Monitoring the nutritional status of rainfed rice crops in Benin by DRIS method

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Monitoring the nutritional status of rainfed rice crops in Benin by DRIS method

ANAGO N. Firmin, OUSSOU C. T. Brice, AGBANGBA C. Emile, DAGBENONBAKIN D. Gustave, AMADJI G. Lucien
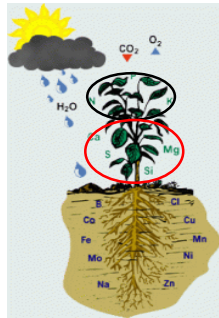*E-mail: firmin.anago@gmail.com; Tel: (229) 97750183*

Background

Figure 1. Nutrients applied

Nutrients removed
https://bioorganicfertilizer.wordpress.com/2011/09/22/bio-organic-fertilizer-contains-plant-nutrients/

Nutrients most widely supply in rice cultivation in Benin are N, P, and K (Figure 1), and many complex fertilizers are only made up of these major nutrients (Anago *et al.*, 2020).

It has been recognized around the world that N, P and K fertilizers alone are not always sufficient to provide balanced nutrition for optimal rice yield and quality.

Research focus and Methodology

❑ Assess nutritional status of rainfed rice crop in endogenous systems;
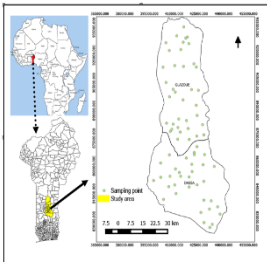❑ Develop DRIS norms of major, secondary and micro nutrient.

Figure 2. Study area and leaf sampling point

72 plant samples were collected and rice yield estimated in 72 farmer's field

✓ The leaf samples were dried in a hot air oven at 65°C to a constant dry weight before being ground in a Willey mill to pass through 0.5 mm screen.

✓ Leaf samples were analyzed at laboratory to determine N, P, K, Ca, Mg, Zn, Fe contents

Leaf samples

> Average yield + SD >

| High yielding subpopulation | Low yielding subpopulation |

DRIS index for each nutrient was calculated as follows:
X indice = $[f(X/A) + f(X/B) +... -f(M/X) - f(N/X) -...]$
Where X/A is the ratio of concentrations of nutrients X and A in the samples of High yielding subpopulation

Results

Figure 3. Nutrient content in leaf samples in the both subpopulation

The P, K, Ca, Mg content of leaves was higher in samples from the high-yielding sub-population than in those from the low-yielding sub-population (Figure 3).

Nitrogen might be the most limiting nutrient, and Ca might be the last limiting nutrient for the production of rice (Figure 4).

The value of nutrient ratio expressions in high yielding subpopulation involving N, P, K, Ca, Mg, Fe and Zn (Table 1) were chosen as the diagnostic norms for rice. These expressions help to differentiate between healthy and unhealthy rice plants from nutrition status.

Table 1. DRIS norms values for the high-yielding sub-population

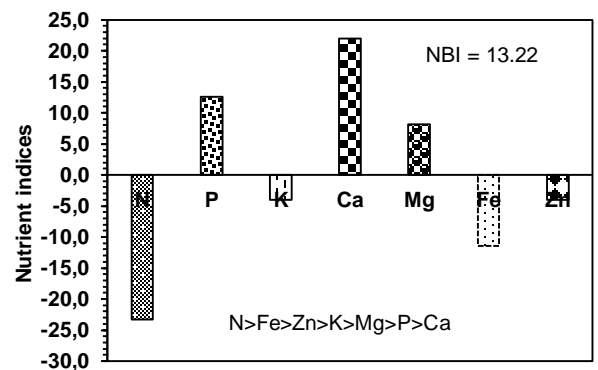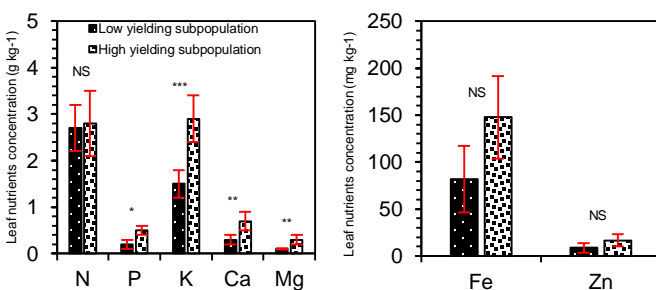| Nutrient ratio	Mean	SD	Var
N/P	6.9	4.4	19.4
N/K	1.1	0.6	0.3
N/Ca	5.3	4.6	21.6
N/Mg	11	5.8	34
N/Fe	240.9	204.6	41867.6
N/Zn	2026	1330	1768304
K/P	6.5	1.7	3
P/Ca	0.7	0.2	0
Mg/P	0.6	0.2	0
Fe/P	0	0	0
Fe/Mg	0.1	0	0
Zn/P	0	0	0
K/Ca	4.6	1.6	2.5
K/Mg	10.6	2	4.2
Fe/K	0	0	0
K/Zn	1926	589	347204
Mg/Ca	0.4	0.1	0
Fe/Ca	0	0	0
Zn/Ca	0	0	0
Zn/Mg	0	0	0
Fe/Zn	9.5	3.4	11.9

NBI = 13.22
N>Fe>Zn>K>Mg>P>Ca
Figure 4. Nutrients indices for rainfed rice

Table 2. Sufficiency ranges of nutrient derived by DRIS technique from nutrient indexing survey of rice

Nutrient	Deficient	Low	Optimum	High	Excessive
			Nutrients [g kg⁻¹]		
N	<1.03	1.03 - 1.91	1.91 - 3.66	3.66 - 4.53	>4.53
P	<0.13	0.13 - 0.30	0.30 - 0.64	0.64 - 0.82	>0.82
K	<1.05	1.05 - 2.00	2.00 - 3.89	3.89 - 4.84	>4.84
Ca	<0.03	0.03 - 0.37	0.37 - 1.05	1.05 - 1.39	>1.39
Mg	<0.09	0.09 - 0.18	0.18 - 0.38	0.38 - 0.48	>0.48
			Nutrients [mg kg⁻¹]		
Fe	<30.85	30.85 - 89.27	89.27 - 206.13	206.13 - 264.55	>264.55
Zn	<-0.13	-0.13 - 8.21	8.21 - 24.91	24.91 - 33.25	>33.25

Conclusion

Nutrient requirement for the rainfed rice production is N>Fe>Zn>K>Mg>P>Ca

Negative indices : N, Fe, Zn and K

Positives indices : Mg, P and Ca.

References: Anago N. F., Dagbenonbakin G. D., Oussou Brice T. C., Agbangba E. C., Saidou A. and Amadji G. L. 2020. Assessment of Nutritional Status of Rain fed Rice in Benin Using Diagnosis and Recommendation Integrated System (DRIS). *International Journal of Plant & Soil Science 32(1)*: 74-83, 2020; ISSN: 2320-7035. DOI: 10.9734/IJPSS/2020/v32i130236