RESEARCHES CONCERNING THE EVOLUTION OF THE MAIN PHYSIQUE AND CHEMICAL QUALITIES THAT CROP ROTATION AND FERTILIZATION INFLUENCE

CERCETĂRI PRIVIND EVOLUȚIA PRINCIPALELOR ÎNSUȘIRI FIZICE ŞI CHIMICE ALE SOLULUI SUB INFLUENȚA ROTAȚIEI CULTURILOR ŞI A FERTILIZĂRII

JITAREANU S.I.[1], AILINCAI C.[2]
[1]University of Agricultural Sciences and Veterinary Medicine Iassy
[2]Comercial and Agricultural Company Podu-Iloaiei

Abstract. *The agricultural activity modifies in time physical, chemical and biological properties of the soil, causing the apparition of direct effects, that are better know (draining the soil of organic matter and nutritious substance, the lack of nutritious elements in plants), but also indirect effects, "physiological costs", difficult to understand, that influence plants, animals and peoples capacity to fight and to resist to biotic and abiotic factors of the environment.*

Knowledge of the influence of environment factors and of the crop technologies over soil durable productivity permits managing its fertility and the evaluation of economic impact on long term agricultural activities.

Rezumat. *Activitatea agricolă modifică în timp proprietății fizice, chimice şi biologice ale solului determinând apariția unor efecte directe care sunt mai bine cunoscute (secătuirea solului în materie organică şi substanțe nutritive, carența plantelor în elemente nutritive), dar şi efecte indirecte, denumite şi „costuri fiziologice", mai greu de sesizat şi care şi care influențează capacitatea plantelor, a animalelor şi a oamenilor de a lupta şi rezista la factorii biotici şi abiotici din mediu înconjurător.*

STUDY AND RESEARCH METHOD

The experiments were performed in the antierosion agrotechnics field on the farm of Comercial and Agricultural Company Podu-Iloaiei Iaşi, witch hydrographic belongs to the inferior basin of Bahlui. In this area we can find soils characteristic to high grass region, represented by chernozems in different stages of degradation, that have earth-clay texture and different content of humus, depending on the degree of erosion, from 2,5 to 3,38%. The content of mobile phosphorus is also differentiated from 14 to 148 ppm, and the content of mobile potassium varies from 162 to 369 ppm.

The researches directed to the influence of crop rotation and its structure over physique and chemical qualities of the soil.

The crops were passed to wheat-corn rotation, whereat experienced different doses of organo-mineral fertilization.

RESULTS AND DISCUSSIONS

Obtained results have proven that the amount of vegetale grout (radicular system and aerial organs), that represents the main source of organic substance of the soil, depends on the development of vegetale mass and on the crop size. Introducing the rotation that match to the crops and implementing the eighth doses of fertilizers drove to the increase of the production and of the vegetale mass (vegetale grout).

The contribution of organic matter associated with a long period from reaping preliminary plants up to sowing, assure in this dry zone the maintain of a favorable structural state of the soil.

Thereby, to the wheat crop, placed in different rotations, the percent of hydrostable units were less influenced by rotation but more by applied fertilizers. The biggest percent of hydrostable unit was recorded to the fertilization with doses of N100P100 or N40P40 + 30 tones of garbage and in the case of location the wheat in crop rotation with ameliator plants.

Table 1

The influence of rotation and fertilizers over hydric stability of soil units to wheat crop (Hydrostable units-% 0,25 mm Ø)

Doses	Depth -cm -	One-crop system	2 years rotation	3 years rotation	4 years rotation
N_0P_0	0 ÷ 10	32,3	38,2	39,6	41,8
	10 ÷ 20	37,4	38,4	49,8	48,9
	20 ÷ 30	40,8	42,4	51,2	50,4
Average	0 ÷ 30	36,8	40,0	46,9	47,0
$N_{70}P_{70}$	0 ÷ 10	34,4	36,9	41,2	41,5
	10 ÷ 20	38,2	42,3	48,4	49,9
	20 ÷ 30	40,9	43,9	58,2	56,2
Average	0 ÷ 30	37,8	41,0	47,3	48,2
$N_{100}P_{100}$	0 ÷ 10	36,8	35,2	43,8	43,2
	10 ÷ 20	40,2	38,8	48,6	48,9
	20 ÷ 30	40,6	40,9	53,9	59,2
Average	0 ÷ 30	39,2	38,3	50,1	50,4
$N_{40}P_{40}$ + 30 t garbage	0 ÷ 10	38,6	41,2	44,2	43,9
	10 ÷ 20	40,8	42,6	58,2	56,3
	20 ÷ 30	44,2	43,9	49,4	58,2
Average	0 ÷ 30	41,2	42,6	50,6	52,2

To the corn crop, the differences regarding the percent of hydrostable units between one-crop system and 3 and 4 years rotations were more stressed. Thereby, for the corn one-crop and for the wheat – corn rotation, the percent of hydrostable units swing from 36,8 to 42,6, and by introducing the ameliator plants in crop rotation, their value grew to 46,9 – 52,2 (Tab.1)

The effectuated makes regarding the apparent density of the soil emphasized that for the wheat crop its value swing, depending on rotation and

administered fertilizers doses, from 1,29 to 1,37 g/cm^3. The biggest values were recorded for wheat – corn rotation (1,32 ÷ 1,37 g/cm^3), fact that reflects a small degree of settling (2 ÷ 2,5% of volume). (Tab 2)

To the corn crop, situated in different rotations, the biggest values for apparent density were registered for the corn one-crop and for the wheat – corn rotation (1,34 ÷ 1,39 g/cm^3), where the settling degree (calculated depending on the minimum necessary porosity and the total porosity) grew to 3 ÷ 5 of volume (Tab 3).

The researches concerning the influence of crop rotation and fertilizers over the evolution of the main agrochemical index of the soil cued important changes.

Thus, for all the rotations and for all the administered doses of fertilizers, the soil Ph values swing from 6,1 to 7,3 (weak acid - neutral). The smallest values were registered for the corn one-crop, for the wheat-corn rotation and for a long use of $N_{100}P_{100}$ doses. For the wheat one-crop and for the rotations with ameliator plants, the decrease of the ph value, by administering fertilizers with acidifiant effect (ammoniac azotate) was considerably diminuated.

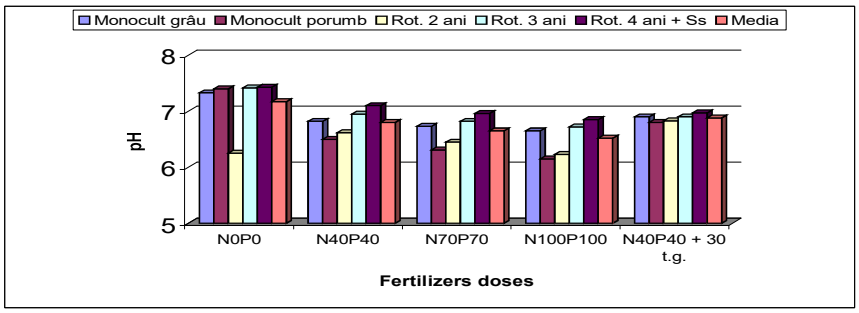
By analyzing the influence of crop rotation and fertilizers about the content of humus in the soil it was discovered that its highest values have been recorded to the 3 and 4 years rotations, and the lowest values for the corn one-crop system.

Table 2

The influence of fertilizers and rotation over the apparent density of soil to wheat crop - g/cm^3-

Doses	Depth -cm -	One-crop system	2 years rotation	3 years rotation	4 years rotation
N_0P_0	0 ÷ 10	1,30	1,32	1,32	1,29
	10 ÷ 20	1,32	1,35	1,34	1,30
	20 ÷ 30	1,34	1,37	1,34	1,32
Average	0 ÷ 30	1,32	1,34	1,33	1,30
$N_{70}P_{70}$	0 ÷ 10	1,30	1,32	1,30	1,30
	10 ÷ 20	1,32	1,36	1,32	1,30
	20 ÷ 30	1,34	1,36	1,34	1,32
Average	0 ÷ 30	1,32	1,34	1,32	1,31
$N_{100}P_{100}$	0 ÷ 10	1,32	1,30	1,30	1,30
	10 ÷ 20	1,32	1,34	1,30	1,30
	20 ÷ 30	1,34	1,36	1,30	1,30
Average	0 ÷ 30	1,33	1,33	1,30	1,30
$N_{40}P_{40}$ + 30 t garbage	0 ÷ 10	1,30	1,30	1,29	1,29
	10 ÷ 20	1,32	1,32	1,29	1,29
	20 ÷ 30	1,32	1,34	1,30	1,30
Average	0 ÷ 30	1,31	1,32	1,29	1,29

The obtained results cued that by annual use of fertilizers doses up to $N_{70}P_{70}$ for the wheat and corn one-crop system and up to $N_{40}P_{40}$ for the ameliator plants rotations, the content of humus in the soil decreased with 0,4%, for the wheat one-crop and with 0,85% for the corn one-crop.

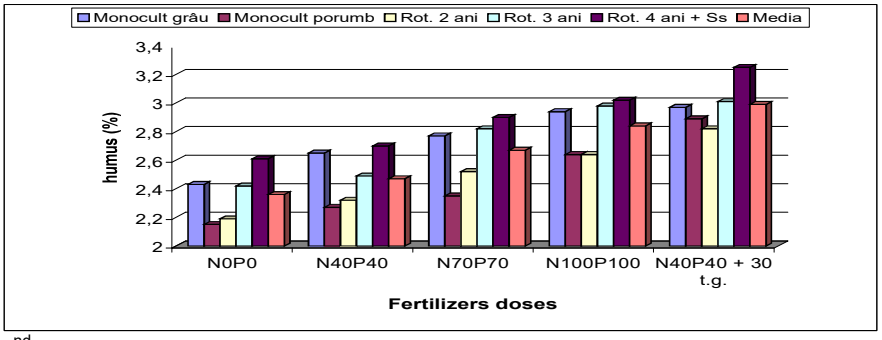


1st Figure - The influence of fertilizers and rotation over the soil reaction to the medium cambic erodated chernozem in SCDA Podu Iloaiei

Table 3

The influence of fertilizers and rotation over the apparent density of soil to corn crop - g/cm^3-

Doses	Depth -cm -	One-crop system	2 years rotation	3 years rotation	4 years rotation
N_0P_0	0 ÷ 10	1,34	1,34	1,32	1,29
	10 ÷ 20	1,38	1,36	1,34	1,32
	20 ÷ 30	1,44	1,38	1,36	1,34
Average	0 ÷ 30	1,39	1,36	1,34	1,32
$N_{70}P_{70}$	0 ÷ 10	1,32	1,32	1,30	1,30
	10 ÷ 20	1,36	1,36	1,32	1,32
	20 ÷ 30	1,42	1,38	1,34	1,34
Average	0 ÷ 30	1,37	1,35	1,32	1,32
$N_{100}P_{100}$	0 ÷ 10	1,31	1,32	1,32	1,29
	10 ÷ 20	1,36	1,36	1,32	1,30
	20 ÷ 30	1,42	1,38	1,34	1,32
Average	0 ÷ 30	1,36	1,35	1,33	1,30
$N_{40}P_{40}$ + 30 t garbage	0 ÷ 10	1,30	1,30	1,29	1,29
	10 ÷ 20	1,32	1,32	1,32	1,30
	20 ÷ 30	1,36	1,36	1,34	1,32
Average	0 ÷ 30	1,33	1,33	1,32	1,30



2nd Figure - The influence of fertilizers and rotation over the contain of humus to the medium cambic erodated chernozem in SCDA Podu Iloaiei

Table 4

The evolution of the main agrochemics index of the soil on the influence of different rotations and doses of fertilizers

Rotation	Fertilizers doses	Ph (H_2O)	Humus %	N total %	P-AL ppm	K-AL ppm	Ca^{2+}	Mg^{2+}
							Mg / 100 g soil	
Wheat one-crop	N_0P_0	7,33	2,43	0,134	19	196	11	4,86
	$N_{40}P_{40}$	6,82	2,65	0,137	37	190	12	4,53
	$N_{70}P_{70}$	6,75	2,77	0,142	41	202	13,5	4,25
	$N_{100}P_{100}$	6,65	2,94	0,151	43	226	12,3	3,77
	$N_{40}P_{40}$ + 20 t. g.	6,90	2,97	0,153	39	245	13,5	4,77
Average		**6,89**	**2,75**	**0,143**	**35,8**	**211,8**	**12,5**	**4,44**
Corn one-crop	N_0P_0	7,4	2,15	0,126	12	189	7	3,95
	$N_{40}P_{40}$	6,50	2,27	0,125	29	189	8	3,98
	$N_{70}P_{70}$	6,31	2,35	0,136	35	196	8	4,25
	$N_{100}P_{100}$	6,15	2,64	0,141	39	196	9	4,75
	$N_{40}P_{40}$ + 20 t. g.	6,80	2,89	0,145	42	238	9	3,85
Average		**6,57**	**2,46**	**0,135**	**31,4**	**201,6**	**8,2**	**4,16**
Wheat-corn rotation	N_0P_0	6,25	2,19	0,120	13	194	7	3,95
	$N_{40}P_{40}$	6,62	2,32	0,125	27	183	8	4,25
	$N_{70}P_{70}$	6,45	2,52	0,131	45	189	6	4,25
	$N_{100}P_{100}$	6,23	2,64	0,131	48	186	9	4,86
	$N_{40}P_{40}$ + 20 t. g.	6,83	2,82	0,154	50	274	7	4,95
Average		**6,48**	**2,50**	**0,132**	**36,6**	**205,2**	**7,4**	**4,45**
Pea-wheat-corn rotation	N_0P_0	7,42	2,42	0,130	14	135	11,5	4,17
	$N_{40}P_{40}$	6,95	2,49	0,134	33	168	9,5	4,25
	$N_{70}P_{70}$	6,82	2,82	0,143	52	172	13	4,25
	$N_{100}P_{100}$	6,72	2,98	0,145	61	195	13	5,47
	$N_{40}P_{40}$ + 20 t. g.	6,9	3,01	0,162	53	254	10	5,78
Average		**6,96**	**2,74**	**0,143**	**42,6**	**184,5**	**11,4**	**4,78**
Pea-wheat-corn –sun flower + grass sole rotation	N_0P_0	7,43	2,61	0,134	16	191	11	5,17
	$N_{40}P_{40}$	7,10	2,70	0,144	29	183	11	5,15
	$N_{70}P_{70}$	6,96	2,90	0,149	41,5	181	10,5	5,17
	$N_{100}P_{100}$	6,85	3,02	0,156	46,5	191	11	6,08
	$N_{40}P_{40}$ + 20 t. g.	6,97	3,25	0,158	49	291	11,5	5,86
Average		**7,06**	**2,90**	**0,148**	**36,4**	**207,4**	**11**	**5,49**

By using $N_{100}P_{100}$ or $N_{40}P_{40}$ + 30t/ha garbage doses, the content of humus in the soil increased from 2,43 to 2,97% for the wheat one-crop and from 2,61 to 3,25 % in ameliator plants rotations.

By administrating for a long time the $N_{100}P_{100}$ doses for the wheat one-crop and for the wheat – corn rotation, the content of humus in the soil mantained to its initial value, and by organic-mineral fertilization ($N_{40}P_{40}$ + 30t/ha garbage), the content of humus increased very little(0,15%).

The values registered to the other macroelements (N,P,K,Ca, Mg) shows that the provisioning of the soil can be considered as being normal, against the requirements of the agricultural crops(Tab 4).

CONCLUSIONS

The main limitative factor is the erosion of the soil, witch determine the removal of levels with humus, small settling of the level to the depth of 15 ÷ 20 cm (hardpan in formation) and the degradation of the structure to the surface of the soil, pursuant to the technologic fluxes and to practicing of the one-crop of corn or of the wheat-corn rotation.

By compressing the results obtained can be found that on acclivous fields where the soil-cultivating conditions are less favorable to the crops, through organizing the rotations and long using of $N_{100}P_{100}$ doses or $N_{40}P_{40}$ + 30t/ha garbage, the main agrochemical indexes maintained in favorable limits to evolution and development of the plants.

On acclivous fields, with a small content of humus, is enforced the organic fertilization, witch assures a part of the nutritive substance necessary for the plants (one tone of stable garbage causes the productive re-using the plants of 3,5 kg N, 2,0 kg P_2O_5 ÷ 6 kg CaO and 2 kg MgO). The same quantity of stable garbage also contains the meaned amount of microelements (4 ÷ 5 g boron, 20 ÷ 25 g zinc, 7 ÷ 9 g copper, 45 ÷ 60 g manganese and 90 ÷ 180 g iron) and conduces to the cumulation of the humus substances from soil.

These results demonstrate that for sustaining the fertility of the acclivous fields it is necessary assuring the equilibrium of the humification and mineralizing process that presupposes the evaluation and the control of the nutritive elements in the soil which suffer modifications much more fast that plan fields, by reason of applied technologies and the erosion process.

REFERENCES

1. **Ailincăi C. and co-workers** – *Research concerning the biological activity of soil microflora for different crop systems in Moldova's Plain*. Agronomic researches in Moldova, 3-4 Volume, Iaşi.
2. **Archer J.,** 1988 – *Crop Nutrition and fertilizers use.* Copyright, Farming Press Ltd, Reprinted 1993
3. **Davidescu D. and co-workers,** 1981 – *Agrochemics*. Bucharest Academy Press
4. **Eliade G., Ghinea L., Ştefanic G.,** 1975 – *Soil microbiology.* Ceres Press, Bucharest
5. **Kiss S., Ştefanic G., Daniela Paşca,** 1991 – *Environment enzymology*. Ceres Press, Bucharest
6. **Zarnea G.,** 1994 – *Treaty of general microbiology.* Romanian Academy Press, Bucharest