THE INFLUENCE OF AGROMETEOROLOGICAL CONDITIONS ON SOME AGROECOSYSTEMS COMPONENTS FROM THE VINGA PLAIN IN NO-TILL CULTIVATION SYSTEM

INFLUENȚA CONDIȚIILOR AGROMETEOROLOGICE ASUPRA UNOR COMPONENTE ALE AGROECOSISTEMELOR DIN CÂMPIA VINGĂI ÎN SISTEMUL DE CULTURĂ NO-TILL

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Abstract: The r*esearch was carried out on the trial field and it is confirmed by laboratory analyses. The trials were set on a cambic chernozem medium clayish-loamy land of the Prodagro Vest Agri-Centre.*

Rezumat *: Pentru atingerea obiectivelor propuse cercetările s-au desfăşurat concomitent în câmpul experimental şi laborator**.** Câmpul experimental este amplasat pe un cernoziom cambic lut argilos mediu, dominant în cadrul agrocentrului Prodagro Vest Arad.*

Key words: *system, plant culture, influence, component, agro ecosystem*
Cuvinte cheie*: sistem, cultură, influență, componentă, agroecosistem*

INTRODUCTION

In the present social-economical and political context, when our country hopes to come back to its rightful place among the civilized countries of the EU, it is necessary to know very well our "offer" both as absolute values and relative values.

Referring to the western part of Romania, the pedological and agrochemical systematic studies made by the OSPA offices (Timişoara, Arad and Bihor) in many cycles (5 – 6), completed by the long term experiments with fertilizers of the ASAS network and INCDPAPM network, as well as other occasional researches about soils quality and environmental pollution confirmed a dramatical decreasing of soils quality state and the dependence of agriculture on the materials and energy import from industry (CANARACHE ET AL., 1991, TEACI, 1995, BORZA ET. AL., 2003, ȚĂRĂU ET. AL., 2004).

The performed researches are part of the sustainable agriculture systems, responding thus to the national requirements regarding the forming of scientific data bases necessary for the establishment of the technology and for the elaboration of integrated management measures of agro ecosystems (GUŞ ET AL., 1999, MONICA ANDRU, 2001, PĂLĂGEŞIU ET AL., 2002).

MATERIAL AND METHOD

The research was carried out on the trial field and is confirmed by laboratory analyses.

The trials were set on the land of the Prodagro Vest Agri-Centre within the cadastral territory of the Arad town, and monitored for three agricultural years (2005-2007) on wheat, maize, and soy, using technologies specific to the classical and no-till cultivation systems.

The trials were of the bi-factorial 2 x 4 type, set after the subdivided plot model with 4 replications (48 plots). The area of a plot is 36 m^2 (4 x 9), the total area of the trials being 2,500 m^2.

The experimental factors are the following:

The agricultural basic workings were executed with machines and devices belonging to the agri-center Prodrago Vest Arad (tractor 119 CP, maize seeder Massey Ferguson 543 –

4,2; graminaceous seeder Ferguson 4,5 etc.), this agri-center assuring in the same time the seeds, fertilizers, and the necessary chemical substances. The works specific to the experimental technique were executed by the members of research team (related to their qualification), using specific means of the experimental technique.

Factor A	Soil tillage system
a_1	No-till system
a_2	Classic system
Factor B	Phytosanitary treatment
b_1	No treatment
b_2	Phytosanitary foliation treatment

In order to observe the influence of the no-till cultivation system comparing to classic system in the specific pedo-climatic conditions, was open a soil profile in the chosen terrain of agri-center Prodrago Vest Arad, terrain considered to be uniform both pedologically and morphologically, and then there were collected a series of samples.

In the soil profile the samples were collected on pedogenetic horizons, both in natural position (undisturbed) and modified (disturbed) positions.

Soil samples collecting in the natural position (undisturbed) was made in order to characterize some physical and hydro-physical parameters of soil, and were used in this scope metallic cylinders with a known volume (for determination of momentary soil humidity) and in cardboard boxes, specially made up (in order to characterize the micro-morphology of soil).

Research of the ecopedological conditions was made according to the Methodology of Pedological Studies Elaboration (volume I, II, III), elaborated by ICPA Bucharest in 1987, completed with specific elements from the Romania System of Soils Taxonomy (SRTS–2003).

Analyses and other measurements were done in accordance with national norms and standards, and approved by the Standardization Association from Romania.

OBTAINED RESULTS AND THEIR INTERPRETATION

From the geo-morphologically point of view the area where the experiment was established is part of the large physical-geographical unity named Banat-Crişana Plain (BADEA L., I. BERINDEI, E. NEDELCU, 1983), subunity High Plain of Vinga (V. MIHĂILESCU, 1966).

The High Plain of Vinga was formed as an erosive-accumulative tableland, being placed between the Lipova Plateau and the low plain of subsidence and divagation from the west of the country.

The general aspect is a plain which is going down unto north-west as stages which appeared by the recession of the Panonic Lake, with smooth transitions, in most of cases without terrace fronts, these last being specific to the junction between the Mureş Meadow and the Aranca Plain.

The area where the experiments were placed is in the north-western sector of the high plain Vinga, above the third terrace of the Mureş river, on the alignment Tisa Noua-Felnac-Secusigiu, at altitudes by 100 -120 m and presents a tabular plain aspect, with quasi-horizontal surfaces which contains a multitude of micro-depressions and valleys.

Hydrographically, the perimeter where the experiments were carried out belongs to the hydrographic basin of Mureş river which flows at about 2-3 km N from research area.

In Mureş river come out a series of tight valleys with intermittent debit, these valleys have the role to drain the rain water from the researched area.

The underground water level is at depth between 5,1 – 10 m in the plane zones (without any intervention in pedogenetic processes), and between 1,5 – 3,0 m on the valleys direction.

The climate is temperate-continental with Mediterranean influences, the multiannual average temperature being 10,4°C (table 1), and the multi-annual average precipitations quantity 593,5 mm. (table 2).

Table 1

Monthly and annual average temperatures (2004-2007) and multi-annual temperatures between time interval 1931-2007 (^{0} C), Weather Station ARAD

Year	Monthly												
	IX	**X**	**XI**	**XII**	**I**	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**Annual**
04--05	15,7	13,0	5,8	1,9	-0,6	-3,9	2,9	11,0	16,5	19,0	21,6	19,9	10,2
05--06	16,0	13,0	3,0	1,0	-1,9	-0,7	4,2	12,2	15,9	19,2	23,1	19,6	10,4
06--07	17,1	12,0	6,9	2,0	4,2	5,2	8,1	12,1	17,9	22,1	24,3	22,9	12,9
Normal	16,3	10,7	5,3	0,6	-1,8	0,8	5,4	10,9	16,0	19,0	20,8	20,2	**10,4**
Deviations													
04--05	-0.6	+2.3	+0.5	+1.3	+1.2	-4.7	-2.5	+0.1	+0.5	0.0	+0.8	-0.3	-0.2
05--06	-0,3	+2.3	-2,3	+0,4	-0,1	-1,5	-1,2	+1,3	-0,1	+0.2	+2,3	-0,6	0,0
06--07	+0,8	+1,3	+1,6	+1,4	+6.0	+4,4	+2.7	+1,2	+1,9	+3,1	+3,5	+2,7	+2,5

Table 2

Monthly and annual average precipitations (2004-2007) and multi-annual precipitations between time interval 1931-2007 (mm), Weather Station ARAD

Agricultural year	Monthly												A Annual
	IX	**X**	**XI**	**XII**	**I**	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	
04--05	50,6	44,6	85,6	43,2	13,4	49,4	58,4	121	70,2	54,4	32,8	118	741,6
05--06	82,6	17,4	29,0	26,4	25,6	36,8	64,6	53,2	74,2	95,6	65,3	81,8	652,5
06--07	23,9	13,4	25,3	25,2	28,8	77,0	44,1	0,0	82,4	58,8	30,5	45,8	455,2
Normal	44.2	46.6	48.5	45.3	35.1	30.9	35.6	48.1	65.6	81.1	60.3	52.2	593.5
Deviations													
04-05	+6.4	-2	+37.1	-2.1	-21.7	+18.5	-22.8	+72.9	-4.6	-26.7	-27.5	+65.8	+148.1
05-06	+38.4	-29.2	-19.5	-18.9	-9.5	+5.9	-29.0	-5.1	+8.6	-14.5	+5.0	+29.6	+59.0
06--07	-20.3	+33.2	23.2	-20.1	-6.3	+46.1	+8.5	-48.1	+16.8	-22.3	-29.8	-6.4	-138.3

Related to the multi annual average values was observed an increasing tendency of temperatures during the agricultural year 2006-2007, when was recorded a plus by 2,5 ^{0}C (table 1) and a humidity deficit by 138,3 mm (table 2).

The vegetation of researched area belongs to semi-wet forest-steppe and is strongly influenced by the frequent and long anthropic intervention, archeologically demonstrated starting with the pre-roman period, but is replaced now with agricultural cultures.

As a resultant of interaction between cosmic-atmospheric factors with telluric-edaphic factors in condition of forest-steppe vegetation, the cambic chernozem soils specific to the studied perimeter were generated.

The analyzed soil is characterized by a low acid reaction (with values between 5,9 – 6,8) in the first 80 cm of soil profile, neutral reaction in the interval 80- 125 cm, and low alkaline in the interval 125 – 200 cm. The mobile phosphorous (P) supplying state in the arable layer (Ap) presents medium values (35,0 ppm), at the alert limit regarding the nutrition deficiency; the mobile potassium (K) supplying state presents as well medium values (153 ppm), values which are decreasing with the profile depth.

Humus reserve in the first 50 cm is large, and the nitrogen index (I.N.) presents medium values both in the worked layer of soil and in the interval 0 – 45 cm.

Soil texture of the studied soil, as a physical feature with strong stability, is medium clayish-loamy within the entire profile.

The apparent density (DA) or volumetric density (GV) of soil, as any porous structure, represents the rapport between soil mass and its volume, and take large values within the analyzed soil profile (between 1, 47 – 1, 58) in the intervals 0 – 33 cm and 59 – 96 cm, being in great measure a resultant of anthropic influences by soil tillage workings (0 – 33 cm), excessive irrigations, which pressure upon the pedogenetic processes (59 – 96 cm).

Total porosity (PT) represents the totality of pores or spaces reported to the soil volume in natural position, and in the case of the analyzed soil profile confirms much better the anthropic and pedogenetic impact and take low values both in interval 0–33 cm and 45–96 cm.

After setting up the plant cultures, like in the first year of researches, were made their maintenance workings, as well as a series of observation in order to identify and inventory the main species of the vegetal or pathogenic flora and prejudicial fauna which frequently populate the wheat, maize and soybean agroecosystems.

Referring to the soil humidity evolution, the performed observations (by soil samples collecting and laboratory analyzes) within the three plant cultures distinguished the following aspects:

-This fact is due in great measure to the low quantity of precipitations in the beginning of the agricultural year 2005-2006, when were registered a plus by 11,2 mm (table 2), but in a very exceptionally way to those from the last part of agricultural year 2004-2005 when in August 2005 was recorded a plus by 65,8 mm comparing to multiannual average (table 2).

-The most powerful humidity deficit was registered in agricultural year 2005-2006 in June-August period, when was recorded a deficit by 242,78 mm in soybean culture from No-Till experiment (table 2).

-This fact is due in a certain measure to the climatic conditions of this period when was recorded a deficit by 9,5 mm comparing to the multiannual average (table 2), but especially to the humidity deficiency with value by 70,0 mm (table 2), followed by a droughty period in April when the humidity deficit was by 5,1 mm (table 2).

Table 3

Water reserve from soil in the interval 0-100 cm (W mm) related to the value of field capacity (FC=381,76 mm)

Plant culture		Specific periods									
		IX-X		XI-III		IV		V-VII		VIII	
		2005	2006	2005	2006	2005	2006	2005	2006	2005	2006
Wheat	Classic	367,43	244,15	329,13	315,63	332,30	289,72	157,00	297,74	282,14	210,55
	No-till	366,91	224,61	335,99	324,44	315,86	277,33	146,86	279,86	260,74	218,82
Maize	Classic	331,41	227,35	336,28	259,94	330,29	229,02	158,48	245,63	253,00	136,16
	No-till	361,06	218,61	335,78	284,71	310,45	237,93	145,04	281,44	332,83	228,35
Soybean	Classic	378,65	247,24	332,30	303,31	332,3	302,05	154,10	285,87	285,24	211,39
	No-till	375,45	238,18	353,17	316,60	318,02	292,55	139,01	271,68	299,72	256,66
Deviations											
Wheat	Classic	-14,36	-137,64	-49,49	-66,16	-49,49	-92,07	-224,79	-84,05	-99,65	-171,24
	No-till	-14,87	-157,18	-65,93	-57,35	-65,93	-104,46	-234,93	-101,93	-121,00	-162,97
Maize	Classic	-50,38	-154,44	-51,50	-121,85	-51,50	-152,76	-223,31	-136,16	-128,79	-179,78
	No-till	-20,73	-163,18	-71,33	-97,07	-71,33	-143,85	-236,75	-100,35	-48,96	-153,44
Soybean	Classic	+16,86	-134,55	-49,49	-78,48	+49,49	-79,74	-227,69	-95,91	-96,55	-170,40
	No-till	-6,00	-143,61	-63,72	-65,18	-63,77	-89,24	-242,78	-110,10	-82,07	-125,12

-Water reserve from soil in interval 0-100 cm (W mm) registered values under the field capacity (CC mm), with a single exception when these values are exceeded with 16,86 mm, in soybean cultivated in classic system, in the period September-October of the agricultural year 2005-2006 (table 3).

Regarding the level of obtained crop production of the three cultures in all the three experimental years, we can remark the followings:

- In wheat, the obtained production was comprised between 4428-4030 kg/ha, the higher production (distinctly significant) was 4030 kg/ha in the classic system with foliation phytosanitary treatment, and the lowest production was 4428 kg/ha in the No-till system without treatment (table 3).

- In maize, the obtained production had a value between 4300-5084 kg/ha, the higher production (distinctly significant) was by 5084 kg/ha in the classic system with foliation phytosanitary treatment, and the lowest production was 4030 kg/ha in the No-till system without treatment (table 4).

- In soybean, the obtained production was comprised between 2751-3384 kg/ha, the higher production by 3384 kg/ha being registered in the classic system with foliation phytosanitary treatment, and the lowest production was 2751 kg/ha in the No-till system without treatment (table 5).

Table 3

Influence of No-till cultivation system upon average wheat production (2005-2007) on a cambic chernozem, medium clayish-loamy/medium clayish-loamy from Aradul Nou

Nr.	Experimental variant	Average production Kg/ha	Difference Kg/ha	%	Signification
1	Classic, no treatment	4180	-	100	
2	Classic, treated	4428	+249	106	**
3	No-till, no treatment	4030	-150	96	0
4	No-till, treated	4321	+141	103	*

DL 5% 103 1% 190 0.1% 421

Table 4

Influence of No-till cultivation system upon average maize production (2005-2007) on a cambic chernozem, medium clayish-loamy/medium clayish-loamy from Aradul Nou

Nr.	Experimental variant	Average production Kg/ha	Difference Kg/ha	%	Signification
1	Classic, no treatment	4854	-	100	-
2	Classic, treated	5084	+230	105	**
3	No-till, no treatment	4300	-554	89	000
4	No-till, treated	4435	-419	91	000

DL 5% 88 1% 161 0.1% 358

Table 5

Influence of No-till cultivation system upon average soybean production (2005-2007) on a cambic chernozem, medium clayish-loamy/medium clayish-loamy from Aradul Nou

Nr.	Experimental variant	Average production Kg/ha	Difference Kg/ha	%	Signification
1	Classic, no treatment	3286	-	100	
2	Classic, treated	3384	+98	103	
3	No-till, no treatment	2751	-535	84	000
4	No-till, treated	2799	-487	85	00

DL 5% 123 1% 226 0.1% 501

CONCLUSIONS

In order to accomplish the proposed objectives were started a series of activities together with the manager of the agri-center:

- establishment in a certain order of experiments with wheat, maize and soybean, using machines and devices belonging to the agri-center ProdAgro Vest (Andagra) Arad;
- workings specific to the experimental technique were executed by the research team members (related to their qualification and their competence domain), under observation from the plant rising until the cropping the following aspects: plant evolution in culture (growing rhythm, size, development of roots mass), weeding degree, evidence and estimation of diseases and pest attack, according to the objectives of the research project in 2006;
- although the crop productions in the classic system (for maize and soybean) are superior to the no-till system, the costs necessary for establishing the plant cultures in no-till system are economically lower, as well as the pressure upon the soil (by reducing the number of passing with heavy machines and devices), comparing to the classic cultivation system;
- regarding the evolution of soil humidity in the experimental period, respectively the years 2004-2007, the monthly observations (by soil samples collecting and laboratory analyzes) within the three plant cultures put in evidence that the no-till system presents more uniform values on the soil profile.

Water reserve from soil in the interval 0-100 cm (W mm) related to the field capacity (CC mm) registered values under field capacity values, with a single exception when these values are exceeded with 16,86 mm, in soybean cultivated in classic system, in the period September-October of the agricultural year 2005-2006.

The higher humidity deficit was recorded in the agricultural year 2005-2006 in June-August period when the deficit was by 242,78 mm in soybean culture from No-Till experiment.

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