

THE ROLE OF CHEMICAL AND ORGANIC FERTILIZERS IN RECLAIMING THE STERILE DUMPS

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Abstract

The open cut mining is the most aggressive form of soil degradation. The resulting soil is a mingle of diverse materials with a very low fertility. Applying fertilizers or manure or both is an important mean to reclaim these lands. The experiments carried out at Husnicioara – Mehedinti sterile dump have shown that corn, sunflower, alpha-alpha and chickpea can be cropped on these soil using several doses of fertilizers, manure or compost. The best results were given by alpha – alpha.

Key words: opencut mining, reclaiming, organic fertilizer, alpha-alpha, chickpea

The soil is heart of the terrestrial ecosystems. This is why the understanding of the soil as a system is the key of success in making and preserving a healthy environment by human activity striving (Brady and Weil, 2008).

By its specific functions as support and life source of superior plants the soil is one of the essential factors of biosphere of which the human existence itself depends as well as his social and spiritual development (Dumitru, M., 2005).

This is the reason why the preserving the soil quality is a priority task that is enclosed within the European Directive of soil protection.

Even though much has been done, the soil undergoes aggressive factors that tend to destroy it.

The most aggressive form of soil degradation is open cut mining. By this method of extraction of ores or coal there are produced several phenomena of soil degradation, of reversing and mixing the geological strata, the migration of nutritive elements (Mocanu, R., 2007).

The surfaces affected by lignite extraction in our country are about 279,000 ha, on the first place being the Gorj District, with 15,610 ha, followed by Mehedinti with 750 ha. These surfaces are covered by sterile dumps made up of a mingle of geological strata in function of the exploitation zone having a strong impact on the environment (Calinoiu, L., 2010).

In these conditions, the reclaiming of the sterile dumps is an imperative task that needs peer research to find the most appropriate solutions in order to reclaim these surfaces of which the using of fertilizers is paramount.

MATERIAL AND METHOD

In order to establish the effect of different chemical and organic fertilizer doses in reclaiming the sterile dumps there were made researches within the 2001-2004 and 2005-2007 periods on the sterile dumps from Husnicioara quarry, District Mehedinti, Romania.

Within 2001-2004 period the researches have been focused on the using of chemical and organic fertilizers on several crops.

Within 2005-2007 period there have been made experiments with several crops using compost and fertilizers.

The soil that resulted after extracting coal from Husnicioara quarry is formed of chemically and physically diverse lithological materials of different ages that form the psamic entantrosoil. This soil has a profile composed of 4 lithological strata, S₁ – S₄ with a sandy texture and coal inclusions that has features presented within the first table.

This soil has a very low nitrogen, phosphorus and potassium contents that makes the plants growing conditions improper. The evaluation mark is 10.5 belonging to the fifth quality class.

Within 2001-2004 period there have been used the following fertilizer doses on 25 t/ha manure background as well as without manure background:

- with the corn and sunflower crops: not fertilized, N₁₀₀, N₁₆₀, N₁₃₆P₈₀, N₁₃₆P₈₀K₈₀;
- with lucerne crop: not fertilized, N₆₄, N₉₆, N₁₂₀, N₉₆P₆₄.

RESULTS AND DISCUSSIONS

a) after applying fertilizers and manure

With the corn crop in average for 4 years of trials there have been obtained yields written in the *second table*.

There can be noticed that due to unfavorable physical and chemical conditions for plant growth, especially nutrients, if no fertilizers either chemical or organic are applied there is not obtained grains whatsoever but some organic mass. The applying of nitrogen doses determine the obtaining of 1898 kg/ha corn grains and if phosphorus and potassium are added the yield reaches 2208 kg/ha.

When the same fertilizers are applied on 25 t/ha manure background the corn yield almost doubles.

The sunflower crop gives yield even without any chemical or organic fertilizers though it is only of 263 kg/ha. The applying of several fertilizer doses makes the yield of 853 kg/ha (N₁₃₆P₆₄K₈₀). The using of the same fertilizer doses on 25 t/ha manure background makes the yield double 1036 – 1536 kg/ha (table 3).

Of all experimented crops on the sterile dumps, the best results were given by the lucerne

that even without any fertilizer gives 861 kg/ha hay in average for 3 years and after fertilization the yield reaches 4,717 kg/ha.

b) As a result of compost applying

The compost has had the following chemical composition: N = 1.74%; P₂O₅ = 0.73%; K₂O = 0.16%; CaO = 0.15%; MgO = 0.084%. There have applied on the corn, sunflower and chickpea crops the following doses: 10, 20 and 30 t/ha. The results are written in the fifth table.

There can be observed that the corn, sunflower and chickpea yields increases along with the increasing of the compost doses applied. With the corn crop the maximal quantity of compost, 30 t/ha has given three times higher yield than the not fertilized variant, with the sunflower the increase was double and with chickpea by 1.7 times higher than not fertilized variant.

The annual applying of compost conducts to the highest yields with all crops.

Table 1

The physical and chemical features of the psamic entiantrosol from Husnicioara

Soil layer	Fine sand %	Thick sand %	Silt + clay %	pH H ₂ O	Humus %	Total N %	P ppm	K ppm	Texture
S1 0-23 cm	75.3	21.5	3.2	8.7	0.2	0.11	6.90	44.9	S
S2 24-37 cm	51.9	39.3	8.8	8.9	0.3	0.08	4.50	39.9	SS
S3 38-62	47.3	45.5	6.2	9.0	0.3	0.14	5.09	33.2	S
S4 63-128 cm	62.1	30.9	7.0	8.0	0.2	0.06	11.10	33.1	S

Table 2

The corn yields as a result of applying chemical fertilizers and manure on the sterile dumps from Husnicioara (average 2001-2004)

Variant	Without manure				25 t/ha manure background			
	Yield Kg/ha	%	Diff.	Sign.	Yield Kg/ha	%	Diff.	Sign.
Not fertilized	0	-	-	-	1068	100	-1654	000
N ₆₄	1315	85.0	-232	0	1812	170.5	-900	00
N ₁₀₀	1645	106.3	98	-	2210	206.9	-502	0
N ₁₃₆	1775	114.7	228	-	2682	251.1	-30	0
N ₁₆₀	1898	122.7	351	-	3341	312.8	625	-
N ₁₃₆ P ₈₀	1993	128.8	446	-	3802	355.9	1090	xx
N ₁₃₆ P ₈₀ K ₈₀	2208	142.7	661	-	4064	380.5	1357	xxx
Average	1547	100	0	ctrl	2712	253.9	ctrl	

DL 5%=606 kg/ha; DL 1%=807 kg/ha; DL 0.1%=1088 kg/ha; DL 5%=689 kg/ha; DL 1%=896 kg/ha; DL 0.1%=1191 kg/ha

Table 3

The influence of chemical and organic fertilizers on the sunflower yield

Variant	Without manure				25 t/ha manure background			
	Yield Kg/ha	%	Diff.	Sign.	Yield Kg/ha	%	Diff.	Sign.
Not fertilized	263	100	0	-	515	100	-	-
N ₆₄	496	188.6	233	xxx	1036	201.6	521	xxx
N ₁₀₀	577	219.4	314	xxx	1157	229.6	624	xxx
N ₁₃₆	587	223.2	324	xxx	1197	232.4	682	xxx
N ₁₃₆ P ₆₄	650	247.2	387	xxx	1265	245.6	750	xxx
N ₁₃₆ P ₆₄ K ₈₀	853	324.3	590	xxx	1536	298.3	1021	xxx

DL 5%=67 kg/ha; DL 1%=89 kg/ha; DL 0.1%=119 kg/ha; DL 5%=99 kg/ha; DL 1%=131 kg/ha; DL 0.1%=176 kg/ha

Table 4

The hay yield as a result of fertilization

Variant	Without manure				25 t/ha manure background			
	Yield Kg/ha	%	Diff.	Sign.	Yield Kg/ha	%	Diff.	Sign.
Not fertilized	861	100	-		1112	100	-	
N ₆₄	1653	191.9	792	xxx	2679	240.9	1567	xxx
N ₉₆	1947	226.1	1086	xxx	3537	228.1	2425	xxx
N ₁₂₀	2378	276.2	1517	xxx	3766	338.7	2654	xxx
N ₉₆ P ₆₄	2883	334.8	2022	xxx	4717	424.2	3605	xxx

Table 5

The corn, sunflower and chickpea yields as a result of compost applying as fertilizer

Variant	corn			sunflower			Chickpea		
	Yield Kg/ha	Diff.	Sign.	Yield Kg/ha	Diff.	Sign.	Yield Kg/ha	Diff.	Sign.
Not fertilized	914	-		619			596	-	
10 t/ha	2600	1686	xxx	708	89	-	728	132	xxx
20 t/ha	3325	2411	xxx	1058	439	xx	791	195	xxx
30 t/ha	3793	2879	xxx	1167	548	xxx	926	330	xxx
Every year	4696	3782	xxx	1085	466	xx	986	390	xxx
Every two years	2297	1382	xxx	815	196	-	882	286	xxx
Every three years	1499	585	x	764	145	-	663	67	xxx

DL 5% = 519

DL 1% = 653

DL 0.1% = 1050

DL 5% = 201

DL 1% = 304

DL 0.1% = 486

DL 5% = 41

DL 1% = 51

DL 0.1% = 82

CONCLUSIONS

The sterile dumps from Husnicioara quarry has a low fertility degree being enclosed in the fifth fertility class (10.2 points).

The applying of fertilizers has a high importance for the crops on the sterile dumps. Without chemical or organic fertilizers the wheat or corn crops do not produce any grains.

The applying of N₁₃₆P₈₀K₈₀ dose determines yields of 2200 kg/ha with corn, 853 kg/ha with sunflower and the yield doubles on 25 t/ha manure background.

The compost applying gives best results when the dose is 30 t/ha every year with all crops: corn, sunflower and chickpea.

The lucerne is the crop which gives the best results on the sterile dumps. Even without

fertilizers it gives 861 kg/ha hay and the applying of N₉₆P₆₀ on 25 t/ha manure background gives 4717 kg/ha.

BIBLIOGRAPHY

- Brady, C.M., Wiel, R.R., 2008** - *The nature and properties of soils*, Forthreen Edition, Publisher: Pearson – Prentice Hall a trademark of Parson Education.
- Calinoiu, Ion, 2010** - *Doctoral thesis (Romanian)*, University of Craiova.
- Dumitru, M., 2005** - *The ecological reclaiming, the technological elements, methods and practices of recultivation and pollution fixing (Romanian)*, Editure Eurobit Timisoara.
- Mocanu, R., 2000** - *The ecological reclaiming of the sterile dumps from Husnicioara, Mehedinti*, Sitech Editure, Craiova.