INITIAL CORN GROWTH IN POTS FERTILIZED WITH ORGANOMINERAL FERTILIZERS MADE FROM DEHYDRATED POULTRY MANURE

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Abstract
Brazil is the second-largest producer of chicken meat globally, generating substantial amounts of manure with potential environmental impacts if inadequately managed. Dehydrated chicken manure can be a technique used to reduce volume, lower emissions, and increases shelf life however, its fertilization efficiency can be lower than that of mineral fertilizers. This study aimed to develop organomineral fertilizers combining dehydrated manure with mineral nutrients and to evaluate their effectiveness in supplying potassium (K) relative to KCl and K_2SO_4. Five NPK formulations were applied to nutrient-poor sandy soil in a greenhouse experiment using corn as an indicator crop. The aboveground biomass was harvested, dried, and weighed to assess dry matter production and agronomic efficiency. All fertilized treatments enhanced growth compared to the control. T1 achieved the highest dry matter (6.48 g·pot ^{1}) and agronomic efficiency (49.40%), followed by T5 (5.89 g·pot ^{1}, 43.48%), whereas T3 exhibited the lowest efficiency (10.78%). The results indicate that the organomineral formulations can viable alternatives in supplying K to corn.

Keywords: potassium, corn, agriculture

INTRODUCTION

Brazil is the second-largest producer of chicken meat in the world, with 15.10 million tons, trailing behind only by the United States, which produced 21.395 million tons (USDA, 2024). However, higher production levels also generate larger amounts of manure, which can negatively impact the environment when its production rate exceeds its degradation rate (Freire, 2020).

According to Oliveira (2022), chicken manure is "the excrement of caged laying hens that accumulates on belts or in pits during the laying period, depending on the technological level of the farm; in other words, it is the pure excrement." Immediately after deposition, the manure begins to decompose, releasing ammonia an high concentrations of ammonia can compromise the bird´s health and productivity, as well as the health of the farm workers (Ghaly & Alhattab, 2013; Ishizuka & Bottura, 2023).

Proper residue management is essential and can add value to the product if appropriately certified (Freire, 2020). Dehydration of the manure reduces its initial volume, lowers pathogens and ammonia emissions, and increases shelf life (Li et al., 2020; Oliveira, 2022). However, Oliveira (2022) reported that dehydrated manure alone did not achieve satisfactory fertilization compared to conventional fertilizers.

Therefore, this study aims to contribute to the development of organomineral fertilizers that can enhance

dehydrated manure, improving its quality for agricultural use, and comparing the efficiency of these organominerals in providing potassium (K) whem compared to KCl and K_2SO_4 fertilizers.

MATERIALS AND METHODS

Organomineral fertilizers were produced at the Fertilizer Technologies Laboratory of Embrapa Solos. Dehydrated manure was grounded and sieved before adding mineral fertilizers. Five organominerals were prepared with the following NPK formulations: 04-14-08 (T1), 10-10-10 (T2), 15-00-10 (T3), 06-24-12 (T4), and 02-08-08 (T5), the latter adapted for organic production systems. The mixtures were granulated using a rotary disc granulator in a batch process with constant rotation and inclination, followed by drying and sieving. The treatments and the according K_2O percentage are listed in Table 1.

Table 1. Fertilizers used in the experiment, composition of the organomineral fertilizers and K_2O percentage of each treatment.

Treatments		K_2O Percentage
Name	Fertilizer	(%)
Control	-	-
T1	04-14-08	8,9
T2	10-10-10	10,0
T3	15-00-10	10,8
T4	06-24-12	12,1
T5	02-08-08	7,6
KCl	-	60,0
K_2SO_4	-	50,0

An experiment in pots was conducted in a greenhouse at Embrapa Agrobiologia, Seropédica, Rio de Janeiro. Plastic pots containing 1 kg of nutrient-poor sandy soil were fertilized with the organominerals, KCl, or K_2SO_4. The experimental design was a randomized complete block with four replicates per treatment, using a potassium dose of 200 mg·kg ^{1} and a control treatment without fertilization.

Corn was used as the indicator crop, with two plants per pot over a 28-day incubation period. Aboveground plant material was harvested and dried in a forced-air oven at 65 ºC for 72 hours. Dry matter production was then measured, and the agronomic efficiency of each treatment was determined.

RESULTS AND DISCUSSION

All fertilized pots showed greater plant growth compared to the control. Dry matter production for each treatment is presented in Table 2.

Table 2. Average dry matter of aerial parts.

	Dry Matter ($g.pot^{-1}$)
Control	1,54 **b**
T1	6,48 **a**
T2	4,45 **ab**
T3	2,62 **ab**
T4	5,00 **ab**
T5	5,89 **a**
KCl	5,66 **a**
K_2SO_4	4,37 **ab**
CV (%)	36,8

Numbers followed by the same letter in the column indicate that the weights do not differ significantly by Tukey 5%.

Treatment T1 resulted in the highest dry matter production per pot (6.48 g), statistically similar to T5 (5.89 g) and KCl (5.66 g). Treatment T3 produced the lowest dry matter mass (2.62 g), although not statistically different from the other treatments. T1 and T5 had more balanced proportions of N, P, and K, which may have helped in greater root growth and nutrient uptake in the soil, while the KCl result highlights it's immediate potassium release.

Regarding the agronomic efficiency (AE), T1 (49.40%) and T5 (43.48%) outperformed KCl, whereas T3 had the lowest efficiency (10.78%), as shown in Table 3. These results suggest that T1 and T5 provided more appropriate nutrient release throughout the crop cycle, reducing losses from leaching or soil fixation and promoting greater potassium uptake compared to the control.

Table 3. Agronomic efficiency of each treatment.

	Agronomic Efficiency (%)
T1	49,40
T2	29,05
T3	10,78
T4	34,60
T6	43,48
KCl	41,15
K_2SO_4	28,30

FINAL CONSIDERATIONS

The results show that the organomineral fertilizers produced from dehydrated manure performed similarly to the most commom mineral treatments used, some even exceeding them in efficiency, making them viable alternatives for not only recycling poultry residues and enhancing them, but also in supplying potassium to corn.

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