EVOLUTION OF THE COMPONENTS OF AGROECOSYSTEMS PRODUCTIVITY FROM BANAT PLAIN, MURES-BEGA INTERFLUVE, IN 2011-2012 AGRICULTURAL YEAR

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***Abstract**: The research are for grounding of sustainable agriculture system, responding of local demands of establishing scientific database and to develop technology actions necessary to support integrated management of agroecosystems. They were made in the stationary experience, in the field of OSPA Timisoara, organized in two locations: Sanandrei and Jimbolia, representative for Banat agricultural area. At Jimbolia, the experiences are placed a typically chernozem, dominant in Jimbolia - Bulgăruş plain and representative for a large area of Banat low plain, as part of Mures Plain, at south of the current course of the Mures. At Sanandrei, the experiences are placed on a an mollic reddish preluvosol, dominant in Plain Vinga and representative of a large surface of Banato-Crisana plain. The goal of research its found theyr origins in current scientific and practical preoccupations to identify and put in place an integrated management of agroecosystems, agronomic effective, with limited energy and financial efforts, ecological and conservativ for the soil and environment. To achieve the objectives, the research were oriented toward the observations and measurements made in the experimental field and in the validation of these observations by laboratory analysis. The research of the ecopedologic conditions was made according to "The methodology of elaborating of pedological studies", vol. I, II and III elaborated by the ICPA Bucharest in 1987, completed with specific elements from the Romanian System of Taxonomy of Soils (SRSTS-2003/2012). Research consists in the accumulation of scientific data on the development of components of agricultural land productivity, on the supply of atmospheric, cosmic, relief and soil, necessary for substantiation of current cultural technologies of performance use of these resources through a complex firm approach of physical-geographical and climatico-edaphic conditions from Banat Plain soils (Mures-Bega interfluve). They were investigated in relation to environmental factors, natural or anthropical, which makes the existence, together forming units ecologically homogeneous area (TEO's) with specific suitability or favorability and different technological requirements.*

***Keywords:** plant culture, system, influence, component, agroecosystem*

INTRODUCTION

Between telurico-edaphic factors and conditions, determined the production capacity of the land, soil conditions are a major component with multiple events both in terms of their characteristics and of the "depositary" of the influence of other environmental factors, recorded at a time in a certain place, they are more stable and easier while recording and studying (even with current equipment, specialized units, less efficient than other branches of the national economy in terms of their ecological efficiency).

To determine the complex relationships that are established between various soil properties were undertaken, both in our country and the world, many studies that have elucidated a number of mutual causality thereby helping to define soil, the genetic aspect, and the fundamental characteristics in relation to their differential contribution to land productivity and plant favorability (Canarache, Teaci,1980, Tabără, Puşcă, 2001).

Between these geomorphological-hydrological traits are set relations that determine the level of crops, to the extent possible given the climatic conditions feature for different climatic zones (Teaci 1980,1995).

MATERIALS AND METHODS

The research of the ecopedologic conditions was made according to "The methodology of elaborating of pedological studies", vol. I, II and III elaborated by the ICPA Bucharest in 1987, completed with specific elements from the Romanian System of Taxonomy of Soils (SRTS-2012).

The main objective of research is establishing relations between pedological conditions and productivity of agricultural land in Plain Banat, Bega- Mures interfluve - evolving in 2011-2012 agricultural year, with application to wheat and corn in two locations: Sanandrei and Jimbolia, on the land of OSPA Timisoara.

Soil testing and other laboratory determinations were performed in Office of Pedological and Agrochemical Studies Timisoara, the Soil and Agrochemical Research Institute Bucharest and the University of Agricultural Sciences and Veterinary Medicine of Banat, where used rules and national standards, approved by the Standardization Association in Romania (ASRO).

At Jimbolia, the experiences are placed a typically chernozem, dominant in Jimbolia - Bulgăruș plain and representative for a large area of Banat low plain, as part of Mures Plain, at south of the current course of the Mures.

The experiences have two factors, by 4 x 3 type, with plots subdivided into four repetitions (48 plots). Area of a parcel is 40 m^2 (4 x 10), the total area of experience is 1920 m^2. The experimental factors are:

	Factor A		Factor B	
	Variety (wheat)	Hybrid (maize)	Fertilization (NP)	
a 1	ALEX	*PR 39D81*	b1	N_{60} P_0
a 2	APACHE	*PR 39F58*	b 2	N_{100} P_{60}
a 3	EXOTIC	*PR 9000*	b 3	N_{150} P_{60}
a 4	CUBS	*PR 37NO1*		

At Sanandrei, the experiences are placed on a an mollic reddish preluvosol, dominant in Plain Vinga and representative of a large surface of Banato-Crisana plain.

The experiences have two factors, by 4 x 3 type, with plots subdivided into four repetitions (48 plots). Area of a parcel is 40 m^2 (4 x 10), the total area of experience is 1920 m^2. The experimental factors are:

	Factor A	Factor B	
	Phosphorus fertilization	Nithogen fertilization	
a1	P_0	b1	N_0
a 2	P_{50}	b 2	N_{50}
a 3	P_{100}	b 3	N_{100}
		b 4	N_{150}

In order to grasp the influence of ecopedological and technological elements on land productivity, in the area especially in the two locations, were opened soil profiles by were have been collected a series of samples.

RESULTS AND DISCUSSIONS

The field research was initiated in autumn of 2011, when, before materializing the field experience, in the area had been harvested several soil samples.

In the soil profile, samples were harvested on pedogenetic horizons, both in the natural and the amended settlement.

Pre-plant in both locations was corn crop was harvested between 05 -09.10. 2011. Land release was made during 10-12.10.2011 and seedbed preparation (fertilized) during the 13-14.10.2011 at Sanandrei and respectively 15-16.10.2011 at Jimbolia.

Masthead for the two cultures depicted schematically as follows:

Wheat: ALEX variety, sown on 20/10/2011 using an amount of 250 kg / ha, seed in the Sanandrei location.

Fertilizer application was done with seedbed preparation, the nitrogen in doses of 50, 100, 150 kg / ha (by administering half the dose listed) and phosphorus doses of 50, 100 kg / ha P_2O_5. As fertilizer with phosphorus was used superphosphate and as nitrogen fertilizer, ammonium nitrate.

The difference in nitrogen dose was administered in 16.03.2012. The aplication of herbicide was conducted at 03.05.2012 with Mustang 0.5 l / ha and foliar treatment (insecticide and fungicide) on 10.05.2012 and 10.06. 2012 (fungicide, Regent + Granit).

The harvesting was conducted at 16.07.2012, issued ground and chopped straw were incorporated in plowing during 19-21.07.2012.

On Jimbolia site, have been used the varieties: Alex, Apache, Exotic, Cubs, were sown on 26.10.2011 using 200 kg / ha of seed sowing when administering a quantity of 175 kg / ha complex fertilizer, types 16 : 46: 00, so dose of 30 kg nitrogen / ha (SA) and phosphorus 80 kg / ha (SA), the difference in nitrogen was administered at 14.03. 2012. The aplication of herbicide was conducted at 09.05.2012 with Mustang 0.5 l / ha and foliar treatment (insecticide and fungicide) on 16.05.2012 and 28.06. 2012 (fungicide, Regent + Granit).

The harvesting was conducted at 13.07.2012, issued ground and chopped straw were incorporated in plowing at 35 cm depth.

At maize, the pre-plant was wheat in both locations, the land is preserved from autumn until spring form field. Seedbed preparation process consisted of two passes through the disc field at the location of the Jimbolia 26.03.2012, respectively at Sanandrei in 28.03.2012.

At Sanandrei, was used PR 39D81 hybrid, which was sown on 02.04.2012, ensuring a total of 62,000 germinable seeds per hectare, and herbicides on 03.04.2012 with Torpedo 2,0 l / ha in 300 l water / ha. Fertilizer application was done with seedbed preparation, the nitrogen in doses of 50, 100, 150 kg / ha (by administering half the dose listed) and phosphorus at doses of 50, 100 kg / ha P_2O_5, using complex fertilizers such as 20:20:00 (200 kg / ha) phosphorus difference being assured of superphosphate applied at the preparation of soil, while the nitrogen of ammonium nitrate applied to 21.05.2012 with mechanical hoeing the corn was about 20-25 cm.The leaf treatment (insecticide and fungicide) was performed on 18.07.2012 and the harvesting was done in 17.09.2012.

On Jimbolia site were used the hybrids: PR 39D81, PR39F58, PR 9000, PR 37N01, which were sown on 29.03.2012 securing the number of germinable seeds per hectare 72,000, with sowing was administed a quantity of 175 kg / ha fertilizer complex type 16: 46: 00, so dose of 30 kg nitrogen / ha (SA) and phosphorus 80 kg / ha (SA), the difference in nitrogen was administered at 18.03. 2012, when mechanical hoeing the corn was about 20-25 cm.

The aplication of herbicide was conducted on 03.04.2012 with Torpedo 2.3 l / ha in 300 liters water / ha foliar treatment (insecticide and fungicide) on 16.07.2012 and the harvesting on 27.09.2012.

Practicing modern agriculture requires to take all necessary measures to ensure the prevention and control of diseases, pests and weeds, the more so as they are also bridges that diseases and parasites are transmitted from plants grown one year to another and from one culture to another, for which after establishing cultures, besides their specific maintenance works were made and a series of observations designed to identify and inventory the major species of flora and fauna plant pathogenic or harmful frequently inhabit wheat and maize agroecosystems.

To characterize the specific climatic conditions of 2011-2012 agricultural year, were used data recorded at total station located by Plant Center of Timis county, on the farm SC Tehnoland SRL Jimbolia (Clari Vii) and those recorded by OSPA Timisoara at Sanandrei Experimental Center (located on Route 56 Timisoara-Arad, Km 15.4).

The climate is temperate continental with Mediterranean influences, the annual average temperature of 10.8 ° C (Jimbolia) and 10.9 ° C (Timisoara) and the average annual rainfall of 516.6 mm in Jimbolia are respectively 629.9 mm in Timisoara.

Table 1

Average monthly precipitation, annual (2011-2012) from Clarii Vii and multianual in the range 1931-2012 (mm) at weather station Jimbolia

Agricol year	Montly												
	IX	X	XI	XII	I	II	III	IV	V	VI	VII	VIII	Yearly
11--12	15,6	37,8	0,6	31,2	37,8	14,8	2,2	62,8	60,2	39,6	83,0	0,2	385,8
normal	45,1	36,8	41,2	47,0	28,0	21,0	28,5	46,2	43,0	70,8	55,0	54,0	516,6

Differences

Agricol year	Montly												
	IX	X	XI	XII	I	II	III	IV	V	VI	VII	VIII	Yearly
11—12	-29,5	+1,0	-40,6	-15,8	+9,8	-6,2	-26,3	+16,6	+17,2	-31,2	+28,0	-53,8	-130,8

In the precipitation of crop year 2011-2012, it can be seen that compared with the annual average was a deficit of 130.8 mm (Table 1) from Clarii Vii, respectively -174.2 mm (Table 2) at Experimental Center Sanandrei.

Table 2

Average monthly precipitation, annual (2011-2012) from Experimental Center Sanandrei and multianual in the range 1931-2012 (mm) at weather station Timisoara

Agricol year	Montly												
	IX	X	XI	XII	I	II	III	IV	V	VI	VII	VIII	Yearly
11--12	10,5	29,5	0,0	11,5	49,5	65,0	6,5	81,2	40,5	38,5	113,0	10,0	455,7
normal	46,1	54,8	48,6	47,8	40,9	40,2	41,6	50,0	66,7	81,1	59,9	52,2	629,9

Differences

Agricol year	Montly												
	IX	X	XI	XII	I	II	III	IV	V	VI	VII	VIII	Yearly
11—12	-35,6	-25,3	-48,6	-36,3	+8,6	+24,8	-35,1	+31,2	-26,2	-45,6	+56,1	-42,2	-174,2

The average amount of precipitation would provide favorable conditions for most crops, if they have a corresponding distribution on months and vegetation phenophases.

Rainfall from summer and winter, the same ratio value between those stations, but the differences were more pronounced in summer to the cold, the most pronounced differences

were recorded in the spring and in early summer, in rainy months when cyclone activity is higher.

To assess the impact of weather conditions on land productivity, the data were recorded in both stationary fot significance compared with rainfall (reference limits in relation to the requirements of agriculture (tab. 3) using data from the Agroclimatic Resources of Timis county (Berbecel, 1979).

Table 3

The significance of rainfall
(the reference limits range with the agriculture requirements)

Interval	Semnification of rainfall quantityes				
	Very dry	Dry	Satisfactory	Optimal	Excedentary
September-octomber	Under 40	41-60	61-80	81-150	Over 150
November-march	Under 100	101-150	151-200	201-300	Over 300
Apil	Under 20	21-30	31-40	41-70	Over 70
Mai-july	Under 100	101-150	151-200	201-300	Over 300
Annual	Under 350	351-450	451-600	601-700	Over 700

The analysis of rainfall data from the 2011-2012 crop year, that it was a dry year in the low plains and satisfactory in high plains (Table 4).

Quantities of water from rainfall recorded, in low plains, were optimum in September and October (tab.4), in the remaining months registering the values under the multiannual average, looking dry or very dry in April.

Table 4

The significance of rainfall
range with the agriculture requirements at Clarii Vii and Sanandrei

Agricol year	Characteristic intervals									
	IX-X	Semnif.	XI-III	Semnif.	IV	Semnif.	V-VII	Semnif.	Anual	Semnif.
Clarii Vii	83,6	optimal	136,2	Dry	1,6	Very dry	91,2	Very dry	385,8	Dry
Sanandrei	40,0	Very dry	132,5	Dry	81,2	Excedent	192,0	Satisfactory	455,7	Satisfactory

In the high plains, the agricultural year 2011-2012 started with a very dry period in September and October (Table 4) continuing then with a dry period in winter, the period from November to March, followed in April to have a surplus character, both situations causing some problems for good crop development (uneven emergence, reduced resistance to freezing point), adding their character issues surplus of April (weeds, diseases attack, reduce the period of cultural works current and sanitary).

In terms of thermal regime, the agricultural year 2011-2012 is characterized by higher temperatures by 1.6 ° C compared to normal (Table 5).

Table 5

Monthly average temperatures, annual (2011-2012) at Sanandrei Experimental Center and multiannual values 1931-2012 range (mm) at Meteorological Station Timisoara

Agricol year	Montly												
	IX	X	XI	XII	I	II	III	IV	V	VI	VII	VIII	Yearly
11--12	20,3	9,8	12,5	3,5	0,7	-5,1	7,0	10,0	17,2	22,7	25,1	23,1	12,5
normal	16,3	11,2	5,8	1,2	-1,1	1,3	5,8	11,1	16,4	19,4	21,2	20,7	10,9

Differences

Agricol year	Montly												
	IX	X	XI	XII	I	II	III	IV	V	VI	VII	VIII	Yearly
11—12	+4,0	-1,4	+6,7	+2,3	+1,8	-6,4	+1,2	-1,1	+0,8	+3,3	+3,9	+2,4	+1,6

Regarding the two cultures production obtained during the first year of experimentation, they were asured statistically in the two locations, provided that the 2011-2012 agricultural year, the climatic conditions have negatively influenced the soil moisture regime, and especially the production obtained level, was lower than the potentially, in both locations at maize and wheat, to Sanandrei location.

Thus, at the location of Sanandrei, the wheat production was achieved between 2348 kg/ha and 4198 kg/ha (Table 6). At the control version (unfertilized) had obtain an output of 2348 kg / ha. The maximum yield was obtained at $P_{100}N_{150}$ version respectively 4198 kg / ha.

Table 6

Effect of nitrogen and phosphorus fertilizers on wheat crop (Alex cultivar) at Sanandrei, in 2011-2012 agricultural year

Version	Medium yield kg/ha	Difference kg/ha	%	Semnification
P_0N_0	2348	-	100	
P_0N_{50}	2903	555	124	***
P_0N_{100}	3130	782	133	***
P_0N_{150}	3694	1346	157	***
Media P_0	**3019**	-	**100**	
$P_{50}N_0$	3271	923	139	****
$P_{50}N_{50}$	3653	1305	156	***
$P_{50}N_{100}$	3952	1604	168	***
$P_{50}N_{150}$	4046	1698	172	***
Media P_{50}	**3730**	**712**	**124**	****
$P_{100}N_0$	3510	1162	149	****
$P_{100}N_{50}$	3635	1287	155	***
$N_{100}P_{100}$	3934	1586	168	***
$P_{100}N_{150}$	4198	1850	179	***
Media P_{100}	**3819**	**800**	**127**	****

AxB DL 5% -121, 1% -165, 0.1%-224
BxA DL 5% -132, 1% -179, 0.1%-238

Unilateral fertilization with phosphorus caused the obtain of increases yield between 923 and 1162 kg / ha. Nitrogen applied only brought increases of yield between 555 and 1346 kg / ha, very significant.Applying fertilizers with nitrogen and phosphorus increases production very significantly, between 1287 and 1850 kg / ha (Table 6).

For maize, due to the drought that began in May and continued throughout the growing season, grain yield ranged from 1977 - 2998 kg / ha (Tab.7). Due to the water lack of soil, plants sprang up late and April due to low temperatures (1.1 ° C lower than normal April), uneven, culture existâtând goals that have been completed.

Table 7

Effect of nitrogen and phosphorus fertilizers on maize (hybrid PR 39D81) on a red mollic preluvosol from Sanandrei in 2011-2012 agricultural year

Version	Medium yield kg/ha	Difference kg/ha	%	Semnification
P_0N_0	1977	-	100	-
P_0N_{50}	2483	506	126	***
P_0N_{100}	2685	708	136	***
P_0N_{150}	2845	868	144	***
Media P_0	**2497**	**-**	**100**	-
$P_{50}N_0$	2033	56	103	-
$P_{50}N_{50}$	2542	565	129	***
$P_{50}N_{100}$	2616	639	132	***
$P_{50}N_{150}$	2922	945	148	***
Media P_{50}	**2528**	**31**	**101**	-
$P_{100}N_0$	2376	399	120	***
$P_{100}N_{50}$	2527	550	128	***
$P_{100}N_{100}$	2642	665	134	***
$P_{100}N_{150}$	2998	1021	152	***
Media P_{100}	**2636**	**138**	**106**	**

A x B DL 5%-180, 1%- 243, 0.1%-323

B x A DL 5%- 189, 1%- 265, 0.1%- 375

To control version (unfertilized) achieved a low production of 1977 kg/ha. The maximum yield was obtained at $P_{100}N_{150}$ version respectively 2998 kg/ha. Unilateral fertilization with phosphorus caused the obtain of yield increases ranging from 55-399 kg / ha. Nitrogen applied only brought increases ranging from 506 to 868 kg / ha, very significant.

Applying fertilizers with nitrogen and phosphorus increases the production very significantly (ranging from 565 to 1021 kg / ha).

At Jimbolia, the wheat production was achieved between 3998 and 7928 kg/ha (Table 8). To control version, at Alex cultivar, version N_{60} achieved a production of 3998 kg/ha. Maximum production was obtained in variety Apache, variant N_{150} P_{80}, respectively 7928 kg/ha.

Table 8

Effect of nitrogen and phosphorus fertilizers on wheat yield on a typical chernozem from Jimbolia, in 2011-2012 agricultural year

Variety	Version	Medium yield kg/ha	Difference kg/ha	%	Semnification
Alex	N_{60} P_0	3998	-	100	-
	N_{100} P_{80}	6679	2681	167	***
	N_{150} P_{80}	7383	3385	185	***
	Media	**6019**	-	100	-
Apache	N_{60} P_0	4898	900	123	***
	N_{100} P_{80}	7743	3745	194	***
	N_{150} P_{80}	7928	3930	198	***
	Media	**6856**	**836**	114	***
Exotic	N_{60} P_0	4360	362	109	**
	N_{100} P_{80}	7103	3105	178	***
	N_{150} P_{80}	7758	3760	194	***
	Media	**6407**	**387**	**106**	***
Cubs	N_{60} P_0	4570	572	114	***
	N_{100} P_{80}	7055	3057	176	***
	N_{150} P_{80}	7840	3842	198	***
	Media	**6488**	**469**	**108**	***

A x B DL 5%-153, 1%- 208, 0.1%-279
B x A DL 5%- 189, 1%- 265, 0.1%- 374

Unilateral fertilization with nitrogen ($N_{60}P_0$) resulted in achieving increases yield, ranging from 362 kg/ha, at Exotic variety and 900 kg/ha in Apache variety. Applying fertilizers with nitrogen and phosphorus bring high production increases very significantly, in all cultivated varieties, ranging from 2681 kg / ha for the variety Alex, the N_{100} P_{80} to 3930 kg / ha for Apache variety, version P_{80} N_{150}.

For maize, due to drought in June (-31.2 mm), but especially in the month of the august (53.8 mm) grain yield ranged from 4975 kg/ha, at PR 39D81 hybrid, in version $N_{60}P_0$ and 8095 kg / ha, at the PR 37NO1 hybrid, in variant $N_{150}P_{80}$ (Table 9).

Unilateral fertilization with nitrogen ($N_{60}P_0$) resulted in achieving in increases production between 1085 kg / ha, at PR 39F58 hybrid and 1800 kg / ha for PR 37N01 hybrid.

Applying fertilizers with nitrogen and phosphorus bring in all hybrids grown large production increases very significantly, ranging from 818 kg / ha, at PR 39D81 hybrid, variant N_{100} P_{80} to 3120 kg / ha, at PR 37NO1 hybrid, variant N_{150} P_{80}.

Table 9

Effect of nitrogen and phosphorus fertilizers on maize production on a typical chernozem from Jimbolia, in the agricultural year 2011-2012

Variety	Version	Medium yield kg/ha	Difference kg/ha	%	Semnification
PR 39D81	N_{60} P_0	4975	-	100	-
	N_{100} P_{80}	5793	818	114	***
	N_{150} P_{80}	6720	1745	135	***
	Media	**5829**	-	100	-
PR 39F58	N_{60} P_0	6060	1085	122	***
	N_{100} P_{80}	6843	1868	139	***
	N_{150} P_{80}	6993	2018	141	***
	Media	**6632**	**803**	**114**	***
PR 9000	N_{60} P_0	6413	1438	129	***
	N_{100} P_{80}	7125	2150	143	***
	N_{150} P_{80}	7653	2678	154	***
	Media	**7063**	**1234**	**121**	***
PR 37NO1	N_{60} P_0	6845	1870	138	***
	N_{100} P_{80}	7503	2528	151	***
	N_{150} P_{80}	8095	3120	163	***
	Media	**7481**	**1652**	**128**	***

A x B DL 5%-213, 1%- 289, 0.1%-388
B x A DL 5%- 216, 1%- 299, 0.1%- 415

CONCLUSIONS

For the doctoral study program were conducted activities such as physico-geographical (natural) conditions of considered space, studying and specifying the type and subtype of soil and morphological characteristics, soil sampling and analysis in laborator, establishing wheat and corn crop experiments, vegetation status monitoring, establishing agricultural productivity compared to the yields obtained, data processing, interpretation and analysis of results.

Actual effect of rainfall on crops is influenced by soil characteristics (texture, porosity permeability, useful water capacity) and relief, features that can facilitate the accumulation, preservation and transfer of water from precipitation differentiated. Regarding the production,

obtained for the two cultures during the first year of experimentation were statistically in both locations.

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