MODIFICATION OF TOTAL POROSITY AND OF AERATION POROSITY ACCORDING TO THE POSITION ON A CAMBIC CHERNOZEM FROM THE PLANTATION OF THE DIDACTIC STATION TIMISOARA IN DIFFERENT CULTURE SYSTEMS

MODIFICAREA POROZITĂȚII TOTALE ŞI A CELEI DE AERAȚIE ÎN FUNCȚIE DE POZIȚIONARE PE UN CERNOZIOM CAMBIC DIN PLANTAȚIA STAȚIUNII DIDACTICE TIMIŞOARA ÎN DIFERITE SISTEME DE CULTURĂ

Casiana MIHUȚ, I. RUSU, V. ŞTEFAN, L. NIȚĂ, Anişoara DUMA-COPCEA

Agricultural and Veterinary University of the Banat, Timisoara, Romania
Corresponding author: Casiana Mihuț, e-mail:mihut.casiana@personal.ro

***Abstract**: This work presents the modification of some physical features of soils: of the total and aeration porosity from the plantation of the Didactic Station Timisoara on the tree row and between the tree rows in apple tree intensive and super intensive culture during the three years of research (2003, 2004, 2005).*

***Rezumat**: Prezenta lucrare prezintă modificările unor proprietăți fizice ale solului: porozității totale şi a porozității de aerație din plantația Stațiunii Didactice Timişoara, atât pe rândul de pomi, cât şi între rândurile de pomi, respectiv la cultura de măr în sistemul de cultură intensiv şi superintensiv în cursul celor trei ani de cercetare (2003, 2004 şi 2005).*

***Key words:** total porosity, aeration porosity*
***Cuvinte cheie:** porozitatea totală, porozitatea de aerație*

INTRODUCTION

The fruit tree plantation of Didactic Station Timisoara occupies a total surface of 7 ha, the apple tree culture occupies 4 ha and the studied apple tree variety occupies 2 ha. The studied apple tree variety is Delicios de Voinesti (Delicious of Voinesti).

The planting distance of the trees in intensive system is of 2 m between the trees on a row and 4 m between the rows and in super intensive system the planting distance is of 1 m between the trees and of 4 m between the rows.

MATERIAL AND METHOD

The experience is polyfactorial of type 2 x 6, having the following factors:

Factor A – culture system: a_1 – intensive system (4 x 2);
a_2 – super intensive system (4 x 1).

Factor B – doses of mineral and organic fertilizers.

In this experience, the variants are arranged according to the randomized blocks.

The total porosity was calculated easier using the calculation formulas of density and apparent density where:

PT – total porosity (%);

DA – apparent density (g/cm^3);

D – soil's density (g/cm^3).

The aeration porosity was calculated using the values of some hydrophysic and physic:

$PA = PT – CC \times DA$

where:

PA – aeration porosity (%);

CC – capacity for water in the field.

RESULTS AND DISCUSSIONS

The values of the total and aeration porosity during the three years of research, 2003, 2004 and 2005, were determined by calculation using the values of the apparent density and soil's density as it can be seen in the tables and figures 1, 2, 3, 4, 5, 6, 7 and 8.

Table 1.

The influence of mineral and organic upon soil total porosity (%), on the tree rows, in the intensive system

Year	Death cm	Factor B						Mean %	Difference %
		$N_0P_0K_0$	$N_{70}P_{30}K_0$	$N_{100}P_{50}K_{20}$	$N_{150}P_{100}K_{50}$	g.g.	g.g. + $N_{50}P_{30}K_{10}$		
2003	0-20	47	47	47	46	55	53	49.6	2.6
	20-40	45	45	44	44	46	46	45.0	-
	40-60	43	43	43	43	44	44	43.4	0.4
2004	0-20	47	47	47	46	52	50	48.4	1.4
	20-40	44	44	44	44	45	45	44.4	0.4
	40-60	43	43	43	43	44	44	43.4	0.4
2005	0-20	46	46	45	45	50	49	47.0	1.0
	20-40	44	44	44	44	45	44	44.2	0.2
	40-60	43	43	43	43	44	43	43.1	0.1

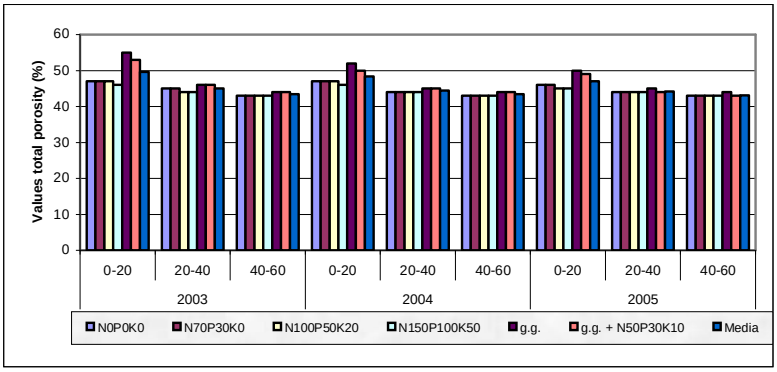

Fig. 1 The influence of mineral and organic upon soil total porosity (%), on the tree rows, in the intensive system

Table 2.

The influence mineral land organic fertilizers upon soil total porosity (%), between the tree rows, in the intensive system

Year	Death cm	Factor B						Mean %	Difference %
		$N_0P_0K_0$	$N_{70}P_{30}K_0$	$N_{100}P_{50}K_{20}$	$N_{150}P_{100}K_{50}$	g.g.	g.g. + $N_{50}P_{30}K_{10}$		
2003	0-20	45	45	45	44	52	49	47.0	2.0
	20-40	44	44	44	43	45	44	44.0	-
	40-60	43	43	43	42	45	44	43.4	0.2
2004	0-20	45	44	44	43	48	47	45.2	0.2
	20-40	44	44	43	43	45	45	44.0	-
	40-60	43	43	42	42	43	43	42.6	-0.4
2005	0-20	44	44	44	43	46	46	44.6	0.6
	20-40	44	44	43	43	45	45	44.0	-
	40-60	43	43	42	42	43	43	42.6	-0.3

In intensive system, the total porosity of soil had values between 43% at 40-60 cm deep and 55% at 0-20 cm deep in variant b_4 (organic fertilized) on the tree row and between 42% at 40-60 cm deep in b_2 and b_3 variants and 52% at 0-20 cm deep in variant b_4 between the tree rows.

Table 3.

The influence of mineral and organic upon soil total porosity (%), on the tree rows, in the super intensive system

Year	Death cm	Factor B						Mean %	Difference %
		$N_0P_0K_0$	$N_{70}P_{30}K_0$	$N_{100}P_{50}K_{20}$	$N_{150}P_{100}K_{50}$	g.g.	g.g. + $N_{50}P_{30}K_{10}$		
2003	0-20	47	47	46	46	54	53	49.4	2.4
	20-40	45	45	44	44	46	46	45.0	-
	40-60	43	43	43	43	44	44	43.0	-
2004	0-20	47	47	46	46	52	50	48.4	1.4
	20-40	44	44	44	44	45	45	44.4	0.4
	40-60	43	43	43	42	44	44	43.0	-
2005	0-20	46	46	45	45	49	48	46.6	0.6
	20-40	44	44	44	44	45	44	44.2	0.2
	40-60	43	43	43	42	44	43	43	-

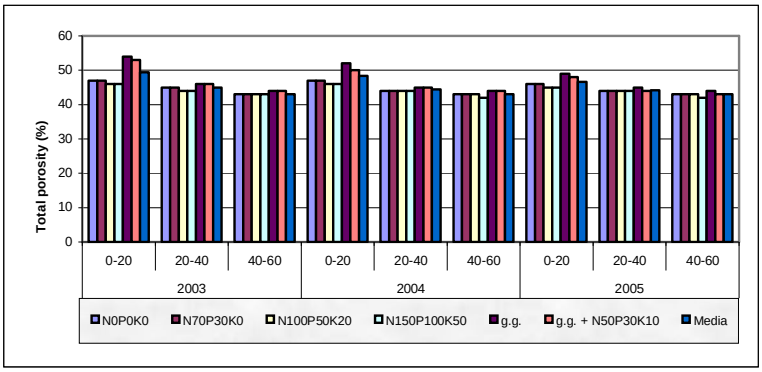

Fig. 3. The influence of mineral and organic upon soil total porosity (%), on the tree rows, in the super intensive system

Table 4.

The influence mineral and organic fertilizers upon soil total porosity (%), between the tree rows, in the super intensive system

Yean	Death cm	Factor B						Mean %	Difference %
		$N_0P_0K_0$	$N_{70}P_{30}K_0$	$N_{100}P_{50}K_{20}$	$N_{150}P_{100}K_{50}$	g.g.	g.g. + $N_{50}P_{30}K_{10}$		
2003	0-20	44	44	44	43	49	48	46	2
	20-40	44	44	44	43	45	45	45	1
	40-60	43	43	42	42	44	44	43	0.2
2004	0-20	44	44	43	43	48	47	44	-
	20-40	44	44	43	43	45	44	44	-
	40-60	43	43	42	42	43	43	43	-
2005	0-20	44	44	43	43	46	45	44.4	0.4
	20-40	44	44	43	43	44	44	43.6	-0.04
	40-60	43	43	42	42	43	43	42.6	-0.3

In super intensive system, the values of the total porosity of soil were between 42% at 40-60 cm in variant b_3 and 54% at 0-20 cm deep in variant b_4 on the trees rows and between

42% at 40-60 cm deep and 49% at 0-20 cm deep in variant b_4 between the trees rows.

As for the total porosity the calculation for the aeration porosity was made using the same calculation formula also considering the values of the field capacity for water of the soil (%)that were calculated according to the rainfall during the years of research 2003, 2004 and 2005, to the soil sample collecting depth and to the values of apparent density.

Table 5.

The influence mineral and organic fertilizers upon soil aeration porosity (%), on the tree rows, in the intensive system

Yean	Death cm	Factor B						Mean %	Difference %
		$N_0P_0K_0$	$N_{70}P_{30}K_0$	$N_{100}P_{50}K_{20}$	$N_{150}P_{100}K_{50}$	g.g.	g.g. + $N_{50}P_{30}K_{10}$		
2003	0-20	12.02	12.00	11.40	9.20	22	21	15.12	3.1
	20-40	11.30	11.08	10.70	8.80	16	15	12.32	1.02
	40-60	9.60	9.20	8.03	8.20	14	14	10.68	1.09
2004	0-20	11.60	11.52	11.20	9.00	19	17	13.54	1.94
	20-40	10.20	10.09	10.00	8.80	15	14	11.58	1.38
	40-60	9.30	9.10	8.12	8.02	12	12	11.71	2.41
2005	0-20	11.45	11.48	11.12	8.80	17	15	12.68	1.23
	20-40	10.12	10.02	9.90	8.72	14	13	11.13	1.01
	40-60	9.20	9.08	8.00	8.00	11	11	9.42	0.22

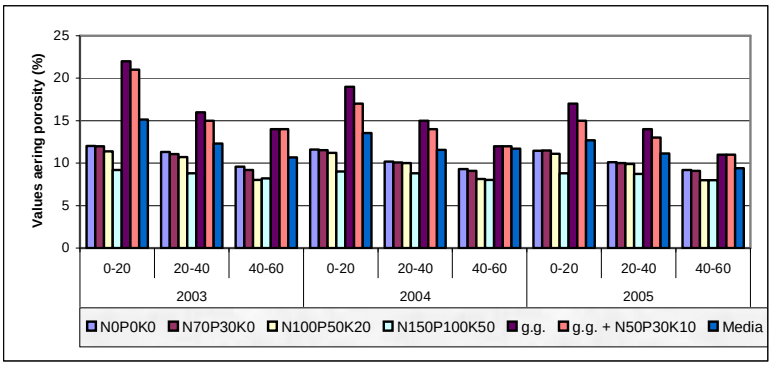

Fig. 5. The influence mineral and organic fertilizers upon soil aeration porosity (%), on the tree rows, in the intensive system

Table 6.

The influence mineral and organic fertilizers upon soil aeration porosity (%), between the tree rows, in the intensive system

Year	Depth cm	Factor B						Media %	Difference %
		$N_0P_0K_0$	$N_{70}P_{30}K_0$	$N_{100}P_{50}K_{20}$	$N_{150}P_{100}K_{50}$	g.g.	g.g. + $N_{50}P_{30}K_{10}$		
2003	0-20	9.80	9.76	9.20	9.02	16	15	11.80	2.0
	20-40	9.02	9.00	8.90	8.60	13	12	10.30	1.28
	40-60	8.60	8.55	8.48	8.30	10	10	9.07	0.47
2004	0-20	9.60	9.56	9.00	8.82	14	12	10.68	1.08
	20-40	8.86	8.70	8.61	8.50	12	11	9.76	0.9
	40-60	8.20	8.00	7.80	7.50	9.92	9.90	8.62	0.42
2005	0-20	9.52	9.43	8.92	8.79	12	11	10.03	0.51
	20-40	8.72	8.59	8.56	8.48	10.12	10.08	9.17	0.45
	40-60	8.10	7.90	7.74	7.45	9.82	9.70	8.52	0.42

In intensive system the aeration porosity of soil had values between 8,00% at 40-60 cm and 22% at 0-20 cm in variant b_4 on the tree row and between 7,45% at 40-60 cm deep in variant b_3 and 16% at 0-20 cm in variant b_4 between the rows.

Table 7

The influence mineral and organic fertilizers upon soil aeration porosity (%), on the tree rows, in the super intensive system

Yean	Death cm	Factor B						Mean %	Difference %
		$N_0P_0K_0$	$N_{70}P_{30}K_0$	$N_{100}P_{50}K_{20}$	$N_{150}P_{100}K_{50}$	g.g.	g.g. + $N_{50}P_{30}K_{10}$		
2003	0-20	12.00	11.80	11.31	9.16	21.60	20.84	14.94	2.94
	20-40	11.20	11.02	10.64	8.72	15.90	14.74	12.20	1.0
	40-60	9.60	9.20	8.02	8.19	13.80	13.80	10.60	1.0
2004	0-20	11.52	11.48	11.18	8.90	18..40	16.02	13.39	1.87
	20-40	10.20	10.09	9.92	8.70	14.70	14.00	11.48	1.28
	40-60	9.30	9.10	8.00	8.00	12.00	12.00	9.82	0.52
2005	0-20	11.40	11.40	11.09	8.70	16.00	15.00	12.44	1.04
	20-40	10.09	10.00	9.81	8.64	14.00	13.00	11.09	-
	40-60	9.20	9.08	8.00	8.00	11.00	11.00	9.42	0.22

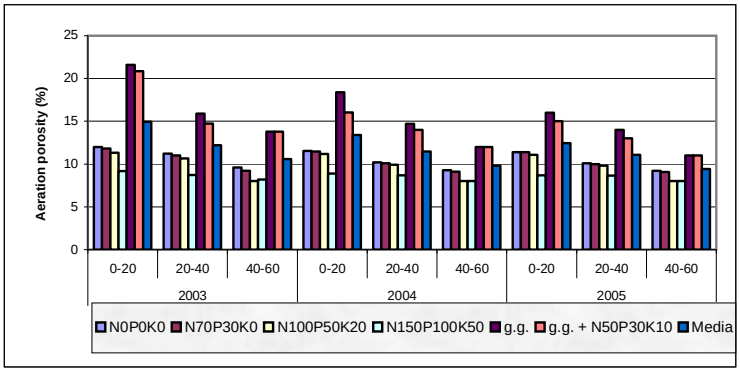

Fig. 7. The influence mineral and organic fertilizers upon soil aeration porosity (%), on the tree rows, in the super intensive system

Table 8

The influence mineral and organic fertilizers upon soil aeration porosity (%), between the tree rows, in the super intensive system

Yean	Death cm	Factor B						Mean %	Difference %
		$N_0P_0K_0$	$N_{70}P_{30}K_0$	$N_{100}P_{50}K_{20}$	$N_{150}P_{100}K_{50}$	g.g.	g.g. + $N_{50}P_{30}K_{10}$		
2003	0-20	9.70	9.70	9.18	9.00	15.00	14.00	9.38	-0.32
	20-40	9.00	9.00	8.86	8.54	12.00	11.00	9.88	0.88
	40-60	8.60	8.55	8.48	8.30	10.00	10.00	9.07	0.47
2004	0-20	9.54	9.50	8.90	8.74	13.00	11.00	10.23	0.69
	20-40	8.80	8.68	8.52	8.40	11.00	10.00	9.32	0.52
	40-60	8.20	8.00	7.80	7.50	9.70	9.60	8.52	0.32
2005	0-20	9.48	9.40	8.82	8.60	11.00	11.00	9.76	0.28
	20-40	8.70	8.62	8.49	8.43	10.06	10.00	9.12	0.42
	40-60	8.10	7.90	7.70	7.42	9.80	9.70	8.50	0.40

In super intensive system the values of aeration porosity of soil were of 8.00% at 40-60 cm deep in variants b_2 and b_3 and 21.60% at 0-20 cm deep in variant b_4 on the trees rows

and between 7.42% at 40-60 cm deep in variant b_3 and 15% at 0-20 cm deep in variant b_4 between the rows.

CONCLUSIONS

The values of total and aeration porosity depend on the same factors that determine the values of density and apparent density.

1. Total porosity had values between 43-55% in intensive system and 42-54% in super intensive system on the trees row and between 45-52% in intensive system and 42-49% in super intensive system between the rows.

The higher values were registered when there was made organic fertilization at 0-20 cm deep and the lower values were registered for variant b_4 at 40-60 cm deep.

The highest values were registered on the trees rows and the smallest values were registered on the interval between the rows.

2. Aeration porosity had values between 8-22% in intensive system and 8-21.60% in super intensive system on the trees row and between 7.45-16% in intensive system and 7.42-15% in super intensive system between the rows.

The higher values were registered when there was made organic fertilization at 0-20 cm deep and the lower values were registered for variant b_4 at 40-60 cm deep.

The highest values were registered on the trees rows and the smallest values were registered on the interval between the rows.

LITERATURE

1. BLAGA GH., RUSU I., UDRESCU S., VASILE D. – Pedology. Ed. Didactică şi Pedagogică, Bucureşti, 1996.
2. CANARACHE A. – Soils Physics. Ed. Ceres, Bucureşti, 1990.
3. NIŢĂ L., RUSU I., ŞTEFAN V. – The Effect of Antropic Activity upon the Apparent Density of Cambic Cernoziom in Timişoara. Scientific Works, Vol. XXXII, Ed. Agroprint, Timişoara, 2000.
4. RUSU I., GOIAN M., IANOŞ GH., BORZA I., ŞTEFAN V. – The Antropic Influence upon Physic Features of Banat's Soils. SNRSS Publications No. 28 A, Bucureşti, 1994.
5. RUSU I., GOIAN M., ŞTEFAN V., SÂMPĂLEANU DORINA, NIŢĂ L. – Modification of Physical Features of Soils in Improvement Systems by Antropic Activities in the West Field. Ed. Agroprint, Scientific Works, vol. XXIX, Timişoara, 1997.