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Research within the coordinated programme on isotope-aided micronutrient studies in rice production with special reference to zinc deficiencies

FINAL REPORT FOR THE PERIOD

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FAO-IAEA/BS Coordinated Programme on Isotope-aided Micronutrient Studies in Rice Production with Special Reference to Zinc Deficiency

Research Contract No. 1417/R_4/RB

Title of the Project: Isotope-aided Micronutrient Studies in Rice Production with Special Reference to Zinc Deficiency

Research Institute : Soil Research Division
Bureau of Soils
Ministry of Agriculture
Manila, Philippines

Period of the Contract: 1974 to 1979

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FIELD FERTILIZER EFFICIENCY STUDY
(ADDITIONAL)

Introduction:

After conducting an investigation on the efficiency of various sources and methods of application of zinc to flooded rice in Pangasinan province, it was agreed during the 1978 IAEA/FAO research coordination meeting at Bogor, Indonesia to conduct an additional experiment of the same nature but with lesser number of treatments.

The additional experiment has the same objectives as the previous field experiment, but was conducted at Bo. Bula, Tiaong, Quezon, 110 kms. from the national highway and can only be reached by hiking. The zinc deficient area is approximately 50 hectares.

Materials and Methods:

The layout of the experiment was a randomized complete block design of 8 treatments with 4 replications. The total number of plot was 32. Rice variety IR-42 was used. Description of the treatments are given in Table 1.

The management of the plots was the same as the previous experiment. Some of the physical and chemical characteristics of the soil are presented in Table 2. The soil is a hydraquent, intensively used for rice production only and irrigation water from artesian well is continuous the whole year round. It is characterized by high pH (7.45) and high organic matter content (5.01%).

Results Obtained:

Early symptoms of zinc deficiency were observed in treatments no. 7 (with NPK and no zinc) and no. 8 (no NPK, no zinc). Although the IR-42 variety is moderately resistant to zinc deficiency, striking response to zinc application was still observed. The plants in the two (2) control plots were stunted, had poor tillering, uneven growth/ stand of crop and showed brown streaks on the older leaves as compared to those plots receiving zinc treatments.

Table 4 shows the results of the height and the number of tillers per hill of the rice plant measured 60 days after transplanting. Plants receiving zinc treatments showed greater number of tillers especially those on treatment nos. 4 and 5 (surface application of zinc sulfate on transplanting and two (2) weeks after transplanting respectively). Plant height also increased with application of zinc.

Surface application of zinc sulfate on transplanting and 2 weeks after transplanting (treatment nos. 4 & 5) increased grain and straw yeilds as compared to those mixed throughout the soil as shown in Table 5. Root dipping of rice plants in 2% ZnO suspension (treatment no. 6) also showed an increased in grain and straw yields.

The above results conform with the findings of Mikkelsen and Brandon (1972) in California as explained by the greater availability of zinc at the soil-water interface. Mixing the

zinc throughout the soil were not as effective as surface application in increasing grain and straw yields which can be explained by the presence of high organic matter in the soil itself, rendering the zinc unavailable to plants.

Again it can be mentioned that for efficient zinc fertilization in rice, method of application is an important factor to consider.

Notes:

1. The chemical and radiochemical analyses of the straw and grain samples were not completed due to the breakdown of our equipment which up to now is still our big problem.
2. The results of the chemical analysis of the soil samples for available zinc (ppm) using 0.05 N NCl are very low due to high pH (7.45) of the soil.
3. The experimental site was completely destroyed by strong typhoons that visited the area and most of the plastic square sheets used in isolating the microplots from the main plots were ripped off rendering it unrepairable. Much to our desire to carry out a residual field experiment, we could not do so due to the above reason which is beyond our control.

TABLE 1 - Description of treatments

Treatment No.	Description
1*	5 kg Zinc as Zinc sulfate mixed throughout the top soil
2*	5 kg Zinc as zinc sulfate plus organic compost mixed throughout the top soil
3*	5 kg Zinc as zinc sulfate plus urea fertilizer mixed throughout the top soil
4*	5 kg Zinc as zinc sulfate applied on the soil surface at transplanting
5*	5 kg Zinc as zinc sulfate applied on soil surface 2 weeks after transplanting
6	Root dipping in 2% ZnO suspension
7	Control (NPK but no zinc)
8	Control (no NPK, no zinc)

* with radioactive microplots

Table 2 - Some characteristics of the soil from Bo. Bula, Tiaong, Quezon

Item	0 - 20 cm depth
Soil pH (1:1) H_2O	7.45
Organic carbon (%)	2.91
Organic Matter (%)	5.01
Avail. phosphorus (Mod. Olsen) ppm	trace
Hot (H_2SO_4) K (ppm)	315.0
Exch. Ca^{++} meq/100 g	54.5
Exch. Na^{+} meq/100 g	1.96
Exch. K^{+} meq/100 g	0.46
Exch. Mg^{+} meq/100 g	5.43
Cation exchange capacity meq/100 g	62.35
Extractable Zinc	
.005 M DTPA (ppm)	1.48
.05 N HCl (ppm)	0.55
Texture	clay loam

Table 3 - Contents of Zn in soil after harvest at Bo. Bula, Tiaong, Quezon, Wet Season 1979

Treatment	Soil Zn (ppm)	
	DTPA	0.05 N HCl
1	2.11	0.25
2	3.45	0.16
3	2.26	0.13
4	3.61	0.20
5	2.55	0.24
6	1.50	0.26
7	.95	0.18
8	1.01	0.30

Table 4 - Tiller count/ hill and plant height (cm)

Treatment	Tiller Count/hill	Plant height
1	30.4	72.7
2	32.7	77.4
3	29.6	77.0
4	33.2	75.5
5	34.8	71.4
6	27.6	66.9
7	29.9	64.8
8	24.4	64.8
L S D .05	4.1	11.4

Table 5 - Weight of Straw and Grain Yield of Rice

Treatment	Weight of Straw kg/ha	Weight of Rough Grain kg/ha
1	4825	4168
2	4325	4212
3	4225	4496
4	5244	4842
5	5230	4603
6	4661	4558
7	4681	4455
8	3110	3176
L.S.D. .05	1418	709