THE DINAMIC OF SOIL HUMIDITY IN CONSERVATION TILLAGE OF SOIL, IN VINGA'S HIGH PLAIN SPECIFIC CONDITIONS

DINAMICA UMIDITATII SOLULUI IN SISTEM CONSERVATIV AL SOLULUI, IN CONDITIILE SPECIFICE CAMPIEI INALTE A VINGAI

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Abstract: *The researches are inscribed on line of substantiation of durable agricultural system, having main objective the prominence of quantitative and qualitative modifications mades on agro-system level under the effect of no-tillage system for wheat, maize and soybeans. Considering the evolution of soil humidity, the observations made monthly (by taking soil samples and laboratory determinations) for the three cultures showed that in the no-till system, there are more uniform values in the soil profile, and in the variants where the deep work of soil was made it could be observed a low increase of the water volume in the soil.*

Rezumat*: Cercetările efectuate se înscriu pe linia fundamentării unor sistem de agricultură durabilă propunându-şi ca obiectiv principal evidenţierea modificărilor de ordin cantitativ şi calitativ care se produc la nivelul ecosistemului agricol sub efectul sistemului de cultură No-Till în aplicaţie la grâu, porumb şi soia. Referitor la evoluţia umidităţii solului, observaţiile efectuare lunar (prin recoltarea de probe de sol şi determinări de laborator) în cadrul celor trei culturi au scos în evidenţă faptul că în cadrul sistemului de cultură no-till, aceasta prezintă valori mai uniforme în cadrul profilului de sol, cu efecte benefice asupra proceselor fizico-chimice de refacere a fertilităţii solului.*

Keywords: *plant culture, system, influence, component, agroecosystem*
Cuvinte cheie: *cultură, sistem, influenţă, componentă, agroecosistem*

INTRODUCTION

Appeared in the Mesolithic Era as a way of producing the needs for everyday life by cultivating plants and husbandry, agriculture became at the same time with the evolution of humans and society a branch of the material production, which involves all the works and methods used for obtaining alimentary products and some prime matters by using the soil in this purpose. The culture technology no-till belongs to the agricultural systems that have to role to conserve the soil, being known in the modern agriculture from the 1950s when on the American continent were settled up the technologies with minimum works in order to find some practical methods for reducing and stopping the soil erosion, a phenomenon that was more and more aggressive on the fields cultivated as an conventional system.

The passing to no-till system change the structure of technological elements, through less soil works, so the impact on agro-system is different comparing with conventional tillage, first lessing the intervention pressure on agro-system ant secondly appears new interactions, new equilibriums and disequilibrium's.

The researches regarding the evolution of the agro-ecosystems' quality and productivity from the Vinga High Plain in the no-till crop system tries to highlight the quality and quantity changes emerged in the agricultural ecosystem. The no-till crop system was applied at the wheat, maize and soy crops.

The first researches of the no-till technology started in the USA, in the 4th decade of the 20th century when it was launched the scientific project and the activity progressed when

the new theme was included in the research program of several laboratories from the USA, Canada, England, Germany and France. In Romania the first stationary experiment with the no-till technology was made by ICCPT Fundulea Institute in 1966 at the maize crop. Other researches treating the minima works system also state in brief about the no-till crop system, either regarding the economical efficiency or regarding the diseases' and the pest's evolution.

MATERIAL AND METHOD

The experimental field is placed on a cambic cernosiom, with a medium content of clay, dominant in the Prodagro West Arad agro-centre and representative for a large surface in the Banat-Crisana Plain, the experiment being situated at approximately 500 m SW from the Andagra farm, located on the Arad cadastral territory, coordinates $46^0$7'55" N latitude and $21^0$17'45" E longitude, 115 m altitude. The experiment has three factors, being of the type 2x2x3, with subdivided parcels into 4 repetitions (144 parcels). The surface of one plot is of 27 sm (3x9), the total surface of the experiment being of 3888 sm.

The experimental factors are: Factor A – the technological system (A1 – without deep soil working, A2 – with deep soil working), Factor B- the culture system (B1- classic culture system, B2- No-till culture system), Factor C- fertilizers doses (C1- N_0 P_0 K_0, C2- N_{80} P_{80} K_{80}, C3- N_{160} P_{80} K_{80}).

RESULTS AND DISCUSSIONS

From the geomorphological point of view the perimeter on which are located the experiments belongs to the large physical –geographic unity called the Vinga High Plain. Vinga high plain is the oldest and the most complex among Banat-Crisana plains and extends south of Mures everglade , west of Lipova hills, north of Bega low plain , east of Galatca plain. It is formed at the convergence of hills glacisist, shaped by a net of flowing waters and erosion valleys.

The area where the experiment was placed is in the North-Western part of the High Plain of Vinga, above the 3rd terrace of Mures river, on the alignment New Tisa, Felnac, Secusigiu, at 100 -120 m height and it has an aspect of tabular plain with cvasi-horizontal surfaces on which there are many small micro depressions and valleys.

Hydrographically, the perimeter where the experiment is placed belongs to the hydrographic basin of Mures river which flows at about 2-3 km north from this. The pedo-phreatic levels are at 5,1 – 10 m depth (they don't interfere in the pedo-genesis processes) in flat areas and between 1,5 – 3,0 m depth in the valleys.

The climate is a temperate-continental one with Mediterranean influences, the medium multi-annual temperature being of 10,4 C and the medium multi-annual rainfall 593,5 mm.

As a result of the cosmic-atmospheric and telluric factors intervention, under vegetation specific to the forest steppe, in the zone were created cambium chernozems, specific to the researched perimeter.

The analyzed soil has an acid reaction (5,9 – 6,8) in the first 80 cm of the soil profile, neutral between 80- 125 cm and low alkaline between 125 – 200 cm depth.

The mobile phosphorus content (P) in the worked soil (Ap) has medium values (35,0 ppm) at the limit of alert threshold (concerning the nutrition lack) the mobile potassium supply (K) having medium values (153 ppm), values which are lower on with the profile.

The humus reserve in the first 50 cm is high, and the natrium index (I.N.) has medium values in the worked layer (Ap) and also in the 0 – 45 cm layer.

Soil's texture, a very stable physical feature, is medium clay on the whole profile. The Apparent Density (DA) has medium values in the worked layer from the classic system,

high in the first 10 cm in no-till system and very high in the middling third of the soil profile in the two systems.

The Total Porosity (PT) has low values in the 0 – 33 cm interval, and also in the 45 – 96 cm one. The aeration porosity, which represents all the pores occupied with air when the soil is in optimum humidity conditions, has very low values, excepting the worked layer from the classic system, where it has low values and the first 10 cm depth in No-till system where the values are very low.

After establishing the cultures, among the specific maintaining works there were made a series of observations in order to identify and stock take the main damaging species from the vegetal or pathogen flora and fauna, which frequently populate the wheat, maize and soybeans agro-ecosystems. The field cultivated as No-Till system is exposed to a higher degree of weeding compared to the classic one. The plants that developed in the wheat, maize and soybeans cultures had an easy progress, especially those which multiplicate vegetative or by seeds (Cyrsium arvense L., Convolvulus arvensis L., Sonchus arvensis L., Cynodon dactylon L., Sorghum halepense L., Rubus caesius L.) or with small seeds and surface germination (Stellaria media L., Capsella bursa pastoris L., Lamium purpureum L.) and infesting those that develop widely in the stubble (Setaria sp., Polygonum convolvulus L., Matricaria inodora L., Rubus caesius L).

Considering the evolution of soil humidity, the observations made monthly (by taking soil samples and laboratory determinations) for the three cultures showed that in the no-till system, there are more uniform values in the soil profile, and in the variants where the deep work of soil was made it could be observed a low increase of the water volume in the soil.

The wather reserve from soil, between 0-25 cm (Table 1),0-50 cm (Table 2) and 0-100 cm (Table 3), comparing with field capacity values, are more less in all theexperimental factors .

Table 1

Wather reserve betwen 0-25 cm (W mm) comparing with field capacity (CC=96,57 mm)

Culture		Characteristic periods									
		IX-X		XI-III		IV		V-VII		VIII	
		2009	Deviation	2009	Deviation	2009	Deviation	2009	Deviation	2009	Deviation
Weath	Clasic	64,97	-31,60	77,11	-19,46	66,96	-29,61	83,93	-12,64	77,42	-19,15
	No-till	65,93	-30,64	86,25	-10,32	66,73	-29,84	74,42	-22,15	69,26	-27,31
Weath+ deep work	Clasic	71,12	-25,45	85,39	-11,18	71,20	-25,37	41,83	-54,74	37,94	-58,63
	No-till	66,17	-30,04	87,77	-8,80	63,68	-32,89	74,09	-22,48	68,52	-28,05
Maize	Clasic	63,01	-33,56	92,8	-3,77	71,53	-25,04	79,70	-16,87	72,17	-24,40
	No-till	69,94	-26,63	90,42	-6,15	73,82	-22,75	68,76	-27,81	65,19	-31,38
Maize+ deep work	Clasic	70,59	-25,98	86,78	-9,79	82,81	-13,76	42,83	-53,74	38,64	-57,93
	No-till	64,42	-32,15	92,42	-4,15	65,59	-30,98	65,52	-31,05	61,93	-34,64
Soya	Clasic	64,05	-32,52	91,18	-5,39	70,29	-26,28	83,32	-13,25	79,61	-17,06
	No-till	63,66	-32,91	93,84	-2,73	73,17	-23,40	77,02	-19,55	71,52	-25,05
Soya + deep work	Clasic	76,30	-20,27	85,27	-11,30	81,37	-15,20	48,85	-47,72	42,59	-53,98
	No-till	83,92	-12,65	95,88	-0,69	68,10	-28,47	76,31	-20,26	68,53	-28,04

Table 2

Wather reserve betwen 0-50 cm (W mm) comparing with field capacity (CC=191,73 mm)

Culture		Characteristic periods									
		IX-X		XI-III		IV		V-VII		VIII	
		2009	Deviation	2009	Deviation	2009	Deviation	2009	Deviation	2009	Deviation
Weath	Clasic	133,84	-57,89	152,22	-39,51	140,05	-51,68	167,00	-24,73	154,93	-36,80
	No-till	129,83	-61,9	180,18	-11,55	149,01	-42,72	158,84	-32,89	147,94	-43,79
Weath+ deep work	Clasic	138,16	-53,57	177,00	-14,73	152,01	-39,72	87,81	-103,9	79,52	-112,1
	No-till	127,83	-63,90	177,55	-14,18	146,59	-45,14	148,59	-43,14	142,84	-48,92
Maize	Clasic	107,64	-84,09	190,76	-0,97	145,51	-46,22	158,54	-33,19	145,27	-46,46
	No-till	139,38	-52,35	182,06	-9,67	154,01	-37,72	150,53	-41,20	147,42	-44,31
Maize+ deep work	Clasic	169,63	-22,10	182,92	-8,81	172,51	-19,22	99,67	-92,06	89,35	-102,4
	No-till	126,47	-65,26	183,63	-8,10	149,37	-42,36	147,21	-44,52	145,29	-46,44
Soya	Clasic	134,31	-57,42	188,52	-3,21	143,81	-47,92	165,08	-26,65	145,32	-46,41
	No-till	134,22	-57,51	187,22	-4,51	152,78	-38,95	153,86	-37,87	147,63	-44,10
Soya + deep work	Clasic	145,11	-46,62	180,80	-10,93	170,51	-21,22	108,75	-82,98	97,59	-94,14
	No-till	151,46	-50,27	188,82	-2,91	153,47	-38,26	151.01	-40,72	146,63	-45,10

Table 3

Wather reserve betwen 0-100 cm (W mm) comparing with field capacity (CC=381,76 mm)

Culture		Characteristic periods									
		IX-X		XI-III		IV		V-VII		VIII	
		2009	Deviation	2009	Deviation	2009	Deviation	2009	Deviation	2009	Deviation
Weath	Clasic	353,41	-28,35	351,31	-30,45	344,20	-37,56	245,76	-136,00	268,51	-113,25
	No-till	313,04	-68,72	342,50	-39,26	335,55	-46,21	264,80	-116,96	269,80	-111,96
Weath+ deep work	Clasic	353,41	-28,35	363,06	-18,70	371,40	-10,36	214,19	-167,57	260,44	-121,32
	No-till	313,04	-68,72	351,99	-29,77	361,85	-19,91	212,81	-168,95	255,67	-126,09
Maize	Clasic	302,46	-79,30	348,89	-32,87	364,21	-17,52	264,24	-117,52	297,67	-84,09
	No-till	366,76	-15,00	375,26	-6,50	369,41	-12,35	284,83	-96,93	303,77	-77,99
Maize+ deep work	Clasic	302,46	-79,30	360,43	-21,33	366,02	-15,74	262,63	-119,13	243,91	-137,85
	No-till	366,76	-15,00	375,83	-5,93	370,80	-10,96	300,43	-81,33	322,46	-59,30
Soya	Clasic	283,46	-98,30	348,32	-33,44	363,93	-17,83	254,25	-127,51	248,69	-133,07
	No-till	323,52	-58,24	339,56	-42,20	346,30	-35,46	297,67	-84,09	314,97	-66,79
Soya + deep work	Clasic	283,46	-98,30	359,89	-21,87	364,95	-16,81	275,38	-106,38	308,00	-73,76
	No-till	323,52	-58,24	359,39	-22,37	354,32	-27,44	301,58	-80,18	325,64	-56,12

About the productions obtained from the three cultures, there can be remarked the followings:

Table 4

Influence of the no-till crop system on to the wheat crop on the cambium chernozem medium clayey earth/ medium clayey earth from Aradul Nou.

	Culture system	Fertilization	Production	%	Diferences Kg/ha	Semnification
Without deep soil working	Clasic	N_0 P_0 K_0	4196	100	-	
		N_{80} P_{80} K_{80}	4341	103	145	**
		N_{160} P_{80} K_{80}	4552	108	356	***
	No-till	N_0 P_0 K_0	4228	101	32	
		N_{80} P_{80} K_{80}	4313	103	117	**
		N_{160} P_{80} K_{80}	4464	106	268	***
With deep soil working	Clasic	N_0 P_0 K_0	4644	111	448	***
		N_{80} P_{80} K_{80}	4686	112	490	***
		N_{160} P_{80} K_{80}	4783	114	587	***
	No-till	N_0 P_0 K_0	4490	107	294	***
		N_{80} P_{80} K_{80}	4600	110	404	***
		N_{160} P_{80} K_{80}	4660	111	464	***

DL 5% 88,34
1% 110,28
0,1% 152,31

For wheat, the production was between 4196-4783 kg/ha, the highest production of 4783 kg/ha, being registered in the classic system with deep work of soil, in N_{160} P_{80} K_{80} dose and the lowest of 4196 kg/ha in the classic system with no deep work of soil, in N_0 P_0 K_0 dose (Table 4) .

For maize the obtained production had values of 5207-5618kg/ha, the highest production of 5618 kg/ha , being registered in classic system with deep work of soil, in N_{160} P_{80} K_{80}, and the lowest of 5207kg/ha in no-till system without deep work of soil, in N_0 P_0 K_0 (Table 5).

Table 5

Influence of the no-till crop system on to the maize crop on the cambium chernozem medium clayey earth/ medium clayey earth from Aradul Nou.

	Culture system	Fertilization	Production	%	Diferences Kg/ha	Semnification
Without deep soil working	Clasic	N_0 P_0 K_0	5307	100	-	
		N_{80} P_{80} K_{80}	5446	103	139	**
		N_{160} P_{80} K_{80}	5607	106	300	***
	No-till	N_0 P_0 K_0	5207	98	-100	0
		N_{80} P_{80} K_{80}	5359	101	52	
		N_{160} P_{80} K_{80}	5475	103	150	***
With deep soil working	Clasic	N_0 P_0 K_0	5482	103	175	***
		N_{80} P_{80} K_{80}	5552	105	245	***
		N_{160} P_{80} K_{80}	5618	106	311	***
	No-till	N_0 P_0 K_0	5371	101	64	
		N_{80} P_{80} K_{80}	5406	102	99	*
		N_{160} P_{80} K_{80}	5458	103	151	***

DL 5% 98,31
1% 125,67
0,1% 139,15

For soya the production was 918-1988 kg/ha, the highest production of 1988 kg/ha , being registered in the classic system without deep working of soil, in N_{160} P_{80} K_{80}, and the lowest of 880 kg/ha in the no-till system with the deep work of soil, in N_0 P_0 K_0 (Table 6).

Table 6

Influence of the no-till crop system on to the soya crop on the cambium chernozem medium clayey earth/ medium clayey earth from Aradul Nou.

	Culture system	Fertilization	Production	%	Diferences Kg/ha	Semnification
Without deep soil working	Clasic	N_0 P_0 K_0	3241	100	-	
		N_{40} P_{80} K_{80}	3352	103	111	***
		N_{80} P_{80} K_{80}	3442	106	201	***
	No-till	N_0 P_0 K_0	3302	102	61	*
		N_{40} P_{80} K_{80}	3299	102	58	*
		N_{80} P_{80} K_{80}	3382	104	141	***
With deep soil working	Clasic	N_0 P_0 K_0	3505	108	264	***
		N_{40} P_{80} K_{80}	3633	112	392	***
		N_{80} P_{80} K_{80}	3724	115	483	***
	No-till	N_0 P_0 K_0	3392	105	151	***
		N_{40} P_{80} K_{80}	3463	107	222	***
		N_{80} P_{80} K_{80}	3542	109	301	***

DL 5% 50,36
1% 67,17
0,1% 85,61

CONCLUSIONS

Considering the evolution of soil humidity, the observations made monthly for the three cultures showed that in the no-till system, there are more uniform values in the soil profile, and in the variants where the deep work of soil was made it could be observed a low increase of the water volume in the soil.

Even if the productions obtained in the classic system are superior than those obtained in the no-till system, considering the economical costs for establishing a culture in the no-till system are lower, the same as the pressure made upon the soil (by reducing the number of passes with the agricultural machines and installations), than the classic system.

The obtained production results can not give a recommendation for one of the two experimented culture systems, but they are valuable data (concerning the evaluation of the natural and manmade resources) by the studies made in the field and laboratory, for the fundament in the future of some adequate technologies for the climatic and soils conditions of the area where the research was made and also for other similar areas.

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