RESEARCHES REGARDING THE SECONDARY COMPACTION EFFECT ON SOME PHYSICAL AND CHEMICAL INDICES OF PRELUVOSOILS FROM THE NORTH-WEST PART OF THE COUNTRY

CERCETĂRI PRIVIND EFECTUL COMPACTĂRII SECUNDARE ASUPRA UNOR INDICI FIZICI ŞI CHIMICI AI PRELUVOSOLULUI DIN NORD-VESTUL ŢĂRII

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Abstract*: The paper presents some modifications of the physical and chemical preluvosoils indices from Oradea, affected by the secondary compaction, and as well some measures for its control.*

Rezumat*:Lucrarea prezintă modificările unor indici fizici şi chimici ai preluvosolului de la Oradea, afectat de compactarea secundară, cât şi unele măsuri de combatere a acesteia.*

Key words*: secondary compaction, physical and chemical indices of the soil.*
Cuvinte cheie*: compactare secundară,indici fizici şi chimici ai solului.*

INTRODUCTION

The secondary or anthropic compaction is caused by the intense traffic with agricultural and for transporting machines for the implementation of the multiple works of preparing the seedbed, of insemination, of upkeep the crops, harvesting, transporting as well as working with the plough for several years at the same depth.

The secondary compaction process is relevant because it constitutes one of the most important forms of physical degradation of the soil, being manifested through the increasing of bulk density value over the normal bounds and the decreasing of soil porosity under these, influencing negatively the conditions of obtaining high agricultural productions.

The negative effects of secondary compaction have been estimated for the entire country (1,2,3,4,5,6,7) through :the increase of the resistance at ploughing with 6-10%;the increase of the number of work for the preparation of the bed seed with 8%;the increase of the energy consumption for the soil's works with 5 %;the decrease of the water –holding capacity by the soil with 10 %;the decrease of aeration porosity of the soil with 15 %;the decrease of water permeability of the soil with 40 %; the generally decrease of the harvest on all the soils with 5%.

In Bihor county, the researches made by Colibas I. et al. at the "Agricultural Research and Development Station" from Oradea since 1978 lead to the quantification of some physical, chemical and biological modifications produced in soil ,to the establishment of their influence on the development of the radicular system and achieving the harvest, as a result of secondary compaction. Knowing the effects of secondary compaction were then established decompaction measures of the soil.

MATERIALS AND METHOD

The researches have been made in the experimental field of ARDS Oradea, on soils in whose frame the secondary compaction process it manifests frequently in production.

Climatic, the area is characterized through some values of the medium temperature through the years of the air of $10,2^0$ C and rainfalls of 621 mm. The years of the research

(2004-2006) were characterized by different climatic conditions regarding the air temperature and the rainfalls.

Table 1

The climatic characterization of the research years (2004-2006) at Oradea

Year	Temperature ^{0} C		Rainfalls mm		Climate characterization		
	Yearly average	Deviations	Yearly average	Deviations	Cold season	Warm season	Yearly
2004	10.3	+0.1	737.5	116.4	M	R	R
2005	10.2	0.0	772.0	150.9	M	R	R
2006	10.7	+0.5	684.9	63.8	M	R	R
Average of (2004-2006)	10.4		731.4		M	R	R
Average of (1931-2003)	10.2	+0.2	621.1	110.3			

In the period of the three agricultural years of research, the yearly medium temperature of the air has exceeded the average of (1931-2003) with 0.1 ^{0} C in 2004 and with 0.5 ^{0} C in 2006, and in 2005 was equal with this one. The calculation of the rainfall's insurances spotlights the climatic nature of the cold season as being medium in 2004-2006.The warm season was "rainy" in 2004-2005 and medium in 2006.

The modifications of the main indices of physical state of the preluvosoils from Oradea were researched in variants of intensity of secondary compaction made through 0,2,5, and 10 passings with the tractor ,wheel by wheel, covering the whole surface of the plot, in 2 ways of phases of compaction(of autumn and spring),in the frame of 5 levels of fertilization in order to mitigate the compaction process: without fertilization; the best economical dose BED=$N_{120}P_{100}K_{80}$ kg/ha a.s; the best technical dose BTD=$N_{140}P_{120}K_{100}$; BTD+50% and BED+30 t/ha manure in the first year.

RESULTS AND DISCUSSION

The modifications of the main chemical and physical indices ,produced under the influence of the secondary compaction, in the most frequently met variant in agricultural practice, the one of secondary compaction through 5 passings with the tractor ,in autumn and in spring at the best economical dose, comparing with the soil without compaction will be presented in the following part.

- ***Bulk density*** is very much influenced by secondary compaction ,especially in the soil layers situated between 0-30cm depth (table 2).This index's values increase with 9-12% on the depth of the ploughed layer (with 11-12 % on the first layer of 0-10 cm thick
- ness from soil and with 9-11 % on the next depth,10-20 cm).The secondary compaction influence decreases a lot then ,the registered increases being 4% between 20-30 cm depth and just 1% on the soil layer from 30-40 cm. So the secondary compaction effect practically is manifesting till the 30cm depth, this fact pointing out till what depth should be applied measures of reloosening of the soil.

Table2

Modifications of bulk density under the influence of compaction on the preluvosoils from Oradea

The variant	Depth (cm)							
	0-10		10-20		20-30		30-40	
	Bulk density							
	g/cm^3	%	g/cm^3	%	g/cm^3	%	g/cm^3	%
Without autumn compaction	1.38	100	1.45	100	1.55	100	1.60	100
Autumn compaction through 5 passings	1.55	112	1.62	112	1.62	104	1.60	100
Without spring compaction	1.47	100	1.47	100	1.56	100	1.57	100
Spring compaction through 5 passings	1.63	111	1.61	109	1.62	104	1.59	101

- ***Soil's macroporosity*** (AP>50μ) including the values of the suction corresponding to the degrees pF0 , 1.6 and 2.0 is reduced by compaction with 42-60 % on the ploughed layer ,with 15-59 % on the 20-30 cm layer and with only 11-13% under 30 cm depth, comparing with uncompacted soil(table 3)

Table 3

Modifications of soil's macroporosity (AP>50μ) under the influence of compaction on the preluvosoils from Oradea

The variant	Depth (cm)							
	0-10		10-20		20-30		30-40	
	Soil's macroporosity (AP>50μ)							
	%	%	%	%	%	%	%	%
Without autumn compaction	9.7	100	9.3	100	8.2	100	4.8	100
Autumn compaction through 5 passings	5.6	58	3.7	40	3.4	41	4.3	89
Without spring compaction	7.7	100	8.5	100	5.5	100	5.5	100
Spring compaction through 5 passings	3.2	41	4.0	47	4.7	85	4.8	87

- ***Resistance to penetration*** increases under the compaction influence with 24-54 % on the ploughed layer and with 12-44 % on the soil layers from 20-40 cm ,the bigger values being registered at the spring compaction(table 4)

Table 4

Modifications of the resistance to penetration under the secondary compaction influence on the preluvisols from Oradea

The variant	Depth (cm)							
	0-10		10-20		20-30		30-40	
	The resistance to penetration(RP)							
	MPa	%	MPa	%	MPa	%	MPa	%
Without autumn compaction	1.99	100	2.83	100	3.10	100	2.61	100
Autumn compaction through 5 passings	2.57	129	3.56	126	4.48	144	4.06	112
Without spring compaction	1.94	100	2.52	100	3.54	100	3.10	100
Spring compaction through 5 passings	2.96	152	3.88	154	4.75	134	4.30	139

- ***Soil's hydraulic conductivity (***table 5).The compaction reduces with 47, 55, 60 and 0%the "K"value in the autumn stage and with 70, 65, 58 and 29 % in the spring stage.

Is noticed as well in this index case, the biggest influence till 30 cm depth and more stressed at the spring compaction.

Table 5

Modifications of hydraulic conductivity under the influence of compaction on the preluvosoils from Oradea

The variant	Depth (cm)							
	0-10		10-20		20-30		30-40	
	Hydraulic conductivity(K)							
	mm/h	%	mm/h	%	mm/h	%	mm/h	%
Without autumn compaction	6.2	100	6.2	100	4.7	100	2.5	100
Autumn compaction through 5 passings	3.3	53	2.8	45	1.9	40	2.5	100
Without spring compaction	6.9	100	4.9	100	3.8	100	2.1	100
Spring compaction through 5 passings	2.1	30	1.7	35	1.6	42	1.5	71

- ***"A. Canarache" agro physical index,*** to express a synthesis of the studied physical indexes and reproducing the soil's physical state, puts into perspective the secondary compaction effect in the worsening of the physical state, the values of this index are reduced compared the uncompacted soil with 39-50% at the autumn compaction and with 61-62% at the spring compaction on the layers of soil up to 20 cm depth, with 56% and 59% on the layer from 20-30 cm and a smaller influence, respectively decreases of 17% and 26% between 30-40 cm depth. (Table 6)

Table 6

Modification of the soil's physical state under the influence of the secondary compaction on the preluvosoils from Oradea

The variant	Depth (cm)							
	0-10		10-20		20-30		30-40	
	"A. Canarache" agro physical index							
	A.P.I.	%	A.P.I.	%	A.P.I.	%	A.P.I.	%
W/o compaction	0.47	100	0.43	100	0.35	100	0.23	100
Autumn compaction through 5 passings	0.29	61	0.22	50	0.15	44	0.19	83
Spring compaction through 5 passings	0.18	39	0.16	38	0.14	41	0.17	74

- ***Soil's reaction*** presents in the ploughed layer just an insignificant trend of stressing the acidity under the compaction influence (table 7)
- ***The nitric and ammonium nitrogen content and*** the ratio between the two forms of mineral nitrogen spotlights the influence of inconvenience of the nitrification processes from the soil because of the secondary compaction. This ratio values decrease with 37, respectively with 21 % in the two stages of implementation of the compaction.(table 7)
- ***The mobile phosphorus and potassium content*** (table 7).The compaction influences the decreases of the mobile phosphorus and potassium content, even if we can talk about a bigger consumption because the obtained harvests were smaller comparing with the variants without compaction; so we attend to a weaker mobilization of the soil's reserves in these elements.

Table 7

Modifications of some chemical indices in the ploughed layer under the secondary compaction influence on the preluvosoils conditions from Oradea

The variant	pH (H_2O)	$N\text{-}NO_3/N\text{-}NH_4$		P	K
		-	%	mobile ppm	
Without autumn compaction	5.58	1.9	100	51.8	106.3
Autumn compaction through 5 passings	5.56	1.2	63	48.9	103.5
Without spring compaction	5.65	1.9	100	63.1	91.0
Spring compaction through 5 passings	5.45	1.5	79	55.0	83.0

CONCLUSIONS

In agricultural activity is necessary to consider some simple's measures of forewarning and control of secondary compaction, as are:

- Reducing at the necessary minimum of the passing numbers with the tractor,the agricultural and for transport machines on the field.
- The implementation of the soil's works in the most propitious conditions of humidity (the humidity value must not surpass 2/3 from the range of available moisture content) in order to ensure a superior quality of these ones.
- The implementation of more works through a single pass ,using equipment in unit.
- The change from one year to another of the implementation depth of the ploughing correlated with the crop's technology from the crop rotation.
- The periodic implementation of the subsoiling at 35-40 cm with the plough plus subsoilier, or of working the soil with the cizel.
- The rational fertilization of the crops.
- The crop succession in a long length rotation ,with the presence of some meliorative crops from soil.
- For establishing the loosening depth must be considered especially in secondary compaction case, the values of soil settling grade, which indicates the emergency of application the control measures.

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