Effects of foliar liquid biofertilizer (BOLAME) on maize yield in Faranah (Republic of Guinea)

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ABSTRACT

The cost of spreading solid fertilizers is a limiting factor for farmers due to the lack of manpower and ignorance of spreading techniques. Liquid fertilizers take precedence over solid fertilizers because of their low cost of spreading and their rapid assimilation by plants. Reducing the cost of spreading by using foliar BOLAME is a sustainable alternative. This work has the general objective of preparing foliar BOLAME and testing its effectiveness in maize cultivation. The Obatampa maize variety was used. The material used for the preparation of foliar BOLAME includes: cow dung, sugar cane molasses, cow's milk and water. The fertilizers tested during the test are: BOLAME (23.2 l/ha), Megagreen (2.5 kg/ha), Codafol (4 l/ha) and Control (0 l/ha). The data collected was subjected to analysis of variance with XLSTAT 21 software for the phenophases and SPSS 22 for the biometric evaluations. Hypothesis tests were done using Duncan at 1 and 5%. The Megagreen and the BOLAME gave high yields without statistical distinction 2.66 and 2.71 t/ha and the low yield was provided by the control 1.48 t/ha.

Key words: *Effects, Foliar BOLAME, Yield, Corn*

1. INTRODUCTION

In West Africa, the recommendation for the application of organic manure remains unique, whatever the type of soil, and independent of the quality of the organic manures available on the farms. They are applied depending on the quality of the manure, between 2.4 and 5.1 t/ha per year on sandy soils and 2.1 and 4.4 t/ha per year for clay soils [1]. The chemical poverty of soils considerably affects crop growth [2]. This poverty does not allow normal plant growth [3]. Soils can be naturally nutrient-poor or depleted by exporting crops without efforts to restore them. Soil fertilization is therefore an essential factor in the growth and development of crops.

According to [4], solid fertilization is the most common method of feeding plants compared to liquid fertilization. This high rate of use of solid fertilizers is due to their speed in stimulating plant growth nutrients and the low nutrient content of organic fertilizers which is in the vicinity of the following values: 9.3% MO, 0.5% nitrogen, 3.36% phosphorus, 1.11% potassium and a pH = 7.0 [5]. Despite this rapid action of some solid fertilizers such as chemical fertilizers, solid fertilization is often accompanied by losses due to leaching and leaching. The use of liquid organic fertilizers in the agricultural sector has positive interests on the yield, the financial result, the handling, the application, the cost of labor, the leaching of nutrients and their combinations with phytosanitary products. [6]. Sometimes, the biofertilizers applied do not exert any disturbance on the life of the soil micro-organisms [7] .Selon [8], le rendement de maïs sous fertilisation organique liquide peut atteint 2,5 t/ha suivant les conditions de culture. Cette fertilisation peut augmenter le rendement du maïs de 40 à 80% par rapport au témoin, environ 1,398 t/ha contre 0,88 kg/ha pour le témoin [9].

Consumers today demand agricultural products free of chemical fertilizers and pesticides and to meet this demand, it is essential to use biofertilizers, whether liquid or solid [10]. There are today on the Guinean market in general and in particular in Faranah, several types of liquid chemical foliar fertilizers which cost more or less. However, there is none of biological origin.

By situating ourselves in this problem, we asked ourselves the following question which this article will try to answer: can the yield of maize be influenced by foliar BOLAME?

To answer this question, we have set the general objective of preparing foliar BOLAME and testing its effectiveness in maize cultivation.

2. Materials and methods

2.1 Hardware

2.1.1. Experimental site: the trial was carried out at the experimental station of the Agriculture Department of ISAV/F. The soil analyzes carried out in 2015 at the Center for Environmental Research Studies (CERE) showed that the site soil has a clean texture (sandy-clay-loamy) according to the American textural diagram with a good porosity of 55.73% and poor in organic matter (2.66%).

2.1.2. Plant material: The Obatampa maize variety was used. This variety has a high yield potential varying between 3 and 6 t/ha.

2.1.3. Foliar BOLAME: The BOLAME comes from the abbreviation of the components: COW USE, COW MILK, Sugar cane molasses and Water. BOLAME foliaire is a greenish colored liquid biofertilizer resulting from the fermentation of these different components. The procedure adopted for the preparation sa was purely traditional and according to the ratio 1 to 1. It was used according to the doses indicated in the variants.

2.2. Methods

2.2.1. Preparation of BOLAME

The preparation procedure was as follows:

- ✓ Dilution of 25 kg of fresh cow dung in 25 liters of water, in a dark plastic container;
- ✓ During the grinding and filtration process, water was added gradually until the planned volume was reached;
- ✓ Mix one liter of whey with 2 liters of molasses in 5 liters of water in a suitable container;
- ✓ Adding this mixture to the filtered cow dung solution, stirred for 2-3 minutes;
- ✓ The final solution was hermetically sealed and fermented at a temperature between 30 to 38°C;
- ✓ 30 days after active fermentation, the solution was used on the plants by foliar application.

2.2.2. Foliar BOLAME analysis

The foliar BOLAME prepared was analyzed at the CERE laboratory in Conakry. The analyzes focused on pH, matter, humus, macroelements, secondary elements and trace elements.

2.2.3. Study Factor and Variants

The study factor focused on the fertilizer with three levels of studies represented by the variants. The variants tested were: Control (0 L/ha), foliar BOLAME (23.1 L/ha), Codafol (4.5 L/ha) and Megagreen (1 kg/hectare).

The device used was the Randomized Complete Block comprising 4 variants each repeated 3 times, i.e. 12 elementary plots of 6.48 m^2.

2.2.4. Phenological and biometric observations

Phenological observations focused on emergence, 3-leaf stage, paniculation, heading and maturation. The average number of seeds per row, the average number of rows per ear, the average length of the ears, the average number of ears per plant were the variables evaluated.

2.2.5. Statistical analysis

The results obtained were subjected to the Analysis of Variance and the means were compared by the test of the least significant difference (PPDS) at the threshold of 5 and 1%. SPSS software version and XLSTAT version 2021 was used.

3. Results

3.1. Agrochemical analyzes of foliar BOLAME at the Center for Environmental Research Studies.

The importance of any fertilizer is the presence of assimilable nutrients. This is why the foliar BOLAME after preparation was analyzed to detect the nutrients assimilable by the plants. The results of this analysis are shown in Table I.

Table I: Agrochemical analyzes of foliar BOLAME

	Setting	Unity	Foliar BOLAME results
pH	pHwater	-	8.0
	pH_{kcl}	-	7.5
Matter	Humidity	%	74.40
	Dry matter (DM)	%	25.60
Humus	Organic Matter (OM)	% (MS)	18.75
Macroelements	$_{Assimilable}$ N	% (MS)	1.765
	$_{Assimilable}$ P_2O_5	% (MS)	0.685
	$_{Assimilable}$ K_2O	% (MS)	2.025
Secondary elements	$_{Assimilable}$ CaO	% (MS)	0.750
	$_{Assimilable}$ MgO	% (MS)	0.087
	$_{Assimilable}$ SO_3	% (MS)	0.345
Trace elements	$_{Assimilable}$ Mo	% (MS)	0.004
	$_{Assimilable}$ Fe^{+++}	% (MS)	0.255
	$_{Assimilable}$ Cu^{++}	%% (MS)	0.007
	$_{Assimilable}$ Mn^{++}	% (MS)	0.003
	$_{Assimilable}$ Zn^{++}	% (MS)	0.005
	$_{Assimilable}$ B	% (MS)	<0.002
	Cl^-	% (MS)	0.050

Analysis of this table shows that the pH of foliar BOLAME in water and in KCl is 8.0 and 7.5 respectively. Its organic matter content is high 18.75% (DM) for a humidity rate of 74.40% and a dry matter rate of 25.60%. The macronutrient content varies from 0.685% (DM) in assimilable phosphorus, 2.025% (DM) in assimilable potassium and 1.765% (DM) in assimilable nitrogen. The assimilable boron content is very low (inferior at 0.002% in DM).

3.2. Effects of BOLAME on maize crop development

The effects of BILAME on the development of the maize crop are presented in Table II.

Table II: Duration of the main phenophases observed in the day after sowing (DAS).

	Paniculation	Heading	Maturation	Cycle
R^2	0.369	0.375	0.396	0.211
F	0.703	0.720	0.788	0.320
Pr > F	0.642	0.632	0.594	0.884

Legend: R^2 = coefficient of determination; F = F. Calculated and Pr >F= F. Theoretical at 1%.

Analysis of this table shows that there is no significant difference between the types of fertilizers used for the main phenophases observed in terms of duration expressed in days. This indicates that the fertilizers used did not influence the corn cycle.

3.3 Biometric evaluation

The different results of the biometric evaluations were subjected to analysis of variance. The results obtained from these analyzes are recorded in Table III.

Table III: Summary of analyzes of variance of the parameters studied

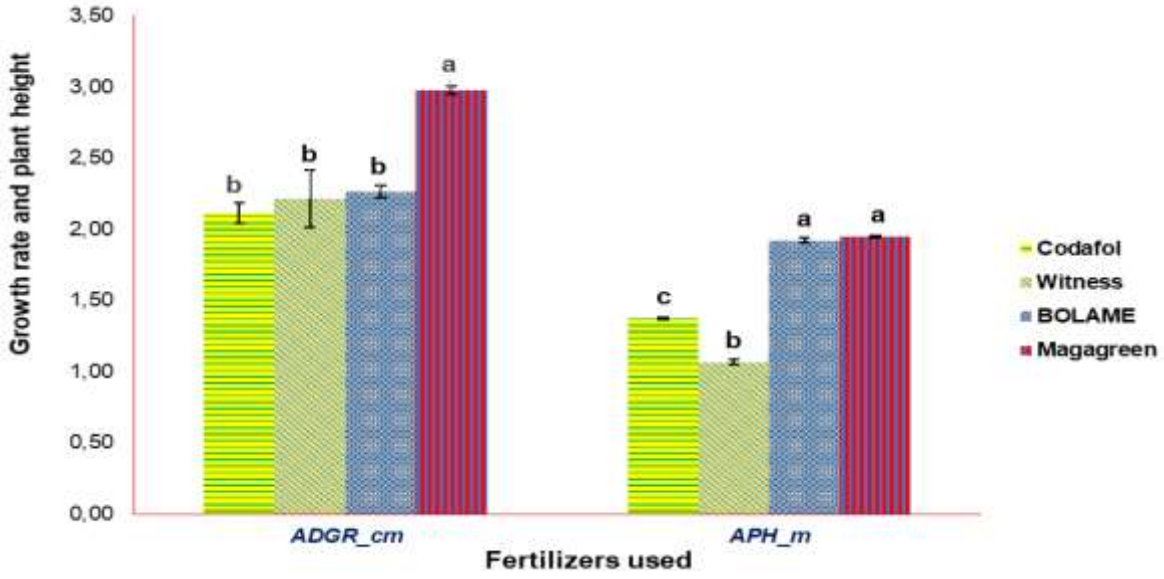
		sum of squares	dof	medium square	F	Sig.
ADGR	Intergroups	1.392	3	.464	12.625	.002
	Intragroups	.294	8	.037		
	Total	1.686	11			
APH	Intergroups	1.678	3	.559	1073.545	.000
	Intragroups	.004	8	.001		
	Total	1.682	11			
AEL	Intergroups	12.538	3	4.179	1.146	.388
	Intragroups	29.186	8	3.648		
	Total	41.724	11			
ANRE	Intergroups	1.474	3	.491	.835	.512
	Intragroups	4.708	8	.589		
	Total	6.182	11			
Yield	Intergroups	3.241	3	1.080	1117.687	.000
	Intragroups	.008	8	.001		
	Total	3.249	11			

Legend: ADGR = Average Daily Growth Rate, APH = Average Plant Height, AEL = Average Ear Length, ANRE = Average Number of Rows per Epi.

From this table, it appears that the difference is insignificant in the Average Length of the Ears and the Average Number of Rows per Ear and highly significant for the Average Daily Growth Speed, the Average Height of the Plants and the Yield. This shows that the different types of applied fertilizers have positively influenced the fertility of the soil thus allowing this differentiation. With a Coefficient of Variation (CV) ranging from 1.21 to 15.03%, i.e. a CVM equal to 6.24%, which is less than 15%, this indicates that the test is of good precision.

3.4. Effect of BOLAME on morphological parameters

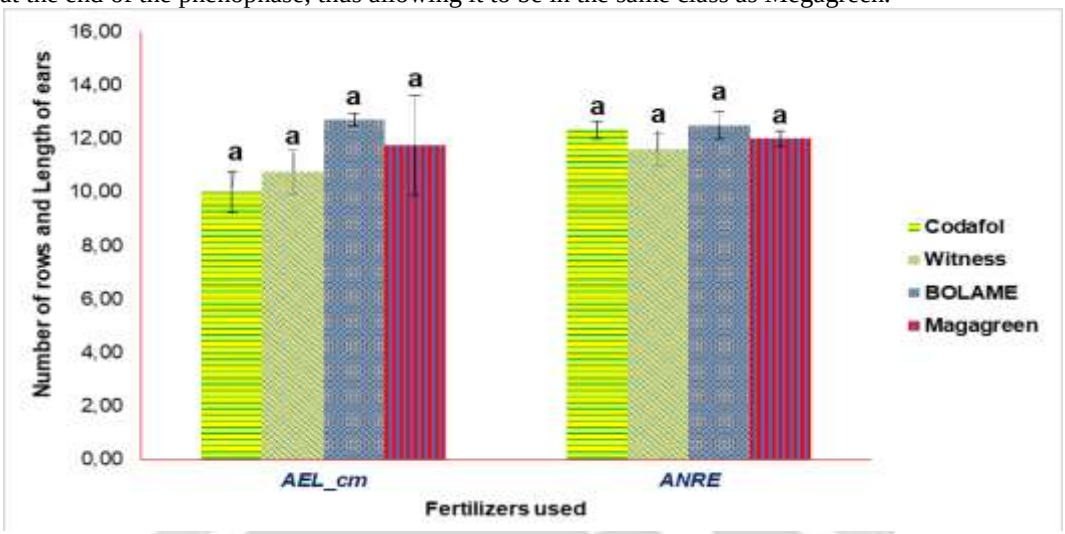
To evaluate the effect of foliar BOLAME on maize cultivation, we compared the means of the different parameters studied. The results obtained are shown in graphs 1, 2 and 3.



Graph 1: Effect of foliar BOLAME on daily growth rate and plant height.

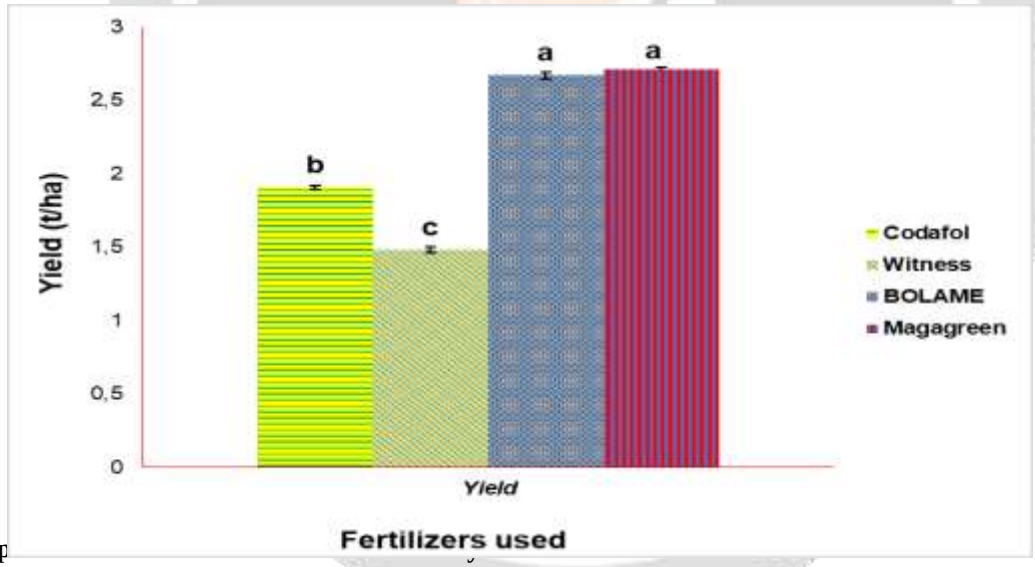
This graph shows that maize plants with the Megagreen variant had rapid growth compared to the types of fertilizers that were found to be in the same class. This difference is due to the rapid assimilation of the nutrients contained in the Megagreen. In contrast, BOLAME and Megagreen fertilizers ranked best for average plant height with values of 2.26 cm/day and 2.97 cm/day, respectively. The second class occupied by codafol and the control. This attests that

BOLAME, although it did not initially influence the development and growth of the plants, released the assimilable elements at the end of the phenophase, thus allowing it to be in the same class as Megagreen.



Graph 2: Effect of foliar BOLAME on the average length of ears in cm and the average number of rows per ear.

This graph tells us that statistically, there is no difference between the variants tested; this means that the fertilizers applied did not influence these 2 components of maize yield.



Grap

Graph 3 shows that the highest yields were obtained with foliar BOLAME and Megagreen with 2.67 t/ha and 2.71 t/ha, respectively. These two types of fertilizers occupied the same class thus demonstrating the importance of the application of BOLAME. The lowest yields were obtained by the control (1.48 t/ha) and Codafol (1.91 t/ha).

4. Talks:

This research consisted in demonstrating that BOLAME of organic origin and foliar application has a positive effect on the cultivation of maize. Thus, we came to the following discussions:

• This BOLAME has appreciable physicochemical qualities: the water pH 8.0 which is higher than that given by [6] which indicate that the pH of fertilizers is equal to 7.0.

• The organic matter content of BOLAME (18.75%) is higher than that obtained by [6] which amounts to 9.3%. This indicates that the BOLAME brings a lot of organic matter to the soil than certain types of fertilizers.

• The macronutrient contents are 1.765% (assimilable N), 0.685% (assimilable P) and 2.025% (assimilable K). These values are similar to those obtained by [6] who say that the N-P-K ratio of organic fertilizers is around 0.5% nitrogen, 3.36% phosphorus and 1.11% potassium.

These first results show that, despite the differences noted by the fertilizers tested, the foliar BOLAME provided

proved to be quite fertilizing in maize production.

The average yields obtained from foliar BOLAME proved that the dose of 23.1 liters per hectare was the best (2.66 t/ha) with Megagreen (2.71 t/ha). These yields are higher than that given by [8] who attest that the yield of maize under liquid organic fertilization reaches 2.5 t/ha. And much higher than that given by [9] which stipulates that the yield of maize produced under organic fertilization amounts to 1.398 t/ha.

5. Closing

This research work allowed us to draw the following conclusion:

- The results of the analyzes of foliar BOLAME revealed that it contains 13 elements assimilable by the plant;
- The different fertilizers tested had a positive effect on the average daily growth rate and the average height of the plants and the yield;
- The Megagreen and the BOLAME gave high yields without statistical distinction 2.66 and 2.71 t/ha and the low yield was provided by the control 1.48 t/ha.

6. RECOGNITION

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7. BIOGRAPHY

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