

## THE EFFECT OF POST-BOGGY GRASSLAND RECLAMATION WITH LIME ROCK ON THE QUALITY OF HAY

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**A b s t r a c t.** In the surrounding of hard coal mine 'Bogdanka' in Lublin province, the winning obtained from drilling was utilized for the reclamation of grassland. These works consisted in covering up meadow bogs with waste rock, then ploughing it, covering with a thin layer of organic soil and sowing with mixed grass.

The back filling of local ground depressions with the winning from the mine caused the levelling of the meadows, their moisture compensation and it also contributed to the improvement of the soil environment as well as the quality of the obtained feed. The high content of potassium and phosphorus in the hay enables limiting their share in the mineral fertilization. It is advisable to continue further research as to the possibilities of agricultural utilizing of the mining waste material.

**K e y w o r d s:** grassland reclamation, lime rock, hay quality

### INTRODUCTION

In the hitherto research pertaining to the problem of using waste material from the hard coal exploitation, the possibility of utilizing it in agriculture is often mentioned [1,3-6]. However, their use is proposed mainly for the levelling of waste land and rarely for the improvement of light textured soil in the respect of its physical and chemical properties [4].

In the surrounding of the hard coal mine 'Bogdanka' you can come across, among others, the utilizing of lime rock from the drilled shafts as well as the waste rock coming from the roof and floor of the coal bed and from, so-called

interlayers of agrillaceous muddy rock and coal stone [5].

The utilizing of the waste material consisted in storing it in dumping ground after the output and in transporting it to the meliorated post-boggy meadows which were still too wet because of peat contraction or flooding it with waters from the mine draining. In this way the levelling of the local hollows as well as the avoiding of the drainage ditches net deepening was achieved.

The Bogdanka area is situated on the borderland of two physiographic units: Chełm Upland and Łęczna-Włodawa Lake Land which are characterised by slight depressions and hollows occurrence [2].

A long-term observation of the meadows showed their differentiation. That is why the aim of the research was to determine the yield and feeding value of the hay.

### MATERIALS AND METHODS

The levelling of the meadows with limy rock and with mining waste materials in the surrounding of 'Bogdanka' mine was carried out on a productive scale in the 1980-ties mainly on grassland in the villages of Zaróbkka and Nadrybie.

It consisted in covering up to tens centimeters the drained and utilized in the 1970-ties peat meadows with the mining waste materials,

then ploughing them and covering with a thin layer of organic soil. After performing the cultivation measures (levelling, harrowing, rolling) and applying mineral fertilizers, the fields were sown with mixed meadow grass (the meadow utilizing method was so-called full cultivation). At places, as the result of thick layer of the winning, the plough did not bring the peat soil from the covered meadow up. That is why, even now, rock can be seen on the surface on which the soil forming process is still at the initial stage. It should be also stressed that farmers have applied minimal doses of mineral fertilizers (under 100 kg NPK/ha) recently.

In spring 1993 soil samples were taken from the surface layer in two meadow-melioration fields with natural peat soil and from two fields levelled with mining waste material.

The above two fields were situated next to each other and are separated with a narrow drainage ditch. The first one came from post-melioration utilization in the 1970-ties and the others were reclaimed in the 1980-ties.

In the soil samples CaO was determined as well as pH and the content of macroelements with the methods commonly used in agrochemical stations. Before harvesting the first cut the approximate harvest was determined and plant samples were taken from each meadow field from the surface of 1 m<sup>2</sup> in 3 repetitions. Then, after weighing, an average sample was taken the weight of which was 1 kg of forage green tops. It was designed for drying and determining the yield in the form of hay and making botanic and chemical analyses as to the content of macroelements.

## RESULTS

Since 1984 the utilization of the mining waste materials for the levelling of meadows

and raising their ground ordinate has been started. The Jurassic and Cretaceous rocks utilized in Zaróbka contained 83 % of CaCO<sub>3</sub> and their pH was 8.2. The clay-mud rock material with a share of stone, i.e., not integrated one, contained at that time 5.9 % of CaCO<sub>3</sub> and its pH was 6.9. The results of the analyses of the meadow soil from the surface layer are presented in Table 1.

On the basis of the data presented in the table, it is difficult to notice significant differences in the phosphorus, potassium and magnesium contents in soil, although a certain upward tendencies were noted which might be the result of long-term mineral fertilization of the meadows, which had been applied by the users for the period of 6-8 years since the management. A distinct difference in soil reaction is significant, however. It normally amounted from pH 5.3 to 5.4 and in the reclaimed soil it was pH 6.7-6.9.

The ground water level in the natural meadows in summer was within 5-85 cm and in the reclaimed ones within 4-130 cm.

As detailed calculations showed, hay yields in Zaróbka in the natural field were higher than in Nadrybie meadows. On the average it was 2.2 t of hay from the first cut.

This might have been caused by leaving too thick layer of mine winning without covering it with the peat soil. Such places are characterised by weak turfness and grass growth and bright green shade of plants, which significantly diminishes the total yield.

In the botanic composition of hay valuable grass predominates and other species of plants also occur (Table 2). For example, Kentucky bluegrass (*Poa pratensis*), i.e. a low grass which amounts to over 63 % of the hay mass grow in the normal meadow in Zaróbka. However, in Nadrybie there are more sedges (*Carex*), i.e. plant of no value testifying to high

Table 1. Reaction and content of macroelements (mg/100 g soil) in various meadows

Locality	Natural meadow				A meliorated meadow			
	pH	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O	Mg	pH	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O	Mg
Zaróbka	5.4	7.6	9.0	28.6	6.7	11.9	26.7	50.4
Zaróbka	5.3	10.2	27.0	22.8	6.8	7.2	21.3	13.0
Nadrybie	5.4	5.2	12.0	13.0	6.9	10.5	16.0	11.0

humidity of the ground. Meadow foxtail (*Alopecurus*) is the second most frequently growing plant in these meadows.

In the reclaimed meadows the occurrence of the greater amount of high grass (reed grass, meadow foxtail, meadow fescue) and greater variety of plants without the predominance of any species can be recorded easily.

The greatest attention was paid to the chemical composition of hay because the improvement of its quality was expected (Table 3). The mining waste materials influenced positively the increase of the ash content in hay as well as the content of potassium and phosphorus, which is partly convergent with the content of these components in soil.

Magnesium and calcium content diminished as the result of high concentration of available potassium in soil. Simultaneously, it testifies to the necessity of careful attention to the fertilizing of the meadows reclaimed in this

way, especially when the mining waste material is differentiated to a great extent in its physical and chemical properties. The results of the chemical analyses show that we can economise on phosphorus and potassium fertilizing, especially that the recorded data exceed the norms of the content of these components for a good quality hay.

## CONCLUSIONS

1. The amelioration of the meadows which are wet and not levelled with the mining waste materials may lead to the improvement of the plants growing environment, especially it may improve the pH of soil. The utilization of the winning is also important.

2. The meadows after the reclamation are more differentiated in the respect of plants variety without the predominance of any plant species, which improves their feeding quality.

Table 2. Botanical composition of hay (%)

No.	Plant species and groups	Natural meadow		Ameliorated meadow	
		Zaróbka	Nadrybie	Zaróbka	Nadrybie
1.	Reed grass	9.7	1.6	38.0	24.6
2.	Meadow foxtail	17.0	40.3	29.1	1.0
3.	Timothy grass	-	-	-	2.5
4.	Meadow fescue	-	-	6.2	29.8
5.	Cocksfoot	1.0	-	-	8.9
6.	Perennial ryegrass	-	-	3.5	3.0
7.	Kentucky bluegrass	63.3	6.4	8.8	-
8.	Red fescue	-	-	-	6.7
9.	Meadow soft-grass	-	-	-	1.0
10.	Couch-grass	-	-	0.2	-
11.	Floating foxtail	-	-	-	0.2
12.	Sedges	-	44.3	-	-
13.	Sieves	-	0.3	-	-
14.	Red clover	1.0	-	0.9	19.9
15.	Snake-root	-	-	-	0.1
16.	Silverweed	-	4.0	-	-
17.	Common dandelion	1.1	0.8	5.3	1.3
18.	Creeping crowfoot	2.9	0.6	-	1.0
19.	Garden sorrel	-	1.6	4.4	-
20.	Field cerastium	1.0	-	3.5	-
I	Good fodder grasses	93.9	48.3	85.7	76.6
II	Medium quality grasses	-	-	0.2	1.2
III	Grasses of no value	-	-	-	-
IV	Cyperaceous and Juncacea	-	44.6	-	-
V	Papilionaceae	0.9	-	0.9	19.9
VI	Herbs and weeds	5.0	7.0	17.7	2.4

**Table 3.** Chemical composition of hay (% d.m.)

Meadow	Locality	Ash	K	P	Ca	Mg	Na
Natural	Zaróbka	6.52	1.71	0.51	0.58	0.20	0.21
	Zaróbka	5.78	1.56	0.49	0.64	0.20	0.19
	Nadrybie	7.39	2.51	0.50	0.54	0.19	0.23
	Nadrybie	6.45	2.14	0.43	0.69	0.23	0.21
	Mean value	6.53	1.98	0.48	0.61	0.20	0.21
Ameliorated	Zaróbka	7.32	3.12	0.59	0.36	0.18	0.25
	Zaróbka	6.41	3.17	0.48	0.45	0.21	0.23
	Nadrybie	7.61	2.84	0.58	0.42	0.19	0.23
	Nadrybie	6.40	2.75	0.49	0.53	0.21	0.20
	Mean value	6.93	2.97	0.53	0.44	0.15	0.23

3. The high contents of potassium and magnesium in hay enables the user to limit fertilizing with these components.

4. Because of the heterogeneity of the waste material, careful analysis of the rocks in the respect of their physical and chemical properties is advisable as well as the further research as to the possibility of its agricultural utilizing.

#### REFERENCES

1. Borowiec J., Magierski J.: Wstępna ocena fizykochemicznej aktywności skały płonnej i wód kopalnianych LZW w aspekcie określenia kierunków ich utylizacji. Conf. Mat. 'Geologiczne aspekty ochrony środowiska'. Kraków, 281-284, 1991.
2. Chałubińska A., Wilgat T.: Podział fizjograficzny woj. lubelskiego. Przewodnik V Zjazdu Polskiego Tow. Geograficznego, Lublin, 3-44, 1954.
3. Łekan S. (ed.): Koncepcja wykorzystania w rolnictwie skał płonnych z Lubelskiego Zagłębia Węglowego w świetle ich cech petrograficznych i właściwości fizyczno-chemicznych. Wyd. Politechniki Lubelskiej, Seria A, 8, 1981.
4. Siuta J.: Sposoby ochrony i rekultywacji gleb Lubelskiego Zagłębia Węglowego. Kosmos, 1-2, 21-33, 1982.
5. Stochlak J.: Raport o dotychczasowej i przeszłej gospodarce odpadami kopalnianymi i energetycznymi CRW w Lubelskim Zagłębiu Węglowym. IKS Lublin, 1979.
6. Strzyszczyński Z.: Ocena przydatności odpadów górnictwa Górnośląskiego Zagłębia Węglowego do rekultywacji biologicznej. Archiwum Ochrony Środowiska, 1-2, 91-123, 1989.

#### WPLYW REKULTYWACJI SKAŁĄ WAPIENNĄ POBAGIENNYCH UŻYTKÓW ZIELONYCH NA JAKOŚĆ SIANA ŁĄKOWEGO

W rejonie kopalni węgla kamiennego 'Bogdanka' na Lubelszczyźnie urobek z wiercenia szybów wykorzystano do rekultywacji użytków zielonych. Prace te polegały na zasypaniu skałą płonną łąk pobagiennych a następnie przeoraaniu i przykryciu cienką warstwą gleby organicznej oraz obsianiu mieszanką traw. Wypełnienie obniżen urobkiem z kopalni spowodowało wyrównanie łąk i ich warunków wilgotnościowych, ale również przyczyniło się do poprawy środowiska glebowego i jakości otrzymywanej paszy. Wysoka zawartość w sianie potasu i fosforu umożliwia ich ograniczenie przy nawożeniu mineralnym. Celowe jest dalsze prowadzenie badań co do możliwości rolniczego wykorzystania odpadów górnictwa.

S ł o w a k l u c z o w e: rekultywacja łąk, skała wapienna, jakość siana.