SUSTAINABLE SOIL AND LAND MANAGEMENT IN THE ARANCA PLAIN – S.W. ROMANIA

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Abstract: *The importance of land-use planning and the use of the soil survey to develop land suitable for its intended purpose were introduces in the early 1960s. The objective proposed in this paper was to make evident the aridization tendencies to the Aranca Plain area, the divisions the urgency zones emplaced in forest belts in order to protect the terrain from Beba-Veche village.*
According with Romanian Taxonomic System of Soils (SRTS 2003) and WRB for SR 1998, in researched area have been identified 6 classes, 8 types, 35 undertypes, 98 varietys and other units, which are different through their propertys, their productiv capacity and measures for maintainance and increase their fertility. Crop production can be done in the different conditions: natural ecosystems (without or with human intervention), or agro-ecosystems, extensive or intensive (direct or indirect involvement of the state) requires with a pressing necessity as deep knowledge of all ecological determinants, for which each of the 136 units of land (TEO) identified were characterized under the current methodology of the soil studies using the 23 indicators of evaluation, indicators which represent character and traits most important, more significant, specific and measurable. These dates were completed by a detailed soil survey effectuated in the Aranca Plain. There were studied 79 main soil profiles from which are dominant Chernozems and Vertisols, both soil types with a high content of soluble salts and sodium.Soil-solution-soil-matrix physico-chemical interactions enhanced by dilute soil solution with high sodium, affect the flow parameters considerably. Vertisols, which is a deep clayey soil, dominated by clay minerals such as smectites, expand upon wetting and shrink upon drying. They form wide cracks from the soil surface when drying out. From the types of existent forest-belt it is estimate that the next belts give a good result for the argillaceous soils from the Aranca Plain: Populus euramericana and Quercus robur with Syringa v., Ligustrum v., Cornus m.; the belt with Pinus silvestris and Quercus rubra with Ribes a., Cornus m., Robinia p. For the 9300 hectares surface of Bebe-Veche village, the necessary of seedling plants is 324670, along the drainage channel, access roads and around the agricultural farms. We recommend also, re-using the drainage water, where the quality of the water is acceptable, but not a direct connection between the drainage system and the irrigation system.

Keywords: *argillaceous soils, aridization, forest-belt, soil survey, sustainable soil*

INTRODUCTION

The concept of sustainability has evolved to meet changing needs, changing realities, technological development, and new understanding of ecosystem functions. Land was often pushed to produce crops that the soil and climate could not sustain. History is largely a record of human struggle to wrest the land from nature, because man relies for sustenance on the products of the soil. Great progress was made during century 20s, with the introduction of contour cultivation, cover crops, and use of manure and crop rotations to restore soil nutrients and organic matter. The need for zoning, education, financial relief and improved practices was recognized at the time to address holistically the roots of problems causing soil degradation and loss.

The importance of land-use planning and the use of the soil survey to develop land suitable for its intended purpose were introduced in the early 1960's. Agenda 21, The United Nations Programme of action, developed at the 1992 Rio Earth Summit, declared: the destruction and degradation of agricultural and environmental resources is a major issue. Techniques for environmental awareness have grown. Soil and water quality are of concern not only for on-farm productivity, but also for human health.

The 1990 Farm Bill defined sustainable agriculture as:

- an integrated system of plant and animal production practices having a site-specific application that will, over the long term, satisfy human food and fiber needs;
- enhance environmental quality and the natural resources base upon which the agricultural economy depends;
- make the most efficient use of nonrenewable resources and on farm ranch resources.

Sustainable agricultural system strive to restore and enhance inherent soil qualities and productivity through improve conservation and management practices, while reducing use of commercial inputs (BERC, 2005).

A great problem in our days is the climate changes. The climate change and the degradation land phenomena due to the human activities are in present a certainty. Aridisation and even desertisation are present in Romania, especially in the south and in Aranca Plain.

Aridisation, means, a change in climate, in the sense of reducing the amount of precipitation and/or of increasing the temperature and the potential evapotranspiration due to global climate changes, and possibly accentuated by some human activities. A change in the soil moisture regime, in the sense of reducing the soil water supply.

It follows climate changes, excessive drainage, removal of vegetation, erosion or other changes induces by different human activities. The amount of rainfall water is insufficient, and allows only xerophytic plants to grow. Sustained agriculture needs irrigation. It is applied mostly to soils of dry steppe and semiarid climates. Aranca Plain is a semiarid area, with an annual P/ET_o ratio of 0.20 – 0.50, with land used extensively as land in crop and pastures, but cropping is susceptible to significant variability from year to year (BERBECEL et al., 1979).

Because of deforestation, forest represent only 3% from total area, there is an actual danger of desertisation. In a general sens, desertisation is an irreversible transformation into a desert of arid or semiarid regions. It is characterized by a considerable reduction in perennial vegetation (resulting in a land cover of <5% of the area) and by its concentration along the hydrological network. There is an obvious decrease in microflora, macroflora and fauna diversity, an increase in soil degradation, and there are increased hazard for human occupancy. In a more specific (and a more restricted) sense, according to UNCCD, any land degradation occurring in arid, semiarid, and dry subhumid regions as a consequence of climate changes or of human activities (ROGOBETE et al., 2005).

The objective proposed in this paper was to make evident the aridisation tendencies to the Aranca Plain area, the soil cover and its main characteristics, the divisions the urgency zones emplaced in forest belts in order to protect the terrain from Beba Veche village.

MATERIAL AND METHODS

For this research we used the dates regarding the climate from the weather station Sânnicolau Mare. These dates were completed by a detailed soil survey effectuated in Aranca Plain, with special analyses for village Beba Veche. The study, for locating forest belts was unfolded in a forest station within perimeter Beba Veche.

RESULTS AND DISCUSSIONS

The Banat Plain, which occupies approximately ½ from the total province area, is graduated in high plain (Vinga, Gătaia, Buziaş, Socol), terrace plain (Recaş, Sudriaş, Biniş) and low plain (Aranca, Bega-Timiş, Jimbolia, Moravița). Founding at the interference of the eastern continental air mass with the wet air mass oceanic, from the west, but also with the Mediteranian influences, the Banat Plain is characterized by the temperate continental climate with submediteranean influences (ROGOBETE, 1997).

As part of Banat Plain, Aranca Plain is characterized by the topoclimate similar with steppe (COSTE et al, 1997). The spontaneous vegetation presents steppes elements with xerophytes grasses. The climate indices (P.A.I., hydroclimatical and climatical) show that from the 7 years, 4 years are droughty or very droughty (Table 1).

Table 1

Climate data of the year 2011th, comparative with the multiannual average

Climate element	Period	Month												Anuual average
		I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
Temperature °C	Month average	-1,05	1,82	7,60	11,82	18,63	23,76	25,32	26,42	21,92	12,97	6,19	2,11	13,13
	Multiannual average	-1,50	0,90	5,50	11,10	16,60	19,70	21,40	21,10	16,70	11,20	5,30	0,30	10,70
	Excess, +	0,45	0,92	2,10	0,72	2,03	4,06	3,92	5,32	5,22	1,77	0,89	1,81	2,43
	Deficit, -	-	-	-	-	-	-	-	-	-	-	-	-	-
Precipitations (mm)	Month average	12,5	15,5	22,2	5,7	34,6	28,5	96,1	-	17,7	25,4	5,2	13,8	277,2
	Multiannual average	31,6	26,9	30,05	45,5	51,1	73,7	56,7	48,7	40,2	34,7	41,5	46,1	527,2
	Excess, +	-	-	-	-	-	-	39,4	-	-	-	-	-	-
	Deficit, -	19,1	11,4	8,3	39,8	16,5	45,2	-	48,7	22,5	9,3	36,3	32,3	250

The last year, 2011, were very droughty, with only 277,2 mm precipitation and a temperature of 13,13°C, comparatively with multiannual average of 527,2 mm precipitation and 10,7°C the temperature.

The land use in Aranca Plain shows for forest area only 3 % from total area (90857.9 ha), and 3.4 % from agricultural land, when it is known that the forest must occupies 30% (Table 2).

Table 2

Areas structure for the main land use in Aranca Plain (1.01.2007, ha)

No.	Place	Arable	Pasture	Hayfield	Vineyard	Orchard	Agriculture total	Forest	Water	Others	General Total
1	Beba Veche	7793	976	3	16	30	8818	4	216	367	9405
2	Cenad	6504	728	43	4	104	7383	366	242	500	8491
3	Dudeş tii Vechi	16257	2715	36	40	14	19062	18	564	1420	20564
4	Periam	7653	749	37	4	600	9043	74	144	572	9833
5	Saravale	7377	2138	98	6	1	9620	81	184	362	10247
6	Sânnicolau Mare	10668	1608	47	12	356	12690	36	320	858	13904
7	Sânpetru Mare	8162	946	56	2	10	9176	120	377	486	10159
	Timiş County	64414	9860	320	84	1115	75792	699	2047	4065	82603
8	Felnac	598,6	58	4	3	1	664,6	429	96	320	1509,6
9	Secusigiu	3525,3	250	123	0	0	3898,3	1601	428	818	6745,3
	Arad County	4123,9	308	127	3	1	4562,9	2030	524	1138	8254,9
	General Total	68537,9	10168	447	87	1116	80354,9	2729	2571	5203	90857,9

Another characteristic element is represented by the drainage systems. Starting in 1700 – 1800 years, these works are increasing very much in 1970 – 1980, with a large extension, with a great descent of the groundwater level, at 4 – 5m from 1 – 2m depth. So, is certain that the lost of groundwater contribution for the whole cultures and the extension of sodium phenomenon from 2.9% affected area to 8.92% (ROGOBETE, 1997).

According with Romanian Taxonomic System of Soils (SRTS 2012) and WRB-SR (2006), in researched area have been identified 6 classes, 8 types, 35 subtypes, 98 varieties, and other units, which are different through their properties, their productive capacity and measures for maintainance or increase the fertility (CANARACHE et al., 2006).

The map of soils, contains: Chernozems (60279,89 ha), Vertisols (8801,94 ha), Pelosols (8785,02 ha), Gleysols (3897,30 ha), Fluvisols (10328,50 ha) and Solonetz (1944,10 ha), as the main soil types (ROGOBETE, 2011).

All the soil types can be grouped in two categories in accordance with particle size distribution: a first group with coarse-medium texture (Fluvisols, Chernozems, Gleysols) and the second group with fine texture and sodium (Vertisols, Solonetz).

Fluvisols are young soils and the stratification is the major characteristic Physically, Fluvisols may be wet through the presence of groundwater, soil salinity and high sodium levels in the first 50 cm from the surface may be a problem.

Chernozems have a deep humus rich mollic horizon, with a well developed crumb structure resulting from a high annual biomass production and a very high biological activity in the soil. The favorable physical and chemical properties especially the high porosity and available water capacity, the high level of nutrients make these soils very fertile. In the territory of Aranca Plain, 75% from soil profiles have the soluble salts in the first 50 cm subsurface.

Vertisols are deep clayey soils (>45% clay), dominated by clay minerals such as smectites, that expend upon wetting and shrink upon drying. They form wide cracks from the soil surface down to at least 50 cm depth, when drying out. Although they have a relatively high water holding capacity, shallow rooting crops may suffer from drought stress, the solute transport is very slow and the soluble salts are concentrated at the bottom of the soil profile.

The dominant physical features of Solonetz are the poor aggregate stability, the impermeability under wet conditions and the hardness of the nitric horizon when dry. The main chemical characteristics are the high amounts of sodium and the high pH, which is more than 9.0.

The forest-belt will be located:

- along the principal and secondary channel (on the single part of the channel), with withed variable between 8-15 meters;
- the forest-belt along the main and the access road;
- the forest-belt around the agricultural farms and along the roads with a minimum of 30 m distance from the civil constructions and the roads.

It is using the axles with different size and also the shrubbery for have a belt which will decrease the speed of wind. The recommended species should to carry out some conditions regarding the rise, the resistance at drought, illness, frost, wind (LUPU et al., 1959).

From the types of existent forest-belt it is estimate that the next belts give a good result for the argillaceous soils from the Aranca Plain, like Vertisols (Figure 1).

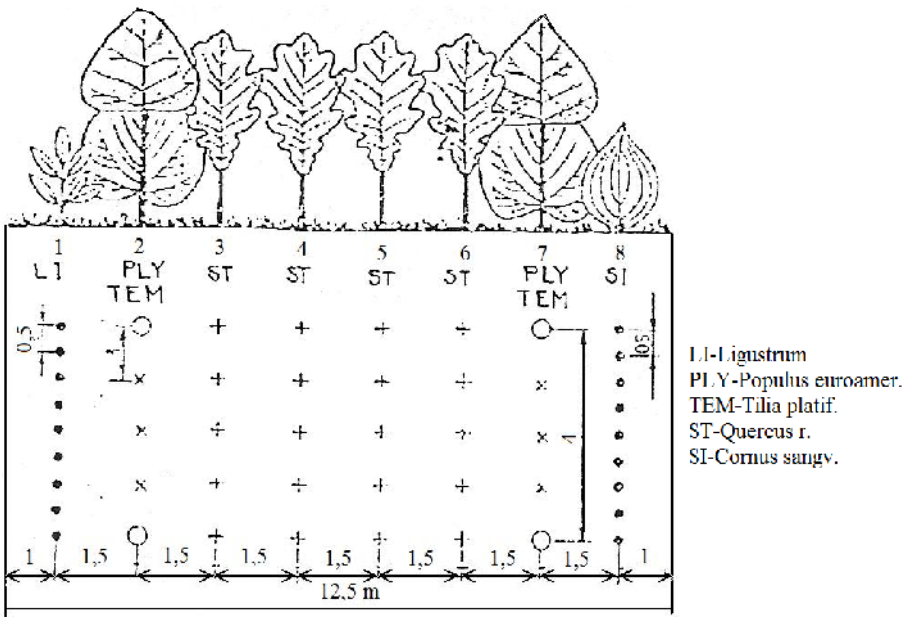

Figure 1. The specific belt for vertosoil

- the belt with Populus euramericana and Quercus robur with Syringa v., Ligustrum v., Cornus s. (Figure 2).
- the belt with Pinus silvestris and Quercus rubra with Ribes a., Cornus m., Robinia p.

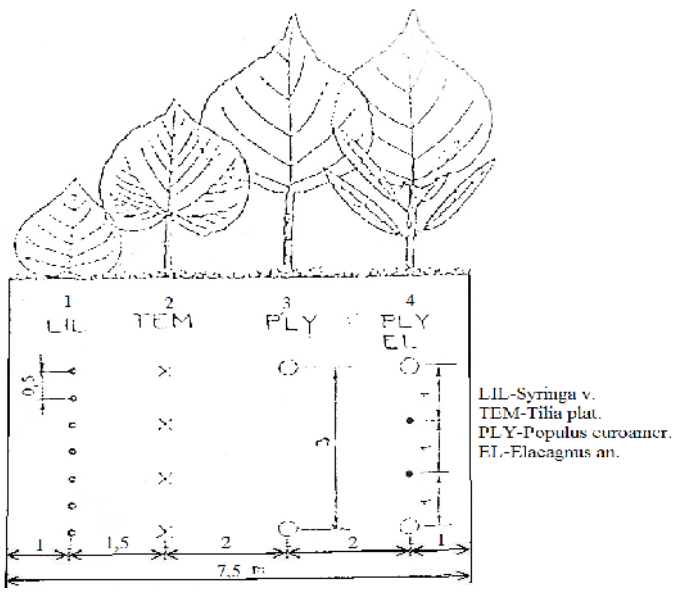

Figure 2. The specific belt for fluvisoil

For the 9300 hectares surface of Beba Veche village, which has 7200 agricultural hectares, 300 intravilan hectares and 1800 hectares with channel and roads, the necessary of seedling plants is 324670 (where 31600 for pasture, 249380 for channels).

The price for have the forest-belts aliniament is circa 1 mld. (old lei). The maximum effect of the belts will be produced around the 15th years. In this period, the terrain occupied from the belts (105, 7 ha) is not productive, so it will registered a damage estimated at 1, 6 mld. Lei (this was calculated taking into account the price of the maize in 2005, Beba Veche).

It is know that the forest-belts have a positive effect on the crops, estimative 8.25% production increase. The influence area resulted from the calculation tote 4861 ha, with a 434 mil lei benefit. Making a costs balance sheet for the installation of belts and the production decrement for a period of 15 years, which tote 1,6 mld. lei and annual benefit obtained by the surplus harvest, it is result that this costs will be recovered in 4th years.

The wood mass production which can be ingather begin from 10 -15 years by the cleaning and cutting tote around 10 m3/ha till the age of exploitations when it can be count on approximately 626 m^3 wood mass annual (NESU, 1999).

-Aranca Plain is a semiarid area, where because of deforestation, forest represent only 3% from total area.

-Soil cover consists predominantly of Chernozems, Fluvisols, Vertisols, with a great content of soluble salts and sodium.

CONCLUSIONS

The protection forest-belt gives the economical advantages after 10-15 years. The climate improvement, the environmental and the habitat improvement for the useful birds and for the wild animals are unquestionable. The protection of belt forest along the main and secondary channels having 8-15 m width. Protect belt along the main and access roads. It is recommended Populus euroamericana, which are very tall and they are resistant to the wind, Tilia cordata, Quercus pedunculatus, Quercus robur. The recommended shrubs are Corylus av., Syringa v., Ligustrum v., Cornus m., Robinia ps., Crataegus m., Prunus sp.

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