VALORISING BANATITE MINING STERILE IN WHEAT CROPS WITH IMPACT ON YIELD AND QUALITY WITHIN THE CARAS – NERA – DANUBE AREA

VALORIFICAREA STERILULUI MINER DE BANATITE LA CULTURA GRÂULUI CU EFECTE ASUPRA RECOLTEI ŞI A CALITĂȚII ÎN TERITORIUL DINTRE RÂURILE CARAŞ-NERA –DUNĂRE

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Abstract *Mining sterile from banatite exploitations in south-west Romania contains considerable amounts of micro-elements (Mn, Mo, Cu, Zn, etc.) and macro-elements (Ca, Mg, S, and P) that ca be valorised on agricultural crops. Alkaline reaction of the material recommends it for applications on acid reaction soils. This paper presents results in wheat by applying a rate of 1 t/ha on the crop and on the main quality features.*

Rezumat *Sterilul miner rezultat de la exploatațiile de banatite din sudul-vestul țării conține importante cantități de microelemente (Mn, Mo, Cu, Zn etc.) şi macroelemente (Ca, Mg, S, P) care pot fi valorificate de culturile agricole. Reacția alcalină a materialului îl recomandă a fi aplicat pe solurile cu reacție acidă. Lucrarea cuprinde rezultatele obținute la grâu, prin aplicarea unei doze de 1 t/ha, asupra recoltei şi a principalelor însuşiri de calitate.*

Key words: *mining sterile, microelements, macro-elements, and wheat*
Cuvinte cheie: *mine steril, microelemente, macroelemente, grâu*

INTRODUCTION

Mining sterile from copper exploitations is stored in dumps of thousands of loose tonnes, so that the wind carried it at long distances with negative effects on human dwellings in the area and on the environment.

Heavy metal content of the material is below European admitted limits, reason for which we suggest the use of the material in agriculture as a source of oligoelements and macroelements. The material has an alkaline reaction because of both high contents in calcium and of the flotation being done with basic elements, which makes it usable also as amendments on acid soils.

MATERIAL AND METHOD

Chemical composition of the sterile material is presented in Table 1.

The rest up to 100% is water and inert material difficult to determine.

The type of soil on which we carried out the experiments was an acid reaction luvisoil (with a pH of 6.50), medium humus contents (2.18%), and medium supply in NPK.

The trials were of the bi-factorial type organised after the sub-divided plot method with three replications.

Table 1

Chemical composition of the dump sterile

Number of sample	Chemical substances (elements) in percentage of the total substances												
	Cu	Fe	S	TiO_2	Va	Pb	Zn	Cd	Ra	CaO	SiO_2	Al_2O_3	Total*
1	O.11	7.23	2.26	0.15	0.017	1.0	0.09	0.001	0.104	20	31.61		61.275
2	0.12	5.47	1.79	0.23	0.30	1.0	0.05	1.0		24	31.56		63.460
3	0.13	5.56	3.80	0.77			0.12	1.0	1.0	18	33.75		60.330
4	0.90	6.40	0.45	0.37	0.020	urme	0.01	0.001	0.002	15	32.65		54.543
5	0.07	3.83	0.61	0.31	0.020	0.01	0.06	urme	0.003	24	32.70		61.003
6	0.09	4.40	0.71	0.24		0.001	0.06	1.0		4	30.39		40.181
7		5.28	1.02	0.36							32.12	5.67	43.430
8		4.40	0.71	0.24							30.32	4.32	39.350
Media	0.08	5.32	1.42	0.33	0.01	0.25	0.05	0.38	0.14	13.13	31.89	1.25	54.25

RESULTS AND DISCUSSION

The synthesis of the results is presented in Table 2.

We can see that, due to climate differences, on the average per experimental years, we recorded significant annual crop differences.

Applying sterile in amounts of 1 t/ha increased the yield with 18% compared to the control, with no sterile, i.e. a difference of over 500 kg/ha.

Nitrogen fertilisation on an agri-fund of $P_{60}K_{60}$ increased the yield with 31%-107% depending on the rate. The yield response curve presented in Figure 1 point out that on the agri-fund with sterile, nitrogen fertilisers were better valorised at the level of all rate graduations.

Figures 2 and 3 present the weight features of the seeds on an agri-fund with and without 1 t/ha of sterile.

It is obvious that the volume of 1,000 grains was favourably influenced by the mining sterile applications, i.e. on the average for all the fertilisation levels, with 1.43 g.

Hectolitric volume was higher in all the variants on the agri-fund with mining sterile.

Figure 4 shows the evolution of protein content, which, on the average for the fertilisation levels, was higher with 0.92% on the agri-fund with, sterile.

Moist-gluten content (Figure 5) was higher on the sterile agri-fund, on the average for fertilisation levels, with 1.1%.

CONCLUSIONS

1. Using banatite mining sterile from copper exploitations is recommended on acid soils as a source of oligoelements with positive effects on pH correction too, its reaction being an alkaline one, while heavy metal content is at the level of maximum admitted limits.

2. The increase in yield in wheat due to the application of 1 t/ha of mining sterile is of 18.00%, i.e. an increase of the yield with over 500 kg/ha on the luvosoil on which the research was carried out.

3. Applying mining sterile in amounts of 1 t/ha increased the volume of 1,000 grains with 1.32 g, hectolitric volume with 1.10 kg/ha, protein content with 0.92%, and gluten content with 1.1%.

Table 2

Yield results synthesis in wheat 2004-2006

A year	Sterile	C - Nitrogen doses ($P_{60}K_{60}$)				Average factor A			
		$N_0P_{60}K_{60}$	$N_{50}P_{60}K_{60}$	N_{100} $P_{60}K_{60}$	N_{150} $P_{60}K_{60}$	Crop kg/ha	%	Difference kg/ha	Significance
2004	S0	1818	2316	3095	3721	3114	100		
	S1t/ha	2350	3140	3780	4695				
2005	S0	2028	2844	3821	4536	3665	118	551	XX
	S1t/ha	2690	3325	4290	4992				
2006	S0	1530	2013	2916	3505	2652	85	-462	0
	S1t/ha	1812	2440	3120	3880				

Dl 5% = 283 Dl 1% = 464 Dl 0.1% = 571

Average factor C

Specification	$N_0P_{60}K_{60}$	$N_{50}P_{60}K_{60}$	N_{100} $P_{60}K_{60}$	N_{150} $P_{60}K_{60}$
Crop kg/ha	2038	2679	3503	4221
%	100	131	172	207
Difference kg/ha		641	1465	2138
Significance		XXX	XXX	XXX

Dl 5% = 215 kg/ha Dl 1% = 344 kg/ha Dl 0.1% = 497 kg/ha

Average factor B

Specification	S0	S 1t/ha
Crop kg/ha	2845	3374
%	100	118
Difference kg/ha		529
Significance		XXX

Dl 5% = 189 kg/ha Dl 1% = 275 kg/ha Dl 0.1% = 388 kg/ha

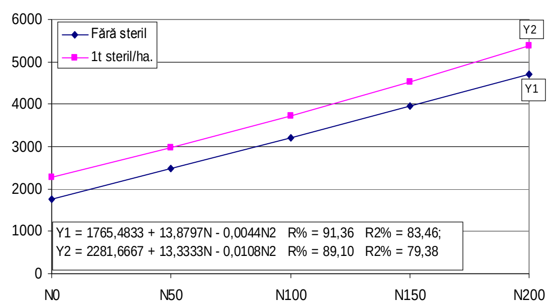

Fig.1.Response curve to nitrogen fertilisers applied on a $P_{60}K_{60}$

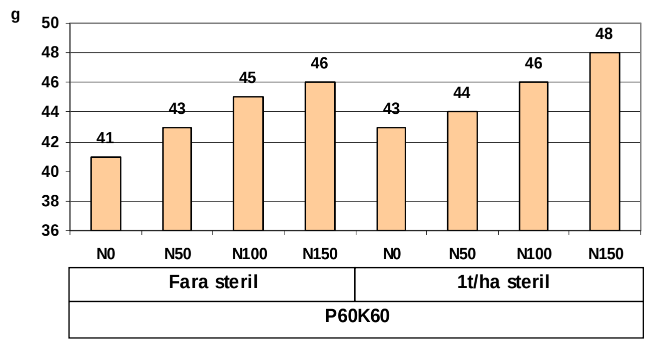

Fig.2. Influence of mine sterile on the 1000 grains mass (g)

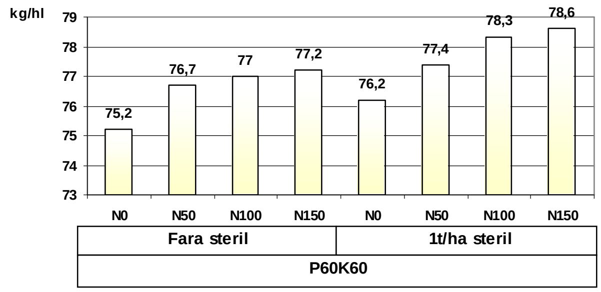

Fig. 3. Influence of mine sterile on hectolitric mass (kg/hl)

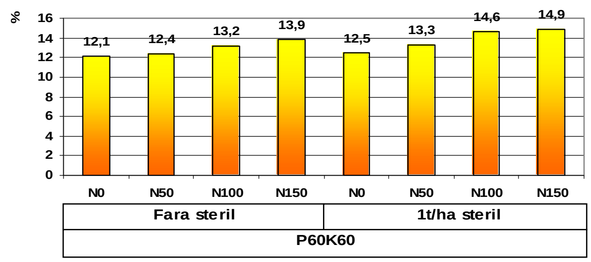

Fig. 4. The variation of protein content

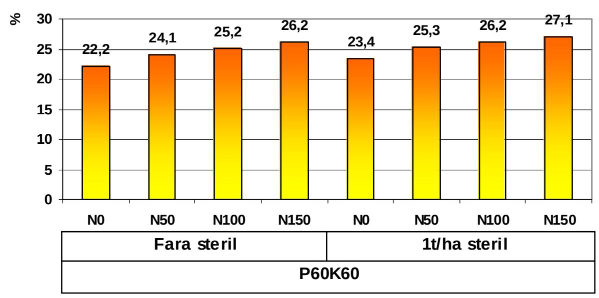

Fig. 5. The content of wet gluten

LITERATURE

1.BORCEAN I., GOIAN M., VÎLCEANU R., - *Une possible utilization de sterils des tones minieres*, Lucr. Simp. Franco-Român, Agricultura şi mediul înconjurător, Timişoara, 1991.

2. BORCEAN I., DAVID GH., BORCEAN A., IMBREA FL., SIMONA NIȚĂ, VERDEȚ S., BOTOŞ L. –*Possibilities of valorising steril from banatite mining explostations in southern Banat*, Lucr. Şt. USAMVB Timişoara, Facult. Agricultură, 2006, P.39.

3.VERDEȚ S., BORCEAN I., - *Rezultate privind utilizarea sterilului minier de banatite la culturile de fasole şi cartof*, Vol. XXXIV , Lucr. Şt. USAMVB Timişoara, Facult. Agricultură, 2002, p. 255.

4.VERDEȚ S., -*Cercetări privind utilizarea sterilului minier de banatite la principalele culturi de câmp în zona dintre Caraş ți Dunăre.*, Teză de Doctorat USAMVB Timişoara 2002.