THE USE OF ^{65}Zn FOR DETERMINING SEVERAL SOIL CHARACTERISTICS

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ABSTRACT

Three experiments have been carried out to determine (1) zinc fixation capacity, (2) zinc transformation in sub merged condition, and (3) capacity factor (buffering capacity) of zinc using ^{65}Zn , a gamma emitter radioisotope with a 243.6 days half life. By using ^{65}Zn it was able to show that there was difference in zinc fixation capacity of the soils used ranging from 2% - 42%. With the radioisotope it could be determine that after 24 hours the ^{65}Zn applied was already retained by the soil up to more than 90%. For the capacity factor of the soil data obtained revealed that it range from 270 - 2400. Some of the data obtained were, % ^{65}Zn fixed in soil ranged as follows for soil from: Pusakanegara (42,56%) > Bogor (42,19%) > Pasar Jumat (26,10%) > Batumerta (2.50 %). For % ^{65}Zn found in soluble form in submerge condition after: 3 weeks (range 0.05% - 0.23%) < 2 weeks (range 0.18% - 0.40%) < 24 hours (range 0.17% - 2.44%). The lowest capacity factor was obtained by soil from Batumerta (270), followed by soil from Pasar Jumat (714) and Bogor (1000) and the highest was for soil from Pusakanegera (2400).

Keywords : zinc fixation capacity, radio isotope, soil characteristics, gamma emitter radioisotope

Zinc is one among the seven micro-nutrients absolutely necessary for plant growth (Channal & Kandaswany, 1997) . It mainly serve as a metal component of a series of enzymes which in turn regulate the physiological factors of the plant. One of these enzymes is tryptophan a precursor of indole asetic acid (Deb *et al.*, 1997).

Zinc deficiency in crops is a global phenomenon. In spite of this the role of zinc as one of the many micro-nutrients in stabilizing crop production has not yet been properly appreciated (Deb & Sachder, 1994). Micro-nutrient research has been particularly handicapped because of the smaller concentrations of these nutrients encountered in the soil solution of agricultural soils. One of the way to solve this problem is the use of radioisotopes. Further it was revealed that the use of radioisotopes could help to determine the mechanism of micro-nutrients behavior in the soil.

Zinc deficiency in several soils in Indonesia has also been recognized as shown by several research carried out by Institut Pertanian Bogor and the Center for Soil and Agroclimate Research (Soepardi, 1981; Al-Jubrie *et al.*, 1991). In connection with further research of zinc in Indonesia, it might be that the radioisotope ^{65}Zn could be use to clarify the behavior of it in soil; so that the need of Zn application could be more accurate.

In this paper the use of ^{65}Zn a gamma emitter radioisotope with a half life of 243.6 days for determining several soil characteristics have been reported.

METHODS

The material and methods where ^{65}Zn was used is described a follows. Soils from different locations have been used, namely, Oxisol (Latosol) from Pasar Jumat, South Jakarta; Inceptisol (Regosol) from Bogor, West Java; Histosol (Alluvial) from Pusakanegara, West Java; and Ultisol (Red Yellow Podzolic, RYP) from Batumerta, South Sumatra. The physical and chemical characteristics are presented in Table 1. The soils might not represented the soils deficient in zinc, but the employment of these soils in the experiments are due to their availability in the Centre for the Application of Isotopes and Radiation, Jakarta.

Table 1. Chemical and physical properties of soil used for experiment I, II, III.

	Jakarta Oxisol (Latosol)	Bogor Inceptisol (Regosol)	Pusakanegara Histosol (Alluvial)	Batumerta Ultisol (RYP)
pH (1:1)				
H_2O	5.4	5.7	6.35	5.20
KCl	4.3	4.4	5.44	4.20
Organic-C (%)				
Total-N (%)	1.25	1.58	3.82	1.92
Total-P Bray 1 (ppm)	0.14	0.15	0.20	0.15
Total-P Olsen (ppm)	-	-	16.60	15.20
Exchangeable base (ml/100g)				
Ca	10.1	8.7	23.94	3.12
Mg	3.4	2.2	6.71	1.08
K	0.3	0.1	0.72	0.25
Na	0.4	0.1	0.50	0.22
C.E.C.	27	21.1	33.08	12.20
Al 3+	-	-	1.06	5.99
H+	-	-	0.50	0.60
Texture				
Sand (%)	0.7	7	25.90	19.17
Silt (%)	30.3	39	24.40	43.15
Clay (%)	69.0	54	49.70	37.68

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