THE INFLUENCE OF RECULTIVATION OF THE STERILE DUMPS ON THEIR AGROCHEMICAL FEATURES

Mihail SUSINSKI, Ana Maria DODOCIOIU, Romulus MOCANU

University of Craiova, Faculty of Agriculture
Corresponding author: m_susinski@yahoo.com

Abstract: *The recultivation of the sterile dumps implies certain changing in their properties. In order to emphasize this aspect we have researched the evolution of the main agrochemical features of the sterile dumps from Husnicioara under the influence of recultivation and fertilization using chemical and organic fertilizers within the 2002-2008 period. The recultivation was done using corn, both on 25t/ha manures background and without manure using the following chemical fertilizers doses: N_{40}, N_{80}, N_{120}, N_{160}, $N_{160}P_{80}$, $N_{160}P_{80}K_{80}$. As nitrogen fertilizer there was used the urea, as phosphorus, the simple superfosfate and as potash, KCl. After 7 years of cropping corn in corn-wheat crop-rotation there were noticed the following changing's of the agrochemical features: The soil reaction – was, in 2002, weak alkaline (pH=8.05-8.10) due, primarily to the N fertilizers. The applying of large urea doses, of N_{120}, N_{160} determines the decreasing of the pH value from 8.10 and 8.09 to 7.74 and 7.59, with 0.36-0.50 units without manure and 0.18 and, respectively, 0.25 units on 25 t/ha manure background. The evolution of the mobile phosphorus – in all no manure variants where there were applied no phosphorus fertilizers (the 1-5 variants) the concentration of soluble phosphorus from the soil has decreased after 7 years in comparison with the initial concentration. Within the variants where there were applied phosphorus fertilizers, the final concentration of the soluble phosphorus was higher than the initial one (the 6, 7 variants), from 34.71 ppm P – 59.00 ppm P). Within the variants where manure was applied, the initial and final concentrations are almost equal excepting the case where over the manure background there were applied phosphorus fertilizers (simple super phosphate) and in these cases the soluble phosphorus concentration after 7 years of researching is higher than the initial concentration (34.96 ppm – 59.53 ppm P). The evolution of the soluble potash – the soluble potash from the soil has decreased within all fertilized variants with simple nitrogen or nitrogen and phosphorus as well as with manure yet it increased with the potash fertilized variants (59.12 – 113 ppm K) The evolution of the humus content – the humus content has recorded an increasing tendency only with the variants fertilized with manure (0.774 – 0.810%) yet with large nitrogen doses applied alone there even was recorded a decreasing.*

Key words**:** *biological re cropping, sterile dumps, fertilizers*

INTRODUCTION

Within the sterile material depositation, due to the technological fluxes from quarries there can not be respected an order of sterile deposition, according with the initial stratification. This is the reason why the deposition is considered chaotically resulted a heterogeneous mixture of rocks with different characteristics even at a small scale.

In order to integrate the sterile dumps within the zone landscape and its recovery for the economical capitalisation there must be respected the following steps:

- the technical mining management that assume: soil preservation, sterile dump fixation, deposition of the vegetal soil on levelled surfaces, dumps terrain re designing;
- biological re cropping that assume the recovery of the useful part of the soil production capacity by technical and biological treatmens. Within the biological step there will be made the on site re cropping using specific cropping technologies (during 4-5 years);

We are looking to identify some spects on the agrochemical features of the sterile dumps as a result of re cropping and of using different chemical and organic fertilizers and we have researched this thing within some field experiments at Husnicioara research field.

MATERIAL AND METHODS

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RESULTS AND DISCUSSIONS

The results are presented in the first and second tables.

The evolution of the pH in water solution under a corn crop, after 6 years of cropping and fertilization

From the first table we can observe that with all cases there take place a decreasing of the pH values which means an increasing of the hydroxyl ions and an acidification of the soil.

From the data of fourth table there can be observed that the pH differences are as higher as the urea dose increases. There, also, can be noticed that the pH differences, for all variants, are smaller when the chemical fertilizers are applied after manure.

The explanation of pH variations under the influence of fertilizers is given by their physiologic action. Urea and potash chloridehave a high acid physiologic action that conduct to the decreasing of the pH in water solution.

The evolution of the available phosphorus under the influence of anthropic factors

The initial and final values of the available phosphorus are written in the first and second tables. The average values of the available initial and final phosphorus for every variant are written in the sixth table.

From data of the fifth table there can be noticed that with all variants without manure where no phosphorus fertilizers were added (variants 1-5) the concentration of the soil available phosphorus has decreased after 7 years of trials over the initial concentration. With the variants where phosphorus fertilizers were added, the final concentration of soil available phosphorus was higher than the initial one (variants 6-7).

These results can be axplained by a phosphorus balance that emphasize the quantities that entered and exit the soil.

The evolution of the available potash under the influence of human factors.

The data on the potash balance in the sterile dump from Husnicioara are presented in the 6^{th} and 7^{th} tables.

Table 1

The variation of the agrochemical parameters: pH,available phosphorus, available potas and humus in the experimental field (sterile dump) Husnicioara, District Mehedinti, after 7 years of fertilization with different NPK doses, with and without manure, with corn crop

	i	f	i	f	i	f	i	f	i	f	i	f	I	f	
	2		7		5		3		6		4		1		
pH	**8,10**	**7,94**	**8,15**	**7,57**	**7,98**	**7,50**	**8,03**	**7,71**	**8,10**	**7,82**	**8,04**	**7,68**	**8,13**	**8,10**	
P	**35,92**	**29,23**	**34,78**	**59,23**	**36,03**	**26,02**	**33,89**	**26,42**	**34,25**	**60,89**	**34,43**	**25,15**	**35,68**	**30,33**	R_4
K	**60,25**	**56,43**	**64,78**	**115,74**	**67,00**	**56,40**	**63,11**	**53,52**	**59,51**	**51,78**	**60,77**	**52,17**	**65,57**	**59,15**	
H	**0,715**	**0,721**	**0,728**	**0,735**	**0,739**	**0,742**	**0,803**	**0,755**	**0,751**	**0,749**	**0,742**	**0,750**	**0,768**	**0,773**	
	5		4		1		6		3		7		2		
pH	**8,19**	**7,68**	**8,15**	**7,75**	**8,21**	**8,15**	**8,08**	**7,79**	**8,01**	**7,71**	**8,12**	**7,51**	**8,11**	**7,93**	
P	**35,81**	**25,73**	**33,95**	**26,73**	**36,08**	**30,58**	**35,73**	**59,82**	**34,67**	**25,81**	**34,58**	**58,97**	**33,77**	**28,13**	R_3
K	**66,12**	**57,22**	**59,45**	**53,21**	**63,73**	**58,83**	**60,18**	**52,14**	**64,24**	**54,03**	**57,89**	**120,18**	**61,35**	**55,72**	
H	**0,702**	**0,710**	**0,758**	**0,760**	**0,763**	**0,760**	**0,732**	**0,723**	**0,748**	**0,751**	**0,690**	**0,703**	**0,753**	**0,761**	
	3		6		5		2		7		1		4		
pH	**8,10**	**7,75**	**8,10**	**7,80**	**8,07**	**7,58**	**8,00**	**7,82**	**7,93**	**7,33**	**8,02**	**8,02**	**8,13**	**7,75**	
P	**36,14**	**26,93**	**35,24**	**60,15**	**33,81**	**25,75**	**34,37**	**27,70**	**35,74**	**59,47**	**33,80**	**29,80**	**34,25**	**25,03**	R_2
K	**56,23**	**53,61**	**61,17**	**51,33**	**59,71**	**56,43**	**62,44**	**55,84**	**58,16**	**100,48**	**65,23**	**59,05**	**60,42**	**51,90**	
H	**0,744**	**0,750**	**0,801**	**0,795**	**0,767**	**0,772**	**0,734**	**0,750**	**0,774**	**0,747**	**0,730**	**0,728**	**0,821**	**0,828**	
	1		2		3		4		5		6		7		
pH	**8,06**	**8,03**	**7,99**	**7,78**	**8,05**	**7,72**	**8,09**	**7,78**	**8,12**	**7,63**	**7,97**	**7,72**	**8,04**	**7,49**	
P	**33,21**	**30,43**	**35,14**	**29,01**	**33,63**	**25,67**	**34,58**	**24,95**	**34,28**	**25,90**	**35,18**	**59,55**	**33,74**	**58,33**	R_1
K	**59,32**	**58,30**	**61,46**	**56,82**	**57,31**	**52,72**	**59,16**	**52,80**	**62,37**	**55,70**	**58,81**	**50,81**	**55,67**	**117,25**	
H	**0,713**	**0,705**	**0,698**	**0,708**	**0,752**	**0,741**	**0,721**	**0,732**	**0,693**	**0,712**	**0,778**	**0,781**	**0,685**	**0,718**	

i = inițial
f = final

Table 2

The variation of the agrochemical parameters: pH,available phosphorus, available potas and humus in the experimental field (sterile dump) Husnicioara, District Mehedinti, after 6 years of fertilization with different NPK doses, with and without manure, with corn crop

	i	f	i	f	i	f	i	f	i	f	i	f	i	f	
	2		7		5		3		6		4		1		
pH	**8,05**	**7,92**	**8,05**	**7,74**	**8,10**	**7,84**	**8,10**	**7,93**	**8,09**	**7,97**	**8,07**	**7,89**	**8,08**	**8,07**	
P	**34,50**	**37,25**	**34,93**	**60,48**	**34,95**	**25,32**	**35,32**	**35,72**	**34,88**	**57,21**	**35,18**	**30,78**	**35,70**	**41,82**	R_4
K	**61,56**	**63,75**	**59,86**	**91,58**	**61,46**	**39,48**	**60,82**	**59,20**	**60,12**	**33,72**	**62,74**	**51,74**	**62,74**	**75,43**	
H	**0,755**	**0,769**	**0,832**	**0,846**	**0,773**	**0,788**	**0,711**	**0,725**	**0,733**	**0,745**	**0,808**	**0,824**	**0,784**	**0,799**	
	5		4		1		6		3		7		2		
pH	**8,08**	**7,84**	**8,08**	**7,90**	**8,09**	**8,07**	**8,07**	**7,93**	**8,10**	**7,95**	**8,07**	**7,77**	**8,06**	**7,96**	
P	**34,72**	**27,64**	**35,67**	**31,83**	**35,20**	**40,98**	**35,01**	**59,06**	**35,21**	**34,68**	**35,02**	**59,13**	**35,24**	**37,54**	R_3
K	**62,23**	**37,83**	**63,28**	**51,89**	**63,18**	**78,05**	**59,93**	**28,51**	**59,86**	**57,95**	**58,92**	**93,38**	**63,14**	**63,02**	
H	**0,758**	**0,772**	**0,823**	**0,838**	**0,813**	**0,830**	**0,789**	**0,802**	**0,780**	**0,737**	**0,748**	**0,761**	**0,765**	**0,778**	
	3		6		5		2		7		1		4		
pH	**8,09**	**7,94**	**8,06**	**7,93**	**8,10**	**7,83**	**8,05**	**7,94**	**8,09**	**7,78**	**8,07**	**8,02**	**8,09**	**7,91**	
P	**34,25**	**32,44**	**35,18**	**58,23**	**35,18**	**27,43**	**35,20**	**38,01**	**34,82**	**57,48**	**34,90**	**39,45**	**34,89**	**32,18**	R_2
K	**61,43**	**59,52**	**58,55**	**30,68**	**61,17**	**42,17**	**62,38**	**67,14**	**59,29**	**90,24**	**61,45**	**76,21**	**60,71**	**53,72**	
H	**0,783**	**0,800**	**0,728**	**0,740**	**0,787**	**0,802**	**0,798**	**0,813**	**0,787**	**0,800**	**0,748**	**0,764**	**0,757**	**0,773**	
	1		2		3		4		5		6		7		
pH	**8,08**	**8,06**	**8,04**	**7,95**	**8,11**	**7,93**	**8,08**	**7,89**	**8,05**	**7,80**	**8,06**	**7,94**	**8,05**	**7,76**	
P	**34,30**	**39,27**	**35,15**	**36,88**	**34,83**	**35,12**	**34,90**	**30,44**	**34,65**	**26,40**	**34,78**	**55,94**	**35,07**	**61,02**	R_1
K	**62,21**	**75,48**	**61,54**	**65,63**	**59,88**	**57,82**	**64,05**	**50,51**	**60,82**	**40,39**	**59,84**	**29,54**	**58,44**	**95,15**	
H	**0,738**	**0,750**	**0,782**	**0,796**	**0,819**	**0,835**	**0,792**	**0,808**	**0,759**	**0,774**	**0,815**	**0,829**	**0,803**	**0,817**	

i = inițial
f=final

Table 3

ValorileThe average initial and final pH values for all researched variants

Nr.crt.	Variants	No manure		With manure	
		Initial pH	Final pH	Initial pH	Final pH
1	N_0 - Control	8,10	8,07	8,08	8,05
2	N_{40}	8,05	7,86	8,05	7,94
3	N_{80}	8,04	7,72	8,10	7,94
4	N_{120}	8,10	7,74	8,08	7,90
5	N_{160}	8,09	7,59	8,08	7,83
6	$N_{160}P_{80}$	8,06	7,78	8,07	7,94
7	$N_{160}P_{80}K_{80}$	8,06	7,47	8,06	7,76

Table 4

pH differences and the difference averages for all variants and replications after 7 years of organic and anorganic fertilization

Variants	Without manure					With manure				
	Replications				Average	Replications				Average
	R_1	R_2	R_3	R_4		R_1	R_2	R_3	R_4	
1	0,03	-	0,06	0,03	0,03	0,02	0,05	0,02	0,01	0,0250
2	0,21	0,18	0,18	0,16	0,1825	0,09	0,11	0,10	0,13	0,1075
3	0,33	0,35	0,30	0,32	0,3250	0,18	0,15	0,15	0,17	0,1625
4	0,31	0,35	0,40	0,36	0,3625	0,19	0,18	0,18	0,18	0,1825
5	0,49	0,49	0,51	0,48	0,4925	0,25	0,27	0,24	0,26	0,2550
6	0,25	0,30	0,29	0,28	0,2825	0,12	0,13	0,14	0,12	0,1275
7	0,55	0,60	0,61	0,58	0,5850	0,29	0,31	0,30	0,31	0,3025

Table 5

The average values of the initial and final phosphorus content from the sterile dump from Husnicioara after 7 years of trials

Variant	Without manure		With manure	
	Initial P	Final P	Initial P	Final P
1	34,69	29,35	35,03	40,38
2	24,64	28,52	35,02	37,42
3	34,58	26,39	34,90	34,49
4	34,30	25,46	35,16	31,30
5	34,98	25,85	35,87	26,70
6	35,10	60,10	34,96	57,61
7	34,71	59,00	34,96	59,53

Table 6

Balance data on potash from the sterile dump with the variants where no manure was applied

Variants	Initial K, ppm			Aggregated yield 6 years, t/ha	K export from the soil along with harvest			K input from vegetal debris ppm	Final K after 6 years, ppm	
	Initial into the soil	K from fertilizers.	Total		kg K_2O/ha	kgK/ha	K ppm		Theoretical	Experimental
1 N_0	63,46	-	63,46	0	0	0	0	-	63,46	58,83
2 N_{40}	60,90	-	60,90	4,377	71,56	59,32	19,77	26,26	67,39	56,20
3 N_{80}	60,22	-	60,22	5,736	94,64	78,45	26,15	34,14	68,21	53,47
4 N_{120}	59,95	-	59,95	5,883	97,07	80,47	26,82	35,29	68,42	52,52
5 N_{160}	63,80	-	63,80	6,405	105,68	87,61	29,20	38,40	73,00	56,43
6 $N_{160}P_{80}$	59,91	-	59,91	6,792	128,57	106,58	35,53	40,21	64,18	51,51
7 $N_{160}P_{80}K_{80}$	59,12	63,38	122,50	7,416	122,36	101,43	33,81	44,49	122,21	113,41

Table 7

Balance data on potash from the sterile dump with the variants where manure was applied

Variants	Initial K, ppm				Aggregated yield for 6 years, t/ha	K export from the soil along with harvest			K input from vegetal debris ppm	Final K after 6 years, ppm	
	Initial into the soil	K from manure	K from fertilizers	Total		kg K_2O/ha	kg K/ha	K ppm		Theoretical	Experimental
1 N_0	62,39	30,44	-	92,83	3,645	60,14	49,85	16,61	21,60	97,80	75,88
2 N_{40}	62,15	30,44	-	92,59	5,970	98,50	81,67	27,22	35,40	100,68	65,04
3 N_{80}	60,49	30,44	-	90,93	7,155	118,05	97,87	32,62	42,91	101,11	57,97
4 N_{120}	62,69	30,44	-	93,13	8,865	146,27	121,25	40,42	52,82	105,51	52,38
5 N_{160}	61,42	30,44	-	91,86	11,556	190,67	158,07	52,68	69,05	92,18	38,84
6 $N_{160}P_{80}$	59,61	30,44	-	90,05	13,218	218,09	180,80	60,26	78,18	107,97	30,45
7 $N_{160}P_{80}K_{80}$	59,12	30,44	63,38	152,86	13,806	227,75	188,80	62,93	82,83	172,76	92,66

The values for the final available potash that are between 51.5 and 113.4 ppm are lower than initial ones which proves a high potash consumption if plants have enough nitrogen. The phenomenon is not very influenced by suplementary fertilization by organic fertilizers.

Table 8

The average values of the humus content from the sterile dump (%)

Variants	Without manure		With manure			
	Initial humus	Final humus	Initial humus	Final humus	Δ H	
					Absolute values	%
1 N_0	0,743	0,741	0,771	0,788	0,017	2,20
2 N_{40}	0,725	0,735	0,775	0,789	0,014	1,80
3 N_{80}	0,762	0,749	0,773	0,774	0,001	0,13
4 N_{120}	0,760	0,767	0,795	0,810	0,015	1,18
5 N_{160}	0,725	0,732	0,769	0,784	0,015	1,95
6 $N_{160}P_{80}$	0,765	0,762	0,767	0,779	0,012	1,56
7 $N_{160}P_{80}K_{80}$	0,719	0,725	0,792	0,806	0,014	1,76

The evolution of the humus content from the sterile dump under the influence of human factors

The humus content from the sterile dump for every variant and replication are presented in the first and second tables. The average values for organically fertilized variants with or without organic fertilizers are presented in the eighth table.

From the data of table 8 there can be noticed that without manure the humus content does not vary after corn cropping and chemical fertilizers after 7 years. With some variants (V_1, V_3, V_6), there is even, recorded a diminishing of the humus content.

With the variants where manure was applied there take place a slow accumulation of humus. After three years of corn cropping with chemical fertilizers and 25 t/ha manure the humus content has increased by 1.2% which means 900 kg humus/ha.

CONCLUSIONS

The processes of forming, mineralisation and accumulation of humus is slow and it stabilizes when climax state is achieved. The humus can be rapidly destroyed by inapropriate cropping techniques. The accumulation of organic compounds and especially humus has a high importance in order to capitalise the sterile dumps by reforestation. The experimental data show that the humus accumulation process take place under wide row crops only when organic fertilizer is applied.

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