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CONTENT OF TOTAL AND EASY SOLUBLE COBALT IN THE VERTISOLS OF KRATOVO - ZLETOVO VOLCANIC REGION

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ABSTRACT

M. Gjorgjiev and D Petkovski (1994). Content of total and easy soluble cobalt in the vertisols of Kratovo-Zletovo volcanic region. Ekol Zast. Zivot.. Sred., Vol. 2, No. 2, Skopje.

The paper represents the investigations on total and easy soluble cobalt content in the vertisols of Kratovo-Zletovo volcanic region.

The content of the total cobalt is 3,00 to 18,00 ppm. The soils of profile 734 and 720 have the highest content of total cobalt, while of profile 15,727 and 7 have the lowest one. The contents of an easily soluble and total Co and pH, and the content of carbonates direct relation is not noticed.

Key words: Volcanic vertisols, total and soluble cobalt content.

ИЗВОД

Ѓорѓиев, М. и Петковски, Д. (1994). Содржината на вкупен и лесно растворлив кобалт во смол-ниците на кратовско-злетовскиот вулкански регион. Екол. Зашт. Живот. Сред., Том 2, Бр. 2, Скопје.,

Трудот ги презентира истражувањата на содржината на вкупниот и лесно растворлив кобалт во смолниците на кратовско-злетовскиот вулкански регион.

Содржината на вкупниот кобалт се движи во границите од 3,00 до 18,00 ppm. Истражуваните почви содржат доволно лесно растворлив кобалт за исхрана на растенијата. Зависност помеѓу содржината на лесно растворлив кобалт и pH реакцијата на почвата, како и со содржината на карбонатите не беше воспоставена. Намалувањето на содржината на хумусот во почвениот профил го условува намалувањето на содржината на кобалт.

Клучни зборови: Вулкански смолници, вкупен и растворлив кобалт.

INTRODUCTION

In practice, cobalt is of less significance for the vegetable than for the animal nourishment. It is known that the cobalt as a metal component of vitamin B12 is required for the animal nitrogen metabolism. Insufficient contents of Co in the fodder can lead in some cases to a deficiency of Co with the ruminants. According to Mitchell (1945), in case the Co content in the fodder is less than 0,08 ppm Co in the dry substance some signs of a deficit appear with the sheep.

According to Henkens (1965) soil contents of 0,1 ppm (extract of acetic acid) is not sufficient for obtaining fodder with the necessary content of Co for the animal feeding.

Having in mind the above mentioned and taking into consideration that the supply with an easily soluble cobalt has been investigated so far only in some soils of low-hills and mountain pastures (Gjorgjiev and Jekić 1970) and on cinamonic forest soils in Macedonia (Spirovski and Gjorgjiev 1971), in 1993 the content

of the total and easily soluble cobalt in the vertisols of Kratovo - Zletovo volcanic area was

investigated, and the results obtained are presented herein.

MATERIAL AND METHODS

The soil samples of the chosen vertisols localities are presented in Tab. 1 and Tab. 2.

The mechanical composition of the soils was determined by the pipette method (Resulović 1971), the reaction (pH - value) by the electrometric analysis, the carbonates by Schibler calcimeter and the humus - on the basis

of their total carbon according to Grišin (1981, Simakov 1957). The content of the total cobalt in the soils was extracted with 10% hydrochloric acid (Scharrer and Taubel 1955) and for the easily soluble cobalt with buffered solution of acetic acid (Baron 1954) and was determined by Perkins - Elmer atomic spectral-photometer.

RESULTS AND DISCUSSION

The investigated vertisols of Kratovo - Zletovo volcanic area (Tab. 1) according to the mechanical composition are heavy soils because they contain over 35% colloidal clay. According to the obtained results, the vertisols formed on the andezite breccias (profile 11 and 743 with colloidal clay over 50%) are the heaviest ones.

The humus percentage in the superficial horizons is an average and a high one, whereas when deepening, in most of the profiles it decreases.

In respect of the carbonates content, the soils are noncalcareous and weakly calcareous in the superficial horizons while in the deeper horizons, from noncalcareous to considerably calcareous ones.

Depending on the carbonates quantities the reaction of the soils varies from acid to weakly basic one.

The results on Tab. 2 show that the vertisols of Kratovo - Zletovo eruptive region contain enough cobalt for plant nourishment (according to the experiments, 0,5 ppm soluble Co in 0,5 acetic acid is enough in Holland, while in Scotland, the researches show 0,25 ppm Co). The decreasing of the humus content along the profile depth decreases its content, too. The vertisols of profile 74.3 contain the highest content of easily soluble Co, while the lowest one is of profile 727.

According to the Baron's data (1954) the content of easily soluble Co in soils varies considerably and are of 0,50 to 6,00 ppm. The sandy soils have small quantities of Co, as well as the low land marshy soils and the soils formed by weathering of the primitive rocks

on a granite basis. The cobalt content is most often here under 0,2 ppm. On the contrary, the clay soils, especially the soils formed by weathering of basalt and the salt soils are considerably rich in cobalt (to 6 ppm). In this respects our results are in accordance with Baron's data (1954).

The highest content of total Co have the soils of profile 734 (formed on paleogenic sediments) and 720 (formed by proluvium on paleogenic sediments) while the lowest one is of profile 15 (formed on hornblende - augite - biotite - andesite), 727 and 7 (formed on andesite tuffs).

Direct relation among the contents of an easily soluble and total Co and pH - value, and the content of the carbonates, is not noticed. That is the reason that we did not present these results in this article.

The soils may have a lot of different quantities of total cobalt (Mengel 1968). According to Hill et al. (1953) the content of total Co in soils varies between 0,2 and 31 ppm. However, Co is mainly built - in crystal grating of separate minerals. Similarly as with the Cu the concentration of Co in the soil solution is also extremely low. The available Co for the plants is mainly sorptively bound to the soil colloides.

The vertisols of Kratovo - Zletovo volcanic area compared to some soils of low - hills and mountainous pastures in Macedonia (Gjorgjiev and Jekić 1970) are better supplied while, compared with the cinnamonic forest soils in Macedonia (Spirovski and Gjorgjiev 1971) contain less concentrations of easily soluble Co for plants nourishment.

Tab. 1 Mechanical composition and the classification of veitisols of Kiatovo - Zletovo eruptive region

Таб. 1 Механички состав и класификација на смолниците во кратовско-злетовскиот вулкански регион

Profile numb. (бр. на проф.)	Locality (локалитет)	Horizon (длабочина)	Depth in cm (хоризонт)	Geological composit. (геолошки состав)	Content of particals in % (содрж. на мех. честици во %)				Classif. acc. (класиф. според..) Scheffer and Schach.
					0,2-2 mm	0,02-0,2 mm	0,002-0,02 mm	< 0,002 mm	
720	Batania (Батаниа)	a	0-37	Proluvial deposits from paleogen sediments ¹	15,30	37,30	15,20	32,20	loamy clay ¹¹
		AS	42-73		10,00	36,80	15,00	38,20	loamy clay
		C	73-100		9,30	30,00	18,70	42,00	loamy clay
764	Stubol (Стубол)	a	0-17	Andesite tuffs ²	15,60	34,20	13,30	36,90	loamy clay
		A	17-32		16,00	31,80	13,00	39,20	loamy clay
		AC	32-48		15,10	30,60	16,10	38,20	loamy clay
		C	48-110		20,60	34,20	14,20	31,00	loamy clay
734	Lezovo (Лезово)	A	0-20	Paleogen sediments ³	10,00	31,00	20,60	38,40	loamy clay
		A	20-50		11,10	28,80	19,40	40,70	loamy clay
		A	50-78		4,13	35,17	20,00	40,70	loamy clay
		SC	51-78		3,30	36,40	16,10	44,20	loamy clay
		C	100-120		1,10	36,00	16,70	46,20	loamy clay
763	Plešanci (Плешанци)	A	0-20	Marly and bituminous argilite ⁴	6,60	24,10	25,10	46,20	heavy clay
		A	20-51		50,60	18,20	20,00	56,20	heavy clay
		AC	51-78		5,50	35,30	22,00	37,20	loamy clay
		C	78-120		10,00	45,40	21,10	23,50	loamy clay
15	Nivičani (Нивичани)	A	0-21	Hornblende- augite -biotite- andezines ⁵	12,00	26,70	21,10	40,20	loamy clay
		A	21-39		10,20	26,40	21,70	41,70	loamy clay
		A	39-61		13,60	30,00	17,30	35,90	loamy clay
		AC	61-80		16,80	30,00	17,30	35,90	loamy clay
743	Kukovo (Куково)	A	0,25	Andezine breccia ⁶	11,10	15,70	22,50	50,70	heavy clay ¹²
		A	25-60		13,10	20,70	15,15	49,70	heavy clay
		AC	60-82		14,20	21,60	15,80	48,40	heavy clay
11	Vrbica (Врбица)	A	0,25	Andezine breccia ⁷	5,30	23,00	16,60	55,10	heavy clay
		A	25-50		4,30	21,40	18,10	56,20	heavy clay
		AC	50-61		4,60	22,20	19,20	54,00	heavy clay
		C	61-90		6,73	27,57	19,00	46,70	heavy clay
760	Petrašino (Петрашино)	A	0-20	Andezine ignemori- tes ⁸	12,10	31,70	14,00	42,20	loamy clay
		A	20-50		8,00	30,80	21,00	40,20	loamy clay
		A	50-88		9,10	29,70	16,90	44,30	loamy clay
		AC	88-115		17,70	22,90	19,20	40,20	loamy clay
		C	115-160		17,30	35,50	13,00	34,20	loamy clay
7	Gornji Balvan (Горни Балван)	A	0-15	Andezine tuffs ⁹	19,90	30,60	13,50	36,00	loamy clay
		A	25-43		21,10	29,80	14,90	34,20	loamy clay
		A	43-60		24,70	24,60	11,80	38,90	loamy clay
		AC	60-72		20,90	29,60	11,20	38,30	loamy clay
		C	72-100		21,70	23,70	16,40	38,20	loamy clay
272	Dolno Trogirski (Долно Трогирци)	A	0-23	Andezine tuffs ¹⁰	17,06	25,74	18,80	38,40	loamy clay
		A	23-48		13,00	27,00	18,80	41,20	loamy clay
		AC	48-66		17,30	27,40	21,10	34,20	loamy clay
C	66-85	21,90	22,50	18,40	37,20	loamy clay			

¹ Пролувијални депозити од палеогени седименти; ² Андензински седри; ³ Палеогени сменти; ⁴ Лапорести и битуменизни аргелити; ⁵ Амфиболни-аугитски-бититски андезини; ⁶ Андезински бречи; ⁷ Андезински бречи; ⁸ Анденсински игнеморити; ⁹ Андезински седри; ¹⁰ Андезински седри; ¹¹ Иловеста глина; ¹² Тешка глина.

Tab 2 Chemical properties and content of total and easy soluble cobalt in vertisols of Kratovo - Zletovo volcanic region

Таб 2. Хемиски особености и содржина на вкупен и лесно растворлив кобалт во смолниците на кратовско-злетовскиот вулкански регион

Profile numb. (бр. на профил)	Horizon (хоризонт)	Locality (локалитет)	Depth in cm (длабочина во см)	CaCO ₃	pH in (pH во)		Humus (хумус)	ppm Co		
					H ₂ O	nKCl		Total (вкупен)	Available (достапен)	
720	A	Batania (Батаниа)	0-37	4,93	7,70	6,90	3,36	12,0	1,0	
	AC		42-73	19,76	7,70	7,10	2,14	14,0	0,6	
	C		73-100	39,09	7,70	7,10	1,38	13,0	1,3	
764	A	Stubol (Стубол)	0-17	2,89	7,40	6,70	3,02	7,0	1,1	
	A		7-32	4,09	7,50	6,75	2,72	9,0	1,1	
	AC		32-48	19,70	7,70	7,00	1,80	8,0	0,5	
	C		48-110	32,20	7,70	7,10	1,36	7,0	0,8	
734	A	Lezovo (Лезово)	0-20	0,00	6,40	6,00	3,32	16,0	1,5	
	A		20-50	0,00	6,40	5,95	3,25	17,0	1,5	
	A		50-78	0,00	6,40	5,95	2,47	17,0	1,0	
	AC		78-100	0,00	6,40	5,95	1,89	16,0	0,9	
	C		100-120	0,00	6,50	6,00	1,51	18,0	0,9	
763	A	Plešanci (Плешани)	0-20	0,00	5,70	5,40	4,96	9,0	1,3	
	A		20-51	0,00	5,80	5,40	2,46	8,0	1,0	
	AC		51-78	0,00	5,90	5,50	1,38	10,0	1,1	
	C		78-120	7,33	7,00	6,60	0,72	4,0	0,5	
15	A	Nivičani (Нивичани)	0-21	0,00	6,00	5,60	6,25	4,0	1,3	
	A		21-39	0,00	6,00	5,60	2,09	5,0	0,8	
	A		Spačevo (Спанчево)	39-61	0,00	6,10	5,70	1,34	5,0	0,6
	AC		61-80	0,00	6,60	6,00	0,97	3,0	0,6	
743	A	Kukovo (Куково)	0-25	0,00	6,10	5,80	4,73	10,0	2,2	
	A		25-60	0,00	6,15	5,70	3,50	9,0	2,0	
	AC		61-80	0,00	6,15	5,70	2,56	7,0	2,1	
11	A	Vrbica (Врбица)	0-25	0,00	6,30	5,80	4,60	9,0	1,5	
	A		25-50	0,00	6,40	5,90	3,40	10,0	0,9	
	AC		50-61	16,75	7,50	7,00	2,42	9,0	0,4	
	C		61-90	42,75	7,70	7,10	1,16	9,0	1,2	
760	A	Petrašino (Петрашино)	0-20	0,00	6,35	5,80	3,23	7,0	1,5	
	A		20-50	0,00	6,40	5,80	2,70	7,0	0,8	
	A		50-88	0,00	6,40	5,90	2,36	7,0	1,1	
	AC		88-115	37,24	7,60	7,10	1,10	8,0	0,7	
	C		115-160	36,34	7,70	7,20	0,61	7,0	0,4	
7	A	Gornj Balvan (Горни Балван)	0-250	0,00	6,50	5,90	3,52	6,0	1,0	
	A		25-43	0,00	6,50	5,90	3,67	5,0	1,1	
	A		43-60	0,00	6,40	5,80	3,33	7,0	0,9	
	AC		60-72	1,03	7,00	6,60	2,94	6,0	0,7	
	C		72-100	39,99	7,70	7,10	1,44	9,0	1,1	
727	A	Dolno Trogirci (Долно Трогирци)	0-23	0,00	6,30	5,90	4,79	5,0	0,9	
	A		23-48	0,00	6,40	6,00	3,38	6,0	0,9	
	AC		48-66	2,47	7,30	6,80	1,51	4,0	0,5	
	C		66-85	17,14	7,65	7,10	1,24	4,0	0,4	

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СОДРЖИНА НА ВКУПЕН И ЛЕСНО РАСТВОРЛИВ КОБАЛТ ВО СМОЛНИЦИТЕ НА КРАТОВСКО – ЗЛЕТОВСКИОТ ВУЛКАНСКИ РЕГИОН

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РЕЗИМЕ

Истражувањата на содржината на вкупен и лесно растворлив кобалт во смолниците на Кратовско - Злетовскиот вулкански регион ги дадоа овие резултати:

Почвите се снабдени со доволно лесно растворлив кобалт за исхрана на растенијата. Со намалување содржината на хумус по длабочина на профилот се намалува неговата содржина. Највисока содржина лесно растворлив Со има смолницата на профилот 743 додека најниска на профилот 727.

Содржината на вкупен кобалт изнесува од 3,00 до 18,00 ppm. Најголема содржина вкупен Со содржат почвите на профилот 743 додека најмала на профилот 15,727 и 7.

Меѓу содржините на лесно растворлив и вкупен Со и рН односот содржината на карбонати не се приметувва директен однос.