ZINC CONTENT OF ALLUVIALS AS AFFECTED BY RESIDUAL SOIL FROM THE UPPER CATCHMENT AREA

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ABSTRACT

Residual soils, whose geology is marine and terrestial sediments, have higher available zinc content than those whose geology is marine clastics. These residual soils come from the upper catchment areas of alluvial soil. Available zinc contents of four alluvial soil series, namely Palo, Umingan, San Manuel and Mandaue, were observed to vary with the geology of their upper catchment areas. Alluvial soils derived from the residual soils of marine and terrestial sediments have higher available zinc than alluvial soils derived from residual soils of marine clastics. Two out of 8 alluvial soil types derived from marine and terrestial sediments contain available zinc in amounts lower than the critical value of 1 ppm. On the other hand, 3 out of 8 soil types derived from marine clastics have available zinc in amounts greater than 1 ppm. Zinc deficiency would most likely occur in alluvial soils derived from marine clastics and least likely in alluvial soils derived from marine and terrestial sediments.

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INTRODUCTION

Zinc deficiency is perhaps the most important soil disorder next to nitrogen and phosphorus in limiting the yield of lowland rice. Thus, there is a need to pinpoint zinc-deficient areas, by noting the geologic origin of the alluvium which serves as parent material of alluvial soils. This study presents the effect of the residual soils of the upper catchment areas on the available zinc content of some alluvial soils in Leyte and Southern Leyte.

Studies have been conducted on ways to predict micronutrient status of soils based on parent materials. Thorne *et al.* (1942) reported that a field study of soil texture and parent materials may be a reliable indicator of probable zinc deficiency. Nichols (1956) stated that a soil may be subjected to trace element disorders if it is derived from parent rocks which contained either too little or too much of the element in question. Brady (1974) stated that the parent material tends to influence the micronutrient content of the soil more than its macronutrients. Kalpage (1972) claimed that the soil micronutrient content depends on the rock from which the parent material was derived. In alluvial soils, the trace elements in the alluvium are related to the soil's geological origin. Thus, the residual soils of the upper catchment areas from which the alluvium were derived could influence the available zinc content of alluvial soils.

MATERIALS AND METHODS

Ten soil samples were collected from the first foot layer of each alluvial soil types composed of Palo, Umingan, San Manuel and Mandaue series in 11 catchment areas. Likewise, 5 samples from the first foot layer were collected from the most dominant residual soils of the upper catchment areas. The soil samples were collected from various catchment areas and locations (Table 1).

Alluvial and residual soil samples were collected through bamboo samplers, thoroughly air-dried, and sieved in a 2-mm sieve. Available zinc was determined by using 0.05 N HCl (Katyal and Ponnamperuma, 1974).

RESULTS AND DISCUSSION

Available Zinc Content of Residual Soils of Upper Catchment Areas.

Residual soils which were derived from marine and terrestial sediments have higher available zinc (2.42-3.15 ppm) than those derived from marine clastics (0.20-1.47 ppm) (Table 2). The difference in available zinc content between the two soils could be attributed to their degree of weathering, which depends upon the age of the parent materials, and their mineralogy. Marine and terrestial sediments formed during the Pliocene — Pleistocene era have shallow marine sedimentary formations which include clay and its conglomerate. Marine sediments were mapped together with terrestial sediments of swampy facies, because both gave rise to similar soils. This formation is expected to have higher available zinc content since zinc released from weathering is incorporated and absorbed on clays which are formed into shale. Terrestial sediments which are lake-swamp deposits have high amounts of clay and limonitic concretions and have high available zinc. These sediments are less weathered since they are not subjected to constant pounding of the seas as is the case with marine clastics.

Marine clastics are formed during the upper Miocene period. Marine clastics are older formations and are relatively more weathered than marine and terrestial sediments. This is so because they are derived from weathering and erosion of the preceding land mass that are partially exposed. Brady (1974) noted that they have been pounded and eroded

Table 1. Sampling location of residual and alluvial soils.

CATCHMENT	SAMPLING LOCATION	
	Residual Soils	Alluvial Soils
Daguitan	Mt. Mahagnao, Burauen, Leyte	Palo clay loam — Bo. San Diego, Burauen, Leyte Umingan clay loam — Burauen, Leyte
Quilot	Mt. Cancajanag, Dagami, Leyte	Palo clay loam — Bo. Maribi, Tanauan, Leyte San Manuel fine sandy loam — Bo. Cansamada, Dagami, Leyte
Carigara	Bo. Caghalo, Carigara, Leyte	San Manuel undifferentiated — Bo. Bislig, Carigara, Leyte Palo clay loam — Carigara, Leyte
Hemanglos	Bo. Makalpe, Carigara, Leyte	Palo clay loam — Bo. Lactusan, Barugo, Leyte San Manuel silt loam — Bo. Nasonogan, Barugo, Leyte
Bongquirongan	Bo. Kangiros, Hilongos, So. Leyte	Mandaue clay — Bo. Talisay, Hilongos, Leyte
Salog	Bo. Hilaan, Bontoc	Umingan clay loam — Bo. Divisoria, Bontoc, So. Leyte
Pandan	Bo. Buac Daku, Sogod, So. Leyte	Umingan clay loam — Bo. Buac Gamay, Sogod, So. Leyte
Salug	Bo. Bagumbayan, Hilongos, So. Leyte	Mandaue clay — Bo. Naval, Hilongos, Leyte
Pagbanganan	Bo. Makinhas, Baybay, Leyte	San Manuel silt loam — Bo. Can-ipa, Baybay, Leyte Umingan clay loam — Bo. Candadam, Baybay, Leyte
Bagahupi	Mt. Bagahupi, Babatngon	Palo clay loam — Bo. Bagahupi, Babatngon, Leyte
Pagasangaan	Bo. R. M. Tan, Ormoc City	San Manuel silt loam — Bo. Liloan, Ormoc City.

Table 2. Available zinc content of residual and alluvial soils.

	Available Zinc (ppm)							
	Geology of Residual Soils[1]		Alluvial Soils[2]					
CATCHMENT	Marine and terrestial sediment	Marine clastics	Palo clay loam	San Manuel fine sandy loam	San Manuel silt loam	San Manuel undifferentiated	Umingan clay loam	Mandaue clay
Quilot	2.54		1.21	0.79				
Daquitan	3.15		0.75				4.28	
Carigara	2.51		7.26			1.17		
Hemanglos	2.42		1.34		1.76			
Pagsangaan		0.36			1.45			
Bagahupi		0.76	0.99					
Pagbanganan		0.65			1.79	0.59		
Bongquirongan		0.98						0.77
Salug		0.98						0.33
Salog		1.47				0.62		
Pandan		0.20				1.39		

[1] Mean of 5 samples
[2] Mean of 10 samples

by the waves for years in the ocean before they are deposited and stratified. After several cycles of destruction, what remain are allogenic minerals that are extremely resistant to decomposition and solution. As zinc-containing olivine is unstable, and as augite, magnetite and hornblende are metastable, these minerals are least expected to be found in marine clastics. Marine clastics have somewhat higher coverage of sandstone and conglomerate rock outcrops and surface stones than the more shaly areas.

Available Zinc Content of Alluvial Soils.

Table 2 shows the available zinc content of the soil types studied. Available zinc content of alluvial soils varies according to the residual soils of the upper catchment areas. Alluvial soils derived from residual soils of marine and terrestial sediments have higher available zinc (0.75-7.26 ppm) than alluvial soils derived from residual soils of marine clastics (0.53-1.45 ppm). Of the 8 soils derived from marine and terrestial sediments, only 2 contain available zinc in amounts lower than 1 ppm. These are the Palo clay loam in Daguitan and San Manuel fine sandy loam in Quilot. The critical level of available zinc for rice determined by using 0.05 N HCl extractant is 1 ppm (Katyal and Ponnamperuma, 1974). Of the 8 soils derived from marine clastics, only 3 contain available zinc in amounts greater than 1 ppm. These are San Manuel silt loam of catchments Pagsangaan and Pagbanganan and San Manuel undifferentiated of Pandan.

Based on the results of this study, there is a high probability that zinc deficiency would occur in alluvial soils derived from residual soils of marine clastics than from those derived from marine and terrestial sediments. Such difference can be attributed to the age, mineralogy and degree of weathering of both residual soils where alluvial soils were derived.

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