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Valuation of Vinasse as Organic Fertilizer on the Corn Field

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Abstract

"Vinasse" is an aqueous effluent of sugar refinery. It is largely made up of water, organic matter, and mineral salts. It represents a considerable source of potassium (average 9.37 g/L) for plants and its organic matter content and also improves the fertility of the soil. A study showed that in spite of its strong acidity (pH of 4.5 on average), the growth of sugar cane was not affected by 15 000 L / ha liquor spread in the furrows just before planting. "Vinasse" was also used as fertilizer in some societies for maize. Higher outputs were observed due to improvement of the physiochemical properties of soil on pieces of land which received "vinasse" compost of 28% of organic matter. There was an observed fall pH value of the soil after the addition of "vinasse", followed by a temporal increase caused by the microbial oxidation of the organic matter. "Vinasse" increases the concentration of basic ions of the soil. This results in the reduction of the exchangeable aluminum which is caused by rise of the pH value of the soil. The mineralization of nitrogen in the soil due to the application of "vinasse" stimulates the microbial activity and this is the reason why there is fall availability of nitrogen). Field follow-up soil physicochemical properties like the pH and electric conductivity does not show noticeable differences, (except small % K of cation exchange capacity) between the piece of land where "vinasse" had been added, and land fertilized with only artificial fertilizer.

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Key words: "Vinasse"; nutritive elements; output; sugar cane; maize; organic matter.

1. Introduction

The mixed residue of sugar refinery, not completely used for sugar, is already been used a long time ago in small quantity as raw material for the production of industrial rum or ethanol on some sugar companies in Cameroon, notably in SOSUCAM. The waste that comes out, notably "vinasses", are used in the cultivation of corn amounting to 20 Ts/ ha. For every liter of ethanol produced, 13 liters of waste ("vinasses")[1] comes from it, facing her flamed of the price of the chemical manures. The valorization of the "vinasses" in agriculture presents it as a non-negligible economic and environmental asset [2].

Table 1: Characteristics of "vinasse" of ethanol refinery from mixture of sugar cane

Parameters	**Hawaii** [7]	**Island meeting** [8]	**Brazil** [9]	**Inde** [10]	**Inde** [11]
PH	6-7.7	4.6	-	4.5	4.5
Temperature	31-38	-	70	75	-
Conductivity	-	-	-	5100	-
Biological need in CO_2 (mg/L) O_2	3000	-	-	55000	50000
Chemical need in (mg/L) O_2	7400	103000	-	92000	800000
Material in suspension (mg/L)	19000	-	-	2000	700000
Solid underneath (mg/L)	-	-	-	-	65000
Total Nitrogen (mg/L)	3	2935	284	1700	1200
Total phosphorous (mg/L)	0.17	240	99	350	1000
Total potassium (mg/L)	-	14416	1165	9000	7000
Total calcium(mg/L)	-	2277	330	75000	-
Total magnesium (mg/L)	-	1,220	125	-	-

2. The charaterestics of "vinasse"

2.1 The chemical composition

The industry of sugar refinery provides various liquid raw materials of sugar cane waste and malasses' [3].The ethanol and the rum is the main product of the refinery of these sugar raw materials. The production of one liter of ethanol generates on average between 10-15 liters of "vinasse" [4] that is characterized by high acidity, an important organic content (organic acids, amino acids, sugars, polysaccharides, proteins) and a high temperature of about 800C out of the factory. Figure1 presents a summary of the features of the "vinasses" as they have been presented by different authors. As indicated in the Table1 the physical and chemical features of "vinasses" vary

considerably; they even vary ethanol production from one day to another and from one refinery to another depending on the conditions of fermentation and distillation [5]. The input for fermentation determines this variation, because it can be the sugar cane as in Brazil and Mauritius, or beet in Europe. The sugar cane generates a "vinasse" of which the sodium content is higher than the one gotten from beet [6].

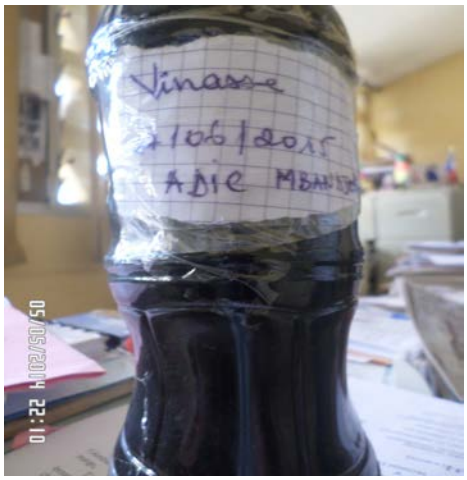

Figure 1: vinasse of ADIC refinery

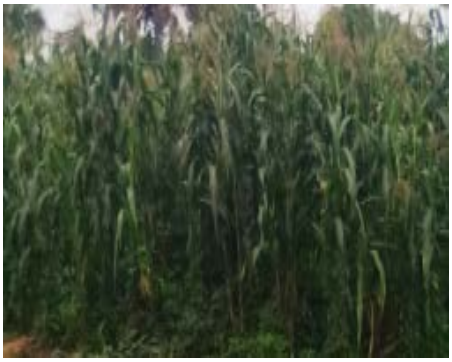

Figure 2: Field received vinasse

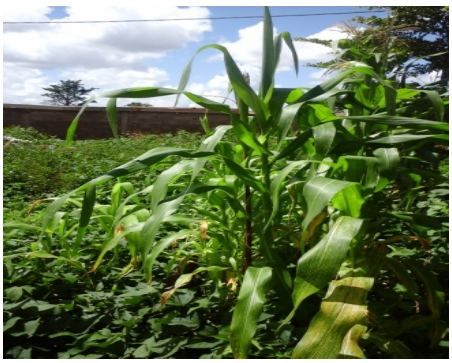

Figure 3: Field without vinasse

The “vinasse” also contains useful organic compounds for fertilization of plants and biology of soils [12,13]. For example, the microbial flora of the evaporation chamber transforms the constituent organic matter of the “vinasse” in volatile fatty acids.

3. Studies achieved particularly on the use of vinasse in the cultivation of corn

Several studies carried out on the beneficial effects of “vinasse” on the output of corn have been achieved by ADIC. Based on this one, not only observed a rise in the output of corn following the contribution of “vinasse” but also the higher outputs in starch. These rises in output have been attributed to more absorption of potassium found in “vinasse”.

Some studies showed the positive impact of “vinasse” also on the productivity of corn [14]. Therefore, following an application of the “vinasse” of about 100 m3/ha, the output increased from 27% to 65%.

4. Conclusion

To conclude, this research gave an interesting, strong and valid result which indicated that the addition of a large quantity of “vinasse” can be accepted, it is not less true that it presents environmental risks, hence it is necessary to master the technique and the corresponding quantity.

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