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Evaluation of FVH Fertilizers as a Sustainable Alternative to Mitigate Greenhouse Gases

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Abstract: The need to generate alternatives to climate change and the reduction of greenhouse gases drives us to know whether the processing of farms excreta through simple composting and bokashi method, influences the growth of hydroponic green forage, led to a detailed investigation about the elements that influence the development of green hydroponic forage. The experiment is carried out in Morelia Michoacán, at an altitude above sea level of 1,920 m, the climate that predominates is temperate with rains in summer and the temperatures that oscillate are of 12°C as minimum and 22°C as maximum. Two composting groups were used, group 1, with which simple composting was performed and only rabbit excrement was used and group 2, in which 750 g of rabbit dung, 500 g of sawdust, 500 g of lime were used and 250 g of ordinary dirt, with a group which the bokashi method was performed and which served as a control group. Each group with its respective materials was placed on the concrete surface which was isolated from the rays of the sun and rain, enough amount of water was applied to each group so that the materials were wet, each group was mixed separately twice a day for 10 days, as well as water was applied in each mix to conserve the moisture of the materials.

Key words: greenhouse gases; simple composting; bokashi method; green hydroponic forage
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1. Introduction

The excreta, have different nutrient concentrations, due to the food that's provided to these animals, as well as sometimes the manure of these is constituted by remains of the beds, such as straw, sawdust, hair (Blumetto & Torres, 2015), meaning the excreta from farms is an alternative fertilization for plants, instead of the use of chemical fertilizers, since the use of organic fertilizers improves the availability of nutrients for crops (Cruz, 2010).

Organic fertilizers such as bokashi are rich in nutrients necessary for the development of crops, which are obtained from the fermentation of dry organic materials such as manure, straw, litter, lime, dirt, among others (MAG, 2011), which are conveniently mixed, and are these the ones that suminister necessary and adequate nutrients to the ground, where they're absorbed by the roots of the crops to achieve normal development (FAO, 2011).

In the green hydroponic forage production systems, where the roots of the crops are exposed, fertilization is

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carried out with nutritive solutions based on chemical fertilizer formulas, which have the purpose to import the necessary chemical elements for the crops, especially nitrogen (Romero et al., 2009), these elements are necessary for the optimal growth of the forage, as well as they're in charge of giving the plants palatability and good digestibility (Corona, 2011).

The formulas of chemical fertilizers used routinely in the fertilization of crops; which only offer certain minerals to plants such as nitrogen, phosphorus and potassium, cause malnutrition in crops (ERP Agrícola, 2016) and these, in turn, transmit it to the animals that consume them, causing low rates of animal production and as a consequence decreasing the cost effectiveness of the producing units (Santos, 2014).

In the biochemical degradation processes of excreta, which are transformed into a biochemically inactive and odorless compound, through a bioxidative process, in which numerous organisms intervene (Álvarez, 2005), variable amounts of minerals and stabilized, rich in microbial populations organic matter are generated, being useful for plants, eliminating malnutrition in crops and favoring their nutritional level (Bertolí et al., 2015).

The transformation of rabbit excreta through composting for the crop fertilization, besides regenerating the ground, increases the humus content in it and represents a nutritional store for cultivated plants, as well as it helps the formation of organic phosphorus, prevents the formation of pathogens in the ground, and reduces the formation of greenhouse gases (Cruz, 2010).

2. Objective

The objective of this research is to evaluate the growth of hydroponic green forage through fertilization with Bokashi and simple composting as an alternative to reduce greenhouse gases that cause climate change.

3. Problem Statement

The need to counteract the climate change generated by greenhouse gases leads us to generate more environmentally friendly technologies and produce good quality forage, it has now become a challenge for intensive livestock farming, since the use of commercial fertilizers that focus on the supply of three minerals to the ground, mainly such as nitrogen, phosphorus and potassium, cause malnutrition to the plant and this, in turn, causes malnutrition in animals, besides these fertilizers representing a high cost, likewise, untreated fecal waste produced on farms represents a problem since, besides causing the accumulation of greenhouse gases, they're a problem for public health.

4. Justification

The importance of this research lies on the fact that the intensive production of hydroponic green forage is a viable alternative for the production of food of high nutritional quality for the animals, in addition to reducing costs due to fertilization based on simple composting and bokashi and non-chemical, thus increasing the cost effectiveness of the production units by reusing their organic waste and reducing their environmental impact.

5. Materials and Methods

The experiment is carried out in Morelia Michoacán, at an altitude above sea level of 1,920 m, the prevailing climate is temperate with rains in summer and the temperatures that fluctuate are 12°C as a minimum and 22°C as

a maximum (INEGI, 2009).

To achieve the objective of the present investigation, 2,750 kg of rabbit excrement, 250 g of ordinary soil, 500 g of wood sawdust, 500 g of lime, 1 kg of wheat, 2 commercial cake trays with their respective lid were used, 20.5 mm stainless steel sieves, 2 large black plastic garbage bags, a Microdin disinfectant. A concrete surface isolated from the sun's rays and rain was used, as well as a mason spoon for mixing the materials, a Torrey brand digital scale, a wooden strip measuring up to 30 cm, the water used was obtained from the same network of the unit where the experiment is carried out.

With the total of products, two groups were formed, G1 (n = 2 kg of rabbit excrement) group with which simple composting was made out and G2 (n = 750 g of rabbit excrement, 500 g of sawdust, 500 g of lime and 250 g of ordinary land) group with which the bokashi method was made and which served as a control group. Each group with their respective materials was placed on the concrete surface which was isolated from the sun's rays and rain, in the case of group 2 these materials were interspersed by layers of each material respectively, enough amount of water was applied to each group so that the materials were moistened, each group was mixed separately twice a day for 10 days, as well as water was applied in each mixing to conserve the humidity of the materials. Once 10 days of mixing of each group had been completed, each group was dispersed on the concrete surface for two days and the water suministration was suspended, to allow the drying of the composts, in the case of the forages to fertilize, two groups were weighed with 500 g of wheat each and were placed in a container with 1 liter of water each in which 6 drops of Microdin disinfectant product were applied, the wheat remained in fermentation for 48 hours, once completed a sieve was placed in each plastic tray for cake and the fermented seed was poured over the sieve, both trays were covered and placed inside the black plastic bag for 48 more hours, once these hours fulfilled the forage already born was fertilized with 20 g of compost of each group, the growth of the forages of both crops was measured for five days. With the data obtained, an Excel sheet was prepared, which was analyzed in the descriptive statistics methodology, the values to be measured were: growth of the hydroponic green forage of each group, fertilized with bokashi and simple composting.

6. Results and Discussion

It was found that the total growth in 15 days of the hydroponic green forage fertilized with simple compost was 18±4.2 cm while for the forage fertilized with the bokashi method it was 22±2.5 cm, as shown in Table 1.

Table 1 Growth and Standard Deviation for Hydroponic Green Forage Fertilized With Simple Composting and the Bokashi Method

Composting	Growth	S.D.
Simple	18 cm	4.2
Bokashi	22 cm	2.5
General	Average	
3.35	20 cm	

According to what is established by (Agriculturers, 2017; Zagal et al., 2016), which indicate that the growth of hydroponic green forage at 16 days is from 22 to 25±4.5 cm; Therefore, it was found that the hydroponic green forage fertilized with the bokashi method is within that reported by (Agriculturers, 2017; Zagal et al., 2016).

It was found that in the case of hydroponic green forage fertilized with simple composting, its growth is below the reported by Agriculturers (2017), Zagal et al. (2016), my fertilized with entries that exceeds the reported by (Vargas, 2008), which tells us that the growth of the hydroponic green forage at day 10 is 25 cm.

7. Conclusions

It's possible to reduce the emission of greenhouse gases and climate change with the adaptation of environmentally friendly technologies such as FVH with organic fertilizers that at the same time reduce pollution.

The use of rabbit excreta for composting is a favorable alternative, as it provides a large amount of nutrients for the preparation of this process.

Fertilizing hydroponic green forage with bokashi-type composting represents a viable alternative for forage production, since it achieves the established growth rates of hydroponic forage.

The use of organic fertilizers for the fertilization of crops represents a promising alternative, besides guaranteeing the nutrition of the soil and crops, it constitutes a low cost for the producer.

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