

INTRODUCTION

Celosia (*Celosia argentea*) are annuals used as both ornamental and vegetables. In Nigeria, Celosia are called Lagos spinach, and they are used in sauces and soups in southwestern states, making other dishes more palatable. Celosia enjoys a wide range of soil for germination, but it is most productive on soils rich in organic matter, which are commonly fertilized with manure and chemical fertilizers in large scales (Dupriez, 1989).

Over 95% of the land area of southwestern Nigeria have very low available zinc in the plough layer of the soil (Adepetu, 1986). This study analyzed leached sandy soils, soils with little nutrients and low levels of zinc, since they represent the soil of the Kwara State (Lochart, 1988).

Zn deficiency and its toxicity cause the malformation of nuclei and nucleoli of meristematic root cells and disrupt mitosis (Jones, 1972). This analysis determines the best Zn level to keep plants from poor inflorescence, premature flower dehiscence, and poor fruit and seed setting, characteristics of negative impact of Zn.

OBJECTIVES

- To observe the effect of different quantities of applied zinc (Zn) on celosia.
- To observe the antagonistic effect of phosphorous (P) on celosia plant with application of different levels of zinc to the soil used.

DESIGN AND METHOD

The soil sample was randomly collected from the top soil (0-15cm) and thoroughly mixed. Original soil was kept for laboratory analysis. The studies were conducted in pots. Celosia seeds were first planted on a nursery bed then transplanted into 16 plastic buckets where each Zn level (50, 100 and 150mg/kg) were replicated in four places and arranged in a randomized complete block design, 0 mg/kg of Zn was used as control. NPK fertilizer was applied to each of the pots at the rate of 80 kg N/ha (15:15:15).

Starting from 2nd week of transplant, average height (cm) and number of leaves per plant in each pot was taken every week till 6th week when they were harvested. The roots of each harvested plant were removed (4 stands were removed leaving one) and weighed. Plant shoots and roots were wrapped, labeled, and oven dried at 80°C for 3 days and analyzed for Zn levels.

Laboratory analyses were done on the soil samples for each pot after harvesting, on the different parts of the plant that were also stored dried. Particle sizes were determined by hydrometric method, organic matter content was also determined by using acidified (K₂Cr₂O₇) solution, available phosphorus was extracted using Bray's No 1 method, and other adequate lab processes. The Zn content extracted from both the soil and the plant were analyzed using atomic absorption spectrophotometry.

FORMULA AND CALCULATIONS

$$\% \text{Silt and Clay} = \frac{\text{Hydrometer reading (40 sec)} \times 100}{\text{Weight of soil sample}}$$

$$\% \text{Clay} = \frac{\text{Hydrometer Reading 2hrs} \times 100}{\text{Weight of soil sample}}$$

$$\% \text{Silt} = (\% \text{Silt} + \% \text{Clay}) - \% \text{Clay}$$

$$\% \text{Sand} = 100 - (\% \text{Silt} + \% \text{Clay})$$

$$\% \text{Organic C} = \frac{(\text{Blank} - \text{Sample Reading}) \times N \times 0.003 \times 1.33 \times 100}{\text{Weight of soil sample}}$$

Blank = Blank Titre Value(ml), Sample Reading = Sample Titre Value, N = Normality of Ferrous Sulphate, %Organic Matter = Org. C X 1.729

$$\text{ppm of the P in the soil} = \frac{\text{ppm of P in solution} \times \text{Total Volume diluted}}{\text{Weight of soil sample}}$$

$$\text{Total Acidity} = \frac{\text{titre} \times \text{dilution factor} \times 100 \times \text{Normality of NaOH}}{\text{Weight of soil sample}}$$

$$\text{Ca} + \text{Mg} = \frac{\text{dilution factor} \times \text{titre value} \times 100 \times \text{normality}}{\text{Weight of soil sample}}$$

$$\text{Ca} = \frac{\text{dilution factor} \times \text{titre value} \times 100 \times \text{normality}}{\text{Weight of soil sample}}$$

%N = (T-N) x N x 140, T = Sample Titration (ml), B = Blank Titrating (ml), N = Normality of H₂SO₄, S = sample weight (mg)

TABLE OF VALUES

TABLE 1

Soil Test	General Characteristics	Zinc Content in the Experimental Soil Sample			
		0(mg/Kg) Zn	50(mg/Kg) Zn	100(mg/Kg) Zn	150(mg/Kg) Zn
pH	5.4	5.0	5.1	5.1	5.2
%Sand	72.24	75.35	75.25	75.74	75.49
%Silt	11.76	13.10	13.00	13.25	13.75
%Clay	16.00	11.56	11.76	11.01	10.76
%Org. Mat.	10.35	6.04	6.75	6.20	6.00
%Total N	1.120	0.154	0.160	0.150	0.153
K (cmol/Kg)	0.076	0.0503	0.0545	0.0545	0.0588
Na (cmol/Kg)	0.078	0.0770	0.0585	0.0598	0.0553
Ca (cmol/Kg)	4.40	0.60	0.60	0.50	0.650
Mg (cmol/Kg)	2.80	1.30	1.23	1.00	1.23
C.E.C	0.30	0.182	0.120	0.113	0.112
P (cmol/Kg)	0.40	Check Table 2 for adequate comparison			
Zn (cmol/Kg)	0.57	Check Table 2 for adequate comparison			

TABLE 2

Zn Level (mg/kg)	Shoot Zn Content (cmol/kg)	Soil Zn Content After harvesting (cmol/kg)	Available P (cmol/kg)	Shoot Dry Matter (g)	Plant Leaf No.	Plant Height (cm)
0	0.26	0.168 a	0.144 a	5.76 a	17	36.12
50	1.30 b	0.630 ab	0.272 b	6.63 ab	18	36.02
100	2.72 bc	0.615 b	0.278 bc	6.00 b	17	38.01
150	2.45 b	2.140 ab	0.225	5.30 ab	19	36.22

RESULTS AND DISCUSSION

The general characteristic of the soil sample are shown on Table 1 in the first column. The original soil is slightly acidic, having a pH of 5.4. The organic matter is low and, available P is also low. The remaining nutrients are typical of the soils in a savanna region. The soil is a sandy loam, having 72.24% sand, and 11.76% silt. CEC was 0.57 meq / 100 g soil, higher than the 0.473 meq / 100 g soil reported for nearby forest soil.

Table 1 also includes the characteristics of the soil after harvesting the vegetable; the pH reduced with each level of Zn application, especially when Zn was applied at 100 mg/kg. Organic matter was also reduced.

Table 2 compares the average of the Zn content of the shoot, Zn content of the soil after harvesting, available soil phosphorus after harvesting, shoot dry matter, leaf number and plant height.

From the analysis of variance of the parameters above, there was no significant difference in leaf number or plant height for the different Zn levels. However, there were significant differences between the Zn levels in the shoot, soil Zn after harvest, available P after harvest, and shoot dry matter. Using 100 mg Zn/kg appears to be the best for *C. argentea*.

This level also resulted in the highest residual Zn level in the soil after harvest. Applying 50 mg/kg and 150mg/kg (Zn) gave the same effect on the phosphorus in the plant, but there was lower phosphorus levels between the control and 100 mg/kg.

RESULTS – ANOVA TABLES

Shoot Zn Content

Sv	DoF	SS	MSS	F
Trt	3	15.422	5.141	64.258
Error	12	0.961	0.080	
Total	15	16.383		

$f_{table} = f_{3,12,0.05} = 3.49$, $f_{cal} = 64.258$
H₀: Treatments are the same Decision Rule: Reject H₀ if $f_{table} > f_{cal}$. DMR Test: $KD_r = K_r \times SD_e$, $SD_e = 0.49$

Zn in soil After Harvesting

Sv	DoF	SS	MSS	F
Trt	3	8.910	2.97	79.625
Error	12	0.448	0.0373	
Total	15	9.358		

$f_{table} = f_{3,12,0.05} = 3.49$, $f_{cal} = 79.625$
H₀: Treatments are the same Decision Rule: Reject H₀ if $f_{table} > f_{cal}$. DMR Test: $KD_r = K_r \times SD_e$, $SD_e = 0.339$

Dry matter content of shoot

Sv	DoF	SS	MSS	F
Trt	3	3.65	1.2200	4.473
Error	12	3.28	0.773	
Total	15	6.93		

$f_{table} = f_{3,12,0.05} = 3.49$, $f_{cal} = 4.473$
H₀: Treatments are the same Decision Rule: Reject H₀ if $f_{table} > f_{cal}$. DMR Test: $KD_r = K_r \times SD_e$, $SD_e = 3.62$

Available P after Harvesting

Sv	DoF	SS	MSS	F
Trt	3	0.0721	0.0240	18.07
Error	12	0.0159	0.00133	
Total	15	0.088		

$f_{table} = f_{3,12,0.05} = 3.49$, $f_{cal} = 18.07$
H₀: Treatments are the same Decision Rule: Reject H₀ if $f_{table} > f_{cal}$. DMR Test: $KD_r = K_r \times SD_e$, $SD_e = 0.063$

CONCLUSION

The application of 100 mg/kg of Zn to soil will give a better yield. The uptake of the zinc at this level was aided by the decrease in pH. (Tisdale et al., 1984).

RECOMMENDATION

It could be recommended that periodic soil test should be done to observe the reduction in the level of micronutrients especially Zn in the soil of this area.

REFERENCES

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