THE CHANGING OF THE SOIL REACTION AS A RESULT OF APPLYING SEVERAL FERTILIZER TYPES

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As a result of long term applying of chemical fertilizers with different crops, the soils have changed their agrochemical features of which the most sensitive to the fertilizer applying is the soil reaction. In order to evaluate the changing underwent by the soil reaction as a result of using different fertilizer types of nitrogen with the corn and wheat crops on a typical reddish preluvosoil we have researched during 2004 and 2008 years the evolution of the soil reaction with 11 fertilized variants that were fertilized comparatively with the not fertilized control. At the begging of the experiment, in 2004, the soil reaction with all 12 researched variants was weak acid to neutral (pH 6.44 – 6.95) between variants being a variation of the pH value of o.3-0.7% due to the soil unevenness. After 4 years of research, for all variants, the final pH was lower than the initial one. The pH variations were lower or bigger in function of the type of the fertilizer. With the not fertilized control the pH variation was of 2.16 and the soil has acidified in natural conditions.

***Key words**: soil reaction, fertilizers, physiological acidity, urea, ammonium nitrate.*

The applying of different types and doses of fertilizers with field crops has had a beneficial effect on the yield.

The applying of the fertilizers determines, along with the beneficial effect of increasing the yield, not desired effects that affect both the soil and yield quality [R. Mocanu, 2007]. The main impact that the fertilizers inflict on the soil is the changing its reaction most frequently by acidifying. The soil acidification as a result of applying chemical fertilizers is done due to the following causes:

- fertilizer physiological reaction or interaction between soil-plant-fertilizer;
- the increased consumption of bases along with yield as a result of fertilizer applying;
- soil ammonia nitrifying and fertilization and including the resulted protons within the clay – humic complex instead the bases that pass through the soil solution and leach.

In order to evaluate the acidification of the reddish preluvosoil from the Central Oltenia we have researched on this soil type within an experiment with different types and fertilizer doses that were applied to wheat in 2004-2008 period, the way the soil reaction has evolved.

MATERIAL AND METHOD

The soil reaction evolution has been made within experiments with different doses and fertilizer types that were applied to wheat and corn crops on the reddish preluvosoil from SDE Banu Maracine, Craiova in the Center Oltenia at the beginning of them, in 2004, and at the end, in 2008. The experiments comprise 12 variants in three replications as follows: V_1 – not fertilized control; V_2 – N_{120} – ammonium nitrate; V_3 – N_{120} – urea; V_4 – N_{120} – nitrocalcar; V_5 – K_{100} – potassium sulphate; V_6 – manure 30 t/ha applied at the beginning of the experiment, in 2004; V_7 – P_{72} – superphosphate; V_8 – N_{120}+P_{72} – ammonium nitrate + superphosphate; V_9 – N_{120}+P_{72} – urea+superphosphate; V_{10} – N_{120}+P_{72} – nitrocalcar + superphosphate; V_{11} – K_{100}+P_{72} – potassium sulphate + superphosphate; V_{12}- 30 t/ha manure + superphosphate.

The soil were the experiment took place is the reddish typical preluvosoil with the following horizons: Ao, AB, Bt, Bt2, C, with a silty – sandy texture, a bulk density with an average value of 1.36 g/cm^3, a total porosity of 48.5%, with reduced values of the hygroscopicity coefficient, of 5.84%.

The humus content of 2.5% and the total nitrogen of 0.131% show a supplying degree weak to middle and middle to well supplied with phosphorus and potassium. The natural conditions from the researching period emphasize an average annual temperature of 11.9^{0}C over 10.8^{0}C that is the multiannual average and the rainfall are 658.5 mm over 546,5 mm that is the multiannual average.

RESULTS AND DISCUSSIONS

The changing in time of the soil reaction is given in the *table 1*.

Table 1

The influence of fertilization by different types and doses of fertilizers on the soil reaction, 2008 over 2004

#	The researched variant	pH-H_2O		% pH final over initial	The pH variation	
		Initial 2004	Final 2008		Total – due to natural cond. + fert.	Partial – due only fertilizers
1	not fertilized control	6.90	6.75	97.84	-2.16	-
2	N_{120} – ammonium nitrate	6.95	6.54	94.13	-5.87	-3.71
3	N_{120} – urea	6.88	6.27	91.06	-8.94	-6.78
4	N_{120} – nitrocalcar	6.74	6.39	94.77	-5.23	-3.07
5	K_{100} – potassium sulphate	6.70	6.50	96.97	-3.03	-0.87
6	$N_{120}P_{72}$ manure 30 t/ha	6.44	6.40	99.38	-0.62	1.54
7	P_{72} – superphosphate	6.52	6.39	98.05	-1.95	0.21
8	N_{120}+P_{72} – ammonium nitrate + superphosphate	6.47	6.14	94.87	-5.03	-2.97
9	N_{120}+P_{72} – urea+superphosphate	6.55	6.23	95.11	-4.89	-2.73
10	N_{120}+P_{72} – nitrocalcar + superphosphate	6.47	6.17	95.36	-4.64	-2.48
11	K_{100}+P_{72} – potassium sulphate+ superphosphate	6.58	6.42	97.51	-2.49	-0.33
12	30 t/ha manure + superphosphate	6.78	6.53	96.3	-3.70	-1.54

On the basis of the enclosed data, there results the following:

At the beginning of the experiment, in 2004, the soil reaction in the 12 researched variants has been weak acid and neutral (pH between 6.44 – 6.95) among the sampled plots existing variations of the pH values between 0.3 – 0.7 % due the soil unevenness that underwent several previous fertilizations more or less uniform. After 4 years of experimentation, for all variants the final pH was less than initial one, the pH variations being more or less, in function of the nature of the applied fertilizers. With the not fertilized control the pH variation has been of 2.16, the soil has acidified without being influenced by the fertilizers. With all other variants the soil acidification is due both to natural conditions (the not fertilized control) and due to the applying of several fertilizer types and doses. Subtracting from the total acidity the acidity of the not fertilized control variant there is obtained the variation of the soil reaction due to fertilizers. The applied fertilizers, urea, ammonium nitrate, nitrocalcar and the potassium sulphate acidify the soil according with their physiological acidity action, more urea, for what the pH variation is -6.78% and less the potassium sulphate whose pH variation is only – 0.87%. With the case of these fertilizers, the soil acidification due to them is added to the one determined by the soil and clime conditions, such way the pH variation resulted from the experimental measurements is of – 8.94% for urea and – 3.03% for the potassium sulphate the pH value decreasing by 0.61 and 0.20 pH units. Of all applied fertilizer types only the simple superphosfate has had an alkali action the pH variation being of -0.62% according with the neutral physiological reaction and with the probable dicalcic phosphate content, a minor component with alkali physiological reaction.

The manure has had the most alkali action, even bigger than simple superphosphate. The variation of the pH due to manure has been of 1.54%. The phenomenon is determined of the basic ions contribution brought by the organic fertilizer and of the immobilization of these ions into the soil as alkali earthy insoluble humates and this phenomenon has prevailed to the microbiological oxidation of the ammonia that is released when the manure is mineralized along with the free of protons. The soil alkalization due to manure has been less than the acidification determined by the soil and clime conditions such way the final result of the whole process has been the weak acidification of the soil of – 0.62% and a very slight decrease of the pH by 0.04 pH units.

There is very likely whether the manure fertilization continues in the farm to reach a real alkalization of the soil.

The fertilizers binary mixings corresponding to the other variants determine a soil acidification that represent, as scale, the resultant of the physiological reaction of their components. The higher pH variation has been of 2.97% for the mixture superphosphate + ammonium nitrate and the smaller, - 0.33% for the mixture superphosphate + potassium sulphate.

The total pH variation has been, due, both to fertilizers as well as natural conditions for the upward fertilizers has been of -5.03% and, respectively, -2.49%. D. Davidescu (1981), I. Timbota and M. Goian (2001), also, emphasize an increase

of the pH value with the applying of manure on a podzol and brown clay illuviated soil.

CONCLUSIONS

The using of different types and doses of fertilizers within experiments with wheat and corn on the reddish preluvosoil from the Central Oltenia during 4 years has conducted to changing of the soil reaction in function of the fertilizer type:

- the soil reaction decreases in time due to the natural conditions, too;

-The nitrogen fertilizers: ammonium nitrate, urea, nitrocalcar applied alone decrease the pH value, acidifying the soil, the highest acidifying action being recorded with urea and ammonium nitrate, by 8.94% and 5.87%;

-The nitrogen fertilizers applied on superphosphate background decrease the soil reaction lesser than when applied alone;

- Of the applied fertilizers, only the superphosphate has a weak alkali reaction;

- Manure has had the most intense alkali action, higher than simple superphosphate, the pH variation being of +1.54%.

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