector 1B), 8 seed stands totalizing 124 ha;
- high altitude beech stands (ecological sector 3A), 7 seed stands – 136 ha;
- thermophilic oak stands on sandy soils (ecological sector 6D), 5 seed stands -46 ha;
- mixed Turkey –Hungarian oak and pure Hungarian oak stands on soils with pseudogleyzation (sector 7A), 5 seed stands -76 ha;
- small forests in steppe region (sector 8A), composed with species like: Turkey oak, wild cherry, flowering ash, black pine, black locust, greyish oak, silver lime, 12 seed stands – 16 ha;
- greyish oak stands on sandy soils (sector 8B), 2 seed stands – 16ha;
- pedunculate oak stands on swampy soils (sector 9B), 9 seed stands totalizing 217 ha.

The National Catalogue of Basic Materials will include the nursery stool beds for obtaining forest reproductive material for the "Qualified" category for poplar selected clones and hybrids (31.55 ha) and for willows (10.89 ha) [7].

Considering the future of stands' regeneration through afforestation, we may admit that if the mean annual temperature modifies by approximately 1^{o}C very probable there will be a translation of the Romanian vegetation zones meaning a slight transition from steppe to semi desert conditions, from forest steppe to steppe conditions, form plain forest to forest steppe. There will be registered also an increase of the altitude of the vegetation layers: the sessile oak stands will move up to the beech stands layer, the beech stands layer will move up to the one of mixed beech and conifers stands, these will reach the Norway spruce stands level and finally the Norway spruce stands will go up to alpine zone, resulting in an increase of the superior altitudinal limit of forests [1], [3], [4], [12], [13].

As a result of the climatic changes, the most affected forests will be those which already have a reduced resistance to biotic and abiotic factors, mainly located in the plain region: the stands including pubescent oak, greyish oak, Hungarian oak, Turkey oak, pedunculate oak, black locust stands located in unfavourable conditions etc [11]. Less affected by the climatic changes will be the mixed stands including a rich spectre of species.

The species selected for afforestation must take into account the establishment of the forest compositions best suited to the actual climate conditions; the introduction of exotic species should be done only after convincing research studies.

It is necessary to rehabilitate the degraded forests and to promote the species more resistant to drier and drier conditions from forest steppe and plain forests, and, as well the broadening of the Norway spruce in the subalpine region, of the stone and mountain pines in the inferior alpine zone (Giurgiu, 2010).

In order to ensure the forests' stability it is necessary to avoid the mono species plantations and to promote the diversified regeneration compositions taking into account the conservation of genetic biodiversity.

In the plain region should be found an alternative to the black locust pure plantations by promoting other species like elms, flowering ash, xerophyte oaks, European nettle tree, European wild pear, beam tree.

Within the forest steppe and plain forest regions, the oaks will remain the main forest tree species but their proportion in the regeneration composition should not exceed 60% in order to include also secondary species.

In the hilly region, the mezo xerophyle species should be promoted as well as the pedunculate oak, according to the site conditions.

On medium and high altitude hills it is necessary to promote the three sessile oak subspecies: petrarea, policarpa and dalechampi, the first one in the cooler region of Moldavia, and the other two in the southern part of the country concurrently with introducing of the secondary species, keeping in mind that in some parts the existence of common hornbeam and limes is essential for ensuring the stands' stability.

Within the sessile oak subregion, especially on compact soils, as it is naturally distributed in Pătrăuţi region, the pedunculate oak should be introduced.

The beech stands will continue to be de main resistance belt of the Romanian forests; however where the natural regeneration must be helped, the silver fir should be reintroduced if from certain reasons it disappeared in regions where the site condition are favorable for it.
Within the beech stands mixed with conifers vegetation layer, the Norway spruce pure stands should be replaced in the future with mixed Norway spruce, beech and silver fir forests. In the Norway spruce stands vegetation sub zone in order to increase the stands' stability and to diminish the proportion of negative phenomenon (wind blows, snow brakes, insects' attacks etc) there should be reintroduced species like beech and silver fir and to promote the European mountain ash where the site conditions are suitable for its development. In order to fortify the stands from this region, it should be used forest reproductive materials from seed sources selected for their capacity to adapt to extreme site conditions.
In the future time the alpine zone will probably be the main zone of expansion and retaking of very important forest lands. Here we will find, the stone pine, the European larch, Norway spruce, mountain ash, green alder, mountain pine etc.
In the region of overflowed meadows, especially in the Danube Delta, in the conditions of a steppe or forest steppe climate, dry or semidry, the most labile but in the same time most productive ecosystems are established. The total surface covered by poplars and willows totalizes 125 085 ha representing 2% of the total national forested area. In order to realize a management that ensures a higher stands' stability, the hydrological (the duration and frequency of the floods and the underground water) and soil (soil texture and humus content) conditions must be taken into account.
In these areas there must be realized the rehabilitation and preservation of the natural habitats, to ensure the ecosystems' stability, but in the same time to obtain high value wood. It must be ensured the conservation of the forest genetic resources established for autochthonous species especially those of black and white poplars, white and crack willows. The ecological reconstruction of these areas should be made by replacing the poplar clonal plantations planted in improper conditions with plantations of indigenous poplars and some hardwood species (oak, ash and elm) compatible with the site conditions. The plantations with hybrid poplars and selected willows must be promoted only in very good site conditions in order to obtain vigorous stands. For accomplishing this objective the nursery stool beds network has been remade using all the clones attested for use in plantations. In order to prevent the losses from the young hybrid poplars plantations and to avoid the drying of the mature stands as a result of climate change and descending of the underground water, a new planting technology using large sizes poplar big slips.
In the regions where water flows produce shore fall, the regeneration works will have to consider the creation of a continuous forest belt composed by autochthonous species, with a multistage structure which to ensure the shores protection. For satisfying the increasing demand of wood in the plain region, an alternative that must be considered is the development of agro-forest plantations meaning the plantations of forest tree species in and agricultural lands, among the agricultural cultures. The best known combination between agricultural – forest plantation is that of the forest shelter belts, one of the best solutions for a sustainable management of de agricultural lands. A mandatory condition is to update de technical guidelines for a more intensive establishment and management of plantations in order to obtain more stable and better quality stands.

CONCLUSIONS

The current status of the stands' regeneration through afforestation was largely influenced by climatic, pedo – hydrological and antropic factors, leading to a percentage of 18-25% of damaged plantations.
As a result of the forests' restitution process, the afforestations' quantum decreased due to the fact that they were mainly realized in the state owned forest (more than 90%).
For the future afforestations, taking into account the climatic changes, the National

Catalogue of Basic Materials has been revised and updated in order to ensure forest reproductive materials genetically improved and adapted to various site conditions.
There were realized guidelines for afforestation works on vegetation zones.

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RESEARCH ON DROUGHT TOLERANCE OF PIONEER AND FUNDULEA INSTITUTE TOP COMERCIAL CORN HYBRIDS TESTED IN DIFFERENT PEDO-CLIMATIC ZONES OF THE SOUTH EASTERN OF ROMANIA

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Abstract

The experiment was conducted over three years: 2009, 2010 and 2011, in five locations: Fundulea, Calaraşi county; Valu lui Traian, Constanta county; Sarichioi, Tulcea county; Cazasu, Brăila county and Caracal, Olt county. These locations were selected as being representative for corn cropping area from South Romania. Eight corn hybrids (F475M, Olt, Paltin, F376 from Fundulea Institute and PR35F38, PR37Y12 , PR36V74, PR37F73 from Pioneer) were tested using two levels of water regime: irrigated with 800 ^{3}/ha and non-irrigated. The study showed that the 2009 was less favorable for corn crop in all testing areas, comparing with 2010 and 2011 which were favorable for corn crop. In the case of non-irrigated corn trials the yield was influenced by the climatic conditions of the year, while in the case of irrigated corn trials, the yield was much higher and stable. The hybrid PR36V74 had the highest yield in all irrigated and non irrigated testing locations. Average yield of the hybrids over three years varied between 93.8 q/ha (F475M) and 130,3 q/ha (PR36V74) in non-irrigated conditions, while in irrigated conditions average yield increased significantly by applying of 800 m^3/ha varying between 101.2 q/ha (F475M) and 155,9 q/ha (PR36V74).

Keywords: corn yield, cropping areas, drought tolerance, irrigation, Zea mays L.

INTRODUCTION

Corn plant is the most surprising system present in nature for energy accumulation. From a kernel weighting about one third of a gram, a plant tall of two-three meters emerges and develops in approximate nine weeks, and after about eight following weeks this plant will produce 600-1000 kernels [2].
Corn (*Zea mays* L.) an outstanding generous species, by its yielding potential, large diversity of utilization as food and feed, and raw material for industrial processes, grown worldwide on large areas, as well as in Romania, occupies a primary place in creation and development of a modern and performing agriculture market and consumer requirements lead corn breeding research towards more and more performing hybrids in terms of yielding capacity [5]. Till 2020, 20% from the total of the fuel used in European Union should be biofuel and the most important source from an economical point of view to achieve this objective is represented by corn crop. Thus, increasing of corn cropping area is stimulated [4].
Research on water consumption in connection with corn irrigation represents also a major objective aimed to increase the contribution of corn to vegetal material supplying.
At global level the drought and the desertification affects about 47% of the dry land, with varying degrees of the aridity.
In the past 15 years there is a tendency to expand the areas affected by drought in most

parts of the country and a reduction in irrigation water resources.

Given that our country became a member of the European Union and in the current market economy, the worldwide financial crisis is crossed by broad, obtaining high yields and stable economic efficiency and environmental protection is an urgent necessity.

Corn occupies third place among the world's crop, totaling, according to statistics from 2005, area 147.0 million ha, with 3587 kg / ha The largest areas are in U.S. corn 30.8 million hectares, as following China (25.2 million hectares), Brazil (11.4 million ha), Mexico (8.0 million hectares), India (7.4 million ha). Obtain high yields Italy (10063 kg / ha), USA (9315 kg / ha), France (8095 kg / ha) [1].

Our country has significant weight between corn-growing countries. In 2001, 3.1 million hectares cultivated, resulting in a lower average yield of only 2419 kg / ha and in 2005 we have grown mil.ha 2662, with an average of 3743 kg / ha.

The objective of this study is to characterize eight top commercial hybrids grown in Romania in terms of yielding capacity parameters in connection with their water stress tolerance.

For South East Romania, an average irrigation rate of 800-1500 m^3/ha is recommended. If irrigation is not applied in the period of maximum water consumption of the corn plants, water deficit will affect significantly the grain yield [3].

MATERIAL AND METHOD

Research was performed in five locations in a factorial field trial, designed as split-split-plot with the following factor graduations:

Factor A – water stress level: a1-non irrigated (drought tolerance), a2-irrigated with a pedological rate of 800 m^3/ha of water, using small sprinklers;

Factor B – hybrid: b_1 F475M, b_2 Olt, b_3 Paltin and b_4 F376 from Fundulea institute, the main local corn breeding company and b_5 PR35F38, b_6 PR37Y12, b_7 PR36V74 and b_8 PR37F73 from Pioneer;

Factor C – pedoclimatic area: c_1 Valu lui Traian, Constanţa county, c_2 Sarichioi, Tulcea county, c_3 Cazasu, Brăila county, c_4 Fundulea, Călăraşi county and c_5 Caracal, Olt county, between 2009-2011.

The experiment was three times replicated in both irrigated and non irrigated conditions. Soils from all locations where the trials were performed are typical for corn cropping area from Romania.

In all three years, in graduation a2, an irrigation of 800 m^3/ha was applied. In 2009 due to abundant rainfall no significant differences were registered between irrigated and non-irrigated.

Grain weight was measured in each experiment plot and yield at 14% grain moisture was computed. ANOVA applied to a three factorial split-split-plot was used to process and interpret yield data.

RESULTS AND DISCUSSIONS

It is well know, that corn is affected by drought at anthesis-silking interval – beginning with the second part of July till towards the end of August. Additional irrigation water supplying in this period contributes to corn grain yield increasing.

Data from this study (ANOVA, not presented) showed that water stress levels represented by irrigated and non-irrigated testing conditions and genotypes represented by corn hybrids, as well as all possible interactions between the two factors and between experimental factors and environmental condition represented by years and locations produced significant variations of the grain yield. Specific hybrid reactions to water stress levels were noticed.

The influence of the location on corn grain yield (averaged over years, water stress levels and hybrids), Fig.1, shows that the high yielding potential of the corn cropping from South-East of Romania, enhanced by irrigation, could satisfy the current increasing requests for agriculture products.

Thus, the influence of the irrigation regime on corn grain yield is presented in Fig.2 Application of irrigation resulted in a significant average yield increasing of 16.2 q/ha versus non irrigated conditions.

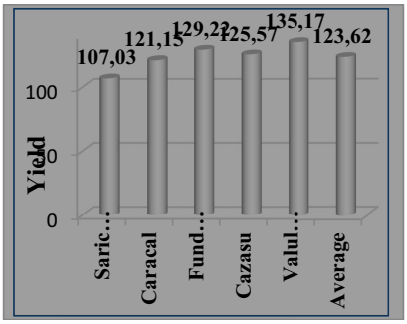

Fig.1 Influence of the location on the corn yield, averaged over 8 hybrids and 3 years

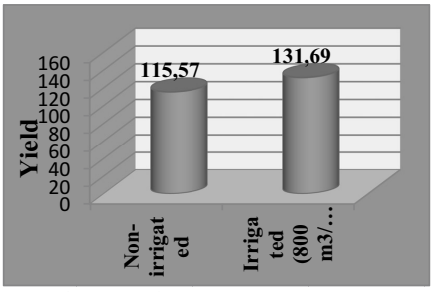

Fig 2. Influence of the irrigation regime on corn grain yield averaged over 8 hybrids, 5 locations and 3 years

Average grain yield of the tested hybrids varied between 107.7 q/ha (F475M) and 124.5 q/ha (PR36V74) in non irrigation conditions (Table 1).

Table 1. Influence of the hybrid on the yield in non-irrigated conditions, 2009-2011

Hybrid	Yield q/ha, Non-irrigated	Difference	Signification
(b)	(a1)		
b1 – F475M	107.0	-8.4	0
b2 - Olt	119.0	3.5	-
b3 - Paltin	117.4	1.8	-
b4 –F376	107.5	-7.9	0
b5 – PR35F38	119.1	3.5	-
b6 – PR37Y12	110.6	-4.9	-
b7 – PR36V74	124.5	8.9	**
b8 – PR37F73	119.1	3.5	-
Average (control)	115.5		-

DL 5% = 5.28 q/ha DL 1% = 6.97 q/ha DL 0,1% = 9.02 q/ha

The best performing hybrids in non-irrigated conditions were Olt, PR35F38 and PR37F73 and particularly PR36V74 which significantly over passed the control represented by the hybrids mean (124.5 q/ha PR36V74 versus 115.5 q/ha hybrid mean).

Significant lower yield versus hybrid mean in non irrigation conditions were registered at F376 and F475M from Fundulea. PR37Y12 had also a lower grain yield but mostly due to its remarkable earliness. In irrigation conditions (Table 2) grain yield of the tested hybrids, averaged of over locations and years, varied between 119.7 q/ha (F376) and 145.2 q/ha (PR36V74). Similarly to non irrigated conditions, F376 and F475M had the lowest performances.

Table 2. Influence of the hybrid on the yield in irrigated conditions, 2009-2011

Hybrid	Yield q/ha, Irrigated	Difference	Signification
(b)	(a_2)		
b_1 – F475M	121.1	10.5	0
b_2 - Olt	137.7	6.9	*
b_3 - Paltin	130.3	-1.3	-
b_4 –F376	119.7	-11.9	0
b_5 – PR35F38	135.3	3.6	-
b_6 – PR37Y12	128.2	-3.4	-
b_7 – PR36V74	145.2	13.6	***
b_8 – PR37F73	135.8	4.1	-
Average (control)	131.6	Mt	-

DL 5% = 5.28 q/ha DL 1% = 6.90 q/ha DL 0,1% = 9.02 q/ha

Irrigation produced a general significant grain yield increasing of 16.1 q/ha (average over hybrids); Olt had the best performance from local hybrids and PR36V74 gave the highest yield increasing in irrigated conditions versus non irrigated conditions (20.7 q/ha) (Table 3).

Table 3. Yield in irrigation and non-irrigation, conditions, average over years and locations

Hybrid	Yield q/ha, Irrigated	Yield q/ha, Non-irrigated	Difference	Signif.
(b)	(a2)	(a1)	(q/ha)	Dif.a2-a1
b1 – F475M	121.1	107.0	14.0	***
b2 - Olt	137.7	119.0	18.6	***
b3 - Paltin	130.3	117.4	12.8	***
b4 –F376	119.7	107.5	12.1	***
b5 – PR35F38	135.3	119.1	16.2	***
b6 – PR37Y12	128.2	110.6	17.6	***
b7 – PR36V74	145.2	124.5	20.7	***
b8 – PR37F73	135.8	119.1	16.7	***
Average (control)	131.6	115.5	16.1	***

DL 5% = 5.28 q/ha DL 1% = 6.97 q/ha DL 0,1% = 9.02 q/ha

Hybrid mean grain yield averaged over environmental factors (year and location) and water stress levels (Table 4) outline several superior products for cropping area from South-East of Romania such as Olt from local hybrids

and PR35F38, PR37F73 and PR36V74 from Pioneer.

Table 4. Influence of the hybrid on corn grain yield , 2009-2011 average

Hybrid	Yield		Difference q/ha	Semnif.
(b)	q/ha	%		
b_1 – F475M	114.0	100	-	-
b_2 - Olt	128.4	112.5	14.3	***
b_3 - Paltin	123.8	108.5	9.7	***
b_4 –F376	113.6	99.6	-0.4	-
b_5 – PR35F38	127.2	111.5	13.1	***
b_6 – PR37Y12	119.4	104.6	5.3	**
b_7 – PR36V74	134.9	118.2	20.8	***
b_8 – PR37F73	127.4	111.7	13.3	***

Dl 5%=3.37 q/ha Dl 1%=4.45q/ha Dl 0,1%=5.73q/ha

CONCLUSIONS

Results of this study underline that irrigation is one of determinant factor of the expression of the high yielding ability of both local and Pioneer hybrids. In non-irrigated conditions, the local hybrid Olt and the Pioneer hybrid PR35F38 and PR37F73 and particularly PR36V74 had a better performance.

For specific conditions of the corn cropping area from Romania, obtaining of high and stable yield requires irrigation, particularly in the South of the country as one of the most important factors of corn cropping technology.

In irrigated conditions, both local and Pioneer hybrids could express better yield with Olt and PR36V74 performing outstanding in such favorable conditions. Although, moderate to no stress occurred in the experimental years 2009-2011, the consistent yield differences obtained for all local and Pioneer hybrids in irrigation conditions versus non-irrigated proved the superiority of irrigated technology for reaching the outstanding yielding potential of modern corn hybrids.

The regime of water applied in addition, in the limits of possibility to each farmer, it brings usually a very significant increase in the production capacity of any used maize cultivar, of course translated into a bigger profit to the unit of area.

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NEW CONCEPT AND SOLUTIONS FOR POST-SEISMIC ASSESSMENT AND STRENGTHENING OF BUILDINGS

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Abstract

Due to the time evolution of the design provisions, there are buildings that were designed decades ago, using less stringent provisions. Thus, when the earthquake is produced, there are many cases where the buildings are badly damaged. Structural engineering is closely related to parameters such as acceleration, velocity, displacements, and spectral composition, therefore, with the widespread use of strong motions apparatus, in the '70s they started seismic instrumentation with help of seismic stations located in the buildings, dams and bridges. According to the modern approach of the post-seismic investigation the damage building assessment should be clearly foreseen and properly planned in order to obtain dynamic parameters for the analysis. The objectives of the paper are to present both a new concept for building performances assessment and a modern solution for building strengthening. All the aforementioned ideas are illustrated through a study case. The dynamic parameter evolution of 3D model of reinforced concrete at natural scale it will be analysed. In case of masonry panels inserted in reinforced concrete frames a modern and efficient solution is panel strengthened with Carbon Fibers as fabrics and plates. Therefore, the researches on the strengthening solution effectiveness of masonry walls are presented. Experiments on a large scale of modular elements of masonry buildings, tested and strengthened with CF were carried out in Research and Testing Laboratory on Materials, Components and Structures for Buildings - INCERC at universal press 4MN, submitted them to compression on diagonal direction. The results were demonstrated that the application of CF on the masonry panels is efficient, but to optimize costs it is necessary to review the size and disposal of plates used.

Keywords: *seismic action, structural analysis, dynamic parameters, strengthening works, Carbon Fibers*

INTRODUCTION

To analyze the behavior of buildings, after each strong earthquake, authorities, owners and professionals take as a reference the intensity of the seismic movement on that site. Structural engineering is closely related to parameters such as acceleration, velocity, movement, and spectral composition; therefore, with the widespread use of strong motion resistant seismographs, the seismic instrumentation has been started, by installing stations in constructions, dams, bridges etc.
In the U.S., the provisions of the most well-known construction regulatory - Uniform Building Code, recommends for seismic zones 3 and 4 the installing of accelerographs in the new tall buildings with more than six stories high and a total area of at least 5574 m2. In general, it is required to install at least 3 devices: at the base, in the middle and at last level of the building, devices interconnected to trigger simultaneous and with common sampling and time base. In buildings with more than 10 levels, without taking into account the area of construction, the seismic instrumentation is mandatory and there must be provided at least three triaxial accelerographs.
The seismic information system for emergency response CUBE (initiated in 1990 by Caltech and USGS Pasadena), transmits data within minutes with the magnitude and epicenter of an

earthquake to the civil defense agencies, authorities, private companies, and the Automated Monitoring Of Earthquake Strong-motion (AMOES) provides rapid measurements of the acceleration of strong seismic movements through INTERNET.

In Japan, the seismic networks have been developed and equipped with a large number of devices by using funds of the Ministry of Construction, through care of the research institutes in the construction sites for large ports, bridges, tunnels and buildings.

After the Kobe earthquake in 1995, a new strong-motion earthquake recording network K-NET (Kyoshin) was implemented, based on 1000 new specially-designed seismic stations, with INTERNET communication capability; the K-NET 95 seismographs, installed on the open ground, at an average distance of 25 km can record any earthquake of magnitude 7 in Japan.

Development of seismic networks in Europe has been slower, but now several thousand instruments have been installed.

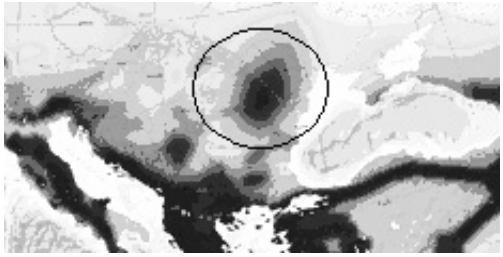


Fig. 1. Seismic map of Europe highlighting the Vrancea area

In Italy, one of the priority projects of the National Seismic Service is On-Building Seismic Observation System, which aims both at building an instrumental network of measuring and recording the seismic response for a significant number of buildings sample and the creation and updating of numerical models for them, using advanced techniques.

In Turkey, besides the recording network of strong-motion earthquakes, which includes over 100 devices, the monitoring system for structural resistance and immediate alarm in case of an earthquake for bridges of greater openness has been developed. Such a system is installed on the new suspension bridge over the Bosphorus.

In Romania, the seismic design code, index P100-1/2006, states in Annex A, the following regarding the future seismic instrumentation for buildings in Romania:

- In seismic areas where the design acceleration value a_g, with IMR (average recurrence) ≥100 years is $a_g \geq 0.24$ g, buildings with a height of more than 50 m or more than 16 stories high or with a surface area of over 7500m^2, will be instrumented with a digital acquisition system and minimum 4 (four) triaxial acceleration sensors.
- This minimal instrumentation will be located as follows: 1 senzor in the open field, near the construction, 1 sensor in the basement and 2 sensors on the top floor. Instruments will be placed so that access to equipment could be possible at any time.
- Instrumentation, maintenance and operation is funded by the building owner and undertaken by approved organizations.
- Records obtained during strong earthquakes must be made available to the competent authorities and specialized institutions in 24 hours from the earthquake occurence.

The cost of seismic data acquisition system is low compared to the total value of a multi-story building, with finishes, furnishings, modern facilities and equipment, or to that of an industrial investment, which would otherwise be decommissioned pending the traditional expertise.

Proper understanding by the designer of the importance and influence of different factors on the structural dynamic response and their correlation with the beneficiary's objectives of interest, leads to a choice and to a suitable distribution of the seismic monitoring systems components in the building.

Overall, the measurement of the own vibration period may reveal a number of structural damage, endured by the structure until the moment of measurement; measuring this size, before and after the earthquake, is a comprehensive method for assessing changes in the rigidity of a construction due to seismic stress, noting that rigidity such highlighted corresponds to low levels of stress.

MATERIAL AND METHOD

Modern concept of post-seismic structures investigation

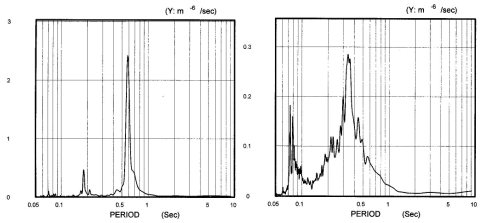
The experimental model presented in the case study was conducted in 1990-1991 in the seismic Hall of INCERC Bucharest, in view of full-scale tests.
The construction is based on a modular square grid 3.90 x 3.90 m and a floor height of 2.75 m, consisting of two openings and two bays, which comprises a single structural wall.
At the intersection of axes, constant cross-section poles are placed, 500 x 500 mm, covering the entire height of the building. Pillars are prefabricated for two-story height, with a non-concrete portion in the middle of 350 mm, which includes reinforcement of strips of plate. Full-scale tests were conducted as follows [1]:
- The first step of testing the experimental system was to load the tare weight and more concrete weights.
- In 1995 took place the first test with lateral loading forces, using presses, while in 1996 post-elastic horizontal loads were applied, in 8 cycles (incremental loads).
- In 1997 the experimental model testing was resumed, aiming at the evaluation of the behavior to breaking stress.
To simulate the behavior of a future earthquake damaged building, the following steps were followed:
- Determination of the own vibration periods by microseism measurements and their processing;
- Modeling a spatial structure identical to that found in seismic Hall; noting that the model was created with five levels unlike the existing one that had four levels (being tested at the top--floor - terrace to simulate the loading of an extra floor).
- The time-history analysis to determine the structure response spectrum using accelerograms recorded in the earthquakes in from the '77, '86 and '90.
Following the above steps, microseism measurements were made on the experimental model, following two sensor placement schemes presented in Fig. 2. Measurements were made both by applying shocks in the center of the 2nd floor and the microseism movement from the site.
Microseism measurement results obtained in the case of the full-scale experimental model, with GF+3 floors are presented in Table 1. These values of own periods of vibration are determined from the Fourier spectrums. Processing the records made at this stage of cracking of the model are presented in Fig. 4 [4].

Fig. 2. *Full-scale experimental model*

Fig. 3. *GEODAS 12-USB, 12-channel seismic station, Buttan Service, Japonia*

Table 1. *Dynamic characteristics of the experimental model in the present state of cracking*

Equipment / Program used	**T (s) dir. x**	**T (s) dir. y**
GEODAS 12-USB, Buttan Service, Japonia /Microwave tremor observation	0.60	0.32



a) x direction b) y direction

Fig. 4. The *response spectrums obtained by processing the microseism records*

For structural calculation, the following material characteristics were used:

- Concrete features: elastic modulus E=22.500 MPa, the weight per voume unit ρ_W=23 kN/m^3.
- Steel features: elasticity modulus E=199.900 MPa, the weight per voume unit ρ_W=77 kN/m^3.

T_1=0,64s z-x plane | T_2=0,49s x-y plane | T_3=0,34s y-z plane

Fig. 5. *Own modes of vibration. System dynamic characteristics*

Note: reinforced concrete diaphragm is arranged by the structural model y direction.

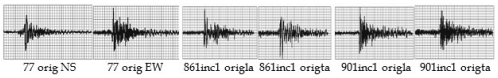


Fig. 6. *Accelerograms used in the time-history analysis*

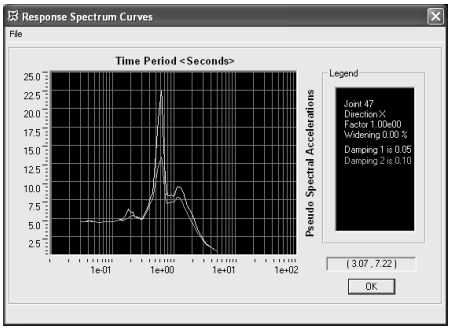


Fig. 7. *The response spectrum obtained at the top level of the structure for the accelerogram recorded on the N-S direction in the '77 earthquake, applied to x direction*

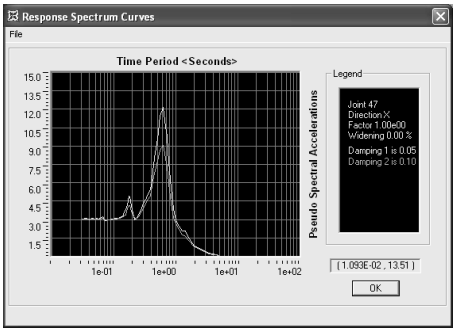


Fig. 8. *The response spectrum obtained at the top level of the structure for the accelerogram recorded on the longitudinal direction in the '86 earthquake, applied to x direction*

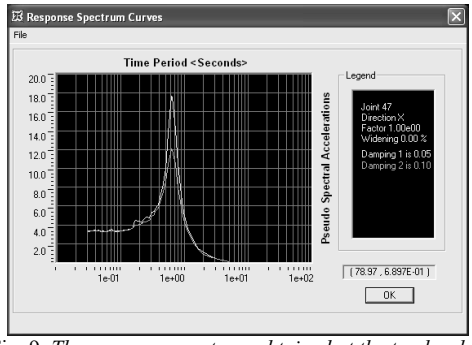


Fig. 9. *The response spectrum obtained at the top level of the structure for the accelerogram recorded on the longitudinal direction in the '90 earthquake, applied to x direction*

The linear modal time-history analysis provides the results as graphs and comprise, for the structural system studied, the movement and acceleration variations versus time, in a node at the top level and at the level 1.

RESULTS AND DISCUSSIONS

Regarding the movements, the results are shown in Fig. 10 and Fig. 11.

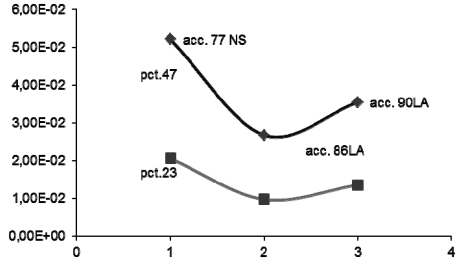


Fig. 10. *Maximum values of movements in the x direction, corresponding to nodes 47 and 23 at different earthquakes ('77, '86 and '90)*

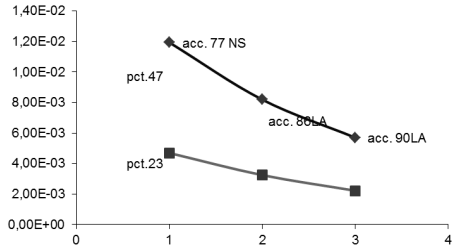


Fig. 11. *Maximum values of movements in the y direction, corresponding to nodes 47 and 23 at different earthquakes ('77, '86 and '90)*

- In terms of accelerations, the results are shown in Fig. 12 and Fig. 13.

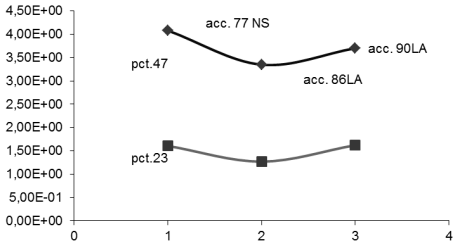


Fig. 12. *Maximum values of accelerations in the y direction, corresponding to nodes 47 and 23 at different earthquakes ('77, '86 and '90)*

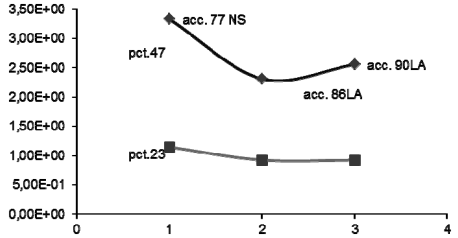


Fig. 13. *Maximum values of accelerations in the x direction, corresponding to nodes 47 and 23 at different earthquakes ('77, '86 and '90)*

Solutions to strengthen the masonry panels in reinforced concrete frames structures

To highlight the efficiency of carbon fiber reinforcement, the full-scale attempts made in the INCERC Bucharest laboratories are presented. The masonry panels presented are made of ceramic blocks with vertical hollows.

Strengthening with carbon fiber strips

The basic concept of the experiments was to use a standardized test - *the diagonal test* – on the same specimens of masonry in two situations: in the initial state, masonry made according to usual procedures and after applying a reinforcement with carbon fiber strips attached to specific adhesives [3].
The results indicated that the tested systems are effective, with the clarifications that it is also advisable to apply the strips on the diagonal of the panels in two directions close to the main efforts, so that the strips work on stretching. In this case, it would be reasonable to recalculate the size and arrangement of the strips used, for cost optimization.

Fig. 14. Making specimens, by applying the Carbodur S 1012 strips

Since parametric testing was done in one direction, in static stress, monotone increasing, while the real seismic application is dynamic in nature, it is necessary to extend the research, to highlight the differences in behavior. It is advisable to symmetrically apply the strips on both sides of the specimens, as consolidation on only one side can cause failure by bending in a direction normal to the sample plane, at forces below the original test. The application process can be done on masonry with superior resistance characteristics, thus ensuring the entry into work and working together between the two materials during the stress application, avoiding crushing masonry in the nodes areas. From this point of view, because in practical applications two diagonal strips are applied, at higher levels of alternating stress, it is possible that masonry work stop of the corners of the frame may occur successively, where the grip is redundant, the rest of the strip remaining as active zone, on the long direction, but with

some contribution of the strips from the other direction. These considerations should be taken into account in determining the actual size of the strips area of contact with the masonry, in relation to the computing area. If anchoring the strips to concrete slabs on the contour, some of these effects may be compensated, the strips may work efficiently throughout the whole stress application. Additional tests are needed to clarify the concrete behavior particularities and the strips adherence to concrete in the node zone.

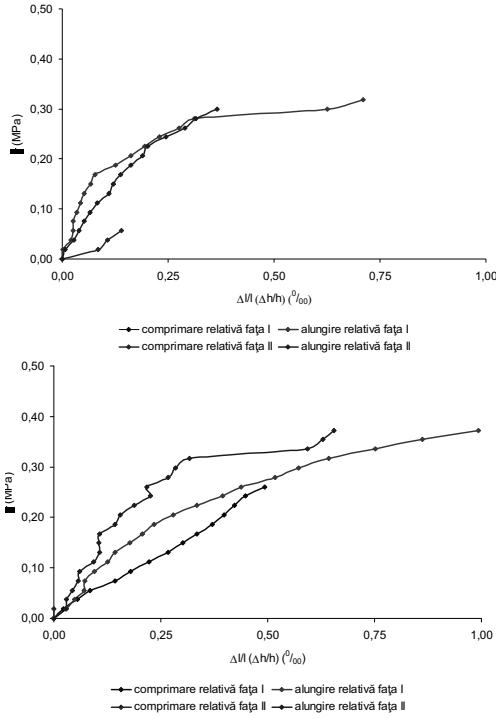


Fig. 15. *Relationship between effort - relative compression / relative elongation corresponding for two of the samples tested*

Strengthening masonry panels with carbon fiber fabric

The aim of the trials carried out at INCERC was to test for bending four models of masonry made of ceramic blocks, with the same plan dimensions 1.50 x 1.00 m, but with different thickness: 2 models with 30 cm thickness (M30) and 2 models with 38 cm thickness (M38) [2].
Attempts have been made at various stages, as follows:

- In the first stage two models of simple masonry (different thickness) were tested;
- In the second stage the other two models were tested, but this time they were consolidated on the side with fabric from reinforced carbon fiber. The test results of the two stages will be presented in comparison to highlight the effectiveness of consolidation.

The two models tested in the second stage were consolidated on the side with carbon fiber fabric from ISOMAT, MEGAWRAP type. To apply this fabric, a bicomponent Epoxy resin was used, from the same company, type EPOMAX-LD.

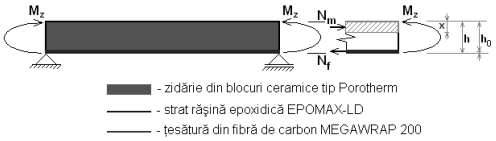


Fig. 16. Schema de calcul a secţiunilor dreptunghiulare la încovoiere

To highlight the need to strengthen with a larger or smaller number of carbon fiber fabric layers, the model with 30 cm thickness was coated with two layers of fabric overlapping on a width of 20 cm, while the model with 38 cm thickness was coated on the side with only one layer. In Fig. 16, a calculus scheme to determine the required reinforcement area at stretched fiber.

From the balance equations results that:

$$M_z = N_m h_m$$

$$\begin{cases} N_f = N_m \\ N_f = A_f f_f \\ N_m = bxf_m \end{cases} \Rightarrow x = \frac{A_f f_f}{bf_m}$$

where x is the height of the compressed zone (neutral axis position).

$$\begin{cases} M_z = N_m h_m \\ h_m = h_0 - \frac{x}{2} \end{cases} \Rightarrow M_z = bxf_m (h_0 - \frac{x}{2}) \Rightarrow M_z =$$

$$= bxf_m h_0 - b\frac{x^2}{2} f_m \Rightarrow M_z = A_f f_f h_0 - \frac{(A_f f_f)^2}{2bf_m} \Rightarrow$$

$$(A_f f_f)^2 - 2bf_m h_0 (A_f f_f) + 2bf_m M_z = 0$$

The acceptable solution of the second degree equation is:

$$A_f f_f = bh_0 f_m \left(1 - \sqrt{1 - \frac{2M_z}{bh_0^2 f_m}}\right) \Rightarrow$$

$$A_f = \frac{bh_0 f_m}{f_f}\left(1 - \sqrt{1 - \frac{2M_z}{bh_0^2 f_m}}\right)$$

where A_f = area of the carbon fiber fabric.

Fig. 17. *The M30 model after failure*

In Fig. 18 and Fig. 19, the force-arrow diagrams are shown in comparison, with the two versions of the M30 model: unconsolidated and consolidated.

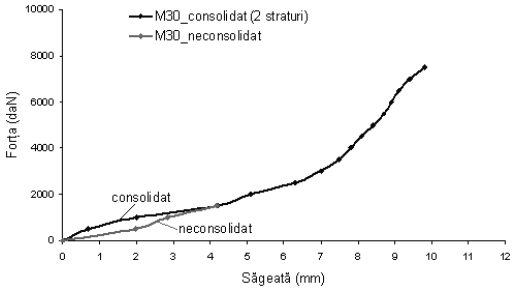


Fig. 18. *Force-arrow diagram for the M30 masonry model (30 cm thick)*

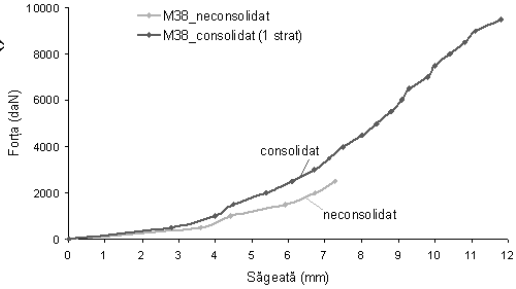


Fig. 19. *Force-arrow diagram for the M38 masonry model (38 cm thick)*

Comments

- Results demonstrate the efficiency obtained for the application of layers of carbon fiber fabric on the model stretched fiber.
- After the failures of the two modules, was found that the masonry failed, as expected, because it exceeded the compressive resistance on the compressed side.
- Under the conditions of these tests, the contribution to the rigidity conferred by the blocks size was greater than the contribution given by applying a double number of layers of carbon fiber fabric;
- Because the failure point doesn't appear in the zone of the stretched fiber, where for fabric is applied, but in the compressed side with simple masonry, a single layer of fabric is enough, because the advantage of an increased number of layers may not be exploited.

CONCLUSIONS

The concept of investigating the performance of a building proposes the validation of calculations with a program dedicated to structural analysis using instrumental data processing techniques.
Based on the results obtained on site with the GEODAS 12-USB seismic station, Buttan Service, Japan, a structural model with identical dynamic characteristics has been modeled and thus the behavior of the existing structure to strong earthquakes in Romania has been studied. We can say that in this way one can predict how certain structures that have experienced earthquakes in the last century will respond to future earthquakes.

In the case of the modern solutions to consolidate masonry panels, the results obtained in both cases of consolidation have revealed positive values for applying the solution. In addition, these consolidation solutions are differentiated from the traditional solutions through the reduced execution times.

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GREENING SURFACE IN ORDER OF SUSTAINABLE DEVELOPMENT AND ENVIRONMENTAL PROTECTION IN URBAN AREAS

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Abstract

In this paper will be covered the previous works on the preservation of the environment of city urban areas, which can mobilize resources of urban agriculture. The need for creating favorable environment for human life in the last decade become a key issue, ie. how to repair the problems of environmental pollution from the products of human activity, and how to change the an awareness of such a lifestyle. The reduction of green areas, with a disproportionate increase in the number transport vehicles and pollution from agriculture and other economic activities, inducing specific "urban" environment. Its characteristics condition the temperature rise of 2-6 degrees of cities, increased concentration of pollutants harmful to human health, as well as the disappearance of plant species typical for the locality. In order to increase the surface area covered with vegetation, and in accordance with horticultural principles, characteristics can be used for special purpose lawn. The lawn is an integral part of bio-gases, which fully reflects, by combining vegetables, flowers and ornamental trees. It is therefore important to know the possibilities for utilization of grass species, as well as respect for the calendar works entering the lawn and measure their recovery in order to get the desired results. In this way will be possible to integrate the point of production from the standpoint of environmental protection. With respect to the concept of urban and peri-urban agriculture, with food production in urban conditions, together with landscaping of public and private property there will be favorable conditions for sustainable development of rural and urban areas.

Key words: *environmental protection, sustainable development, Urban and Peri-urban agriculture*

INTRODUCTION

United Nations (UN) identified over 40 different forms of agricultural practice: from gardening (fruit and vegetable production), through aquaculture (fish farming); from small garden for a household to large garden that can be used for the production for sale (market), including raising of livestock species - from birds, rabbits and goats to the breeding of snails, silkworms and bees breeding. Food production in cities are dealing with almost 800 million people, which produced about 15 % of the total world food production. FAO defines urban agriculture as an economic activity based on production, processing and sale the food and fuel for needs of consumers which mostly living in urban areas. Production is carried out intensive methods of production in smaller areas, the use of land and water dispersed within or around the edges of cities, as well as reuse of organic waste. Urban agriculture involves works within the agro-forestry and horticulture. In the last decades the problem of the urban areas is in high concentrations of air pollutants and increased air temperature lead to reduction of green areas that represent the "*lungs of the city*." As the question arises how to solve the problem in future pollution, considering that the population in cities increased migration from rural areas.

Increased emissions of pollutants into the air, constantly increasing the temperature and noise, disturb the quality of life for residents in urban areas. Every company is faced with the problem of increased human activities, in pursuit of profit forgotten the basic principles of nature and resources, who on earth is limited. Products of agriculture, can be partly used in the cycle of reusing, but products of other economic branches deteriorate existing ecological condition of the environment. In addition to these activities are extremely important in providing food for the population

of the city, and its importance in the recycling of urban organic waste, local authorities often prohibit the production of food in the cities or to her treated as a necessary evil. With few exceptions, food production in cities until recently occurred without institutional help of agricultural experts and urban planners. More than one third of food in rich countries end up as trash (rest of the food, food with an expired shelf life, waste of food preparation). The majority of municipal waste is actually organic and his collection, removal and disposal of spent a significant portion of funds from the city budget. Decomposition of organic matter in landfills produces methane, the gas that affects global warming and climate change, and who as a gas with greenhouse effect thirty times more harmful than carbon dioxide.

MATHERIAL AND METHOD

The work will be included in the present knowledge about the environmental situation in the Republic of Serbia, as well as opportunities for further development, based on data representative of the state institutions in the field of public health and agriculture. Discussion is planned in a holistic approach to the collection of literature and analytical separation of the results obtained.

The most important role in implementing sustainable development strategies have local communities, through the institutionalization of the action plan called "Agenda 21". Agenda 21 is covered by 115 different and specific programs designed to facilitate or force on sustainable development. The plan included work on the burning issues of our time, but also aims to prepare humankind for the challenges in the future. It reflects a global consensus and political commitment at the highest level on development and environmental cooperation. Its successful implementation is first and foremost responsibility of government. National strategies, plans, policies and processes are crucial in achieving this. International cooperation should support and supplement such national efforts. In this context, the United Nations has a key role at the global level. Other international, regional and subregional organizations are also invited to contribute their engagement sustainability efforts. The broadest public participation and active involvement of NGOs and other groups should also be encouraged. As an integral part of Agenda 21 states and the concept of green economy, which is defined as one that transmitted a small amount of carbon, and the efficient use of natural resources and which is socially inclusive, with the widespread application of renewable energy sources, increasing the number of jobs and investment in so-called *green industries*.

The Republic of Serbia aims to promote policies and programs, economically viable and environmentally safe energy systems (particularly new and renewable energy systems), which will contribute to the development of energy efficiency and rational use of energy.

Therefore, application of the concept of urban agriculture through the use of institutional package of measures at the local level, will contribute to increasing awareness and improving the habits of the people, as a strategy for employing people, reducing crime and improving living conditions in cities, with special reference to rural areas.

If we decide to design the city in accordance with the concept of local food production, we will open additional opportunities for development. The formation of horizontal gardens will impact positively on the climate in the facility at which it is inserted, open the possibility for the accumulation and refinement of atmospheric precipitation can still be used for irrigation, as well as technical water for the facility, or even as drinking water.

One of the directions of the implementation of agricultural development activities in the field of harvested areas is the insistence on the aesthetic and decorative contents of the field, especially in the vicinity of important contemporary and historical. The greening areas in urban environments interfere with the concepts of landscape architecture, according to which the fon - lawn - the basis on which all others are sorted design elements of space (buildings, trees, shrubs, flowers, small art forms, plastic, etc..). Emphasizing the process of greening cities condition the increase in seed production, which will intensify the process of

agricultural production, which can be compatible and overlap with other industries. The greening of urban areas will cause a reduction in the presence of indicators of environmental pollution.

RESULTS AND DISCUSSIONS

The identity of an urban area can give greenery. Green infrastructure, just like any other are strategically planned. Green areas are multifunctional resource that improves the quality of life in the community and support its sustainability. The importance of urban green spaces in the process of preserving a healthy environment and human health is great. They in the form of parks the nature and forestsabsorb a large amount of carbon dioxide from the atmosphere, affecting a certain percentage of humidity and temperature (reduced temperature microclimate city to 2-6°C), preventing soil erosion, are important for biodiversity conservation, etc.. Green areas and protection can separate the residential from the industrial zone. World Health Organization (WHO) recommended level of greeneng cities from 50 m^2 of urban and 300 m^2 of suburban green space per citizen (Lješević, 2002.).

Grasslands for a special purpose, are from great importance for the visual-spatial integration of villages and districts. The importance of grasslands is manifested through the increase of space, clear visual perception of nature areas, physical separation and protection from environmental influences, prevent passing, etc.. We can not exclude the importance of protective-erodible, which is reflected in the protection against abrasive erosion (water): the high slopes and coastal forts, as well as protection from the wind (wind erosion) to easily movable land, on the landfill of industrial ash dumps, ore tailings ponds etc.

For the establishment of efficient and easier to maintain green lawns in public it is necessary to choose a good mixture of herbs for specific environmental conditions and grassland categories. In practice, today more attention is paid to this requirement, which was not the case. This is contributed to the grasslands difficult based, and short-lived.

Should be taken care about results of foreign authors, because can not be fully applicable to local conditions, because it can lead to reduced yields and loss in the aesthetic and decorative characteristics. They can be used for comparison with results obtained in a local practice in all areas in which the production of grass for landscaping can be applied.

Grasslands in the urban divide is considered decoration, the most memorable part of any garden, park, etc. It is therefore important to set out the facts supporting the important question of their use.

The division of turf of horticultural importance by way of use is as follows:

- Decorative
- Recreation
- Functional

Horticultural greenery according to the place and method of use combine urban, suburban and interurban greenery in the urban greenery, we find:

- Parks (central and no region),
- Block greenery (between the buildings and gardens),
- Greenery square and the street (along the road, in front of buildings, greenery along the river banks and channels, etc..)
- The greenery of the special characters (with public institutions, schools, industrial facilities, cemeteries, etc..)
- Green areas in the form arboretruma, botanical gardens and zoos,
- Gym facilities (playgrounds, school gyms, sports centers and general recreation areas, etc.).

Blades of grass, which are the basis of green cover and which are necessary for raising, have these basic characteristics:

- low growth habit,
- expressed višegodišnjost,
- the ability of education of a stable meadow,
- a good recovery,
- tolerance to frequent and low mowing,
- tolerance to trampling,
- ornamental value.

Is necessary to keep in mind that the grass cover is observed in the field and we want to rearrange it, because the lawn must be aligned with other species and the environment. *Lux-*

grassland are grasslands of the first type formed on the soils that are favorable morphological characteristics, with surface roughness and without a fully unified by color and floristic composition, free of weeds, stains, and a bunch of countries. In categorie of lux grassland are included fine, dwarf grass, regular leaf nervature. These are decorative lawns, beautiful looks, who can not tolerate trampling. Grass for fine lawns are composed mainly of species of Bent, Fescue and Meadow grass. These are the following types: - Creeping bentgrass (*Agrostis stolonifera, L.*), - Common Bent (*Agrostis tenuis, L.*), Velvet bent (*Agrostis canina, L*), and the type Red Fescue (*Festuca rubra, L.)* and Hard Fescue (*Festuca ovina, L.*). The common characteristic is that the cluster-type rice, that are widespread in nature, and they are also cultural mixtures. Do not tolerate drought and require lots of water. Express their decorative leaves. It is therefore extremely important to make an excellent soil preparation and provide favorable conditions for quality breeding, because they require daily care or lose their use value. The regular park lawns, which are used in resorts, picnic grounds, on squares, in front of public buildings, etc.. Associations that make this type of grassland species in the genus counted ryegrass and meadow, which is characterized by increased wear tolerance, although they may be sensitive to lack of soil moisture. Characteristic is widespread in nature and easy to maintain in the cultivated lawns, where they can be used very extensively. Utilization of grass is profitable, because abundant large number of available species and it is possible to make mixtures with precisely the given characteristics to length of use, purpose, quality, production intensity, frequency of use, etc.. (Jovanovic et al, 2012., P. 132). Application of this method of greening cities, greatly reducing the lack of fresh air, with a high quality living conditions.

In practice is not usually to use the weed species for the greening process in certan area, precisely because competition to the cultivated plants, which are on lawns for special purpose commonly used. In landscape architecture, the importance of weeds is far greater, precisely because of their quick adaptability to external conditions, low requirements for maintenance and to establish the aesthetic value of the urban environment. Owing to the diversity of shapes and sizes the weed community, interesting appearance, color and etc..; the world of weeds can often contribute to alleviating a number of deficiencies in the urban environment. Especially if it is green roofs, which is a common practice in the European Union. The economic benefits of greening roofs lie in the fact that the plants on roofs last longer, a reduction in costs for the removal of precipitation water, and reduced costs for heating of buildings. Any lowering of temperature by 0.5 º C can reduce the amount of electricity by 8%. The studies that were conducted in Canada, the roof-storey building, showed that the roof is covered with grass, with 10 cm of substrate (soil for the time being), 25% reduced need for cooling during summer in relation to a building with no verdant roof.

For plant species that grow in urban areas there is a technical title-sinurban vegetation. According to these data, the condition of green spaces in urban areas in the Republic of Serbia is bad, although there are resources to implement the urban development projects and the re-greening of public spaces. Each of the above mentioned aspects is equally important to achieve the ultimate goal - improving the quality of life. Most common are the so-called green areas first association of a green city. City parks, park-forest, grassy areas, playgrounds, recreation areas, landscaped gardens, botanical gardens, private, public or semi-public courtyards and so on. These are the places that are an oasis of peace, or anti-stress games and recreation.

Reducing the effects of human activities, such as the increased presence of pollutants such as carbon monoxide, carbon dioxide, nitrogen oxides, phenols, etc., then cutback intensity noise generated by traffic and the efficient utilization of land in the future will represent an important development strategy urban areas.

Taking advantage of knowing the grass species and their ability to survive in the often very ungrateful of urban life, but will initiate investments in environmental protection and development of agricultural production of quality seeds, with characteristics that are

necessary for proper lawn. Special grasslands, which are used to disperse terrain-park, urban lawns beside roads, and ultimately the courts for sporting purposes, require knowledge of the characteristics of plant species-grasses that are most important. Proper soil preparation, which includes the land on which the seed is to be the ideal structure, the particles of soil must not be larger than the size of sand particles, free from admixture of construction debris and dirt, prihranjeno adequate amounts of mineral and organic fertilizers. The process of drainage field is carried out on areas where it encounters the presence of heavy soil that is clay and water-tight, in which plant roots will not grow and there are not enough nutrients.

Raising the green space by using the technique grass carpet is the quickest and best way of greening, because the fastest turf grass root, leaving the seeds of weeds that are activated, even if found in the soil. Since the terrain, the purpose for which the person chooses will depend on the quality of work.

In this way, the concept of sustainability of urban areas, with the concept of environmental protection, pollution reduction, resulting from the activities of human life, affects the activation of urban agriculture, which will trigger some other economic activity with which they are in a close relationship.

CONCLUSION

Planting areas in urban areas, provides great opportunities for the development of urban and peri-urban agriculture in all cities. The concept is easily adjustable in all areas, because it affects the applicability of the principles of sustainability and environmental protection.

Looking at urban areas as separate entities may be noted that in cities there is a marked difference from the suburbs and countryside. This distinction is based on "urban climate", which causes higher temperatures and increased pollution due to human activities. In order to minimize adverse effects on quality of life, reduced activation of the sustainability of urban areas, by putting the most important concept that will ensure a balanced development between socio-economic progress and protection of urban environment.

Using every inch of free space for landscaping or bringing any agricultural production, We will make significant progress in the intensification of human resource development (job growth) in the world crisis.

Environmental benefits of investment in green lie in reducing the pollution of urban areas, reducing konecntracija pollutants in the air, reducing temperature to 2-6 ° C, reducing noise. Reducing the presence of harmful compounds such as methane gas, carbon dioxide, carbon monoxide, phenol etc. Will affect the state of repair in ecological terms.

Encapsulation field grass for special purpose, which is dominated by fine-leaf plant species nervatura, achieves the decorative aesthetic significance, promotes the quality of life and mitigate the changes in the fauna, ie. maintain the genetic potential of a particular plant species.

The concept of sustainability of urban areas is a green city designed as an oasis, which works great in green ekomije system, which exploits the positive features of human activities, and products that could potentially degrade the environment, re-utilized in the recycling process (use of secondary raw materials from agriculture).

Possibility of applying the principles of sustainability, re-start the production process, increasing the number of jobs (mobilization of radon-age population), positively will increase the awareness of limited resources in the communities where we live. Protection of the environment, creating a green city, in the green economy, one of the parameters of inclusive empowerment of social economy, which touches every aspect of human action.

Prominent production characteristics, the modeling of the usage in urban areas, makes a wide range of usability and affordability.

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THE RESPONSE OF SOME SUNFLOWER HYBRIDS IN LOW WATER-SUPPLY CONDITIONS IN THE CENTRAL DOBROGEA PLATEAU

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Abstract

Aim of the study: The response of some sunflower hybrids in low water-supply conditions. The central part of Dobrogea is chiefly characterized by a warm and droughty climate, with the medium annual temperature of 11ºC and medium annual rainfall of 432,2 mm, which are irregularly distributed during the whole year and therefore for the sunflower crop there isn't ensured a comfortable humidity regime for a normal development of plants. A decreased sunflower yield is drastic if there is an intervining of the hidric shortage. Taking into consideration the importance of the usage of some drought and torridity resistant genotypes, the work aims to find the most adequate germoplasm for obtaining some profitable crops in low water- supply conditions in the central Dobrogea Plateau. The methods used: The sunflower trial was located at S.C.D.A Valu lui Traian, Constanta County in 2011; bifactorial type it was used the randomized blocks method, with the follwing factors and graduations: A Factor: Water- supply level (A_1 unirrigated; A_2 – irrigated with pedological norm of 700 m^3/ ha; A_3- irrigated with 50% reduced pedological norm = 350 m^3/ ha;B Factor: The hybrid (FAVORIT, SINGI, DELFI, PR64A89, TEKNY, KONDI). Results: 2011 proved to be a favourable one for the sunflower crop.The obtained yield while using the sunflower hybrids was influenced by the water – supply level, the average being 42,0 q /ha in unirrigated conditions, 50,4 q/ha taking into account the pedological norm of 700 m^3/ha and 45,7 q /ha, with50% reduced the pedological norm. Conclusions: The classification of hybrids after the obtained yield in different water- supply conditions is: Singi, Kondi, Tekny, Favorit, Delfi and PR 64A89. The average seed- weight per head, 1000 – seed weight and the hectolitric mass varied in terms of the hybrid and the water- supply level.

Key words: *crop, genotype, pedological norm, tolerance, yield*

INTRODUCTION

The pluviometric and termic rate in Romania, irregularly distributed on the territory and the drought periods in South, South – East and South–West in July and August, made neccesary the introduction of irrigation in these echological areas as well as the use of some drought and arid tolerant genotypes .There is a high reduction of sunflower yield when the hidric shortage appears and the sunflower leaves growth and development is significantly affected by the moderate hidric shortag . The appearing of the hidric stress before blooming leads to a decreased weight of sunflower plants, the reduction of stem and head diameters . There is a very reduced quantity of seeds/ plant when the stress turns up in the blooming period. The hidric stress in the maturity stage leads to a low crop coefficient and there is a decreasing in what concern the oil – seed percent [3];[6]. The losses of dry substance yield can be 22 -50 % and the yield reduction is between 20 % and 51 % when there is a severe and moderate coefficient, the water comsuption in the case of sunflower being with 20 % or 47 % less than the crop with an optimal water – supply level [1]. There is a negative correlation statistically ensured by the correlation coefficient r = - 0, 586 ** between the yield and rainfall in the period of bead grain formation, a period corresponding to July and August. If there is an increasing of rainfall over the limit of 130 mm in this period, then the yield decreases from an average potential of 29, 8 q/ ha with 4,6 q/ha for each mm of excedentary rainfall [4]. Dobrogea region is characterized by an irregular distribution in time and space of

rainfall, that's why for the sunflower crop there isn't provided a comfortable humidity rate corresponding to the normal development of plants .Taking into account the important use of some drought and torridity genotypes with tolerance to drought and torridity, the work aims to find the most adequate germoplasma for obtaining a profitable crop in low- water supply conditions in the central part of Dobrogea plateau.

MATERIAL AND METHODS

The research was developed and it was executed a sunflower trial, bifactorial type, located after randomized blocks method with the following factors and graduations: A factor –water insurance level: A_1 unirrigated (drought –tolerance), A_2 irrigated with pedological norm of 700 m^3/ ha,A_3 irrigated with reduced pedological norm 50%= 350 m^3/ha. The B factor: Hybrid- B_1 Favorit, B_2 Singi, B_3 Delfi, B_4 PR64A89, B_5 Tekny, b_6 Kondi. Before sowing there was a fertilization with complex fertilizers 28: 28: 0. The fertilizers were incorporated into soil with disc harrow.The field preparation for sowing was executed before the actual sowing day with the cultivator. In the sowing day, the rows were delimitated with the seeding machine and the trial was marked with sticks according to the trial plan. The necessary seeds were treated with insecto-fungicide. The sowing was executed with the dibble distributing 3-4 seeds together , the depth of 4 cm and distance of 30 cm between the plants on the row. The sowing date was 27th of april 2011. After emergence the plants were spaced leaving , only a planting hole. The plot doesn't have holes .There were made observations and determination in the plot such as: the emergence date , number of days from sowing till emergence; blooming date; harvesting date, plant height, head diameter. The yield was established through the seed weighting on the field after the lateral and frontal elliminations were made. The seed yield was calculated on hectare, at STAS humidity parameters (11%).The 1000- seed weight was determined by the counting of 500 seeds in two repetitionals at each hybrid, their weighting and the reporting of the 1000 – seed medium weight. The hectolitric mass was determined taking into account the average of three executed weightings from the yield of each hybrid. The results were developed through statistical calculations, using the analysis of the variation for bifactorial field trials placed after the randomized blocks method and the correlation between different characters and water supply [5].

RESULTS AND DISCUSSIONS

The year 2011 was a favourable one for the sunflower crop, and this is reflected in the obtained yield. The influence of the different water- supply conditions over the sunflower hybrids' yield is presented in (Table 1). In comparison to the Favorit hybrid (Mt 1), cultivated under low –water supply conditions, which obtained a yield of 44,1 q/ha, the highest yield was obtained by Kondi 54,0 q/ha and Singi 53,5 q/ha hybrids under irrigation conditions with pedological norm of 700 m³ /ha, with significant differences in relation to the witness. Under the same water –supply conditions, Tekny and Delfi hybrids obtain signicant yield differences of 6,7 q/ha and respectively 6,4 q/ha in comparision to Favorit hybrid which is unirrigated.In comparison to Favorit hybrid, irrigated with pedological norm of 700 m³ /ha(Mt 2), only Kondi hybrid cultivated under the same water –supply conditions obtains a higher yield with 5,7 q/ha, significant. Under unirrigation conditions, the yield differences in relation to Favorit hybrid (Mt_2) were negative, and those of Kondi, Delfi and PR64A89, significant distinct, demonstrating the drought sensibility. By reducing with 50% the pedological norm, the yield decreased and the most affected were PR64A89 hybrid with 6,7q/ha and Delfi with 6,6 q/ha, the differences being significant; in this way these hybrids prove their sensibility to the absence or water deficit. There was established a significant distinct relation between the water- supply and the sunflower hybrids yield, but this occurs only in case the crop is not irrigated (Fig. 1).The sunflower hybrids behaviour cultivated under different water supply conditions shows that 2011, was favourable for crop, the medium obtained yield was between 42,10 q /ha(PR64A89) and 49,20 q/ha (Singi). In comparison to the field trial

average (Mt1) only PR64A89 hybrid obtained a lower yield with 3,9 q/ha, significant difference. And in relation to Favorit hybrid (Mt2), PR64A89, had a lower yield with 3,6 q/ha, significant difference (Table 2).The irrigation with pedologial norm of 700 m^3/ ha proved to be the most efficient for a high yield. This was with 4,4q/ha higher comparatively to the field trial average, and with 8,4q/ha comparatively to the unirrigated variant, very significant differences. There was also a yield increasing obtained of 3,7q/ha under irrigation with pedological norm of 350 m^3/ ha in comparison to unirrigated variant, significant distinct (Table 3). The climatic conditons in 2011 as well as the water-supply conditions marked the medium seed weight per head. Under irrigation with pedological norm of 700 m^3/ha, the seed-weight was the biggest(highest), between 90 g at Tekny hybrid and 103 g at Kondi hybrid (Fig. 2). By reducing the water pedological norm with 50% led to the decreasing of the medium seed weight per head at range between 88 g at Tekny hybrid and 98 g at Kondi hybrid.

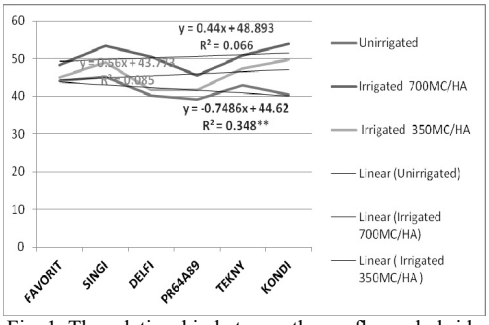

Fig. 1. The relationship between the sunflower hybrids yield and water supply

In what concern the unirrigated variant, the seed weight decreasing per head was the the highest, its range being of 86g at Tekny hybrid and 97 at Kondi hybrid.

Table 1. The influence of water supply conditions different over the production of sunflower (2011)

Variant	Yield (q/ha)	Dif A1b1 (q/ha)	Significant Dif. A1b1	Dif. A2b1 (q/ha)	Significant Dif. A2b1
A1b1 unirrigate-Favorit	44,1	*Mt1*		-4,2	
A1b2 unirrigate - Singi	45,1	1,0		-3,2	
A1b3 unirrigate - Delfi	40,3	-3,8		-8,0	00
A1b4 unirrigate PR64A89	39,2	-4,9		-9,1	00
A1b5 unirrigate - Tekny	42,9	-2,2		-5,4	
A1b6 unirrigate - Kondi	40,4	-3,7		-7,9	00
A2b1 irrigated with pedological norm 700m^3/ha-Favorit	48,3	4,2		*Mt2*	
A2b2 irrigated with pedological norm 700m^3/ha--Singi	53,5	9,4	**	5,2	
A2b3 irrigated with pedological norm 700m^3/ha--Delfi	50,5	6,4	*	2,2	
A2b4 irrigated with pedological norm 700m^3/ha---PR64A89	45,5	1,4		-2,8	
A2b5 irrigated with pedological norm 700m^3/ha---Tekny	50,8	6,7	*	2,5	
A2b6 irrigated with pedological norm 700m^3/ha---Kondi	54,0	9,9	**	5,7	*
A3b1 irrigated with reduced pedological norm 50%:350m^3/ha-Favorit	44,9	0,8		-3,4	
A3b2 irrigated with reduced pedological norm 50%:350m^3/ha-50%:350m^3/ha - Singi	49,0	4,90		0,7	
A3b3 irrigated with reduced pedological norm 50%:350m^3/ha Delfi	41,7	-2,4		-6,6	0
A3b4 irrigated with reduced pedological norm 50%:350m^3/ha-PR64A89	41,6	-2,5		-6,7	0
A3b5 irrigated with reduced pedological norm 50%:350m^3/ha--Tekny	47,4	3,3		-0,9	
A3b6 irrigated with reduced pedological norm 50%:350m^3/ha--Kondi	49,8	5,7	*	1,5	

DL5% =5,7 q/ha; DL1% =7,6 q/ha; DL 0,1% = 10,1q/ha

Table 2. The influence of the sunflower hybrid over the yield under different water supply conditions

Hybrid	Yield (q/ha)	Dif Mt_1 (q/ha)	Signi-ficant Dif. Mt_1	Dif. Mt_2 (q/ha)	Signi-ficant Dif.Mt_2
FAVORIT	45,7	-0,3		Mt_2	
SINGI	49,2	3,2		3,5	
DELFI	44,2	-1,8		-1,5	
PR64A89	42,1	-3,9	0	-3,6	0
TEKNY	47,0	1,0		1,3	
KONDI	48,0	2,0		2,3	
Average	46,0	Mt_1			

DL 5% = 3,3 q/ha
DL 1% = 440 kg/ha
DL 0,1% = 590 kg/ha

There was established a significant correlation between the medium seed weight of the sunflower hybrids and the water- supply level, in conditions of irrigation with pedological norm of 700 m^3/ha and distinct significant in the case in which there is a 50% reduction of the pedological norm, as well as there isn't any irrigation. (Fig. 3).

Table 3. The influence of water supply conditions over the production of sunflower

Water supply	Yield (q/ha)	Dif. Mt_1 (q/ha)	Signi ficant Dif. Mt_1	Dif. Mt_2 (q/ha)	Signi-ficant Dif. Mt_2
Unirrigated	42,0	-4,0	0 0	Mt_2	
Irrigation with pedological norm of 700 m^3/ha	50,4	4,4	***	8,4	***
Iriigation with pedological norm 50%= 350 m^3/ha	45,7	-0,3		3,7	**
Average	46,0	Mt_1			

DL5%=2,3 q/ha;
DL1%=3,1 q/ha;
DL0,1% = 4,1 q/ha

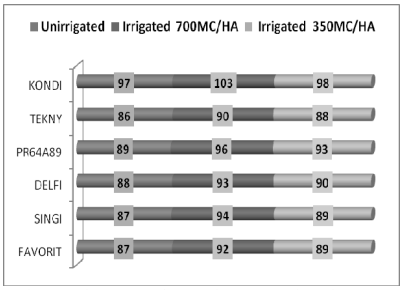

Fig. 2. The medium seed weight (g)per head of sunflower hybrids in terms of water supply level

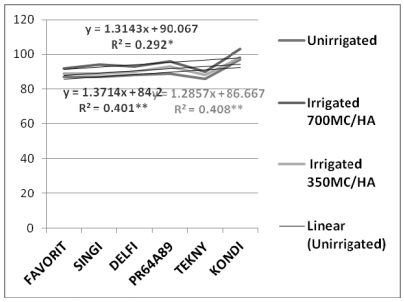

Fig. 3. The relation between the medium seed weight per head of the sunflower hybrids and the water supply level

The influence of the climatic and water-supply conditions was noticed in the 1000-seed weight range of the tested sunflower hybrids in 2011.The influence of irrigation with pedological norm of 700 m^3/ ha was remarked while obtaining the highest 1000-seed weight range: 73 g at Kondi hybrid in contrast with 64 g for unirrigation conditions .Significant differences were also obtained for the 1000-seed weight at the other hybrids comparatively to the irrigated variant with 50% reduced pedological norm or unirrigated variant (Figure 4). The crop irrigation determined the getting of a higher hectolitric mass in comparison with the situation in which the field was not irrigated. The hectolitric mass values were between 38 kg/hl (PR64A89 hybrid) and 40 kg/hl (Singi hybrid) for the irrigated variants with pedological norm of 700 m^3/ ha, between 37,5 kg/hl (PR64A89 hybrid) and 38,6kg/hl (Kondi hybrid) for the irrigated variants with pedological norm of 350 m^3/ ha and between 36 kg/hl (PR64A89and Favorit hybrids) and 37,9 kg/hl (Tekny hybrid) for the unirrigated variant (Fig. 5).

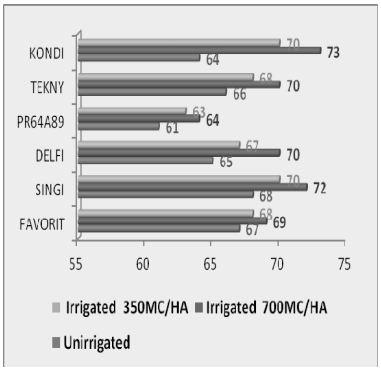

Fig. 4. The 1000-seed weight of sunflower hybrids in terms of water supply level

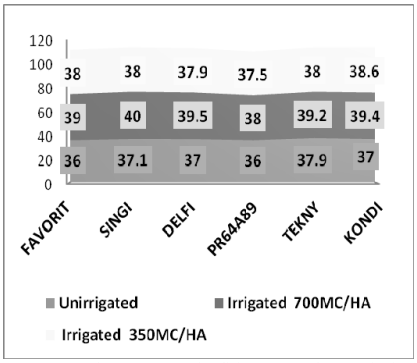

Fig. 5. Hectolitric mass (kg/hl) of sunflower hybrids in terms of the water supply level

CONCLUSIONS

The central part of Dobrogea is characterized by warm and droughty climate with the medium annual temperature of 11ºC and medium annual rainfall of 432,2 mm which are irregularly distributed. 2011 proved to be a favourable year for the sunflower crop.

The obtained yield by the sunflower hybrids was influenced by the water-supply level, the values were between 39,20-44,10 q/ha for unirrigated conditions, 48,30-54,00 q/ha when the pedological norm was of 700 m^3/ ha and 41,60-49,80 q/ha when the pedological norm was reduced with 50 %. There was established a distinct significant relation between the water-supply level and the obtained yield only if the crop was not irrigated.

The classification of hybrids taking into account the obtained yield under different water- supply conditions is: Singi, Kondi, Tekny, Favorit, Delfi and PR64A89.

There was established a significant correlation between the medium seed weight of the sunflower hybrids and the water-supply level, in conditions of irrigation with pedological norm of 700 m^3/ ha and distinct significant in the case in which there is a 50% reduction of the pedological norm as well as there isn't any irrigation. The average seed weight per head the 1000 –seed weight and the hectolitric mass varied in terms of the hybrid and the water – supply level.

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SUSTAINABLE DEVELOPMENT OF RURAL AREA

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LIVESTOCK BIODIVERSITY GOOD PRACTICE IN SOCIO-ECONOMIC ECOZONA CEZIENI IN THE ECOBIOECONOMIC CONTEXT OF FOOD SAFETY AND SECURITY

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Abstract

In science and agriculture technique in Europe was convincingly demonstrated and validated the development, presentation and implementation of best practices specific sectoral areas effectively and decisively contribute to sustainable rural development.On the concept of eco-economy launched in the '90s and bio-economic paradigm (launched by Nicholas Georgescu Roegen in the '70s and '80s), Postdoctoral School of Biodiversity in Livestock, ecobioeconomic context of Alimentary Safety and Security, is essentially the proper quantity and quality aspect of the planet's population needs food by definite orientation of the entire world economy, primarily to ensure quality of life, that the "bios".In combination these findings significant in terms of their socio-economic indisputable time in space and time, Animal biodiversity best practices in ecozona Cezieni, Olt County, demonstrates the variety of species, breeds and hybrids of farm animals increased over the years at CAP Cezieni, reference unit and model scientific organization of production, together with variety assortment of meat products, milk, eggs, and honey obtained, processed and exploited under certain conditions economic and social efficiency, fully demonstrates the validity of the concept on animal husbandry technologies of Romanian agriculture.

Key words: *bio-economic, ecosanogeneza, sustainable agriculture*

INTRODUCTION

Cezieni recovery model by processing and upgrading to EU standards and specific conditions Common Agricultural Policy (CAP) by historiographical research data resulting from a fusion of what was professional and demonstrated practical technical performance and economic-social-economic good animal biodiversity practices, as a variety of species, breeds and hybrids of farm animals raised in the village cooperative Cezieni county, industrial processing of milk products, meat, eggs, honey, in small sectors of the industry same agro units, allows today a revival of rural agro-industries through good husbandry practices of Livestock Biodiversity in socio-economic ecozona Cezieni in eco-bio-economic context of safety and food security.

MATERIAL AND METHOD

The documents from the personal archives of the family on the activities CAP Cezieni, Olt County, of the Eng. Tudor Danacu, who was President for 24 years until 1989, at this protocol unit on the country, himself and with some members of my family whom are advised by activities carried out over decades in the context of evolution and unfortunately partial involution, social and historiographical methodologies through individual files and family components of village administrative units reference to economic and applied research that I conducted by applying in collaboration with specialists of possible forms of economic and social recovery of livestock biodiversity ecozona Cezieni, Olt County.

RESULTS AND DISCUSSIONS

Livestock production cooperative in the village of Cezieni the coordinates optimization developed as technical and material conditions are created. By allocating a significant portion of the value newly created development fund was managed on their own, to raise adequate shelter for animals, to be bought valorous biological material, to ensure a rich and balanced forage base. Also, in developing livestock biodiversity was taken into account tradition and experience, existing in the locality. In this way it was managed that within 5 years be increased milk production by 353. 000 liters, while the meat with 250,000 Kg. Income people who worked in the livestock raising in the same period by 35%.

They specialized in increasing cows, rabbits, birds, sheep, pigs, horses, bees and silk worms and fish. The selection sector had 30 cows with records, with production of over 5000 liters per year, the forage was cheap, varied and enough, respective : 100 acres of alfalfa, 15 ha fodder beet, 20 ha Lolium multiflorum, and in successive crop 550 ha of corn after canola and barley. For each cow was provided 1 ton of hay, a ton of fodder beet, 8 tons of corn silage and straw ton, required concentrated feeds were produced in small industry sector. It was placed a particular emphasis on avoiding infectious disease, nutritional disease that can cause great losses.

They undertook the schooling of all those working in animal husbandry and in units of microprocessor products and by-products resulting from livestock, to obtain qualitative and quantitative performance remarkable, not infrequently recognized nationally and internationally.

Poultry farm, comprising the entire circle of incubator chicks, broilers, laying hens, fattening such as meat and eggs needed was provided in Oltenia region in this unit.

Rabbit farm with a capacity at the beginning of 3600 copies in 1985 reached 24 000 in two years to become even biological material supplier.

Increasing Romanian rabbit meat "Supercuni" able to accomplish in 12 weeks an increase of 2.4 kg with a consumption of 3.5 units per kg increase nutrients, with modern housing conditions that would ensure proper environment, air currents not exceed 0.5 m / sec and the concentration of ammonia as 0.003%, granulated feed made in the same unit.

Photo 1. Livestock to CAP, Cezieni, Olt county, halles laying hens

Photo 2. Livestock from C.A.P. Cezieni, halls to increase milk cows and rabbits

Processing rabbit meat after slaughter, the tanning of leather in the tanning industry, and processing of rabbit fur clothing, soon gained a tradition at Cezieni.

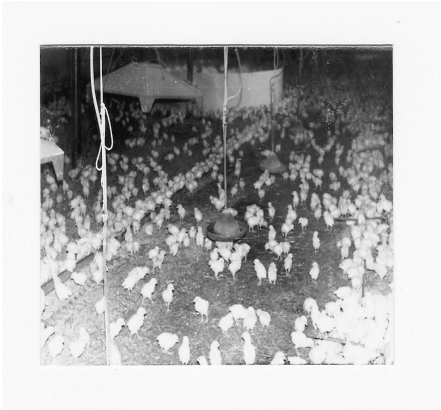

Photo 3. Livestock to CAP Cezieni county, halls growth of broilers

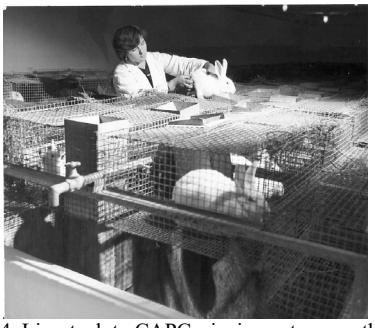

Photo 4. Livestock to CAPCezieni county, growth halls rabbits

Photo 5. Livestock to CAP Cezieni county, Department of rabbit fur garments

The growth of semi-haired sheep, 3,000 head of sheep and sheep to 1200, with milk production per ewe fed from 18 liters to 35 liters at the beginning and the wool from 2 to 3.5 Kg / head, was achieved by providing a valorous biological material using all feed resources, shelters and upgrading of technology, professional training of cooperators who worked in the livestock sector. Analyzing the economic point of livestock and poultry sector to see that, through efforts were framed in the scales of charges set out in financial regulations enacted.

To reach this result was not enough to be applied to technologies appropriate to have construction, to have warehouses full of feed, of course they are necessary conditions, but what is overlooked is but optimizing workforce. Tended to increase as much as livestock and poultry, but we have seen that the dull surface that detineu much better was to optimize the productivity growth due to increasing animal production, a severe selection, maintaining animal production able to deliver performance. Agglomerations of animals, with all the trouble procession that brings this trend, does not solve the problem of meeting growing needs of national economy and modernization. Therefore they had large herds of animals, but is framed in an upward curve in terms of production physical and caloric were hardworking and skilled co-operators, attach communal interests, as the basis for their own welfare.

In the future had come to pass opinion on product integration in all livestock, to bring into operation a modern slaughterhouse, deliver agricultural products and food valuable, cost effective, incorporating, talent, work people, the contribution of new technology and science, so that the desire for 2000 then, was to become a prestigious unit in livestock.

The emphasis on beekeeping, they had to start in 1987 a micro apiary of 100 hives for honey production streamline both and other bee products, but for the actions of sunflower pollination in existing orchards.

Since 1987 turned into a fish pond with an area of 7 hectares of water which was a reserve for irrigation.

It can be said that efficiency was the watchword of the entire activity to production of Cooperative Cezieni village, a central objective, essential for continued and accelerated development of our country. It was a call to action to perform persistent, determined to get bonuses increasing production and revenues increased due to the

decrease of production costs and above all of the material, increasing labor productivity, water management with the high responsibility of land and other means of equipment of all resources and reserves. Achieving a rapid rise of economic efficiency depends directly on each member co-operative efforts, mechanized worker, specialist, all those who inhabited villages.

Photo 6. Lake for increase fish from Cezieni, Olt County

Each at workplace must show love for public property, initiative and creative thinking, to act boldly to reduce production costs, reducing the possible consumption of materials, fuel, energy, chemicals and optimum use of resources mechanical.

Order, discipline, spiritual household were subjective itemswhich at CAP Cezieni manifested everywhere, because each co-op knew that cooperative fortune was also his fortune and return are directly reflected in the salary of each one. In the newly created laboratories, to analyze and were debated issue of agrarian economy, specifically on each link technology. implemented so as to economic thinking, a new spirit.

CONCLUSIONS

In science and european agricultural technique has shown convincingly and validated, presentation and implementation of best practices specific sectoral areas effectively and decisively contribute to sustainable rural development.

On the concept of eco-economy in the '90s and launched bio-economic paradigm (launched by Nicholas Georgescu Roegen in the 70s and 80s), Postdoctoral School of Biodiversity in Livestock, context eco-bio-economic of Alimentary safety and security, is in achieve essentially quantitatively and qualitatively adequate to feed the world population needs by targeting the entire world economy category, primarily to ensure quality of life, that the" bios".

In combination these findings significant in terms of their socio-economic indisputable time in space and time, good husbandry practices ecozona Cezieni biodiversity, Olt County, demonstrates the variety of species and hybrid breeds of farm animals increased over the years the CAP Cezieni, reference unit and model scientific organization of production, together with variety assortment of meat products, milk, eggs, and honey obtained, processed and exploited under certain conditions economic and social efficiency, fully demonstrates the validity of the concept on zootehnizarea Romanian agriculture.

All these achievements were possible then and I think now reviving, Romanian livestock recovery is a necessity, since drama food that we should resume production system integrated, clean green economy, the food industry to recovery provide necessary food for people in the long term.

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This research work was made possible with help from my father, Eng. Tudor Danacu, personal family archives and help from Postdoctoral School for Livestock Biodiversity and Food Biotechnology based on Eco-economy and Bio-economy necessary for Ecosanogeneza , the Romanian Academy and Ministry of Agriculture and Food, for which I tkank them very much.

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APPLING THE PRINCIPLES AND SPECIFIC OBJECTIVES OF METABOLIC ENERGY GREEN POWER FOOD BASED ECO-BIO-ECONOMY, ACCORDING ECOZONA CEZIENI, OLT COUNTY

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Abstract

Green Power Sustainable Food and Euro-Atlantic Romania, integrated and globalized, based on eco-bio-economy, represents a new direction of development that should mark the transition to a new sustainable social market economy, a smarter, greener economy , in which our prosperity is due to innovation, better use of resources and the knowledge to be a key factor. They are also the principles underlying the EU Strategy 2020 and the European bioeconomical Strategy 2030, developed in Germany through which the European Union aims to accelerate progress towards a knowledge economy, but an environmentally friendly economy. Metabolic energy as specific form of nutritional energy by externalizing the productive potential of feed is running photosynthesis so a specific form of solar enrgie obviously fall in global concept of" green power".We believe that Sustainable Food Green Power as a new original concept launched in the Postdoctoral School, is based entirely on complex use of various forms of green energy (solar, wind, hydropower, geothermal energy, etc..), And how to meet specific food production based on eco-bio-social and rural economy (according to the strategies of social inclusion objective of the Lisbon 2030) is actually a confirmation of theoretical and practical aspects and analytical synthesis that the authors have found the-over the years the scientific organization (management) and recovery (marketing) and sometimes record high yields recorded continuously for agro-pedo-climatic conditions of ecozona Cezieni Olt County.

Key words**:** *bio-economic, ecosanogeneza, sustainable agriculture*

INTRODUCTION

Given the increasing food needs of the population in the world, that there are National Strategies and Programs of Absorption of Financial European Grants and that agriculture today for the entire political class, conscious and unanimous agreement, is the priority for economic and social revival of the village, of the country, through sustainable rural development where livestock sciences, soil sciences, agro, horticulture, veterinary medicine, environmental health , conservation of bio-potential agro ecosystems and natural and anthropogenic agribusiness, food biotechnology, innovations and compared ecosanogeneza, applying of principles and specific targets for metabolic energy from green power food, based on eco-bio-economy, and therefore according to ecozona Cezieni, Olt County, are a priority to develop new paradigm eco-bio-economic, an economy for future generations, providing a healthy living environment through the wise use of limited resources earth.

MATERIAL AND METHOD

The paper is relevant to economic and social recovery after decades of stagnation of village development Cezieni, Olt County, on the principles and specific objectives of metabolic energy green power Food, based on eco-bio-economy, according ecozona Cezieni, Olt County and sustainable rural development. For this we used research methodologies that are based on eco-bio-economic requirements for an intelligent world, a healthy environment, a life

of wealth. In the first phase we made an inventory of the main sources of the principles, objectives and directions for implementation of sustainable rural development, including relevant official documents: the United Nations, European Union and the strategies of this Common Agricultural Policy and for the period 2010-2030 the U.E. Romania's position.
Establishment of a collective joint working with staff and some members of my family who are advised by activities carried out over decades in the context of evolution and unfortunately partial involution of ecozona Cezieni, Olt County, social and historiographical methodologies by individual families chips and components of the village administrative unit with economic reference for metabolic energy from green power agro-food based on eco-bio-economy, according to ecozona Cezieni, Olt County.

RESULTS AND DISCUSSIONS

Processing grapes at CAP Cezieni was a wise decision to avoid travel to other processing stations (the closest one was at 45 km), slow processing, unjustified extension of harvest with serious consequences for production environments, losses inevitable quantity and quality during transportation, the possibilities for recovery of marc and reducing fuel consumption and oil.

Photo 1. Processing department of grapes and marc at CAP Cezieni, Olt County

200-300 tons resulting marc was dried, ground and used as an excellent livestock feed, transformed into metabolic energy required in livestock, in 7 to 13% fat and 10 to 12% protein. Is important this transformation by drying, grinding marc, to obtain metabolic energy because the marc unground and processed, the seeds were eliminated entirely, because its were not digested by animals. This resulted to be given greater importance to the expansion of processing activities for the fodder of all reserves and resources from vegetables or results of semi industrial. Also in this section of feed processing residues, using presses they had, they carried out the operation of squeezing the seeds and shells of tomato canning factory, eliminating most of the moisture they had.

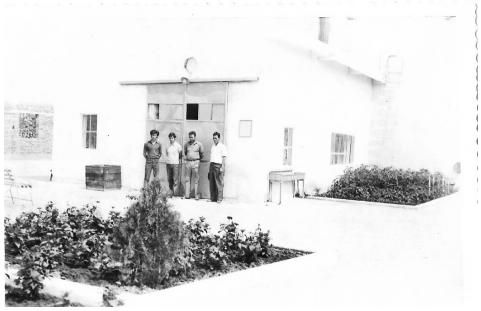
Photo 2. Concentrated feed factory, feeding rabbits, ruminants, sheep, pigs at CAP Cezieni, Olt County

After squeezing were exposed to sunlight for several hours to dry and then were used in the winter as feed in poultry diets, providing the metabolic energy necessary to poultry, being an important source of vitamins, protein and fat.
Development of small industries in Cooperative Production Cezieni, Olt County, imposed increasingly wide use of technologies that require heat.
To this is added the heat for halls in which the cooperators of the unit were working also during the winter.
A boiler so large was not justified at all times, because you cannot use all the heat in all periods, because you cannot use all the heat produced during the entire year. The boiler must operate continuously, even when the energy was not needed to avoid freezing pipes carrying heat from the boiler to the premises in different halls. It was hard to accept such use. So they decided to use the locomotive boiler only in periods when technological steam was needed for the canning and feed, in summer-autumn period.
Then with local experts was made, from internal resources, a boiler type stove with high efficiency and heating capacity of 320 square meters. The fuel for these stoves were provided only from processing residue from wicker and

from the logging made in vineyards and orchards. This type of stove was easily heated, consumed less and meet the needs of the halls, in the premises of sections in the livestock sector, especially in growing rabbits halls.
At Cezieni, nothing was wasted, significant amounts of plant mass resulting from technological operations of vineyards and orchards and the vegetable were used as source of energy in various forms and in various sectors, and peelings from willow twigs processed in the department of wicker, these remains were used instead of raffia, used for tying vines, etc.. Purchased would have cost them about. 70 000lei/year. Other remains were used as fuel in stoves of industries mentioned above. It was approached successfully and practiced the unconventional energy formula namely a section for biogas, another on solar batteries, wind stations that allow them quasi energy independent.
As the primary concern was the judicious use of land so that each parcel be used as economically. For this purpose we analyzed each parcel of land and agro-pedological attributes report was established what use it should have in the future. Cezieni the village was considered in all respects and were found at the same time these modes of use of land: Arable land suitable for: crops, vegetables sloping land suitable for: vine plantations, plantations trees, pastures: wetlands: woodland: afforestation, protection curtains.

CONCLUSIONS

Green Power Food development is a new direction which should mark the transition to a new sustainable social market economy, a smarter, greener economy where our prosperity is due to innovation, better use of resources and the knowledge to be a key factor. They are, in fact, the principles underlying the EU 2020, the European Union aims to accelerate progress towards a knowledge economy, but an environmentally friendly economy.
Metabolic energy as specific form of nutritional energy by externalizing the productive potential of feed is running photosynthesis so a specific form of solar energy falls clearly in the global concept of “green power”.
We believe that green power food as a new original concept launched in the Postdoctoral School, is based entirely on complex use of various forms of green energy (solar, wind, hydropower, geothermal energy, etc..), and how to know specific food production based on eco-bio-social and rural economy (according to the strategies of social inclusion objective of the Lisbon 2030) is actually a confirmation of theoretical and synthetic of practical aspects and analytical which the authors of the scientific papers have found over the years in scientific organization (management) and recovery (marketing) and sometimes record high yields recorded continuously for agro-pedo-climatic conditions of ecozona Cezieni, Olt County.
Therefore at Cezieni it was shown that green power food based on eco-bio-economy provide metabolic energy and not only to ensure an increase in integrated production, food and chemical industry needed as a source of food and energy for human life, animals and plants.
At Cezieni, as it once was, the ecozona can be revitalize economic and social by investing in wind farms, solar, hydraulic or biogas (manure from animals, from birds), biofuels from plant residues (straw, barley, corn stalks, vines cut branches from trees after cleaning, sawdust, wicker waste processing), as it was once.

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CHARACTERISTICS REGARDING NATURAL POTENTIAL OF BIHOR COUNTY FOR RURAL DEVELOPMENT

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Abstract

The subject of this paper is estimate of natural potential in Bihor caunty for establish the possibilitys for rural sustainable development and for determining restricting natural factors who to manifest over rural activities.

Key words: *rural development, natural potential of territory, climat conditions, soil characteristics, hydrographic basin.*

INTRODUCTION

Any strategy for socio-economic development must be based on the assessment of the natural resources that should be turned into good account in a sustainable manner. In order to achieve the highest effect with lowest consumption, the resources should be differentiated according to category and exploitation limits.
The natural potential of a territory is defined by the complex resources constituting the environment and can be analyzed based on the amount and specificity of each particular constituent [2].

MATERIAL AND METHOD

The socio-economic development of a territory depends upon the natural resources that it provides for use according to the requirements imposed by the developmental process shaped into general and sectoral policies and strategies at local, zonal or regional level.
The area under study is located in the North-West Development Area which includes six counties, as follows: Bihor, Bistriţa-Năsăud, Cluj, Maramureş, Satu-Mare, Sălaj, Fig. 1.

Fig.1. The North-West Development Area

This area consists of 421 local administrative units: 6 counties, 42 cities and towns (of which 15 cities) and 399 communes. There are 1,844 human settlements in total, fig. 2, [5].
Concerning its cross-borders, the area under study is partly included in the Bihor-Hajdú-Bihar Euroregion, established by the Bihor County Council and the Hajdú-Bihar Self-government (Fig.3) [2].

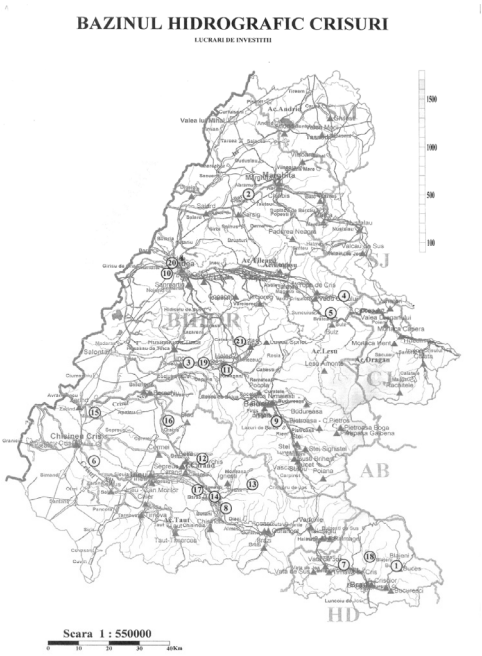

Fig.2. Crişuri hydrographic basin

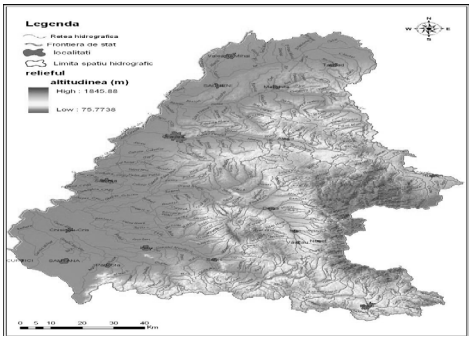

Fig.3 Bihor-Hajdú-Bihar Euroregion

The primary natural potential consists in the basic elements that determine the formation and evolution of the environment and the secondary natural potential, reflects the expression of the environmental factors that are influenced by contemporary human intervention.

RESULTS AND DISCUTIONS

Geographic location and relief layout result in the particular characteristics of the climate. The area under study is defined by the oceanic temperate climate from western and Mediterranean climate from southern and southwestern Europe. [4]. It is noted that there is an oceanic climate in the entire study area, differentiated according to the relief forms, i.e. plain, hills and low-mountains plateaus [1].

The Crişuri hydrographic basin presents great variability of surface deposit types (Fig.4). Thus, the following are present from the border with the Republic of Hungary: Holocene alluvia – gravels, sands, clays (1), wind sands in four sites (3), deluvio-coluvial and proluvial sandy-clayey glacial deposits, associated with terrace deposits (7), eluvio-deluvial deposits formed on neogenic volcanic rocks (14).

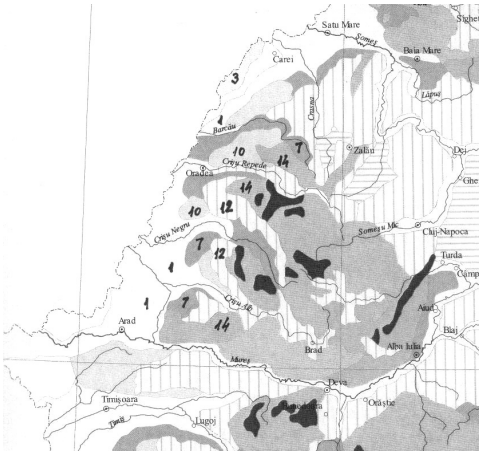

Fig. 4. Surface deposits in the Crişuri hydrographic basin [3]

Soil quality shows a predominance of agricultural lands, included in classes III and IV, which points to the necessity of permanent and intensive improvement interventions destined to ensure high productivity [1].

The lands that are highly subject to degradation are acid soils – total 270 882 ha; acidification affects these soil in varying degrees: slightly acidic, 129 298 ha; moderately acidic, 118 716 ha; strongly acidic, 22 868 ha. There are also almost 40 000 ha of salination-affected soils, out of which 1 300 ha moderately and strongly saline, fig.5.

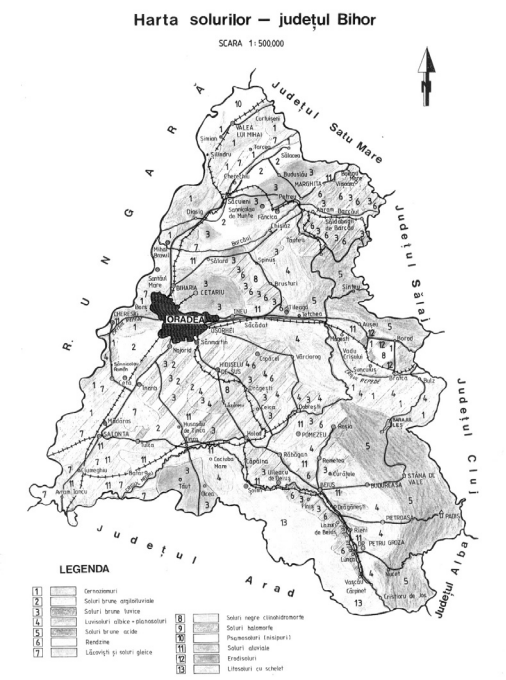

Fig.5. Soils of Bihor County

Moreover, other 2 263 ha of land are affected by erosion while water excess results in the degradation of another 5 677 ha. [6].

The hydrographic basin of the Criş rivers drains an area of over 27 500 km^2, consisting of four main rivers that converge as the branches of a tree: Crişul Alb (the White Criş) - (Foto 1); Crişul Negru (the Black Criş) – (Foto 2), Crişul Repede (the Fast Criş) – (Foto 3) the Barcău. They all collect the waters from the western slopes of the Apuseni Mountains.

The Crişuri hydrographic basin presents the following potential:

- theoretical water resources – 3 116 400 thou mc
- technically usable water resources – 744 734 thou mc.
- fishery – 1 051 thou mc.

Photo 1. Crişul Alb (the White Criş)

Photo 2. Crişul Negru (the Black Criş)

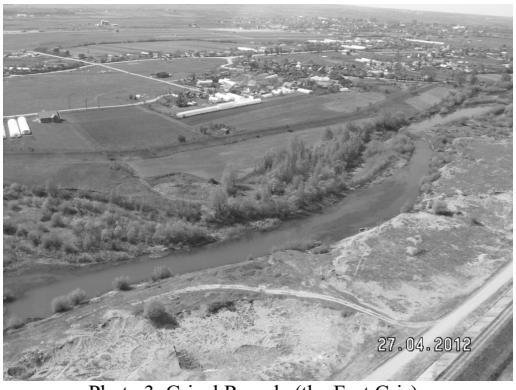

Photo 3. Crişul Repede (the Fast Criş)

CONCLUSIONS

The area of study is rural space with valuable natural potential for rural sustainable development.

Natural potential of Bihor Caunty provided rural sustainable development if to apply

programs for lands improve and land protection.

This programs are necessary to control the effects of restricting natural factors who to manifest over rural activities.

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CONTRIBUTIONS REGARDING RURAL SUSTAINABLE DEVELOPMENT IN URLAŢI AREA THROUGH ELABORATION LOCAL AGENDA 21

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Abstract

The subject of this paper is presentation of the role played, some of the local collectivities involved themselves into the elaboration and application of a participative measure, aiming at elaborating an ample program of sustainable development, compared to the Local Agenda 21.

Key words*: sustainable rural development, local agenda 21, environmental* protection, *environmental and rural space, local stakeholders group.*

INTRODUCTION

A sustainable community uses its own resources to provide for the needs of the current generation, while at the same time securing the necessary resources for future generations. It pulls together its capacities to ensure healthcare services of high standards, a high standard of life for all residents through good waste management, preventing pollution, maximising environmental protection and through developing local resources and using them efficiently for the revitalisation of the local economy [6].

Because so many of the problems and solutions being addressed by Agenda 21 have their roots in local activities, the participation and cooperation of local authorities will be a determining factor in fulfilling its objectives. Local authorities construct, operate and maintain economic, social and environmental infrastructure, oversee planning processes, establish local environmental policies and regulations, and assist in implementing national and subnational environmental policies. As the level of governance closest to the people, they play a vital role in educating, mobilizing and responding to the public to promote sustainable development [7].

In this context, through the implementation of the Local Agenda 21 Program, we express our intention to transform the Urlaţi area into a sustainable community, one that pulls together all its resources for the improved standard of living of its population.

MATERIAL AND METHOD

The local economical development represents the process by which different actors of the public sector, the business environment and non-governmental sector collaborate in order to create better work conditions for the economical growth and to generate new work places, finally aiming to improve the life quality of the entire local community [1].

The concept of local development might be defined as an economical intervention strategy by which the local representatives of the private, public or social sector cooperate to value the human, technical and financial resources, of a collectivity, being associates in the frame of sectoral or intersectoral structures of activity, private or public, having as main objective to create new work places [1].

The local economical development represents a participative process, where the community's members of all sectors cooperate stimulate the local activity, therefore getting the economical sustainable development of the locality. At the same time, it does represent a mean of assistance in order to create new work places

and to increase the standard of living for all the community's members [3].

The chapter 28 of Agenda 21 – local collectivities initiatives – proves that, for elaborating Local Agenda 21, is necessary that all the local collectivities to perform a constant dialogue with the citizens, the local bodies, private business medium, before carrying a program included in Agenda 21 at community's level. Therefore, the local authorities, by the permanent contact with citizens and local, civic, community, trade and industrial associations, get the necessary data to set the most appropriate strategies for a sustainable development [2].

Local Agenda 21 (LA21) is a UN initiative first adopted at the Earth Summit held in Rio de Janeiro in 1992 as a vehicle for promoting sustainable development at local levels. Ten years later, in Johannesburg in 2002, the second global summit promoted LA21 as the principal instrument to use in achieving the well-being of the world's population. Aimed at local administration, LA21 promotes, through public participation, a real balance between economic growth, social equity, and environmental protection.

The concept of sustainable development calls for a constant re-evaluation of the relationship between man and nature, and solidarity between generations, as the only viable option for long-term development.

The most useful tool to achieve an efficient local economical development is represented by the elaboration of a Local Agenda 21. This document with multi-sectoral and participative feature follows the practical achievement of Agenda 21's goals, customed for each local authority, as a training mean to apply a long term strategic plan of action, approaching sustainable development necessities and priorities [2].

The Local Agenda 21 concept was formulated and launched by the International Council for Local Environmental Initiatives (ICLEI) in 1991 as a framework for local governments worldwide to engage in implementing the outcomes of the United Nations Conference on Environment and Development (UNCED)1. ICLEI, along with partner national and international local government associations and organizations (LGOs), championed the Local Agenda 21 concept during the 1991-1992 UNCED preparatory process.

These efforts led to the integration of the Local Agenda 21 concept in the main outcome of UNCED, Agenda 21.

Each local authority should enter into a dialogue with its citizens, local organizations and private enterprises and adopt "a local Agenda 21". Through consultation and consensus-building, local authorities would learn from citizens and from local, civic, community, business and industrial organizations and acquire the information needed for formulating the best strategies. The process of consultation would increase household awareness of sustainable development issues. Local authority programmes, policies, laws and regulations to achieve Agenda 21 objectives would be assessed and modified, based on local programmes adopted. Strategies could also be used in supporting proposals for local, national, regional and international funding [7].

One of the fundamental prerequisites for the achievement of sustainable development is broad public participation in decision-making. Furthermore, in the more specific context of environment and development, the need for new forms of participation has emerged. This includes the need of individuals, groups and organizations to participate in environmental impact assessment procedures and to know about and participate in decisions, particularly those which potentially affect the communities in which they live and work. Individuals, groups and organizations should have access to information relevant to environment and development held by national authorities, including information on products and activities that have or are likely to have a significant impact on the environment, and information on environmental protection measures [8].

RESULTS AND DISCUSSIONS

In Romania, the general issues which have to be customed for each local collectivity, are included into the National Plan of Rural Development (4) materialized on four axes: Axis 1 – the increase of competitive feature of

the agricultural and forestry sectors; Axis 2 – the environmental and rural space improvement;
Axis 3 – life quality in rural areas and diversification of rural economy;
Axis 4 – LEADER, supporting the achievement of the Strategic National Program in the rural space [1].
The main issues comprised by those national documents which have to be approached on the sustainable development programs are:

- the approach and the abatement of the structural drawbacks of the agricultural and forestry sector, in scope of modernizing, strengthening and restructuring, allowing the reaching of a high level of competitiveness and sustainability from the environmental prospective. This would offer a powerful life conservation mechanism in the rural space, enlarging the area of viable work places both for farms and for other structures outside of it, contributing to reaching the venues convergence objective, at the same time keeping the social texture;

- the improvement of the equilibrium between the rural areas development and sustainable use of the natural resources, by maintaining and increasing the activities in the rural areas – as basic elements into the diversification of exploitations and identification of some alternative economical activities;

- paying a special attention to the issues of two large categories of population from the rural areas: the population over the age of pensioning and the active population, partly employed or unemployed [3].

The practical expertise proves that could be identified an universal set of five elements and factors, which provides the success in elaborating the Local Agenda 21:

- Multi-sectoral engagement in the planning process through a local stakeholders group which serves as the coordination and policy body for preparing a long-term sustainable development action plan.
- Consultation with community groups, NGOs, business, churches, government agencies, professional groups and unions in order to create a shared vision and to identify proposals and priorities for actions.
- Participatory assessment of local social, economic and environmental conditions and needs.
- Participatory target-setting through negotiations among key stakeholders in order to achieve the vision and goals set forth in the action plan.
- Monitoring and reporting procedures, including local indicators, to track progress and to allow participants to hold each other accountable to the action plan [5].

More practical, the assessment process of Agenda 21 contains six stages:
I- the knowledge of the overall frame specific to local collectivities;
II- project's launching;
III- setting the diagnosis;
IV- identification of the problems and the causes occurring them, setting the objectives;
V- project's adoption;
VI- follow-up and appraisal of the achievements.

The elaboration of Local Agenda 21 represents a long term process, developed on 3-4 years, having as main stages the diagnosis, the setting and the elaboration.

CONCLUSIONS

1. Most important directions for the implementation of sustainable development in area of study: city infrastructure and public services, education and culture infrastructure and information technology, environmental and natural resource protection, inter-community cooperation, partnerships with civil society and with economic entities.

2. General objectives for Local Agenda 21: environmental protection, economic development,urban regeneration, social protection.

3. Trend towards agriculture which has profitable and highly performing private mechanisms;
4. Establishment of family farms, formed through the acquisition of agricultural areas;

5. Development of small and medium enterprises which process agricultural products;
6. Development of the business environment for agricultural agents.

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DISASTER MANAGEMENT

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LIFE PROTECTION AND EARTHQUAKE PREPAREDNESS IN URBAN AND RURAL SETTLEMENTS

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Abstract

In seismic areas, present and future generations may suffer because of vulnerable built heritage. Security of life in large and densely populated urban settlements involving protection against multiple hazards/threats of the system depends of exposed elements such as buildings or landscape elements and utility networks, social and economic functions, and population. In rural settlements risks can be different with a higher contribution of natural environmental factors: slopes, areas with high level of groundwate etc. This article will present: - Factors depending of seismic risk, in conjunction with sociology, individual and collective psychology, risk perception and social behavior of human community, government and emergency management; - Seismic education programs in the past 20 years, knowledge and the actions needed to behave rationally and effectively, to deal with rumors, panic, to prevent disasters and survive, strengthen and restore buildings and places and life after seismic events with negative effects; - A new concept and applications offered through the Centre for information, education and training of the population; The new approaches take into account the need to use reliable earthquake engineering researchers of URBAN-INCERC, INCERC Bucharest Branch, for training, to identify the gaps in present public information and to cover all age and professional categories of population and public servants, to teach them practical approaches to protect and cope with disaster impact.

Keywords: *earthquake education, seismic risk, Vrancea earthquake.*

INTRODUCTION

Since strong intermediate Vrancea earthquakes occur at large intervals, at present approx. 50% of the exposed population did not live during the direct manifestation of such events.
Thus, the factors influencing the effects size of seismic disaster are closely related and issues in areas such as sociology, individual and collective psychology, risk perception and social behavior of a community, government emergency management and so on, not only those related to the design earthquake.
The social dimension of natural risk is defined primarily by human perception, perceptual relationship with risk events, community reaction to risk. Perception determines a certain attitude and behavior.
Variation in the perception and assessment of event risk, regardless of social determinants such as age, education, income, is based on the [2]:

- magnitude and frequency of occurrence of extreme events;
- the degree to which the earnings and the interests of company concerned are affected;

- combination of personality factors such as belief in control over destiny, how awareness of the natural environment;
- experience.

Response to risk by adopting new ways of adapting to the environment, to reduce damage caused by hazards is different from individual to community [2]:

- the individual, the estimation of economic efficiency of a method for risk adjustment is based on perceived time factor depending on the ratio of benefits and potential losses and the extent to which alternatives exist.
- for communities, selecting a certain way of adapting to the environment depends on the degree of hazard perception of the individuals constituting the community, of alternatives and welfare of the economy, influenced by the stability and scaffolding of the political power.

The idea of seismic protection was reinforced until now through a series of actions, activities and is believed that public education and communication actions and activities involve seismic disasters deeper and more diverse, in order to reach its goal.

Therefore, will be listed, for completion and understanding, other directions and approaches:

- social psychological aspects, continuous education, not confusing messages, negative perceptions of seismic risk is not prevention, probabilistic estimates lose their significance to the question binary about incidence of earthquake (coming or not coming?)
- use various sources, the information is consistent and repeated, use information channels/media stipulations on individual-level actions (what to do or not to do), use charts, establishing partnerships, providing support through group specialists, adapting materials to local needs, mix of verbal and visual use, use opportunities, potential loss description, evaluation software.

On the other hand, a protective strategy, once developed, cannot be considered as final and immutable. Rather, it should be updated periodically as the social and economic development, as well as new data on a new basis and conceptual knowledge.

MATERIAL AND METHOD

Programs, projects and educational campaigns for seismic risk reduction. trends and approaches

Technical Cooperation Project for Seismic Risk Reduction in Buildings and Structures in Romania, in partnership with JICA and the Government of Romania, National Center for Seismic Risk Reduction (2002-2008...), had involved activities such as the public education for disaster prevention, the dissemination of some post-earthquake evaluation techniques for the damaged buildings, development of codes related to seismic risk, development and dissemination of low-cost building techniques (from tall buildings with flexible floor by introducing viscous fluid seismic dampers on the metal casing in the ground floor and the walls of existing concrete on the first 3 floors of the building)

National disaster preparedness campaign, initiated in 2005 and conducted by the Red Cross Petrom Romania, in 2007-2008, had as main objective to improve the response capacity of communities at risk of disasters.

Among the components of campaign was also the education of 600 pupils on safety rules in case of earthquake (students from six schools in Bucharest, gymnasium, the courses were held by Romanian and Japanese seismologists experts (with support of the Embassy of Japan in Bucharest the Japan International Cooperation Agency (JICA)).

The students have learned about the causes of earthquakes and how buildings behave in such situations and, for example, for a construction in case of risks, the presentation was accompanied by a demonstration. They used a mobile minisimulator for earthquakes and a simulator as a trolley on which were mounted wooden frame houses. It was also presented a flexible roller system that sits construction to mitigate shocks terrestrial system that is used in Japan.

Finally, the students took part in a simulation of an emergency in case of earthquake, which could implement preventive measures explained by the seismologist experts.

M.D.R.T. had financed and developed numerous seismic educational materials for population, to implement these materials in education, most recently in 2007 with four sets of books on "Education and protection of students in case of an earthquake".

RESULTS AND DISCUSSIONS

A demonstration platform and a center for earthquake information, education and training of the citizens

The objective of the center will be to provide information and education capacity of the population from the seismic zones including training of citizens and mass media network (the media) to communicate with the citizens [1, 3, 4, 5, 6, 7].

From the analysis results that proposed organizing a center for education and training on earthquake behavior (in the URBAN-INCERC Branch INCERC Bucharest) is based on developing a comprehensive program to exploit:

- facilities (spaces/areas designated for earthquake simulations, virtual reality and also for information, education and training and equipment)
- educational teaching materials and dissemination
- involved and induced activities

Regarding training activities, thematic lectures and course content is related to the basics of:

- seismology, geotechnical, seismic engineering
- practical seismic preparedness and prevention/education and disaster preparedness
- prevention of serious effects on earthquake, protection recommendations (population, buildings)
- emergency management (disaster-response relationship, recovery, risk reduction, depending on the components of social, political, cultural, economic and environmental)
- disaster sociology.

The activities for the education, training and public communication on strengthening buildings and earthquake behavior will be supported by e-learning materials and complex quizzes of general interest, with medium difficulty questions on general knowledge of the learner's initial assessment and planning exercises/simulations for earthquake behavior.

The center will provide a reference center that organizes scientific and logistic activities of education and training in disaster.

The center is a pressing need for Romania in European Research-Development and an effective disaster management has significant impact in reducing loss of life and future economic growth survival and quality of life, creating new jobs and training selectively staff employed on research desiderata simultaneously and disaster management.

By making this investment, some strategic objectives will be achieved:

- will ensure a collaboration with all other centers from Greece, Italy, Japan, USA, New Zealand, etc.
- development research by addressing the fundamental domains/subdomains and applied studies respectively, through provision of equipment, software and hardware, providing access to the most advanced simulation methods, investigation techniques and conventional rehabilitation in line with trends in Europe and worldwide;
- highlight the scientific value of the work in European R & D programs by increasing the number of ISI articles, participation in congresses and conferences, development of research protocols and in collaboration with scientists recognized nationally and globally, reducing the gap to EU research institutions;
- development of activities and services with social and economic impact through the development, planning and provision of equipment and technology, appropriate to European standards;
- optimizing the exchange of information and results within the scientific community made up of academics involved in research development in education, community specialists and the training of scientific and professional training which must attain the performance of university centers EU;
- human resource development through programs such as: master, doctorate,

postgraduate courses, in order to ensure smooth conduct of education and continue research, attracting a large number of young professionals in international research programs that will be developed in the integrated center by arranging and providing equipment and technology;
- enhancing the quality and diversity of education by providing access to students, graduates and researchers in research and intervention techniques after earthquake disaster by engaging all research departments in a joint effort;
- greater involvement of engineers in research and research education programs European RDI projects launching this complex work requires investment in research and innovation by purchasing equipment and professional scientific level; e-learning materials and questionnaires dedicated target groups and types of skills developed etc.

The Center will develop and use specific tools and advanced technology for knowledge transfer:

- presentations and/or on-line training courses or e-learning, with a virtual dialogue, in correlation with the educational level and the psychological profile of various social and professional categories of population – by age, attributions and previous experience;
- e-learning methods – computer technologies including particularly digital technologies, learning techniques where the student uses the computer, and the Internet for a proper development of distance education;
- earthquake simulating software and protective measures against earthquakes - flowcharts and preparing data for the actual development of the software, based on examples from Italy, Greece, Turkey, Portugal, Japan, USA, New Zealand etc. ;
- "earthquake preparedness certificates" for people who, after training courses and e-learning courses, pass the simulation tests, and people developing other activities within the proposed Center;
- the organization of mid-level courses for individuals and/or technical staff – good practice rules concerning self-financed buildings, as well as new construction techniques will be considered as alternatives;
- where appropriate, trainers will be trained to teach volunteers in schools how to explain the protective measures to students; or volunteers, e.g. students, to transfer knowledge to communities;
- communication sessions for public institutions, citizens and the media, will include recommendations and anti-seismic protective measures for public institutions and their staff.

CONCLUSIONS

Earthquake education of citizens is an ongoing process. Preparing for emergencies can contribute significantly to reducing or avoiding loss of life and injuries, to panic, rumors and disruption of social and economic life, reducing the time to return to normal after strong earthquakes and is closely related to the seismic technical protection measures [3, 4, 5, 6, 7].

Correct, continuous and timely information of the population about the situation in affected areas and the interventions, rescue and recovery is a major responsibility of both public institutions and the media. This is in the agreement with the EU Directives on Civil protection and EU Parliament Resolutions about the right to information, education and protection of the population. The press, radio and television should involve, on a long term basis and using specific means, in supplying information about the progress of earthquakes protective systems, education and training of the population to react in a rational way when an earthquake occurs. The knowledge related to earthquake preparedness, individual and group earthquake safety measures may contribute to continuous, clear and accurate information of the population in the aftermath of major seismic events. Apart from the mitigation or prevention of deaths and injuries of the personnel, journalists must be trained to convey information from reliable sources in order to avoid propagation of panic, rumours and disorganization.

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SEISMIC RISK ASSESSMENT OF FACULTY OF LAND RECLAMATION AND ENVIROMENTAL ENGINEERING - BUCHAREST

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Abstract

Increased vulnerability of human society to natural hazards is not so much due to a change in the way phenomena manifest, but also to anthropogenic causes, which require more than ever, a pertinent analysis of risk factors and constant involvement of specialists in all fields activity in reducing the negative effects they may cause to people, to the infrastructure or to environmental factors. Safety of structures is one of the main performance requirements for buildings. Expressed in a quality-like manner, this requirement must be completed with quantitative factors.

Key words: *vulnerability, list, scale, collaps, fragility*

INTRODUCTION

Increased vulnerability of human society to natural hazards is not so much due to a change in the way phenomena manifest, but also to anthropogenic causes, which require more than ever, a pertinent analysis of risk factors and a constant involvement of specialists in all fields activity in reducing the negative effects they may cause to people, to the infrastructure or to environmental factors.

Safety of structures is one of the main performance requirements for buildings. Expressed in a quality-like manner, this requirement must be completed with quantitative factors.

Building design based on experience, rules of thumb and intuitive application of the rules of mechanics, has been used for millennia, until the seventeenth and eighteenth centuries (and even later), when basis of mechanics was founded through the works of Galileo Galilei, Hooke, Mariotti, Bernoulli, Coulomb, etc.. The most important element in the development of calculation methods of construction safety concept is philosophy. This concept has evolved over time and has been elaborated on a scientific basis in recent decades.

MATHERIAL AND METHOD

The case study presented below is aimed to establish the seismic risk class of an existing building that has a reinforced concrete structure (1).

The evaluation procedures used are in accordance with the National Annex of seismic design standard EN1998-3: 2005.

The building selected for evaluation is building A of the Faculty of Land Reclamation and Environmental Engineering, University of Agronomic Sciences and Veterinary Medicine of Bucharest. The building was erected between 1968-1970, and has a resistance structure consisting of reinforced concrete frames designed according to the norms of the respective period, therefore it does not meet many requirements of the current seismic design codes.

Building Department for Land and Environmental Engineering is located in the north of the capital, in the same area there are the Village Museum and Romexpo Hall, and the House of the Free Press. The building consists of three independent sections, separated by narrow expansion joints approximately of 50 mm. For example, seismic evaluation was selected for Building A

Assessed building consists of a ground floor and 4 levels, with a height of approximately 19 m non-structural walls with compartmenting role and made of full brick masonry laid in the system of "American" bricks: two plans separated by bricks arranged longitudinally and crossed about from place to place by transversal bricks. The result is a wall system with a lower weight than the classic one, with acceptable properties in terms of insulation, but with the mechanical properties and deformation much lower. In terms of how reinforcement of reinforced concrete frame elements should be noted and how these were designed as "Norm conditioned building design in seismic regions": P13-1963. Given the limited knowledge of seismic engineering at the time, sectional effort design of beams and columns are associated with a base shear of approx. 4.5% of the construction weight. In addition, compliance and reinforcement of concrete elements are strongly influenced by the requirements and design concepts of "gravity" system from STAS 1546-56. Thus, both plates and beams are reinforced in the "gravity" system of straight bars and inclined bars. Based on the information presented above one should establish which is the appropriate level of knowledge. P100-3/2008 defines three levels of knowledge:

- KL1: limited knowledge;
- KL2: normal knowledge;
- KL3: full knowledge. Thus, the selected knowledge level determines the allowed calculation method and the value of the confidence factor (CF).

RESULTS AND DISCUSSION

Assessment methodology based on Level 3

This is the most comprehensive methodology as it involves the use of nonlinear methods of calculation. It applies to major construction meant to be a more accurate assessment of seismic performance. Also, this methodology is useful in case of complex structures for which, methodologies Level 1 and 2 do not provide sufficiently reliable results (2).

For the seismic evaluation based on level 3 methodology, there were used nonlinear static calculation methods (the "push-over") as well as nonlinear dynamic analysis ("a time-history").

This nonlinear calculation method has been applied according to the provisions of Annex D of P100-1/2006 code and set out to determine the resilience (strength inelastic) structure (F_y) and its ability to move (d_u) . This value of the last movement is finally reported to the displacement requirement (d_s) ,thus obtaining the degree of structural earthquake insurance – the R_3 indicator (2).

When defining characteristics of post-elastic deformation (curves M-θ) for the plastic potential areas, the following assumptions have been adopted:

For each opening of the beams, the longitudinal reinforcement varies widely (Fig. 1) and this makes the identification of the plastic potential areas be both difficult and relatively uncertain. Thus, to define the positions of the plastic joints one must compare the beam flexural capacity in each section along the beam with the moments resulting from the conventional static calculation for each direction of seismic action. As both the diagram of capable moments and the related diagrams for the conventional calculation vary along the beam, the procedure of identifying plastic potential areas becomes extremely complicated. To simplify it, we chose to define four possible positions of plastic hinges for each opening of the beams. Their positions were defined taking into account the variations in the capable moments diagram that show sudden capacity jumps for both positive and negative moments.

In the original reinforcement plans one can observe that the bottom longitudinal reinforcement beams have a length of anchoring shorter than the required length according to current seismic design and therefore it is possible that the end joints cannot mobilize the entire bending capacity. But taking into account that: (a) end beaks presence significantly improves the ability of anchoring the smooth bars and (b) experimental test results have shown that under a correct execution, required anchorage length is actually significantly shorter than the length required in current codes, for the nonlinear analysis performed there was considered that the longitudinal bars work at their full capacity.

For nonlinear static calculation there are used two types of plastic joints:
- "bending"plastic joints that are not influenced by the intensity of axial force. These joints were assigned to the beams because within these elements the axial forces are negligible.
- plastic joints with axial force bending that take into account the influence of the axial force on the capable moment and on the plastic rotation. This type of joints were located at the ends of the pillars, on the height of each level (1).
Capable plastic rotations of reinforced concrete elements were evaluated using the relations (b.1a) and (B.1b) of Annex B of the Code P100-3/2008 (2). For the concrete and the reinforcement, there were used resistance values associated with the materials specified in the original drawings that were actually confirmed by limited range of non-destructive tests. Thus the average values of resistance were divided by the confidence factor CF = 1.20 and by the partial safety factor.

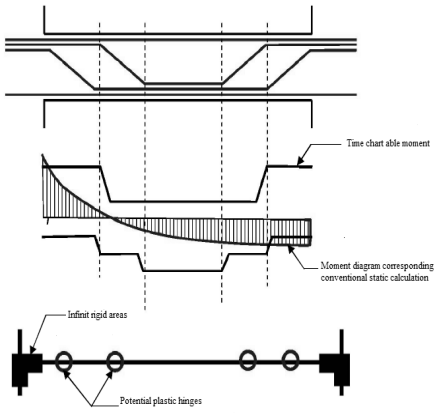

Fig. 1. Plastic potential joint positions for varying the longitudinal reinforcement

The following is an example for the application of this relationship for a beam and a column.
So, at ground level, the end of the axis A transverse beam current framework has a 350x650 mm concrete section and is armed with five longitudinal 5ϕ25 to the top and 2ϕ 20+1ϕ25at the bottom. Transverse reinforcement is made with stirrups ϕ8/200.

Consequently, the following are critical for the axis A value of maximum plastic rotation:

$$\theta_{um}^{pl} = \beta \left(\frac{\omega'}{\omega}\right)^{0,3} f_c^{0,2} \left(\frac{L_v}{h}\right)^{0,35} 25^{\propto \rho_x \frac{f_{yw}}{f_c}} \quad (1)$$

in which

β	It is a coefficient , which has the following β value for beams of=0,008;
H	It is the height of the transversal section; h=650 mm;
L_V=M/V	It represents the shearing branch in the bottom section ; L_V=3.54;
ω, ω'	Reinforcement coefficients of compressed area, respectively wide area. In the end area from the A axis $\omega' = \frac{2454}{250 \times 615} = 0,016$ respectively $\omega = \frac{1119}{250 \times 615} = 0,0073$; $\rho_{S_x} = \frac{A_{S_X}}{b_w s_h} = \frac{2 \times 50,3}{250 \times 200} = 0,002$ represents the transversal reinforcement coefficient ;

α is the confinement effectiveness factor, determined by the following formula, where b_o and h_o is confined core dimensions measured from center of stirrups, and b_i is the distance spacing between longitudinal reinforcement in a stirrup corner or paperclip in the perimeter section, thus:

$$\alpha = \left(1 - \frac{s_h}{2b_0}\right)\left(1 - \frac{s_h}{2h_0}\right)\left(1 - \frac{\sum b_i^2}{6h_0 b_0}\right) = 0,077 \quad (2)$$

It follows that the maximum plastic rotation of beam end section is:

$$\theta_{um}^{pl} = 0,008 \left(\frac{0,016}{0,0073}\right)^{0,3} \times 13,9^{0,2} \times \left(\frac{3,54}{0,65}\right)^{0,35} \times 25^{0,077 \times 0,002 \times \frac{236}{13,9}} \Rightarrow \theta_{um}^{pl} = 0,027 \quad (3)$$

As for items under P100-3/2008 armed with smooth bars, no kinks in critical areas, calculated maximum plastic rotation relationship above is reduced by multiplying by

a reduction coefficient value of 0.5. It follows that the final amount of maximum plastic rotation in the end of the beam axis is beam is $\boldsymbol{\theta_{um}^{pl} \approx 1,4\%}$

On the ground floor interior columns of transverse current frame with a cross section of 500x400 mm and are armed with 3ϕ16 on the longitudinal side. Transverse reinforcement is made with a caliper and a diamond perimeter diameter of ϕ6 willing to step 150 mm. According to Equation (B.1a) evaluation of new seismic code, the maximum plastic rotation pole used in checking the ULS is compressed area and the width of the item. It follows that the maximum plastic rotation pole is:

$$\boldsymbol{\theta_{um}^{pl} = \frac{\beta}{4^{\nu_d}} f_c^{0,2} \left(\frac{L_y}{h}\right)^{0,35} 25^{\propto \rho_x \frac{f_{yw}}{f_c}}} \quad (4)$$

Where β = 0.008 for columns; h=650 mm; L_V=3.54;

$$\rho_{S_x} = \frac{A_{S_x}}{b_w s_h} = \frac{3,41 \times 28,3}{500 \times 150} = 0,0013 \quad (5)$$

and

$$\boldsymbol{\nu_d = \frac{N_{Ed}}{b h f_c} = \frac{860 \times 10^3}{500 \times 400 \times 13,9} = 0,31} \quad (6)$$

width of the element is compressed.

It follows that the maximum plastic rotation pole is:

$$\boldsymbol{\theta_{um}^{pl} = \frac{0,018}{4^{0,31}} \times 13,9^{0,2} \times \left(\frac{1,75}{0,4}\right)^{0,35} \times 25^{0,443 \times 0,0013 \times \frac{236}{13,9}} \Rightarrow \theta_{um}^{pl} = 0,0152} \quad (7)$$

Since all columns are reinforced with smooth bars, and this amount should be reduced by half, so that the final amount of maximum plastic rotation in the transverse current frame inner pillars at ground level, is $\boldsymbol{\theta_{um}^{pl} = 0,8\%}$

Ways of defining the constitutive laws of plastic potential areas are shown schematically in Fig. 2.

The "flow" moment and the latter moment were determined based on reinforcement details of each item. Since last spins values do not differ significantly from one element to another, same values for global maximum plastic rotations were used to model plastic hinges. These are averagely estimated by applying relations P100-3/2008 Annex B of the code for a small number of elements

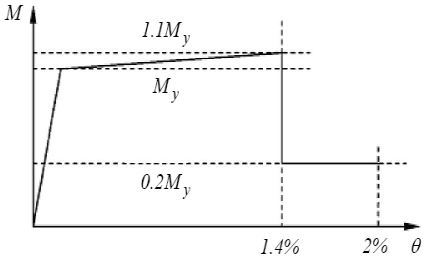

Fig. 2 Low M - θ beams

CONCLUSIONS

Since for the nonlinear dynamic calculation there were not used at least seven movements of the land compatible with the elastic response spectrum of the structure, average values of three analyzes performed could not be used for verification.

Therefore, for the 3 level methodology using nonlinear dynamic calculation methods, the degree of structural seismic insurance at the structure level is the lowest value of those obtained under the action of land movements characterized by the three diagrams for acceleration used:

R_3 = min (0.52, 0, 70, 0, 44) ⇒ R_3 = 0.44 = 44%

Consequently, according to their score indicator R_3 = 44%, Building A building FIFIM falls in seismic hazard class RsII.

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WETLAND RESTORATION PROGRAMS IN THE PRUT RIVER BASIN

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Abstract

The paper presents some aspects concerning two ecological rehabilitation projects that were partly implemented by WWF International – Danube Carpathian Programme within the Lower Prut River Basin region, in the period of years 2003-2006: Elan/Prut River Basin in Romania, respectively "Lower Prut" Scientific Reserve, in Moldova.
The Prut River is one of the main tributaries of Danube River and it forms the border between Romania and Moldova, in South-Eastern part of Europe. The Lower Prut floodplain in Moldova, with a total surface of 19,125 ha, contains about 6,114 ha of wetland habitats which are officially designated under the Ramsar Convention as being a Wetland of International Importance. The floodplain has also a regional importance due to presence of an impressive list of rare and threatened species of flora and fauna, including herons, egrets, cormorants, storks, swans and the globally threatened White pelican, as well as for flood control, nutrients and sediment mitigation and groundwater recharge. The site contains the largest natural lakes in Moldova, Beleu and Manta, which are unique ecosystems, described by some scientists as being part of the last natural floodplains in the Lower Danube River.
Being aware by the global importance of these wetlands, the Moldavian Government has created in 1991 the Lower Prut Scientific Reserve, located at the lower stretch of the river to its confluence with the Danube. The Reserve, with a total surface of 1,691 ha, is covered by about two thirds by lake and one third is represented by alluvial forests (mainly willows). The main purpose of creating the Reserve was to protect the valuable ecosystems mentioned above. The Reserve is also an important component of the biggest freshwater programme in the region, called Lower Danube Green Corridor (LDGC). The LDGC declaration, signed in 2000 in Bucharest, between Romania, Bulgaria, Ukraine and Moldova, aims to help creation an integrated ecological network of healthy, restored and protected wetlands, of about 900,000 ha along the Lower Danube River and to promote sustainable socio-economic development in the area.

Key words**:** *wetlands, ecological restoration, biodiversity, soil erosion, water pollution*

INTRODUCTION

Today, the Lower Danube floodplain is facing serious problems due to the regulation of the Prut River upstream, nutrient pollution and eutrophication, as well as pressures from local resource overuse and poaching. Actually, there is there even a social issue and contradiction with the status of the reserve for the local people, including also the Reserve's staff, for which the reserve represents very often a source for their needs. Instead being under the coordination of the Ministry of Environment in Moldova, like it was ideally, the Lower Prut Scientific Reserve is managed by MOLDSILVA – a state agency for forestry. Among others specific daily issues, Moldsilva coordinates all the scientific reserves in the country.

Now, the reserve is severe affected by different problems, such as: illegal tree cuts, fishing and livestock grazing, these being mainly produced by the local people. There is strong link between land and water management and ecosystems protection. Soil erosion occurred on the surrounding hills along the entire left side of the Lower Prut River represents also a big threat to the reserve, contributing to the siltation of the lake. Obviously, this process leads to a continuously decrease of the water level in the lake, being more visible and loss-making during the dry seasons, leading sometimes to the eutrophication. But, in addition to that, the most important threat of the Reserve is represented by oil exploitation next to, or, even within the reserve territory. There are there over 40 previously unused oil exploitation drills, which have been reactivated since year 2000. Unfortunately, the owner of

the oil exploitation, which is a foreign company, does not entirely comply with the basic environmental requirements.

The UNDP/GEF Danube Regional Project has identified wetland restoration as one potential method for reducing pollution in the Danube River by nutrients and toxic substances. Restoration of large areas of wetlands is also one of the three targets of the WWF Living Waters Programme and is a key area of work for the WWF Danube-Carpathian Programme. This project is aiming to demonstrate how national, regional and local policies, plans and strategies can be amended to facilitate large-scale wetland restoration, and contribute to successful implementation of the EU Water Framework Directive, within a major river basin.

MATERIAL AND METHOD

Being a transboundary river between Romania and Moldova, the Prut River is one of the most important rivers from hydrological, ecological and socio-economic point of view. As a whole, the Prut River catchment is also very important from biodiversity point of view, especially because a number of 225 bird species have been identified here. It represents also a very important fly route of migration for many bird species. Inside this basin have been identified three Important Bird Areas (IBA), among them being also situated the lower part of the Elan River catchment. In this IBA a number of 123 bird species have been recorded, out of which 79 species are nesting here and 99 bird species are used to be a criteria for the identification of the IBA.

The Elan River (which confluence is situated at some 120 km upstream of the confluence of Prut River with the Danube River) is one of the largest tributaries of the Prut, having a length of 73 km and a watershed of 606 km^2 (see the map attached). The multi-annually average discharge of Elan River is about 0.45 cm/sec and the maximum discharge, of 16.1 cm/sec – that was recorded on August 16, 2002.

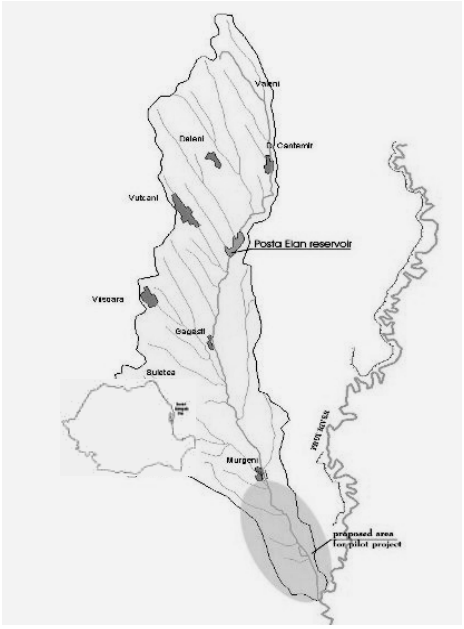

Fig. 1. Location of Elan/Prut River Project - RO

Lower part of the Elan River floodplain (between Murgeni Locality and the confluence with the Prut River), having a surface of about 170 km^2, looks like a delta, especially during the spring time and the wet seasons, being less affected by human influence. A large number of migrating water birds use the area for resting and feeding. During the summer seasons the water table become lower, but many lower spots still remain wet over the summer time.

The floodplain in this area is often flooded both by the Elan River and by the backwater coming from the Prut River (when the discharges on Prut are high), [1].

A special quality of this area is the quietness and openness of large parts of the floodplains and the absence of roads and buildings. This is a quality that is becoming very scarce in Europe and is worth conserving in some places.

The Moldavian Lower Prut River is located in the South-Western part of Moldova, between the localities Cantemir and Giurgiulesti, having a length of 147 km (see the map attached), a total surface of 19,125 ha of floodplain, out of which some 6,114 ha represent wetlands of International importance.

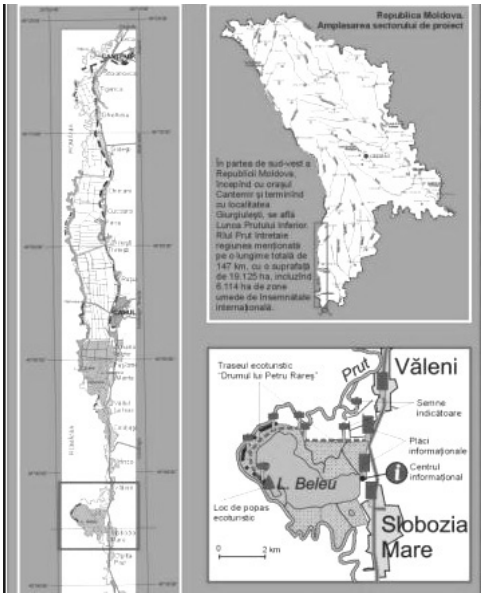

Fig. 2. Location of Lower Prut Scientific Reserve Project - MD

The Lower Prut floodplain is of regional importance for groundwater recharge, flood control, nutrient and sediment trapping, and it does support an imposing list of rare and threatened species of wetland flora and fauna. There are included here species like herons, egrets, cormorants, storks, swans and the globally threatened White pelican.

On the lower stretch of the river to its confluence with the Danube River, the Lower Prut Scientific Reserve (1,691 ha) has been designated for the protection of some of the last natural floodplains in Moldova's Lower Danube Region. The Reserve is included on the Ramsar List of Wetlands of International Importance, the only one which was designated in June 2000, and it is a valuable component of the Lower Danube Green Corridor (LDGC) in Moldova. Today, the Reserve is facing serious problems due to the regulation of the Prut River upstream, over fishing, nutrient pollution and eutrofication, as well as pressures from local resource overuse and poaching. Fish harvests have been decreasing markedly in recent years, forests are generally seen to be deteriorating, and quite a few adverse conservation factors have been listed as requiring attention.

The designation of a UNESCO Biosphere Reserve is planned over a larger area than the currently site. Its establishment and the strengthening of the management of the reserve would be in line with the agreement signed between Moldova, Romania and Ukraine for the establishment of a trilateral Biosphere Reserve, including the already existing Biosphere Reserves in the Danube Delta of Ukraine and Romania (having a total area of 46,672 ha), which is an important component of the Lower Danube Green Corridor Project.

A number of three pilot areas have been selected in the Danube River Watershed, based upon the criteria listed below, and they were proposed to the UNDP/GEF project team for their agreement. The procedure for selecting the pilot sites involved establishment of a guiding principle, agreement of site selection criteria and consultation with UNDP/GEF Danube Regional Project team [1].

The main guiding principle for the project sites projects selection was that the pilot area has to ideally constitute a relatively representative sample of the Danube river basin in terms of geographical, habitat type, and upland/lowland diversity and variation.

The specific site selection criteria were as follows:

1. Is the area *typical* of the ecosystems, and/or socio-economic threats and pressures, prevailing in this part of the Danube River basin?
2. Is there an *accessible base of information,* (e.g. previous land-use or management studies, water management information, biological surveys, or regional/rural development assessments, on the area?
3. Are there *active, credible stakeholders* working on land-use issues in the area?
4. Are new or strengthened plans for wetland restoration arising from the pilot project likely to find support not only from local stakeholders but also from local/regional/ national *governmental agencies and authorities*?
5. Will the selection of the area contribute to the body of knowledge on *nutrient reduction and/or pollution control and/or flood control?*

6. Does the area support *multiple uses or benefits* in the form of socio-economic opportunities and other environmental goods and services?
7. Is the area of *significant value for biodiversity,* nature conservation, and wetland management?
8. Will the selection of the area for pilot studies contribute to the body of knowledge relevant for implementing the *Water Framework Directive*?
9. Are there *significant threats or land-use pressures* on the wetland/floodplain resources?

Based on the above mentioned questionnaire, there were evaluated about ten project proposal sites along the Danube River Basin, and in the end only three sites were selected for the implementation, one of them being Elan/Prut River Basin in Romania.

As mentioned before, the main objective of the UNDP/GEF-DRP 1.4 was consisting in providing technical to the countries from the Danube River Watershed in order to implement the new EU policies and strategies for a better utilization of the lands and wetland restoration, in close connection to the implementation of the Water Framework Directive (WFD).

The analysis of the major causes/pressures of the wetlands reducing and/or degradation as well as their impact on environment, mainly on the Danube River, was carefully performed by the project team using the DPSIR conceptual model. It is about the Driving Forces-Pressures-State-Impact-Responses Model.

RESULTS AND DISCUSSIONS

The two projects were partly implemented by WWF -DCP in the period of years 2003-2006.

As regard to Elan/Prut River Basin in Romania, to protect the existing wetlands and possibly to increase their surface in this area there were necessary to develop measures to preserve and to improve the conditions for nature that can be combined with human use. In this respect, the main objectives of this project were as follows:

- Setting up of a management plan for the whole area with the help of main stakeholders;
- Promoting of a wise and sustainable development of the area, and,
- Protecting of the wetlands along Elan River floodplain, mainly by using the erosion control measures on slopes in order to prevent the siltation of the reservoir (e.g. afforestation of degraded lands, terraces, shelterbelts etc).

Having in view the main functions of the floodplains, especially the biogeochemical, ecological and socio-economical ones, the project was contributing to the improving of water quality in the lower part of the Danube River. This aspect was achieved by reducing substantially the nutrient and toxic amounts from the agriculture and creating good conditions mainly for fisheries, hunting and exploitation of reed vegetation in the area.

As regard to the Lower Prut Scientific Reserve in Moldova, the main goals of the project was to stop the degradation of the Lower Prut ecosystems, to achieve their long-term preservation in harmony with national and international nature conservation legislation, as well as to extent the current Reserve area to the North along the Lower Prut River [2].

The specific project objectives are as follows:

- Baseline survey of the ecological state of the Lower Prut Scientific Reserve;
- Rebuilding of the former visitor/training centre within the Reserve;
- Establishment of a good management plan and capacities for the Lower Prut Scientific Reserve and later on for the entire Lower Prut Biosphere Reserve;
- Regulation the water level in the lake and reducing/stopping its siltation through building up upstream of a small dam equipped with some sluices, as inlets and outlets of the Beleu Lake within the Scientific Reserve;
- Measures for expanding to the North of already existing wetland protected areas, along the Lower Prut River, immediately upstream of the Scientific Reserve on a distance of about 20-25 km, which are

currently agricultural degraded lands or have a very low productivity;

- Preparation of the grounds for the establishment of the Lower Prut Biosphere Reserve over an area of 46,672 ha, as part of the national and the Pan-European ecological networks and the Lower Danube Green Corridor;
- Integration of priority measures for water quality management into the draft Management Plan for the Lower Prut Biosphere Reserve;
- Raising of local communities' awareness and contribution to the protection and sustainable management of natural resources within the biosphere reserve.

Fig. 3. Water pollution with crude oil as one of the main threats of the Lower Prut Scientific Reserve

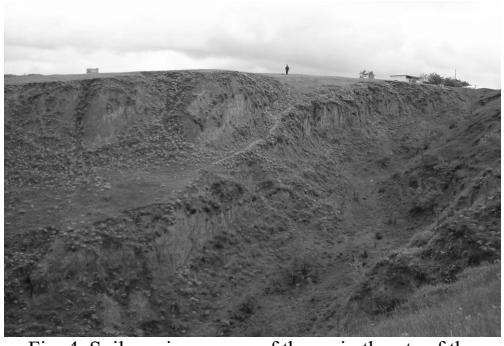

Fig. 4. Soil erosion as one of the main threats of the Lower Prut Scientific Reserve

The specific project objectives are as follows:

- Establishment of a good management plan and capacities for the Lower Prut Scientific Reserve and later on for the entire Lower Prut Biosphere Reserve;
- Regulation the water level in the lake and reducing/stopping its siltation through building up upstream of a small dam equipped with some sluices, as inlets and outlets of the Beleu Lake within the Scientific Reserve;
- Measures for expanding to the North of the already existing wetland protected areas, along the Lower Prut River, upstream of the Reserve on a distance of about 20-25 km, which are currently agricultural degraded lands or have a very low productivity;
- Preparation of the grounds for the establishment of the Lower Prut Biosphere Reserve over an area of 46,672 ha, as part of the national and the Pan-European ecological networks and the Lower Danube Green Corridor.

CONCLUSIONS

The outputs and the key milestones delivered through these projects are as follows:

- Stop the degradation of natural habitats in the area of the proposed Lower Prut Biosphere Reserve;
- A new visitor/educational centre build up within the Scientific Reserve;
- Management Plan for the Lower Prut Scientific Reserve;
- Expanding to the North of already existing wetland protected areas, along the Lower Prut River;
- Strategy for addressing key threats for the Lower Prut Scientific Reserve developed, endorsed by the government and key measures implemented;
- Water quality management programme for the area, with pollution sources and measures for their reduction identified;
- Lower Prut Biosphere Reserve feasibility study and proposal with defined core, buffer zones and zones for sustainable economic activities.

ACKNOWLEDGEMENTS

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EFFICIENCY STRATEGY FOR AN AGRICULTURAL FARM BASED ON THE AMOUNT OF WATER AVAILABLE FOR IRRIGATION

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Abstract

Based on the soil-water-plant relationship and water balance in a river basin, this paper aims to propose a model for maximizing the use of farm resources, based on the amount of water available for irrigation in a reservoir, as established by the operating regulation. For this purpose, we have usde an information system that allows finding out the situation in real time and becomes a tool to support management decision in the agricultural association.

Key words: *Soil-water-plant relationship, irrigations, available water amount, information system, farm efficiency.*

INTRODUCTION

Globally, water is a hardly renewable, vulnerable and limited natural resource. Rivers play an important role in human evolution, providing the water demand for agriculture, industry, population, navigation, aquatic habitat, hydropower energy, etc.

The lack of water and the enhancing hydrological and agricultural drought of the recent decades has important implications for the social and economic potential of Romania.

The statistical analysis of the 2003 hydrological drought in Romania showed an increased frequency of dry and very dry years during 1982-2003, from 33.4% (before 1982) to 80%, which demonstrates a trend towards aridity in the Oltenia Plain, Romanian Plain and Barlad Plain. [1] In 2003, the Danube hydrological regime was reported as the most severe since 1840, being strongly influenced by low rainfall on the upper and middle river basins.

Under these circumstances, irrigation is the drought-control solution. Irrigation is a major factor in achieving high yields, relatively constant every year, with favorable implications for the food security of the population and surplus for the export of agricultural products. [5]

The history of irrigation development in Romania was presented by the founder of scientific research on land reclamation – Marcu Botzan, member of Romanian Academy. [2].

Romania has 14.7 million ha of agricultural land. Its irrigation systems are located almost exclusively in the South and Southeast of the country, where there is a warm climate area that can be divided into five areas: the Oltenia Plain, Olt-Arges area, Arges-Ialomita, Ialomita-Siret area and Dobrogea [3].

The irrigation facilities existent in Romania consist generally of large systems, with areas ranging from 50,000 to 100,000 ha, or even larger (Carasu, Giurgiu - Răsmireşti, Covurlui Plain). [4]

Due to the application of the land law, excessive plotting (expressed by an average of 2.5 ha/family) resulted in an almost impossible controlled and efficient exploitation of the irrigation systems. Consequently, the use of systems decreased dramatically after 1991.

Only a variable percentageis in use annually, that is, 2,998,255 ha - irrigation equipped areas managed by the Romanian National Agency for Land Reclamation (ANIF).

Table 1. Irrigated areas in Romania, 2005-2009

Year	Suitable area for irrigation	Area under contract	Irrigated area (1st watering)	Percentage of suitable area for irrigation on which watering was applied	Percentage of area under contract on which watering was applied
	(ha)	(ha)	(ha)	(%)	(%)
2005	1,500,000	352,890	45,719	3.05	12.96
2006	1,500,000	198,036	96,244	6.41	48.59
2007	1,500,000	433,747	301,450	20.10	69.50
2008	1,500,000	507,863	208,218	13.88	41.00
2009	1,500,000	562,952	294,138	19.61	52.25

For a good evolution assessment of the irrigated and non-irrigated area ratio in Romania, we should consider the 2009-2013 Land Reclamation strategy devised by the Ministry of Agriculture, Forestry and Rural Development (MAPRD). The strategy is based on the following concepts [7]:

- withdrawal from operation of thr economically unsustainable irrigation facilities;
- the existing funding opportunities to develop rural areas, rehabilitation, modernization, refurbishment and expansion of the land reclamation schemes correlated with environmental standards, water demand and the amount of water available for irrigation;
- the existence of the legal and institutional framework that relieves the state from certain expenses incurred for the management of the irrigation infrastructure;
- on the EU level special attention given to environmental protection, drought, aridisation, desertification control, wetland conservation and degraded area improvement.

MATERIALS AND METHODS

The soil-water-plant relationship needs to be customized for each culture according to the depth (H) of the active root layer which differs during the growing season.from one plant to another

In order to determine the water demand of the crops, we operate with the following concepts:
a) wilting coefficient (CO) - the water content of the soil on the depth (H) below which the plant withers irreversibly:

$$CO = (1/2{,}4\ldots\ 1/2) \times CC \qquad (1)$$

where:
CC = field capacity
b) useful water capacity (CU) (active humidity interval - IUA) - the amount of water that soil can hold and make available to plant growth:

$$CU = CC - CO \qquad (2)$$

c) minimum threshold of soil moisture (PM) - the limited water pool below which field capacity ensures the plant biomass close to the maximum:

$$PM = CO + \beta.CU \qquad (3)$$

where:
β = fraction of usable water capacity (CU) above the wilting coefficient (CO) whose value varies according to the soil type [8]
d) net irrigation norm (mo) - the amount of water to be applied on one watering in order to fill the soil reservoir on depth (H), from the minimum threshold of soil moisture to the field capacity.
The water balance equation in the open circuit (without groundwater contribution), used by research institutions in the experimental field network for a given crop during one month, is [9]:

$$ETRo = \Delta R + P + M \qquad (4)$$

where:
-ETRo is the real optimum consumption by evapotranspiration of a crop, obtained from the direct measurements of parameters ΔR, P and M;
- ΔR = Ri - Rf is the variation of soil water reserves during the balance period of time;
- Ri is the initial water reserve in the soil, determined by the gravimetric method at the beginning of the calculation month;

- Rf is the final water reserve in the soil water at the end of the calculation month;
- P is the gross monthly rainfall recorded at a weather station or experimental field;
- M is the gross monthly irrigation norm, measured by amount and applied in the experimental fields of ICITID - Băneasa Giurgiu [9]

Both monthly irrigation norm (M) and gross monthly rainfall (P) cannot be fully used by plants, leading to an overstatement of the monthly water consumption (Etro).

Therefore, it is necessary to correct the equation by accepting and using two parameters:
- net irrigation norm (Mo) - standard monthly net irrigation norm, fully consumed by evapotranspiration <M;
- serviceable rainfall (Pu) - monthly rainfall fully consumed by evapotranspiration <P.

On the account of the numerous relationships appealing to the climatic parameters, Romania has adjusted the Thornthwaite equation (using the mean monthly temperatures and weather station latitude). The relationship (ETp) adopted for (dc) coefficient calculation will be called "reference climate potential evapotranspiration".

The amount of water available for irrigation results from the water balance in a given river catchment area. The basic water management balance equation in a section is:

$$\Delta_{i,j} = Q_{ai,j} - [\sum_{k=1}^{nf} (Q_{pi,j})_k + Q_{di,j}] \quad (5)$$

where:
- $\Delta_{i,j}$ is the surplus (+)/deficit (-) per month;
- $Q_{ai,j}$ are monthly average natural flows tributary in the section;
- $\sum_{k=1}^{nf} (Q_{pi,j})_k$ are the monthly average flows taken upstream and unreturned in the section by the "nf" water uses;
- $Q_{di,j}$ are the average monthly flows effluent from the section.

The effluent flow outcoming from the operating upstream water management works is determined from the basic equation of hydrograph change:

$$Q_{di,j} = Q_{ai,j} - [\sum_{k=1}^{ng} (\Delta Q_{gi,j})_k + \sum_{k=1}^{nf} (Q_{pi,j})_k] \quad (6)$$

where:
- $\sum_{k=1}^{ng} (\Delta Q_{i,j})_k$ is the effect of "ng" upstream water management works on the flow;
- $\sum_{k=1}^{nf} (Q_{pi,j})_k$ is the sum of taken and unreturned flows by the "nf" water uses located upstream the calculation section [10].

We considered the case study of an agricultural association which was supplied with 1 m^3/s from a reservoir for irrigation purposes, on the probable use provision of about 80%. The total surface was 37,300 ha, cultivated with: winter wheat, barley for consumption, three row barley, maize, sunflower, soybean for consumption, beans, sugarbeet, winter potato. The choice was based on suitability and tradition; the owners made the choice and were supported by a specially designed information system. The information system had the advantage of fast simulation, performed with accuracy for the use of the water resulting as available for irrigation at the water intake point in the reservoir and in order to obtain the expected profit immediately.

We proposed work technologies for each crop, estimating the crop budget (valuescoresponding to the 2008-2009 agricultural year) in an irrigated and non-irrigated system.

In order to make an informed selection regarding the water use optimization for irrigation and profit maximization within an agricultural association, we perofrmed a preliminary analysis of the budgets and we found that the highest profit per ton resulted from the irrigated beans crop while the highest profit per hectare resulted from the irrigated winter potato crop.

We conceived scenarios regarding the allocated areas according to crop and production system, following the variation trend of the two basic elements composing agricultural production: the amount of irrigation water and agricultural profit.

We proposed five scenarios, the differences between consisting of the crops selected based on the landowners' demand and water provision method, i.e. irrigated or non-irrigated

system. For any of the five scenarios, we considered:
- the land areas occupied by each crop, divided into irrigation-receiving areas and non-irrigated areas; the area was fully grown;
- we evaluated the amount of water in September, May, June, July, August and we simulated the maximum use of available water given by a reservoir outlet at a rate of 1 m^3/s, according to the agreement with the Romanian Water Authority ("Apele Romane") and specifications of the reservoir operating regulation;
- the share of each crop out of the total area;
- the share of irrigated area out of the total area;
- for every crop and watering method, we calculated the profit per hectare, total profit, share of each crop out of the total profit.

RESULTS AND DISCUSSIONS

Comparing the results of the proposed scenarios, the following could be observed:
- The maximum irrigated surface area was about 4782 ha (scenario 4), i.e. 12.82% of the surface; it appears that the available irirgation water was fully consumed in May and July, basically limiting irrigation of the larger areas; the use of an information system could solve punctual, real-time problems, being able to display the water availability in the reservoir as a result of lack or reduced consumption for other uses. In the current system of water resource allocation, it was chosen to provide the required flow at the design value; there was an excess of irrigation water in April, June, August and September, due to the fact that irrigation could not be assured throughout the entire growing season, as crops required;
- The maximum use level of water was about 62.59% (scenario 2) and demonstrated that the lack of water availability in the peak months (May and July) limited the posibility to increase the irrigation area, leading to the impossible use of significant water amounts; these amounts were not carried forward for irrigation use in the current allocation but were chosen for a constant monthly flow; the under these circumstances, the proposed information system would be able to manage the irrigation water balance in the reservoir as if this amount were independent, operating as a bank account;
- The minimum of total expenditure was about 32,5 mil lei (scenario 5), with an average of 872 lei/ha for the entire association and a weighted average of 873 lei / ha for the irrigated crops.
- The maximum profit was about 82,0 mil lei (scenario 3), with the irrigated crop recording a share of 8.5% in profit for a share of 12.6% in the area; the selected crops had different productivity per hectare and selling price on the market; consequently, there was no proportionality between the irrigated area and the entire organization profit; depending on the amount of available water predicted at the time of production forecast for the agricultural association, decision-making could maximize profits under the given conditions, regarding the use of irrigation water;
- The best benefit/cost ratio recorded is about 2.4 (scenario 3 - 240% of investment), which represented an excellent use of resources in terms of any management system.

Based on the reservoir water balance computation, we drew maps that showed how to use water in the agricultural association. Thus, we justified the use of the information systems in the calculation of water balance for irrigation use, and proved that the mode of representation wass very fast and correlated in time with the events that affected water balance.

Table 2. Summary of scenario results [11]

Crop	Scenario no.1					Scenario no.2					Scenario no.3					Scenario no.4					Scenario no.5				
	Irrigated are (ha)	Non-irrigated area (ha)	Share of system (%)	Share of expenditure (%)	Share of profit (%)	Irrigated area (ha)	Non-irrigated area (ha)	Share of system (%)	Share of expenditure (%)	Share of profit (%)	Irrigated area (ha)	Non-irrigated area (ha)	Share of system (%)	Share of expenditure (%)	Share of profit (%)	Irrigated area (ha)	Non-irrigated area (ha)	Share of system (%)	Share of expenditure (%)	Share of profit (%)	Irrigated area (ha)	Non-irrigated area (ha)	Share of system (%)	Share of expenditure (%)	Share of profit (%)
Winter wheat	-	-	-	-	-	-	-	-	-	-	190	-	0.51	0.39	0.14	-	-	-	-	-	-	-	-	-	-
Barley for consumption	-	-	-	-	-	140	1,360	4.02	2.57	0.97	-	1,190	3.19	2.16	0.61	-	-	-	-	-	-	-	-	-	-
Three row barley	90	1,910	5.36	3.46	1.29	-	-	-	-	-	-	-	-	-	-	-	700	1.88	1.10	0.43	-	1,000	2.68	1.83	0.68
Maize	-	500	1.34	0.93	0.30	-	-	-	-	-	-	-	-	-	-	180	-	0.48	0.30	0.21	-	-	-	-	-
Sunflower	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	155	-	0.42	0.55	0.07
Soybean for consumption	-	-	-	-	-	-	6,000	16.09	26.68	2.07	-	-	-	-	-	12	4,818	12.95	20.29	1.67	-	7,000	18.77	34.36	2.36
Beans	4,200	-	11.26	27.06	4.66	4,100	-	10.99	25.24	5.08	4.000		10.73	26.16	4.29	4,380	-	11.74	25.48	5.40	3,901	-	10.46	26.51	4.71
Sugar beet	-	12,500	33.51	7.26	43.64	-	14,000	37.53	7.78	54.49	103	13,397	36.19	7.96	45.86	-	12,000	32.17	6.30	46.54	-	18,000	48.26	11.04	68.29
Winter potatoes	440	17,660	48.53	61.26	50.09	480	11,220	31.37	37.74	37.40	420	18,000	49.38	63.30	49.09	210	15,000	40.78	46.54	45.74	500	6,744	19.42	25.70	23.89
Total costs				34,294,420					35,899,712					33,782,102					37,992,862.6					32,517,927.5	
Total profit				79,200,144					71,046,932					81,974,477					71,300,141.72					72,876,164.8	
Share of irrigated crops in system				12,68					12,60					12,60					12,82					12,20	
Share of irrigated crops in total profit				8,73					9,84					8,50					7,62					9,45	
Water use percentage				62,28					62,59					62,35					61,00					60,00	
Profit-Cost ratio				2,309					1,979					2,426					1,876					2,241	

CONCLUSIONS

When water resource is limited to 1 m^3/s the best option is Scenario no.3.

However, it is wiser is to recalculate the amount of available water according to the recorded reservoir water level, taking into account both the forecasts and demands of other uses. This way may result not only in a higher delivered irrigation water than the values forecasted at a certain moment (generally, in May and July) but also in a higher percentage of irrigation water use and, consequently, a larger irrigated area.

Such calculations can be performed quickly and accurately with the programs associated to the information systems, and can measure the corresponding areas gained; this approach enables real-time analysis of the situation and the establishment of an optimal variant of water and crop management, as it is a highly suggestive method that may be an important factor not necessarily addressing a water-management specialist but rather a water user.

Thus, the information system will become a tool for farm management decision-making as it fully respects the main desire of any owner: "the full use of resources, accompanied by minimizing costs and maximizing profits".

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THE USE OF GEOGRAPHICAL INFORMATION SYSTEMS AND LIDAR TECHNOLOGY IN THE FIELD OF ARCHAEOLOGY

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Abstract

The paper aims to present the early stages in the implementation of a Geographic Information System in the field of archaeology and its advantages. This field uses the spatial information in the required activities, whether in research or management. The chosen area of study is located in the West part of Galați City. We used as support data the orthophotoplans of that area, produced by National Agency for Cadastre and Land Registration, a topographical map produced by D.T.M, sets of photographs of archaeological sites in the area, taken from the helicopter and a LiDAR dataset for the archaeological site from "Bărboşi".I wanted to highlight the placement of these objectives in the area of study and to present the potential that LiDAR technology has in archaeology. For this I drew up a situation plan based on the digitised data, I realised a Digital Terrain Model using contours and points of known elevation from the topographic map. I generated a Digital Terrain Model based on LiDAR data, for archaeological site from "Bărboşi" and I showed a few of the analysis possibilities on the basis of this model.

Keywords**:** *LiDAR, Bărboşi, GIS, Galaţi, archaeology*

INTRODUCTION

This paper aims to present the possibilities and benefits of using a Geographic Information System in archeology. This domain necessarily uses spatial information in its research or management activities.
Although we can view and create maps with a GIS application we should not confuse this technology with digital cartography. The main difference lies in the fact that a GIS application offers the possibility to manage and analyse data. Therefore any research project that includes spatial information, such as archaeological research projects, needs GIS
In a GIS we can integrate different types of data from different sources in a single computer environment, which brings a huge benefit and contributes to the data protection, management and planning. We can overlay the information in a database with other types of information (maps, plans, photographs, etc.). Thus, a GIS database populated with comprehensive and accurate information, represents the basis for decisions regarding the objectives. Decisions must be fair and prompt, especially since these objectives require protection against destruction.
In our country, the National Archaeological Record of Romania (which is based on GIS technology) was founded for the clear need to locate archaeological sites and to protect them.
GIS also offers the possibility of completing and updating the data during the accumulation of new information.
You can work with 3D data, with 3D models of archaeological sites, thus introducing the

concept of virtual archaeology. You can produce videos through the virtual flights for the presentation and promotion of national tourism.
Fo instance, geomorphological analysis may be carried out on the basis of the accurate and detailed data sets provided by LiDAR technique. You can monitor changes of the objectives over a certain period of time.
Another advantage of building a GIS is the fact that in Romania you can find affordable hardware platforms that can run GIS applications.
Similarly, in the software, there are free solutions and representations of world famous GIS software companies.
For institutions whose business requires such spatial information GIS is beneficial. In our country, though some institutions already use this technology, we have not reached the point where we have a unified system covering all the data.
So, we present the basics of this technology and the first steps in implementing a GIS to be a starting point for further development, serving different purposes.

MATERIAL AND METHOD

The Software used for building the database is ArcGIS, version 9.3.
For the representation of archaeological sites in West side of Galaţi City and their integration into a GIS, I have realized a Digital Terrain Model based on the contours on the topographic map, at 1:25 000 scale and for shaping the site from Barboşi, I used the cloud of points obtained through laser scanning.
In the area there are 19 archaeological sites that will be integrated into database.
In order to cover that area, 12 trapezoid maps were georeferenced and unified at 1:25 000 scale.
The maps were made in 1981 using the Gauss-Krüger projection system. The georeferencing was performed using geographical coordinates of the corners. These coordinates were transformed into a Stereo 70 projection system using the *NEGO* software.
Contours were digitized using assisted method and together with the known elevation points, were the input data for the generation of digital terrain model. The DTM was obtained using Topo to Raster method in ArcGIS.
After generating the digital terrain model, the next step was tracing the areas containing archaeological sites. We're talking about archaeological sites that are difficult to identify on the orthophoto. Therefore tracing has been carried out using the support of photos taken from a helicopter. I created a polygon-type shape file, I digitized every goal and then I attached the appropriate photo, to highlight very well these mounds, using Hyperlink option.
Also, the outlined archaeological areas were highlighted on the photos.
The resulting data was overlapped over the DTM with the help of ArcScene application.
I was also tracing hydrography elements, items that belong to the agricultural, building and road areas.
The archaeological site of Bărboşi was scanned with the Leica ScanStation 2 laser scanner, that retrieves points using the time of flight measurement technique. The data was taken from three positions of the scanner and then were unified into a single cloud of points using the targets placed on the ground. The cloud of points was filtered to use in processing only the points which belong to the ground. Filtering was conducted using *ALDPAT* software (Airborne LiDAR Data Processing and Analysis Tools) with *ETEW* method (Elevation Threshold with Expand Window).
This method filters data, transforming it into a surface consisting of square cells. All points in each cell are removed, except the ones with the smallest share. For the next stage, the cell size is increased and, thus, in each cell there will be another minimum share. This stage is repeated, in order to eliminate the points of a higher share than a threshold situated above the new minimum share.
This entire process is repeated by increasing cell size and threshold share until no other point is removed from one iteration to another.

Then, I imported filtered points file in *Cyclone* and on their basis, I shaped the site (Fig. 1).

Based on the obtained DTM, we can make calculations and complex analysis using functions from the *Cyclone*.

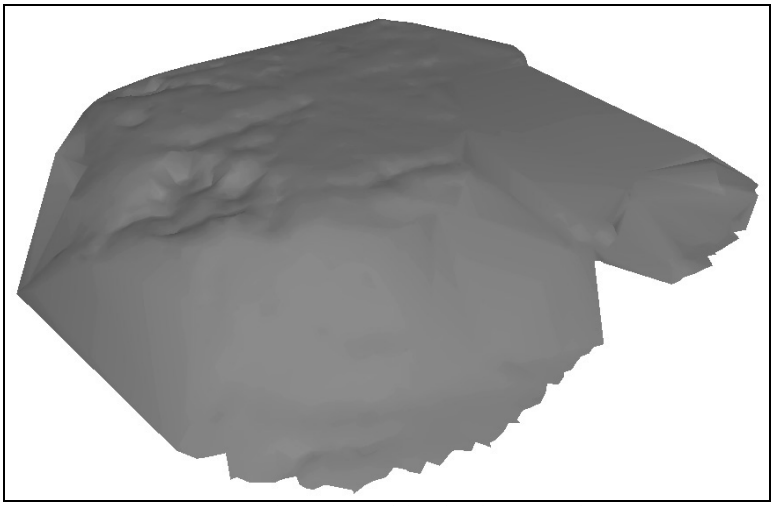

Fig. 1. Digital Terrain Model realized using Cyclone

RESULTS AND DISCUSSIONS

Vector data were overlapped on the digital terrain model using ArcScene application. I also overlapped the orthophotoplan in order to generate a layout as close to reality as possible (Fig. 2).

Secondly, I made the situation plan of the area, based on the vector data (Fig. 3).

For volume calculation, I set a reference plane Using *Cyclone*, obtaining an approximate value of 60,500 m^3 (Fig. 4).

I also created sections for intersecting the model with a vertical plane (Fig. 5) or for establishing an alignment and creating sections perpendicular to it (Fig. 6).

Fig. 2. The result of overlapping

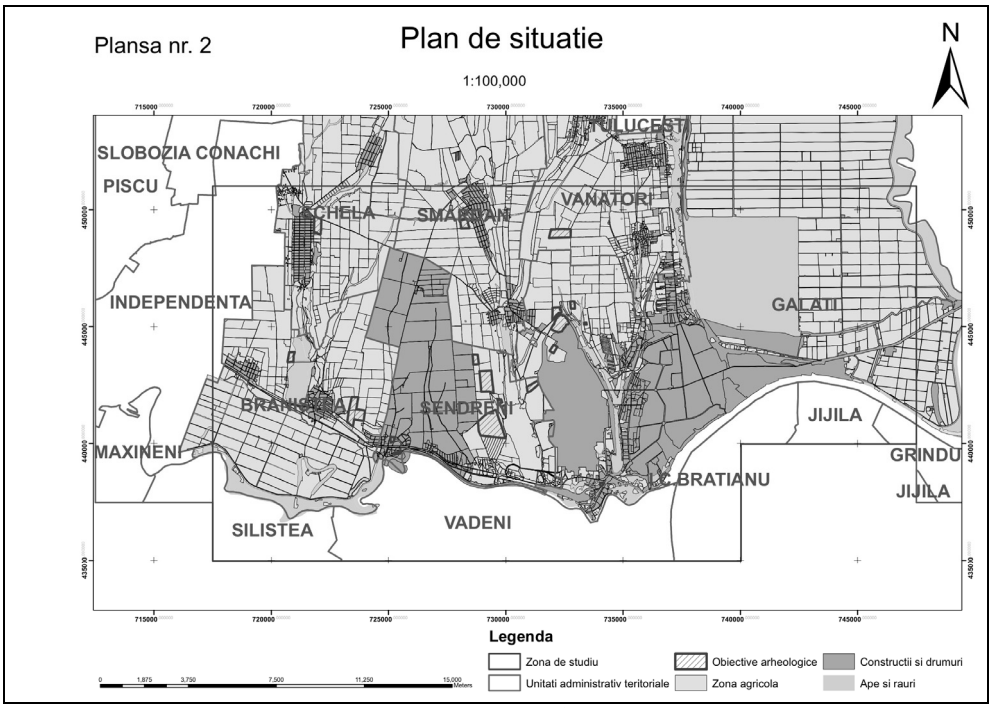

Fig. 3. Situation plan

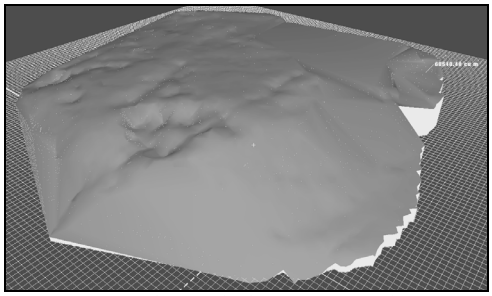
Fig. 4. Volume calculation using Cyclone

Furthermore, I generated contours with equidistance of 2 m, referring to a plane chosen arbitrarily, located at 25 m under the Digital Terrain Model (Fig. 7).

CONCLUSIONS

Geographic Information Systems evolved rapidly and will soon become indispensable in the completion of projects that use spatial information.

LiDAR technology also represents a great potential in archaeology due to data acquisition speed and due to the fact that the cloud of points can be georeferenced directly in the take-over process, if the scanner is placed on a known-coordinates point. Laser scanning offers the possibility of acquisition of an immense amount of data in a short time. Such a 3D scan can be performed for each archaeological site and so may a database can be out together with very high accuracy information.

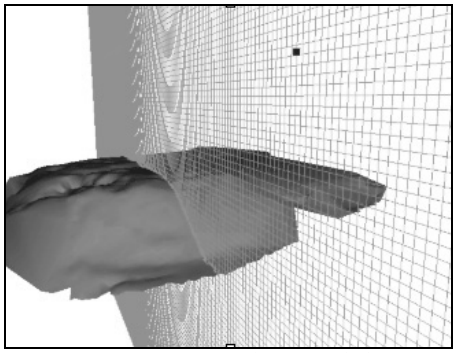
Fig. 5. Intersection with a vertical plane

GIS can also be used to manage the current activities including archaeological excavations. The database may contain

information concerning the types of discoveries from the excavations, it may draw up maps which show the distribution of harvested materials, create complex analysis and so on.

With GIS, materials can be produced for helping people in the field of research but also for the general public.

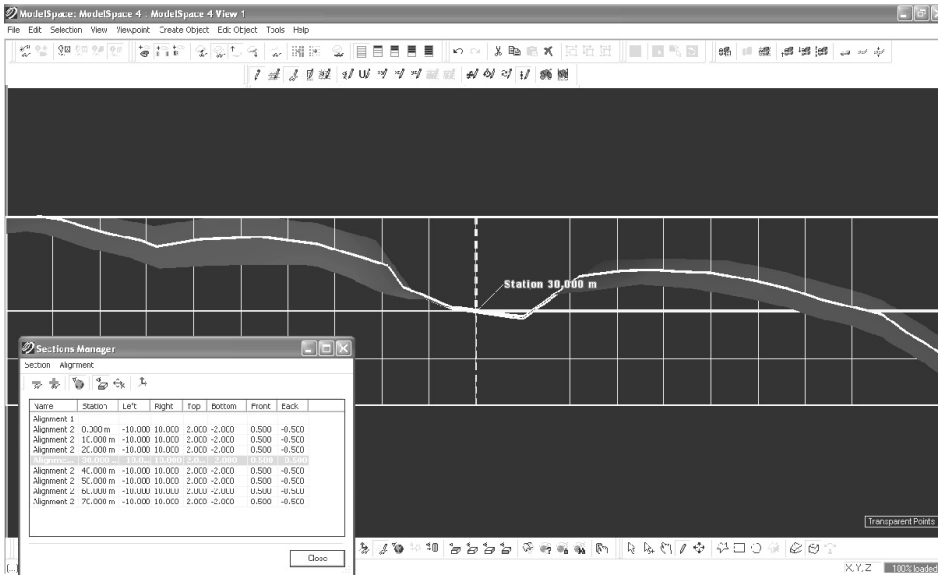

Fig. 6. Section at 30 m from the beginning point of alignment

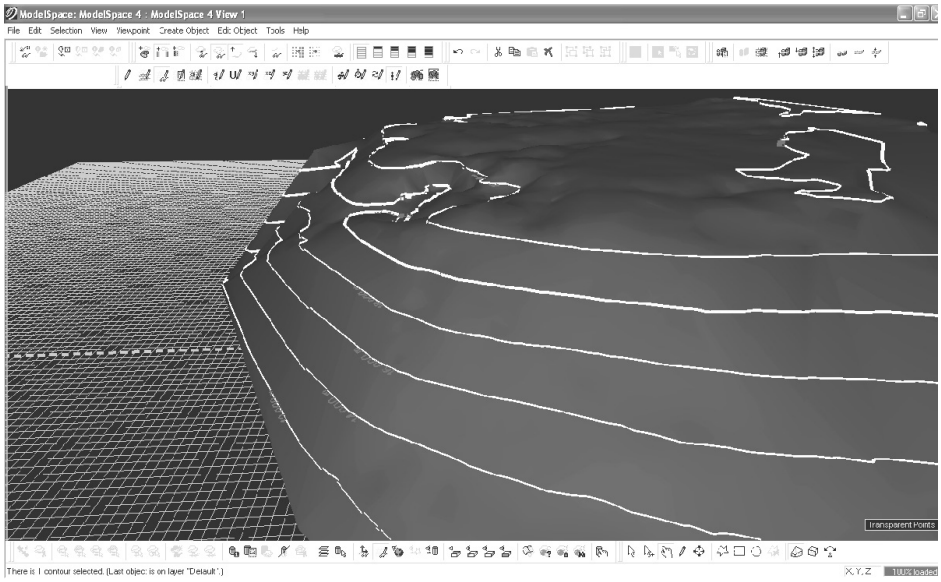

Fig. 7. Contours generated using Cyclone

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SATELLITE DERIVED PRODUCTS FOR VEGETATION STATE MONITORING IN THE LOWER MURES BASIN

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Abstract

Drought refers to a temporary decrease in water availability, for example, when it doesn't rain over a long period of time. On the other hand, water scarcity occurs when the demand for water exceeds the available sustainable resources. Most European countries are affected by the consequences of water scarcity, droughts and land degradation caused by water resources over-exploitation and exacerbated by climate change. The satellite systems present a wide range of new capabilities that can be used to assess and monitor the actual conditions of agro-ecosystems since information can be obtained on remote, wide area, non-destructive and/or real-time bases. Remote sensing data with low spatial resolution and high temporal resolution provide a useful tool for the monitoring of the vegetation activity from global to regional and local scale. The agricultural vegetation condition monitoring is currently possible, ranging from medium spatial resolution satellite derived - products, with daily revisit (NOAA-AVHRR, SPOT-VEGETATION, etc.) to high and very-high spatial resolution, offered by environmental satellites (LANDSAT, SPOT, FORMOSAT, IKONOS, QuickScat etc.) with longer revisit period. The most important parameters are: vegetation indices, maximum greenness during the growing season, total greenness during the growing season, fraction of photosynthetically active radiation and leaf area index.The study is focused on vegetation state assessment based on satellite derived products for drought monitoring (drought duration and intensity). This paper is based on the analysis of several vegetation indexes (NDVI, NDWI, etc) and biophysical parameters (LAI, fAPAR, land surface temperature, etc).The study area is focused on agricultural region situated in the western part of Romania, in the Romanian downstream of Mures River.

Key words**:** *drought, water scarcity, vegetation indexes, remote sensing,Mures*

INTRODUCTION

Climate change predictions point to a warmer world within the next 50 years, yet the impact of rising temperatures on rainfall distribution patterns in much of the world remains far less certain. Agriculture is currently accountable for 85% of the global water consumption, and irrigated areas are expected to rise by a factor of 1.9 by 2050, globally in the highest percentages where water-scarcity is most intense, namely South Europe Countries (Martindale, 2010).

For this reason, the need for improved crop, soil and water management practices, particularly in light of climate change, is growing.

Water scarcity and drought are different phenomena although they are liable to aggravate the impacts of each other. In some regions, the severity and frequency of droughts can lead to water scarcity situations, while overexploitation of available water resources can exacerbate the consequences of droughts. Therefore, attention needs to be paid to the synergies between these two phenomena, especially in river basins affected by water scarcity.

As in most European countries, Romania is affected by the consequences of water scarcity, droughts and land degradation caused by climate change. The situation is

expected to worsen as further temperature increases are expected in Europe (between 1.0-5.510°C) by the end of the century, while the precipitation decreases. The physiographic and biophysical features of many regions change through time, due to natural and/or anthropogenic factors.

STUDY AREA

The basin of the River Mures is shared by Romania (upstream country) and Hungary (downstream country).
The study area is focused on agricultural region surrounding the Pecica town, in the Ier and Crac sub-basins and the Romanian downstream of Mures River (Fig 1). Mean altitude in the study area is between 100 m to 170 m with a mean slope less than 10°.

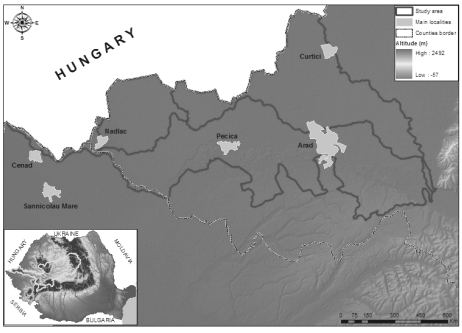

Fig.1. Study area location

DATA USED AND METHODOLOGY

In order to analyse and monitor the vegetation state different types of satellite images have been used: SPOT VEGETATION S10 NDVI products (10 days synthesis) for the year 2011; TERRA/MODIS (Moderate Resolution Imaging Spectroradiometer) vegetation indexes products (VI, NDVI, LAI) for the 2000, 2003, 2005 and 2010; LANDSAT 5 row data for the droughty years (2003, 2006 and 2010).
The methodology used includes the following steps: image geo-referencing, import in the GIS environment and obtain the final documents as cartographic, statistical and tabular and dissemination actions.

RESULTS

In order to monitor the vegetation statement, the medium and high resolution satellite images have been used to obtain the dedicated vegetation indexes. These indexes are good indicators of drought and they are used also by the scientific community (European Drought Observatory).

Normalized Difference Water Index NDWI Gao, 1996) is a satellite-derived index from the Near-Infrared (NIR) and Short Wave Infrared (SWIR) channels from LANDSAT images. The SWIR reflectance reflects changes in both the vegetation water content and the spongy mesophyll structure in vegetation canopies, while the NIR reflectance is affected by leaf internal structure and leaf dry matter content but not by water content. The combination of the NIR with the SWIR removes variations induced by leaf internal structure and leaf dry matter content, improving the accuracy in retrieving the vegetation water content.

The amount of water available in the internal leaf structure largely controls the spectral reflectance in the SWIR interval of the electromagnetic spectrum. SWIR reflectance is therefore negatively related to leaf water content (Tucker 1980).
NWDI holds considerable potential for drought monitoring because the two spectral bands used for its calculation are responsive to changes in the water content (SWIR band). As a result, NWDI is influenced by both the desiccation and wilting of vegetation and may be a more sensitive drought indicator than traditional remote sensing-based indices such as the Normalized Difference Vegetation Index (NDVI), which do not account for changes in the vegetation's water content. This index increases with vegetation water content or from dry soil to free water.

Table 1 reveals the NDWI distribution for the study area. The same drought hot-spots are easily identifiable this time with a lower intensity in the Central-Eastern part of the image.

Tabel 1. NDWI distribution per land-cover classes for the study area

Land cover (CORINE)		NDWI - 2003				NDWI - 2006				NDWI - 2010			
Code/Land classification	Area (sq. km)	Mean	Stdv	Min	Max	Mean	Stdv	Min	Max	Mean	Stdv	Min	Max
211	2525.09	0.30	0.13	-0.67	0.69	0.07	0.18	-0.71	0.67	0.08	0.18	-0.67	0.62
221	51.61	0.23	0.11	-0.60	0.56	0.00	0.12	-0.78	0.56	0.02	0.12	-0.64	0.50
222	16.34	0.16	0.16	-0.80	0.47	-0.06	0.14	-0.21	0.42	-0.06	0.13	-0.65	0.38
231	297.32	0.34	0.11	-0.67	0.72	0.08	0.13	0.02	0.67	0.08	0.14	-0.66	0.60
242	71.57	0.26	0.12	-0.56	0.61	0.03	0.13	-0.40	0.66	0.05	0.14	-0.58	0.64
243	59.01	0.26	0.15	-0.70	0.54	0.03	0.16	-0.71	0.51	0.03	0.16	-0.67	0.50
311	167.65	-0.03	0.15	-0.82	0.53	-0.13	0.12	-0.79	0.51	-0.13	0.09	-0.78	0.53
321	8.60	0.30	0.13	-0.22	0.55	0.06	0.14	-0.68	0.52	0.07	0.14	-0.33	0.52
324	10.87	0.20	0.18	-0.83	0.54	-0.04	0.14	-0.86	0.46	-0.01	0.16	-0.59	0.49

The distribution of NDWI per land classes illustrated in Table 1 confirms the conclusions of the NDVI values distribution per land classes: the pastures and natural grasslands are the most affected land-cover classes followed by the agricultural lands.

By combining the two indexes a drought "pattern" is recognizable: for the year 2003 most of the values are grouped in the upper left part of the chart (low NDVI and high NDWI). In 2006 and 2010 the largest number of values can be found in the lower right corner of the graph (high NDVI and low NDWI), (figures 2 and 3).

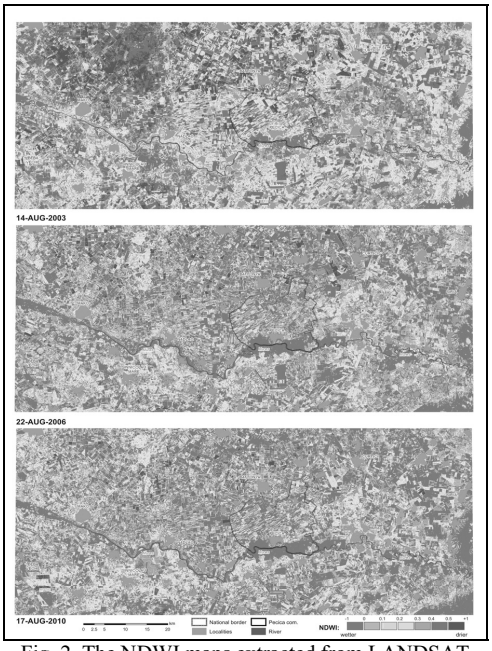

Fig. 2. The NDWI maps extracted from LANDSAT data

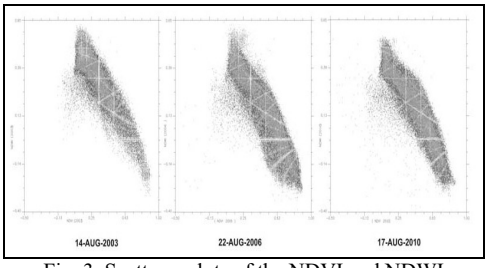

Fig. 3. Scatter – plots of the NDVI and NDWI

Leaf Area Index (LAI)

The LAI variable defines the number of equivalent layers of leaves relative to a unit of ground area. The LAI variable is used as satellite-derived parameter for calculating surface photosynthesis, evapotranspiration, and net primary production, which in turn are used to calculate terrestrial energy, carbon, water cycle processes, and biogeochemistry of vegetation. For MIDMURES Project study area TERRA/MODIS data have been used to obtain the LAI maps. The LAI values confirm the result obtained when observing the NDVI and EVI evolution during the phenophase. More visible this time, are the forest lands, noticeably with higher values of LAI (figure 4).

In order to highlight the plant water stress and drought (according to vegetation status), the LAI evolution has been monitored, starting from March 06, 2011 to October 16, 2011 in the study area. From May 25, 2011 LAI values began to decrease and lasted about 1 month until June 26, 2011 mark out the beginning of drought. This time period matches with latest phenological stages of winter crops (winter wheat), early milk and harvesting (end of June-beginning of July).

During this period were recorded small amount of precipitation that affected the crops and led to lower values of LAI.

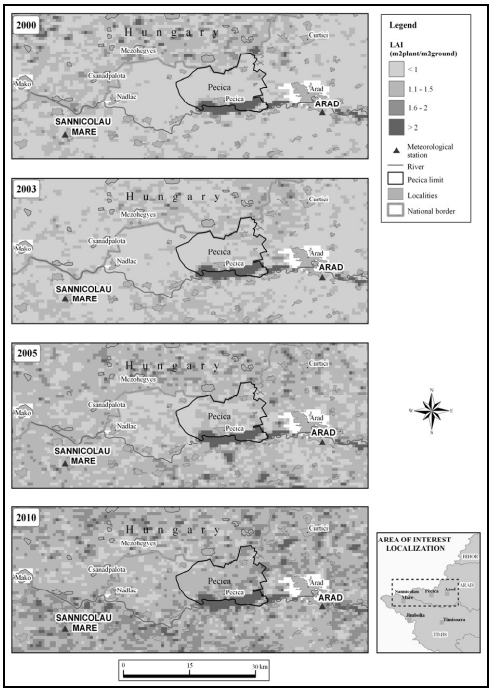

Fig. 4. Spatial variation of LAI values

A critical period can be observed from August to October when precipitation amounts were very low and soil moisture anomalies occurred thus setting up the droughts.

The MODIS LAI values have been validated using the field campaigns that were carried out in the agricultural area of Pecica town. In these campaigns the LAI values ware measured with specific devices (AccuPAR LP- 80). The LAI field measurements were taken for different crops like oats, sunflower, onion and watermelon.

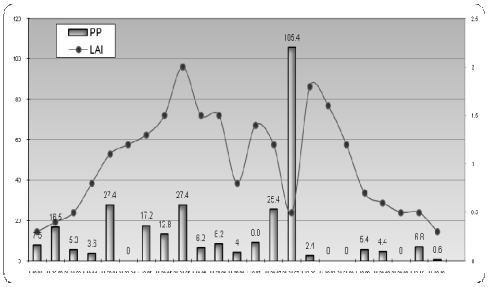

Fig.5. The correlation between LAI and precipitation

Normalized Difference Vegetation Index (NDVI) can be used for the determination of the beginning, the end and the duration of the vegetation season. These biological events play a key role in the interactions occurring at the soil-plant-atmosphere interface.

NDVI values have been extracted from SPOT VEGTATION, TERRA/MODIS and LANDSAT data.

The SPOT VEGETATION data have been used to monitor the vegetation state for year 2011. In figure 6 is shown an example of the NDVI obtained from SPOT VEGETATION data.

The NDVI values can be used in correlations with various agro-meteorological parameters using datasets provided by agro-meteorological models and agro - meteorological observation platforms. The GPS measurements and crop identification on the satellite data allow to correlate the NDVI values (for different crops) with the precipitation values recorded at Arad meteorological station.

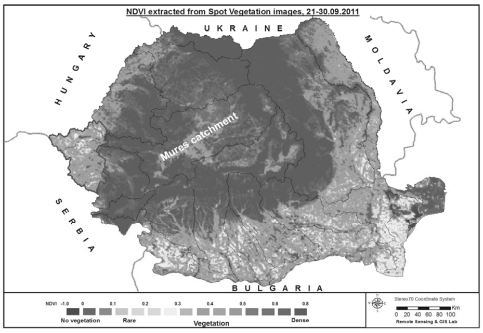

Fig. 6. The NDVI spatial distribution, extracted from SPOT VEGETATION, 21-30.09.2011

The TERRA/MODIS data analysis has been done for different four years (2000, 2003, 2005 and 2010), in order to evidence the drought years.

The difference between 2000 and 2003 on one hand and 2005 and 2010 on the other hand (except some wooded land along Mures) shows the effect of low precipitation and high temperature in 2000 and 2003. That is why NDVI values of more than 0,3 are sparse.

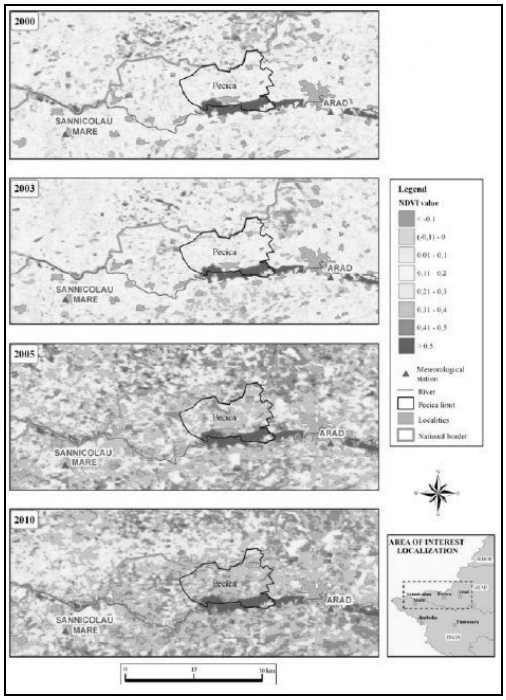

Fig. 7. Spatial variation of NDVI values from 10th of June to 28th of August

Table 2 aggregates the raw information and illustrates the NDVI percentage change between the 3 years under analysis. For the normal years (2006 and 2010), these changes don't exceed 10%. While for 2003 they exceed 30% for a considerable number of land-cover classes. As anticipated above, the pastures seem to be the most sensitive to drought occurrence with changes higher than 40%. The agricultural classes (CLC 211 and 243) suffer also major changes of 30%.

Table 2. NDVI changes (%) per land classes for the study area

Land cover (CORINE)		NVDI % of change		
Code	Area (sq.km)	2003-2006	2003-2010	2006-2010
211	2525.09	37.19	31.64	-8.84
221	51.61	27.45	25.34	-2.91
222	16.34	22.44	21.95	-0.63
231	297.32	46.13	40.94	-9.64
242	71.57	34.81	28.80	-9.22
243	59.01	35.97	31.02	-7.72
311	167.65	-0.60	-0.76	-0.15
321	8.60	38.05	31.28	-10.94
324	10.87	27.08	20.40	-9.16

The NDVI stretched colour scale includes sometimes too much information. In order to isolate only the parts affected by drought a 2 classes classification can be applied, using a "low-vegetation" NDVI threshold. In this regard, the NDVI value of 0.22 was used as "drought threshold". This bi-color representation excludes the "normal" NDVI values. Areas represented in orange in figure 8 can be therefore associated with dry land.

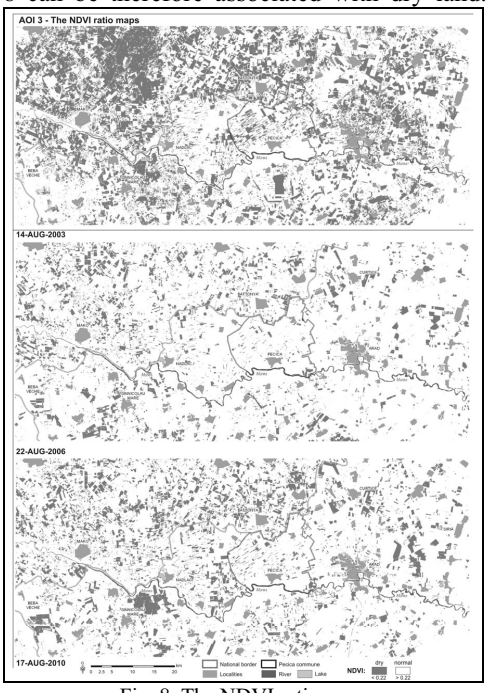

Fig. 8. The NDVI ratio maps

Another approach in evaluating the NDVI maps is by using the histograms (figure F.16). In statistics, a histogram is a graphical representation, showing a visual impression of the data distribution. Such a data evaluation offers the possibility of a general view for the entire set of data. The NDVI histograms can be divided in 2 zones: dry and normal. The values for year 2003 are grouped in the "dry" part while for 2006 and 2010 the opposite situation is recorded.

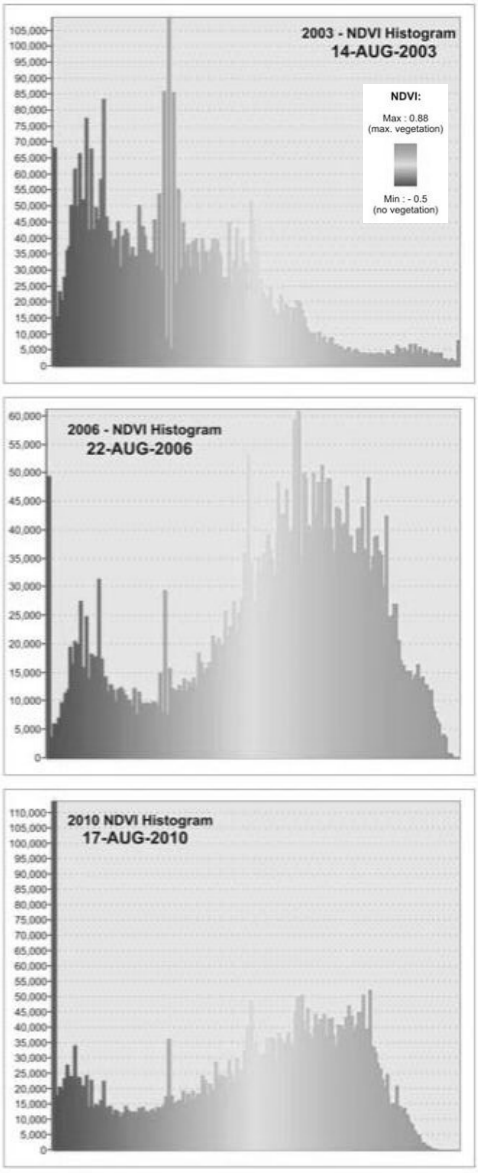

Fig. 9. NDVI histograms

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CONCLUSIONS

It proved that remote sensing techniques can enhance and improve the drought analysis, especially considering the scarce availability of measured ground truth data. The advantage of multi-annual imagery availability allows the overlay and cross-checking of doughty, normal or rainy years.

LANDSAT imagery proved to be a very useful tool in studying historical drought events. Its high spatial resolution enables a detailed observation of the Earth's surface, while its broad spectral resolution allowed the development of numerous LANDSAT drought-oriented current indexes.

SPOT VEGETATION and TERRA/MODIS imagery/products can be used for monitoring the vegetation state during the season (very good temporal resolution) for the large farms (medium spatial resolution).

GIS technologies offer the possibility of crossed-analysis between various data sources such as vegetation indexes.

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POTENTIAL APPLICATIONS IN AGRICULTURE OF NEW MATERIALS SYNTHESIZED FROM ASH

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Abstract

In the last years, zeolites have been researched for a variety of agricultural and environmental applications because possess unique properties: cation-exchange, adsorption, and molecular sieving. Zeolite can be used as soil conditioners, amendments, remediation agents in contaminated soils with heavy metals et all. Because commercially zeolites are expensive the researches have as objectives synthesis of new materials from different materials. These materials are raw or wastes, for example power plant ash, and can to be used effectively in soil applications if understand effects of these in soils or soil-like systems.The aim of this study is synthesis and characterization of zeolitic materials synthesized from power plant ash. Two different zeolite materials, rich in zeolite phases, K–cabazite were obtained from power plant ash, using 3 M KOH solutions at atmospheric pressure, temperature below 90°C and contact time of 4 and 8 hours.New materials were analyzed for their composition and properties. The synthesized products provide a significant increase of CEC (cation exchange capacity) and the high ability to adsorb heavy metal ions (over 39 mg g^{-1}). Because synthesized materials have high cation -exchange capacities that can be used as cation-exchange in a soil. The high cation-exchange capacities determined several researches for using of materials for lead and copper removal from soil.

Key words**:** *ash, cation exchange, characterization, synthesis, zeolite*

INTRODUCTION

Heavy metal ions are widespread in industrial and urban areas as a result of industrial manufactures, metal mining, smelting, soil application of sewage sludge and by-products, production, obtaining of painting materials and their use etc. [1] For reduction such hazards, a lot of researches have been made to develop remediation techniques of heavy metals contaminated soils [2].

Usually remediation techniques are constituted by extraction and immobilization processes. In the case of the first ones is to remove heavy metals from the soil matrix. The immobilization techniques consist in prevent migration of heavy metals into the soil, by improving its properties, decreasing surface area across which pollutants can transfer, or by decreasing the solubility or toxicity of the compounds [3]. For treating heavy metals from contaminated soils immobilization processes are generally preferred [4].

Immobilization is usually realised by mixing contaminated soils with suitable materials which are capable to reduce heavy metals leachability (pH and alkalinity control) in order to decrease their solubility. In other case is possible adsorption, ion exchange and precipitation of pollutants [5, 6].

A variety of materials have been investigated to immobilize heavy metals in soils. Zeolites [7, 8], phosphate rock [1, 9], fly ash [10-12], calcium hydroxide [13] and phosphates [14] can be used for immobilization.

Several mechanisms, such as ion exchange, surface complexation and dissolution followed by precipitation and co-precipitation, have been proposed in the literature to explain the heavy metal immobilization properties of zeolites [15, 16]. Although such mechanisms have not yet been well understood, zeolite seems to be a promising soil additive for the immobilization of heavy metals (Zn, Pb, Cu, Cd and As) in polluted soils [1]. Because the commercially zeolites are expensive, new materials, synthesized from waste are used for soil remediation.

MATERIAL AND METHOD

Material. The studied material was ash and zeolite synthesized from ash [17, 18]. This is obtained by direct conversion of ash at different activation solution/ash ratios, with temperature below 90°C and reaction time between 4-8 hours. Potassium hydroxide solutions with concentration 3 M, at 90°C and 4 h (Z1) and 8 h (Z2)have used for synthesise 2 different zeolites from the same ash. The zeolite material was obtained by direct alkaline conversion processes in autoclaves. The ash was added to a KOH solution 10 mL/g ratio. The zeolites obtained were filtered and dried for 2 hours at 353 K.

Methods. The ash used for synthesis was characterized chemical, mineralogical and technological. For this we performed the chemical analysis, XRD analysis using Difractometer X'PERT PRO MRD, scanning electron microscopy Vega Tescan.

Adsorption capacities were determined using the batch equilibrium method, using Multi-Parameter Consort C831 and Spectro-photometer Buck Scientific for heavy metal detection by atomic spectroscopy [17].

RESULTS AND DISCUSSIONS

The potential application of ash for obtained new materials for contaminated soil results from their properties. From this very important is chemical composition, respectivellyif ash contained heavy metal ions.

From morphologic analysis it can see transformation degree of ash in conversion process, Fig. 1.

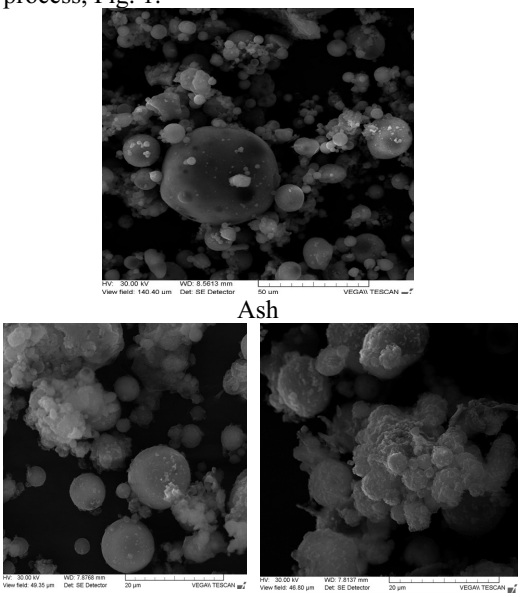


Fig. 1. SEM images for zeolite

From Fig. 1 it can observe that at 8 hours synthesized material have high modifications.

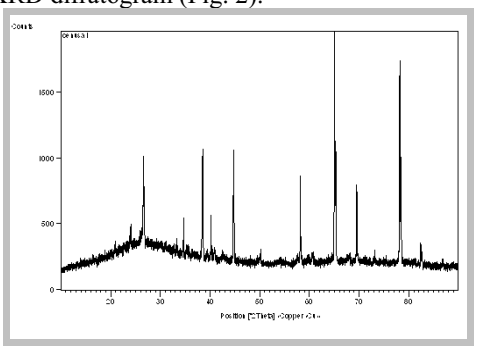
The ash and zeolites synthesized were chemically analyzed and its composition was presented in Table 1.

Table 1. The characterization of samples, %

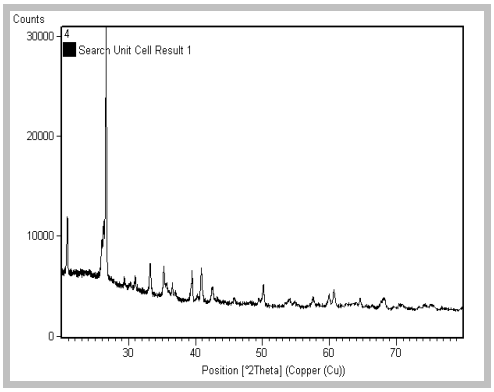
Element	Ash (%)	Zeolite 1	Zeolite 2
O	27.38	26.78	28.24
K	1.38	5.65	5.89
Mg	0.83	1.98	0.76
Al	17.93	17.82	18.88
Si	39.30	38.87	36.58
Na	0.37	0.879	0.92
Ca	5.42	2.45	3.13
Ti	1.65	0.72	0.74
Fe	5.05	5.21	5.74

The analysis demonstrated that in ash and in zeolite principal elements the followings: Si, O, Al, Ca, Fe, Na, K, and small quantities Ti and Mg. In zeolite structure appear K ions, because the synthesis was performed with potassium hydroxides and calcium content decreases,

which justify that potassium, replace the calcium in structure. Based on their chemical composition, this ash is classified in Class F [20, 21].
The analysis of IR spectrums proves that in the ash samples we can find compounds like: hematite, quartz, kaolin, illit, glow, montmorilonite, carbon. Moreover, these are the compounds which can be found in the clayey material, respectively the fuel's ballast.
The chemical analysis allows the determination of elementary or oxide compounds in the material without offering any information about "mineralogical" composition of the ash. To get some further information about the way the oxide compounds bond we have performed the XRD difratogram (Fig. 2).



ash



Z2

Fig. 2. XRD diffractogram for ash and zeolite Z2

As seen XRD diffractogram (Fig. 2) the ash contains crystalline phases: illite, kaolinite, mullite, hematite, magnetite, rutile and noncrystalline phase [22]. For zeolite Z2 it can observe that in this study K-chabazite was prepared from ash.
The adsorption capacity was studied for copper and nickel ions. Adsorption capacities were determined using the batch equilibrium method.
The zeolite Z2 provides a significant increase of CEC (cation exchange capacity) and the high ability to adsorb heavy metal ions (over 39 mg g^{-1}).

CONCLUSIONS

The aim of this study is synthesis and characterization of zeolitic materials synthesized from ash. Two different zeolite materials, rich in zeolite phases, K-cabazite were obtained from power plant ash, using 3M KOH solutions at atmospheric pressure, temperature below 90°C and contact time of 4 and 8 hours.
The ash contains prevalent silicate dioxide, alumina, iron dioxide, plus unburned carbon in different proportions function the burning conditions. XRD shows that the ash contains crystalline phases: illite, kaolinite, mullite, hematite, magnetite, rutile and noncrystalline phase.
The ash can be used as soil amendments, because not contained heavy metals, and have adequate properties.
The synthesized products provide a significant increase of CEC (cation exchange capacity) and the high ability to adsorb heavy metal ions (over 39 mg g^{-1}). Because synthesized materials have high cation -exchange capacities that can be used as cation-exchange in a soil. The high cation-exchange capacities determined several researches for using of materials for lead and copper removal from soil.

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SEAWATER INFLUENCE ON THE BEHAVIOR OF THE EXPANSIVE CLAYS

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Abstract

The paper aimed to determine the rate of change in swelling behaviour and liquid limit of clayey soils when exposed to natural seawater with respect to distilled water. The four clayey soil samples were gathered with different mineralogy and plasticity characteristics and tested to determine liquid limit and swelling characteristics in the presence of distilled water, tap water and seawater. The seawater effect is most noticed on the swelling behavior for montmorillonitic soils which have high plasticity.

Key words**:** *expansive clay, bentonite, free swell, liquid limit, seawater, tap water, distilled water*

INTRODUCTION

Expansive soils are clay soils with high shrink-swell potential. The clayey soils have the property to sensitively modify their volume when moisture changes. As moisture increase, the clay soils increase their volume and they shrink when moisture reduces [5]. These soils have long been recognized as important problem soils in geotechnical engineering, the swelling increase the rate of deterioration of the buildings causing expensive damages.
Numerous reports of expansive soil problems and related damage have been documented in different countries. The Association of British Insurers has estimated that the average cost of shrink-swell related subsidence to the insurance industry stands at over £400 million a year. In the US the estimated damage to buildings and infrastructure exceed $15 billion annually. The American Society of Civil Engineers estimates that one in four homes have some damage caused by expansive soils. In a typical year expansive soils cause a greater financial loss to property owners than earthquakes, floods, hurricanes and tornadoes combined [6].
The focus on this paper is on the behaviour of the plastics and swelling characteristics of different types of clay in presence of seawater, distilled water and tap water.
The studies in the professional literature reported that seawater have a strong impact on the engineering behaviour of clays, especially on the montmorillonitic clay.
Bentonite is very expansive and the dominant clay mineral is montmorillonite. Montmorillonite exhibits an extraordinary potential for volume change with the increase and decrease of water content in the clay.
According to our own studies, the influence of seawater in relation with liquid limits and free swell index was recorded for five types of clay soils, one of this clay is an montmorillonitic clay (bentonite).

MATERIALS AND METHODS

In this study, five clayey soils with different mineralogy were collected.
The physical characteristics of these soils, also used in our own tests, were determined according to the Romanian standard in force, specifically: grading – STAS 1913/5-85; plastic limits – STAS 1913/4-86; free swelling – STAS 1913/12-88.
Based on the physical properties and the calculation relations, the following geotechnical parameters were determined: $A_{2\mu}$ - clay ratio with a less than 0,002 mm diameter; PI – plasticity index; AI – Skempton activity index; CP – plasticity criterion; CI – consistency index; LI – liquidity index.

Properties studied in relation to seawater and distilled water are: liquid limit and free swell index.

The liquid limit is measured following the Romanian standard test method (STAS 1913/4-86). The liquid limit represents the water content, in percent, of a soil at the arbitrarily defined boundary between the semiliquid and plastic states. The liquid limit can be determined by the Casagrande apparatus that consists of a semispherical brass cup that is repeatedly dropped on a hard rubber base (Photo 1). The liquid limit is defined as the water content at wich a groove cut into the soil placed in the cup will close over a distance of 10 mm following 25 blows.

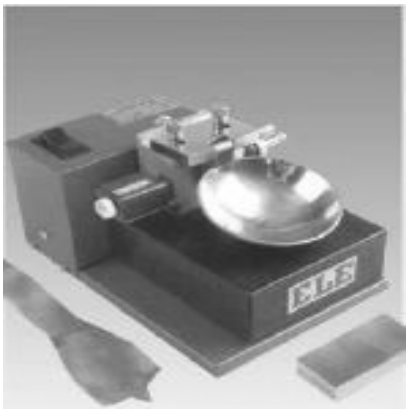

Photo 1. The Casagrande apparatus

The free swell index is determined following the Romanian standard test method STAS 1913/12-88.

According to STAS 1913/12-88, the clayey soils were oven dried at 105°C. After drying, the clayey soils were ground using a mortar and pestle until the soil passed the 0.02 mm standard sieve. 90 ml of water were poured into a 100 ml graduated cylinder. Twelve grams of sieved soil were placed in the water in 0.1 g increments. After the 12 grams were added, additional solution was poured to fill the cylinder to the 100 ml and to rinse any particle of soil adhere to the internal sides of the cylinder. After minimum 16 hour of hydration period after the last increment, the final temperature and the volume of swollen soil were measured. The free swell index, measured by this method, is calculated with:

$$S = \frac{Vf - Vi}{Vi} \cdot 100(\%) \quad (1)$$

where S – free swell (%); V_f – final volume (cm^3) and V_i – initial volume (cm^3).

The free swell index can be determined using correlations proposed by O'Neil and Ghazzally (1977), Johnson and Snethen (1978).

Correlations have been a significant of soil mechanics from its earliest days. The correlations are generally semi-empirical based on some mechanics or purely empirical based on statistical analysis. These empirical expressions relate the swelling parameters to the geotechnical parameters that are determined by means of identification tests [9].

The model proposed by O'Neil and Ghazzally (1977) is written as follows:

$$S = 2.77 + 0.131 \cdot LL - 0.27w(\%) \quad (2)$$

While the model proposed by Johnson and Snethen (1978) is written:

$$\log S = 0.036LL - 0.0833w + 0.458(\%) \quad (3)$$

where S – free swell (%); LL – liquid limit (%) and w – natural water content (%).

SOIL CHARACTERISTICS

Table 1 shows the physical characteristics and the geotechnical parameters specifics for each soil sample.

Table 1. Physical characteristics of the soils

	Soil 1	**Soil 2**	**Soil 3**	**Soil 4**	**Soil 5**
Clay, %	67	63	50	53	100
Silt, %	27	32	36	47	0
Sand, %	6	5	14	0	0
$A_{2\mu}$, %	49	47	44	43	80
w, %	21.32	17.03	18	22.62	-
LL, %	62.19	64.57	43.36	52.65	256.55
PL, %	16.29	16.2	17.95	16.29	54.51
S, %	110	105	80	80	850
PI, %	45.1	48.37	25.41	36.36	202.04
CI	0.91	0.98	0.99	0.83	-
LI	0.09	0.02	0.01	0.17	-
AI	0.92	1.03	0.57	0.845	2.52
PC, %	30.79	32.53	17.05	23.84	172.68

RESULTS AND DISCUSSIONS

The influence of the seawater on the liquid limit is shown in table 2. In presence of seawater the liquid limit decreased.

Table 2. The influence of seawater on the liquid limits and free swell index

Sample #	Liquid limit (%) / Free swell (%)		
	Distilled water	Tap water	Sea water
1	62.19 / 110	62.04 / 115	58.33 / 115
2	64.57 / 105	64.38 / 105	61.88 / 110
3	43.36 / 80	43.29 / 75	41.26 / 80
4	52.65 / 80	52.54 / 80	50.48 / 80
5	256.55 / 850	253.17 / 840	120.24 / 400

These trends are quite consistent with diffuse double layer theory. Increasing the salt concentration and the cation valence decreases the inter-particle distances, resulting the decrease of the liquid limit [10].

The swell indexes of the samples were determined in the presence of distilled water, tap water and seawater. The results are shown in table 2 and fig. 1. The swelling characteristics of the soils wich have low liquid limit (LL < 150...200 %) are not significantly affected by seawater. Furthermore, non-swelling soils have slightly higher volume in the presence of seawater than distilled water (Photo 2).

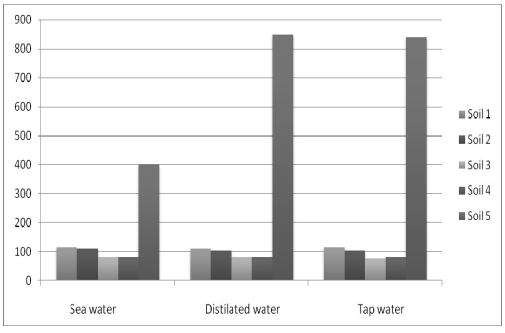

Fig 1. The differences of free swell index

Sridharan (1991) argue that kaolinites have an ability of making edge-to-face particle arrangements because of change in pore fluid chemistry and form flocculated fabrics that govern the engineering properties. The air pockets occurred between the flocculated particles capped the available water during the tests and caused an increase in the liquid limit and sediment volumes of kaolinites. This phenomenon is valid to some extent for mainly kaolinitic and illitic glacial tills. In this regard, the swell volumes of this type of soils can be higher in the seawater because of the flocculated structure [8].

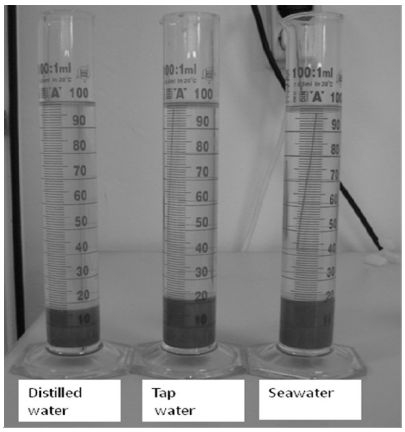

Photo 2. The volume for non-swelling soils in the presence of seawater

The swelling behaviour difference can be clearly seen in Photo 3. The amount of the clay are 12 grams in the three graduated cylinders. In cylinder 1 we have seawater, in the second cylinder we have distilled water and in the third cylinder we have tap water. However, the swell volumes of the samples are extremely different from each other. It should be noted that this difference cannot be seen for non-swelling soils.

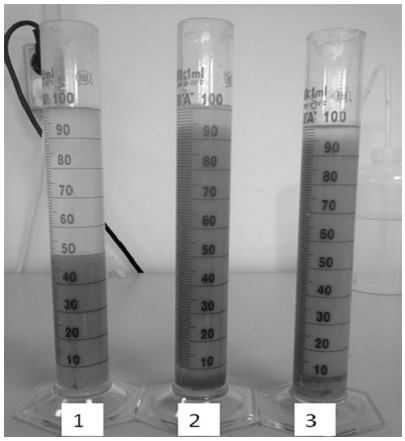

Photo 3. Free swell index determination of the soil 5 (Bentonite)

CONCLUSIONS

In this study, the liquid limit and free swell index were investigated in the presence of seawater, distilled water and tap water.
Based on the laboratory tests regarding the influence of the seawater on expansive soils, the following conclusions may be drawn:
- The differential free swell percent is lower than that in tap water and distilled water for swelling soils (LL > 150...200 %), indicating reduction in swelling potential in seawater;
- The difference in free swell percent between distilled water and seawater is remarkable, between 0% to 200%; zero is for non-swelling soils and 200% is for bentonite;
- The liquid limit decrease in presence of seawater; values of all liquid limits in seawater are lower than those in tap water. This difference can be seen more clearly for the bentonite sample.

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WEATHER PREDICTION AND THE BUTTERFLY EFFECT

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Abstract

This paper deals with a summary presentation of the butterfly effect and of some facts and experiments that makes this effect an important tool for the study of meteorology, especially for weather prediction.

Key words: attractor**,** chaos theory, iterative system, Lorenz attractor, weather pattern

INTRODUCTION

Weather prediction is an extremely difficult problem. Meteorologists can predict the weather for short periods of time, a couple days at most, but beyond that predictions are generally poor. Weather patterns are an example of iterative systems that can exhibit chaotic behaviour. In everyday language "chaos" implies the existence of unpredictable or random behaviour. The word usually carries a negative connotation involving
undesirable disorganization or confusion. However, in the scientific realm this unpredictable behaviour is not necessarily undesirable. In short, chaos embodies three important principles:extreme sensitivity to initial conditions, cause and effect are not proportional and nonlinearity.

WEATHER PREDICTION

The forecast models will not be very reliable at predicting the exact location of the events above. However, the models can give you insight into the potential of the event occurring. This is why weather forecasting is full of predictions that include a probability of occurrence. Weather features often occur on too small of a scale to be realistically forecasted over a particular location.
Probability forecasting basically eliminates this problem. For example, giving a probability of thunderstorms for a city is a more realistic prediction than a forecast saying there will or will not be a thunderstorm at a city. If a thunderstorm misses a city by a few miles when there was a probability of thunderstorms in the forecast it is not a busted forecast. However, if there is a high number probability of thunderstorms in the area and nothing happens in or near the forecast area then this would be a bust.
The smaller the scale of a weather feature the more difficulty the forecast models will have in resolving that feature. This is important because smaller scale features influence larger scale features more significantly as time passes. This fact is what causes the forecast models to tend to be less accurate as time moves forward. This is termed "the butterfly effect". Just a person breathing can have an influence on the weather over time. The smallest of events can have the largest of outcomes over time.
Weather patterns are an example of iterative systems that can exhibit chaotic behaviour. An *iterative system* is simply a function where the output for the next step, or *iteration*, is dependent on the result from the previous iteration. This sort of system can be applied to real life, where all sorts of things depend on their current state.
Edward Lorenz was a mathematician and meteorologist at the Massachusetts Institute of Technology . With the advent of computers, Lorenz saw the chance to combine mathematics and meteorology. He set out to construct a

mathematical model of the weather, namely a set of differential equations that represented changes in temperature, pressure, wind velocity, etc. In the end, Lorenz stripped the weather down to a crude model containing a set of 12 differential equations.

MOTION OF ATMOSPHERIC FLUID

Fluids can transfer heat. For fluids with high Reynolds numbers (chaotic fluids), the fraction of the kinetic energy of the fluid particles that is dissipated by friction as heat is small. Thus, the air, which we may call the atmospheric fluid is most adept at transporting heat ought to be turbulent. It is thanks to this turbulent air that we are alive today. Air's thermal conductivity is low, so when the Earth is heated by the Sun during the day, it does not emit much of this heat into the air via conduction. If winds (and, therefore, convective turbulence) did not exist, then the Earth would have a lot of excess thermal energy each day and would eventually burn us, as surface temperatures could easily reach 373 K!

Another example of how turbulence protects us pertains to carbon dioxide. Since carbon dioxide is the heaviest component of the atmosphere, if the air were motionless, then all of the carbon dioxide in the atmosphere would hover at very low altitudes, poisoning us all. However, there is turbulence, and there are winds, so the carbon dioxide is kept dispersed throughout the atmosphere.

THE WIND

Wind is indeed the flow of a fluid, namely the air, and is a key factor in weather conditions.

Winds are caused by the sum of internal and external forces on the air. Air experiences a gravitational force downward. Under calm conditions, the air is held roughly at the same altitude because the pressure gradient force counteracts the gravitational force.

Whenever the magnitude of the pressure gradient force varies significantly from that of the gravitational force, then a wind begins to blow. The air pressure varies with altitude such that

$$\frac{\partial p}{\partial z} = -\frac{gM}{RT} p , \qquad (1)$$

where z is the altitude, R is the universal gas constant, and M is the molar mass of air in kilograms. Temperature gradients with respect to altitude tend to be rather small, so at relatively high altitudes, we can claim that the temperature is roughly constant over changes in altitude that are not very large. In that case, we can say that

$$p = p_0 e^{-gMz/RT} , \qquad (2)$$

where p_0 is the air pressure at the Earth's surface. Here the temperature is usually assumed to be about 250K. Under calm conditions, the resulting pressure gradient force should be roughly equal in magnitude and opposite in direction to the gravitational force.

Unbalanced pressure gradient forces in horizontal directions lead to wind development just as they do in the vertical direction.

THE BUTTERFLY EFFECT

On a particular day in the winter of 1961, Lorenz wanted to re-examine a sequence of data coming from his model. Instead of restarting the entire run, he decided to save time and restart the run from somewhere in the middle. Using data printouts, he entered the conditions at some point near the middle of the previous run, and re-started the model calculation. What he found was very unusual and unexpected. The data from the second run should have exactly matched the data from the first run. While they matched at first, the runs eventually began to diverge dramatically — the second run losing all resemblance to the first within a few "model" months. A sample of the data from his two runs is shown below:

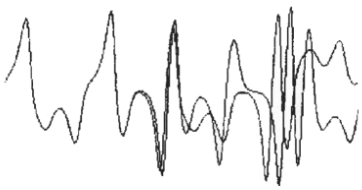

Fig. 1.

Lorenz finally found the source of the problem. To save space, his printouts only showed three digits while the data in the computer's memory contained six digits. Lorenz had entered the rounded-off data from the printouts assuming that the difference was inconsequential. For example, even today temperature is not routinely measured within one part in a thousand.

This led Lorenz to realize that long-term weather forecasting was doomed. His simple model exhibits the phenomenon known as "sensitive dependence on initial conditions." This is sometimes referred to as the butterfly effect, e.g. a butterfly flapping its wings in South America can affect the weather in Central Park. The question then arises — why does a set of completely deterministic equations exhibit this behaviour? After all, scientists are often taught that small initial perturbations lead to small changes in behaviour. This was clearly not the case in Lorenz's model of the weather. The answer lies in the nature of the equations; they were

nonlinear equations. While they are difficult to solve, nonlinear systems are central to chaos theory and often exhibit fantastically complex and chaotic behaviour.

Edward Lorenz's first weather model exhibited chaotic behaviour, but it involved a set of 12 nonlinear differential equations. Lorenz decided to look for complex behaviour in an even simpler set of equations, and was led to the phenomenon of rolling fluid convection. The physical model is simple: place a gas in a solid rectangular box with a heat source on the bottom.

Lorenz simplified a few fluid dynamics equations - called the Navier-Stokes equations - and ended up with a set of three nonlinear equations:

$$dx/dt = P(y - x)$$

$$dy/dt = Rx - y - xz$$

$$dz/dt = xy - By \qquad (3)$$

where P is the Prandtl number representing the ratio of the fluid viscosity to its thermal conductivity, R represents the difference in temperature between the top and bottom of the system, and B is the ratio of the width to height of the box used to hold the system. The simple to solve. However, they represent an extremely complicated dynamical system.

LORENZ ATTRACTOR

If one plots the results in three dimensions the following figure, called the Lorenz attractor, is obtained.

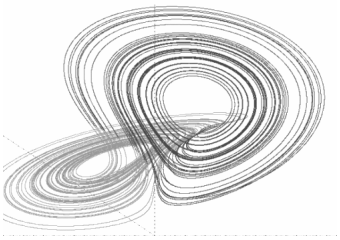

Fig. 2.

The projection on the y-z plane is shown below:

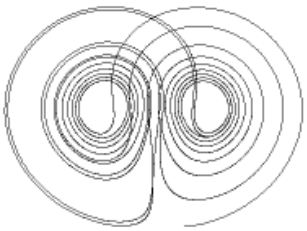

Fig. 3.

The projection on the x-z plane is also shown below:

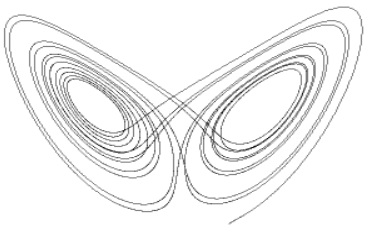

Fig. 4.

LORENZ EQUATIONS

If we vary all three parameters in the Lorenz equations, we will find many different types of solutions. For some sets of parameters, the solution will exhibit **preturbulence**, which is where trajectories oscillate chaotically for a while before reaching a stable stationary or periodic behaviour. Others yield **intermittent chaos**, which is where trajectories alternate between chaos and stable periodic behaviour. Still others lead to **noisy periodicity**, which is where trajectories are very close to being in non-stable periodic orbits. Such trajectories appear chaotic, but they are not.

The parameter values that lead us to the Lorenz Attractor have trajectories that display several properties of turbulence. First, they are non-periodic. In fact, they never intersect themselves when plotted in three dimensions. If they did, then they would start over again with the same initial condition, and the trajectory would be periodic. They also never approach periodic or stationary behaviour.

However, what is particularly interesting about these plots is that their general (rough) geometric form is independent of initial conditions, while the exact form (details) displays sensitive dependence on initial conditions.

One last interesting aspect of the Lorenz Attractor is that its associated trajectories are deterministic. This means that given an exact set of initial conditions, there is only one possible trajectory. Thus, if you were to use exactly the same initial conditions several times, you would be able to reproduce your results.

CONCLUSIONS

Chaotic phenomena occur not only in meteorology, but also in other fields like biology, demography, psychology. Nevertheless, there is growing evidence that spontaneous, deterministic chaotic dynamics is an important element in understanding the world we live in.

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EVALUATION OF WATER QUALITY IN LAKES FROM BUCHAREST

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Abstract

The aims of the present study conducted during May and June of 2012 were to investigate the microbiological level of pollution of some lakes from Bucharest and to determine the concentration of nutrients in order to evaluate the pollution degree. Results indicated that the level of nitrogen species and phosphate pose no danger meanwhile the pH values of the water samples revealed a slightly alkaline reaction. The variety and complexity of water composition is defined not only by the variety of the chemical species but also by the different forms and concentrations of each of them. Microbiological analyses indicated the presence of fungal strains and yeasts.

Key words**:** *lake, nitrate, nitrite, phosphate, pollution*

INTRODUCTION

Monitoring and maintaining the quality of ecosystems is very important from economic and environmental point of view. Water is an important receiver of the environmental issues that appear as consequence of human activities. Also, is an environmental component essential of human settlements sustainable development. Degradation of water quality means an increased risk of eutrophication that is a main cause the destruction of lake ecosystems around the world and decreases the value of its use in various urban purposes.

The quality of lake's water is under considerable threat due to rapid increase of population number, developing technology but also due to domestic and agricultural pollutants. Water pollution is defined as a change in the chemical, physical and biological parameters of a water course due to human activity.

In Bucharest an essential part of the urban ecosystem is represented by the lakes along Colentina River and Dambovita River. Morii Lake is the most extended lake from Bucharest (246 ha) and is a reservoir on the Dambovita River that assure water supply in critical situations and is suitable for leisure activities. Herastrau Lake is part of Colentina River. It has an area of 74 ha and is used for sport and recreation.

The aim of this study was to evaluate the water quality from Herastrau and Morii lakes, taking into account the eutrophization risk. As consequence, we determined the concentration of nitrogen pollutants (nitrite, nitrate, ammonium) and phosphate. It is widely known that increased levels of phosphates and nitrates often indirectly harm the environment by causing bacterial growth and huge algae blooms [1].

Because these lakes are used for recreation also, the presence of microbiological species that could affect human health was considered in this study withal.

Water degradation sources for Morii Lake is represented by dwellings situated on the lake borders non-connected to the sewage network [2].

MATERIAL AND METHOD

1. Sampling

Sampling campaign was performed between May and June 2012, periods of time characterized by similar climatic and hydrological conditions. Water samples were

collected from Herastrau Lake (four randomly poits, figure 1) and Morii Lake (three randomly points, figure 2). Water samples were taken at about 30 cm below surface layer in plastic bottles. The samples were subsequently stored at 4°C for as short a time as possible before analysis to minimize physical and chemical changes.
The samples were allowed to stay until they reached room temperature before analysis.

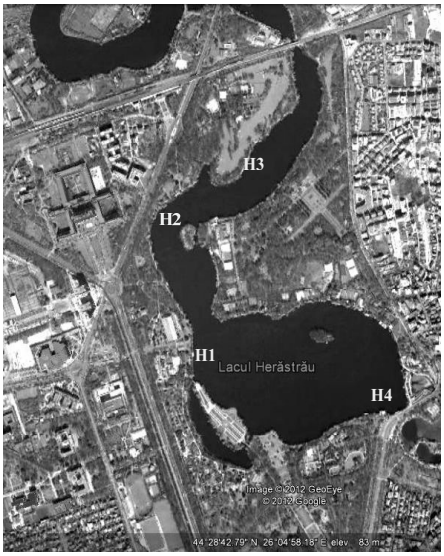


Fig.1. Sampling points from Herastrau Lake

2. Analyses

The chemical analysis of lake water samples was performed by using methods similar to those recommended for drinking water [3]. The assessment of all species was performed in triplicates and the presented results are the average of three similar values of each sample determinations.
Prior to the analysis, all instruments were calibrated according to manufacturer's recommendations.
The concentrations of phosphate, nitrate, ammonium and nitrite species were determined by the spectrophotometric means. Phosphate was quantified as molybdenum blue, for nitrate was used phenoldisulphonic method and for ammonium determination was used Nessler reagent.
Nitrite was quantified by the Griess reaction (sample was treated with sulphanilic acid and naphthyl-1-amine in acidic medium).
pH was determined potentiometrically, after the water samples reached room temperature.
For microbiological analyses was used a PDA medium (potato-dextrose-agar) sterilized at 121^{o}C, 1.2 atm for 15 minutes. Samples were incubated at dark for five days at 22-25^{o}C.

Fig. 2. Sampling points from Morii Lake

RESULTS AND DISCUSSIONS

The analytical results obtained for lake water samples are presented in table 1.

Table 1. Analytical results for water samples

Sample	pH	NO_2^-, mg/L	NO_3^-, mg/L	NH_4^+, mg/L	PO_4^{3-}, mg/L
H1	7.68	0.052	5.23	2.35	0.38
H2	7.92	0.043	6.29	1.71	0.44
H3	7.96	0.023	4.38	2.85	0.28
H4	8.00	0.066	2.27	1.84	0.49
M1	8.38	0.154	<DL	0.85	<DL
M2	7.84	0.162	<DL	1.34	<DL
M3	8.29	0.157	<DL	1.66	<DL

H1, H2, H3, H4 - sampling points from Herastrau Lake
M1, M2, M3 - sampling points from Morii Lake
(<DL-below limit of detection of the method)

Lake waters are belonging to 2nd quality class category because are used for water sports, recreation, leisure [3]. Quality parameters for surface waters are presented in table 2. The pH values for all water samples indicate a slightly alkaline reaction, but the values are within recommended range.

Table 2. Quality parameters for surface waters (STAS 4706-74)

Parameters	Water 1st class category	Water 2nd class category	Water 3rd class category
pH	6,5-8,5	6,5-8,5	6,5-9,0
NH_4^+ (mg/L)	1	3	10
NO_2^- (mg/L)	1	3	-
NO_3^- (mg/L)	10	30	-

According to already published data, pH value of lakes was observed to be into the range 7.3-9.2 (table 3) [4,5].

Table 3. pH values of different natural waters

Water characteristics	pH
Waters of volcanic exhalation	>2
Mine waters	3-4
Swamps	4-6
Groundwaters	5-7
Rivers	6.8-7.8
Fresh lakes	7.3-9.2
Ocean	7.8-8.3
Salt (soda) lakes	up to 10.5

Phosphates and nitrogen species occur in small amounts in all aquatic environments and are required to maintain the growth and metabolism of plants and animals. In excess these species are quite harmful.

It is widely known that the increasing phosphorus concentrations in the surface waters raise the growth of phosphate-dependent organisms, prevent sunlight from entering the water and appear a phenomenon commonly known as eutrophication [1,6,7].

Phosphate concentration was found very low in samples from Herastrau Lake and for samples collected from Morii Lake the levels were below detection limit of the method. The results were much lower than those reported elsewhere [8].

Nitrate and nitrite concentrations for analyzed samples are below admitted levels for all samples. Similar results in the case of Morii Lake were reported by Ghervase et al. [2].

Ammonium was found closer to the maximum level in the case of Herastrau Lake. Instead, for water samples from Morii Lake, the ammonium levels were found lower than those reported by Ghervase et al. [2].

Phosphates, nitrates, and ammonium could be nutrients for different microorganisms and aquatic plants, for example algae. These sometimes are unwanted because of their possible effects in inhibiting water aeration, which can lead to death various aquatic species. Anyway, the values found in our research indicate that these nutrients pose no environmental danger from this point of view.

Microbiological analyses of water samples collected from Herastrau Lake indicated the presence of yeasts and fungal strains (*Aspergillus*, *Penicillium*) (figure 3). The microbiological results obtained for water samples from Morii Lake showed as well, the presence of yeasts and fungal strains (*Fusarium*, *Penicillium*) (figure 4).

Moulds are found in all natural habitats due to their remarkable ability to adapt to the different ambient conditions. In water, the presence of mould is occasional. Mould growth is dependent of organic compounds found in water and can take place only under conditions of aeration. Fungal strains or moulds are vital for the maintenance of ecosystems. By breaking down dead organic material, they continue the cycle of nutrients through ecosystems. Water fungi can play a vital role in the decomposition of some organic materials.

In the meantime, a higher quantity of moulds than it is normally in proper water poses a risk to water quality and aquatic species. Therefore, *Aspergillus* species are found in oxygen-rich environments and could produce infections of respiratory system. *Penicillium* and *Fusarium* species lead to mycotoxins [9,10].

Literature survey reveals that *Penicillium* and *Aspergillus* specied were found in microflora of Dal Lake to be widespread in the water samples, this indicating that the spores of this genus are most widespread in nature [11].

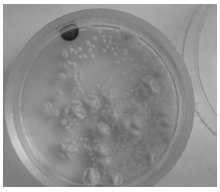
CONCLUSIONS

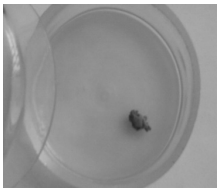
The aim of this study was to evaluate the water quality from Herastrau and Morii lakes having in view eutrophization danger and microbiological species that could affect human health. The results allowed us to conclude:

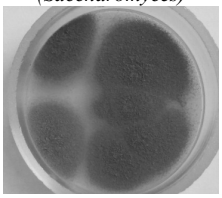
1. the ammonium and nitrite found concentrations are below limits set for surface waters 2nd quality class category;

2. for samples from Morii Lake, the nitrate was below detection limit of the method, situation found for phosphate ions, as well;

3. the pH values indicated a slightly alkaline reaction (7.68-8.38);
4. lower concentrations of nutrients indicate that there is no danger regarding eutrophication process;
5. microbiological analyses evidenced the presence in water samples of yeasts and fungal strains (*Aspergillus*, *Penicillium, Fusarium*).


H1 - yeasts *(Saccharomyces)*


H2 - fungus *(Aspergillus)*


H3 - fungus *(Aspergillus.)*

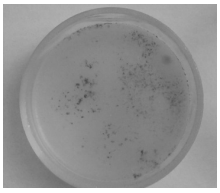
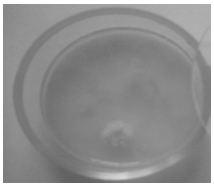
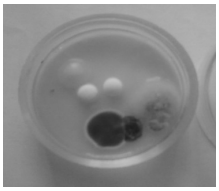
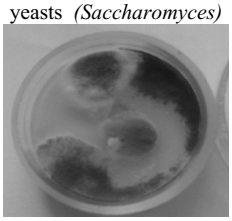

H4-fungus *(Penicillium)*

Fig. 3. Results of microbiological analyses - Herastrau Lake water samples (H1-H4)


M1 - fungus (*Fusarium)* yeasts *(Saccharomyces)*


M2 - yeasts *(Saccharomyces)*


M2 - fungus *(Penicillium, Fusarium)*

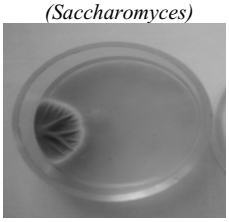

M3 - yeasts *(Saccharomyces)*

Fig. 4. Results of microbiological analyses - Morii Lake water samples (M1-M3)

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