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Morphological characteristics of the baby's breath (Gypsophila Paniculata L.) submitted to different organic compounds

The baby's breath (Gypsophila paniculata L.) is a plant used to compose floral arrangements. The objective of this work was to evaluate the efficiency of the use of Humoativo and Bovine Manure in the morphological characterization of the baby's breath. The experiment was carried out in the vegetation house at the Federal Institute of Education, Science and Technology of Bahia - IFBA - Campus of Vitória da Conquista, Bahia. Different proportions of Bovine Manure - BM and Humoativo - HA were used, constituting the following treatments: T1: 0% BM and 0% HA; T2: 25% BM and 75% HA; T3: 50% BM and 50% BM; T4: 75% BM and 25% HA; T5: 100% BM and 0% HA; T6: 0% BM and 100% HA. The design was completely randomized (DCR), with four replications, totaling 24 experimental units. After transplanting, Plant Height, Number of Flower Stems, Height of Flower Stem, Number of Primary Branches of the Flower Stem, and Flower Diameter were evaluated. The fresh and dry weight of the plant was also checked. Data were subjected to analysis of variance (ANOVA) followed by the mean test (Tukey 5%) using the statistical program SAEG - Statistical Analysis System (GOMES, 1992). The use of BM and HA favored the accumulation of fresh weight of the flower, stem, root, and total fresh weight. The same occurs for dry weight. All analyzed variables increased with the doses of EB and HA.

Keywords: Mosquito; Bovine manure; humoactive.

Características morfológicas do mosquitinho (Gypsophila Paniculata L.) submetido a diferentes compostos orgânicos

O mosquitinho (Gypsophila paniculata L.), é uma planta utilizada para compor arranjos florais. O objetivo deste trabalho foi avaliar a eficiência da utilização do Humoativo e do Esterco Bovino na caracterização morfológica do mosquitinho. O experimento foi realizado na Casa de Vegetação no Instituto Federal de Educação Ciência e Tecnologia da Bahia – IFBA - Campus de Vitória da Conquista, Bahia. Utilizou-se diferentes proporções de Esterco Bovino - EB e Humoativo - HA, constituindo os seguintes tratamentos: T1: 0% de EB e 0% de HA; T2: 25% de EB e 75% de HA; T3: 50 % de EB e 50 % de HA; T4: 75% de EB e 25% de HA; T5: 100% de EB e 0 % de HA; T6: 0 % de EB e 100 % de HA. O delineamento foi inteiramente ao acaso (DIC), com quatro repetições, totalizando 24 unidades experimentais. A partir do transplante, foram avaliadas Altura da Planta, Número de Hastes Florais, Altura da Haste Floral, Número de Ramificações primárias da haste floral, e Diâmetro da flor. Também foi verificado o peso fresco e seco da planta. Os dados foram submetidos à análise de variância (ANOVA) seguida do teste de média (Tukey a 5%) utilizando-se o programa estatístico SAEG - Statistical Analysis System (GOMES, 1992). O uso do EB e do HA favoreceram o acúmulo do peso fresco da flor, do caule, da raiz e peso fresco total. Ocorrendo o mesmo para peso seco. Todas as variáveis analisadas aumentaram com as doses do EB e HA.

Palavras-chave: Mosquitinho; Esterco bovino; Humoativo.

Topic: **Ciências do Solo**

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Sara Moreno Pereira Lacerda
Universidade Estadual do Sudoeste da Bahia, Brasil
http://lattes.cnpq.br/4575166715919352
http://orcid.org/0000-0002-1610-8732
saramp16@gmail.com

Joseane Oliveira da Silva
Instituto Federal da Bahia, Brasil
http://lattes.cnpq.br/2924129863852832
http://orcid.org/0000-0002-5927-4095
joseaneoliveiras@yahoo.com.br

Jacson Tavares de Oliveira
Instituto Federal da Bahia, Brasil
http://lattes.cnpq.br/4043358054791232
http://orcid.org/0000-0002-7073-5593
jacson123@gmail.com

Thamires Oliveira da Silva
Universidade Federal do Sul da Bahia, Brasil
http://lattes.cnpq.br/5986851617646015
http://orcid.org/0000-0002-4213-5793
thamiires.makarena@gmail.com

Felizardo Adenilson Rocha
Instituto Federal da Bahia, Brasil
http://lattes.cnpq.br/1581393124834413
http://orcid.org/0000-0001-6410-5176
felizardoar@hotmail.com

Lucas Farias de Sousa
Instituto Federal da Bahia, Brasil
http://lattes.cnpq.br/6855382097221938
http://orcid.org/0000-0002-4850-6591
eng.sousalucas@gmail.com

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INTRODUCTION

The business of flowers and ornamental plants has grown in the country. The climatic conditions in Brazil are one of the aspects that contribute to this expansion, as it favors the cultivation of flowers in temperate and tropical climates. Besides, the expansion of this sector is also due to the adoption of specific policies, generating employment and income for the country (SEBRAE, 2017).

Floriculture has been consolidating itself as a relevant economic activity, but the main aspect of this segment is its social side. The agribusiness of flowers and ornamental plants is an activity dominated by small rural producers, which contributes to better income distribution (SEBRAE, 2017)

The world market for flowers and ornamental plants moves billions of dollars a year in its production chain, which makes it a business with a significant financial return when compared to other crops, in addition to its importance in generating employment, occupying areas that are unsuitable for agriculture and valorization of family labor (BUAINAIN et al., 2007).

Among the cultivated cut flowers, gypsophila, a botanical genus of the Caryophyllaceae family known as baby's breath, has shown accelerated growth in the Brazilian market (PETRY et al., 2003). The baby's breath has a delicacy in its flowers, and has a varied application, being used as a vase flower and, mainly, in all types of floral arrangements and can also be sold as a dry flower (MATSUNAGA et al., 1995). It is widely accepted by producers, due to the simplicity of cultivation and the facility of grown in the field or greenhouses (GIRARDI, 2012).

To obtain high levels of productivity in their cultivation, producers' resort to chemical fertilizers. Although statistics on the use of chemical products in floriculture are scarce, the great use of chemicals during the stages of fertilization, transplanting, spraying, cutting, and packing of flowers is known (RODRIGUES et al., 2010).

To reduce the use of chemical fertilizers in crops, an alternative is the reuse of organic waste, such as organic fertilizer, and whenever possible, local resources should be used, as well as organic by-products. In the economic aspect, organic fertilization favors the economy due to the reduction in the use of chemical inputs and reduction of income losses caused by the harmful effects of chemical products, in addition to the reduction in the use of pesticides in the environment, improving the physicochemical and biological characteristics of the soil (SEDIYAMA et al., 2014).

The reuse of waste is viable because many of these are rich in nutrients and can come from different sources. Humoativo (solid waste from the wastewater treatment plant of the cellulose industries) and bovine manure are examples of waste that can become raw material as a substrate for plants and a soil conditioner.

The sludge from the pulp and paper industries effluents has a great potential to be used as an agricultural input due to its chemical, physical, and biological characteristics. Also, it is constituted as a corrective and source of nutrients for plants and work like a soil conditioner with low-cost values for the producer. This residue, after going through the drying process and sieved in covered beds is called Humoativo, a substrate with a concentration of nutrients, which can be used as organic fertilizer (FONSECA

et al., 2015).

Organic fertilization with the residue of animal origin is considered a viable option as it increases fertility levels, reduces costs, increases productivity, improves the physicochemical properties of the soil, reduces pollution, and increases the efficiency of use and quality in production systems (PEIXOTO FILHO et al., 2013).

According to Silva et al. (2011), organic fertilization favors an increase in productivity, as well as producing plants with better qualitative characteristics than those grown exclusively with mineral fertilizers. Given the above, the present work aims to study the effects of applying Humoativo and Bovine Manure in the culture of the baby's breath for morphological evaluation of the culture.

MATERIALS AND METHODS

The experiment was carried out in a Vegetation House located at the Federal Institute of Education, Science, and Technology of Bahia - IFBA - Campus of Vitória da Conquista, Bahia. The soil used was the Yellow Red Latosol, collected at a depth of 0 to 20 cm. After collection, the soil was air-dried, unroasted, sieved, which each pot received 3 kg of soil. A soil analysis was applied for chemical characterization, according to the methodology adopted by Embrapa (1997) as shown in Table 1.

Table 1: Result of Chemical analysis of soil used in experiment before implantation.

Depth 0-20 cm	**pH H_2O**	**P**	**Mg**	**K**	**Ca**	**Al**	**H**	**SB**	**T**	**T**	**V**	**M**	**OM**
mg/dm^3	----------	----------	$cmol_c/dm^3$	----------	----------	---%---	mg/dm^3						
LVA	5.1	3	0.8	0.38	1	0.4	2.7	2.2	2.6	5.3	41	15	20

Source: UESB - Laboratório de solos.

After chemical characterization of the soil, it was observed that the soil characteristic was acid, so the acidity correction was performed using 1.8513 grams of dolomitic limestone. After the application of lime, the soil remained moist and incubated for 30 days, the time needed for the limestone reaction to occur and subsequent neutralization of hydrogen.

According to Lourenço et al. (1996), the recommendation for agricultural use of 50 Mg ha-1 of sewage sludge on a wet basis for the corn crop, for the study different proportions of Bovine Manure and Humoativo were used, constituting the following treatments: T1: 0% Bovine Manure and 0% Humoativo; T2: 25% of Bovine Manure and 75% of Humoativo; T3: 50% of Bovine Manure and 50% of Humoativo; T4: 75% of Bovine Manure and 25% of Humoativo; T5: 100% Bovine Manure and 0% Humoativo; T6: 0% Bovine Manure and 100% Humoativo. The Bovine manure was from agricultural houses and Humoativo from an organic compound from the Veracel S.A.

Table 2: Result of chemical analysis of organic compounds**.**

Depth 0-20cm	**pH**	**Ca**	**Mg**	**K_2O Total**	**P_2O_5 Total**	**C**	**N**	**UMID**	**M.O.**	**Fe**	**Zn**	**Cu**	**Mn**
----------	%----------	----------	----------	----------	----------	mg/kg----------							
Humoativo	6.4	2.70	0.23	0.18	0.144	27.4	1.85	10.75	50.68	12735	159	25	145
Bovine Manure	8.5	1.10	0.32	1.60	0.43	27.1	1.05	7.38	50.10	1200	156	21	330

Source: CEPLAC - Laboratório de solos.

Seeds of *Gypsophila paniculata L*., popularly known as baby's breath, were used and planted in polystyrene trays containing plant substrate. After 30 days of germination, the baby's breath seedlings were transplanted to the pots, containing the appropriate treatments. The seedlings were chosen according to the homogeneity of heights, leaving two plants per pot.

The experimental design was completely randomized (DCR) with six treatments (different proportions of organic compounds) and four replications, totaling 24 experimental units. In the evaluation of morphological parameters as a function of time, there was a factorial with six treatments (Humoactive and Bovine manure in different proportions), thirteen times of non-destructive sampling (0, 7, 14, 21, 28, 35, 42, 49, 56, 63, 70, 77, 84 days after transplantation).

The morphological parameters that were evaluated are considered indicative of productivity in the production and commercialization of cut flowers. From the transplant, the following morphological characteristics of the plants were evaluated: plant height, number of flower stalks, flower stalk height: expressed in cm and measured from the plant collar, at the cut point, number of primary branches of the plant. floral stem: branches with more than 10 cm in length, originating directly from the main axis of the stem, were counted. It is indicative of productivity, as it refers to panicle size, flower diameter, resulting from the average of three flowers on each stem, it was measured with a caliper, in cm, by sampling fully open flowers.

The fresh and dry weight of the plant was also determined. After 84 days of transplanting, the plants were harvested, separated into flowers, stems and roots, as well as, fresh weight was determined using a weighing scale. Then, the plant material was taken to the forced air circulation oven at 65 °C until constant weight, to determine the dry weight.

Figure 1: Plant harvest day.

Data were subjected to analysis of variance (ANOVA) followed by the mean test (Tukey 5%) using the statistical program SAEG - Statistical Analysis System (GOMES, 1992).

RESULTS AND DISCUSSION

According to the analysis of variance (ANOVA), the treatments adopted were highly significant for fresh and dry weights of the flower, stem, and total plant (Tables 03 and 04). For the fresh and dry weight of the root, there was no significant effect between treatments, which means that the treatments applied did

not differ from each other.

The coefficient of variation – CV for fresh and dry weight of the flower obtained a value higher than the totally fresh and dry weight. It is because baby's breath needs lots of light and dry environment, as well as different organic compounds in different proportions to bloom.

Table 3: Summary of analysis of variance (ANOVA) for Flower Fresh Weight (g) – FFW, Stem Fresh Weight (g) – SFW, Root Fresh Weight (g) – RFW, and Total Fresh Weight (g) – TFW, submitted to different doses of Bovine Manure and Humoativo.

Mean Square – MS

FV	GL	FFW	SFW	RFW	TWF
TRAT	5	445.5507**	730.5169**	23.61194^{ns}	1549.824**
RESIDUE	18	74.27989	111.1108	10.62498	89.34389
CV (%)		47.110	33.919	27.508	15.439

ns: No significant at the 5% probability level; ** and * significant at the level of 1 and 5% probability by the F test.

Table 4: Summary of analysis of variance (ANOVA) for Dry Flower Weight – DFW (g), Dry Stem Weight (g) – DSW, Dry Root Weight (g) – DRW, and Total Dry Weight (g) –TDW, submitted to different doses of Bovine Manure and Humoativo.

Mean Square – MS

FV	GL	DFW	DSW	DRW	TDW
TRAT	5	49.86233*	54.66914**	1.3769474^{ns}	151.1692**
RESIDUE	18	15.7646	10.81616	0.7395666	28.20462
CV (%)		56.839	38.079	39.509	29.838

ns: No significant at the 5% probability level; ** and * significant at the level of 1 and 5% probability by the F test.

Sodré et al. (2012), working with melissa (*Melissa officinalis*) also obtained similar results for the fresh and dry mass of the plant, finding a significant variation depending on the doses of organic fertilizer. According to Table 5, it is observed that the different proportions of organic compounds did not differ from each other for the fresh weight of flower, stem, and root. However, for total fresh weight, the different proportions of Humoativo and bovine manure differed statistically from the control treatment, except when 50% of each organic compound was added.

Table 5: Comparisons by the Tukey Test mean values for Flower Fresh Weight - FFW (g), Stem Fresh Weight (g) - SFW, Root Fresh Weight (g) - RFW, and Total Fresh Weight (g) - TFW, submitted to different doses of Bovine Manure (BM) and Humoativo (HA).

TREATMENTS	FFW	SFW	RFW	TFW
T1: 0% BM and 0% H.A	6.67 a	10.93 a	8.98 a	26.58 b
T2: 25% BM and 75% H.A	12.80 a	49.67 a	11.69 a	74.17 a
T3: 50% BM and 50% H.A	29.92 a	20.94 a	14.46 a	65.51 ab
T4: 75% BM and 25% H.A	28.58 a	37.73 a	11.46 a	77.77 a
T5: 100% BM and 0% H.A	7.55 a	32.73 a	9.60 a	49.89 a
T6: 0% BM and 100% H.A	24.25 a	34.47 a	14.71 a	73.43 a

Column means followed by the same letter does not differ from each other at the 5% probability level by the Tukey test.

When adding 25% bovine manure and 75% Humoativo there was an increase in TWF of 179% compared to the control treatment, similarly, when adding 75% bovine manure and 25% Humoativo there was an increase of 193% when compared to the initial dose, which was repeated for the dose 0% bovine manure and 100% Humoativo, obtaining an increase of 195% in relation to the control.

Peixoto Filho et al. (2013) verified by working with avian manure in the arugula planting, that the fresh matter presented an increase superior to the other manures used, compared by the Tukey test at 5% probability. The plant dry weight (Table 06) shows that the different doses of organic fertilizer did not differ statistically for the analyzed characteristics, which means that there were no significant differences by the

Tukey test at 5% significance in relation to dry weight.

Table 6: Comparisons by the Tukey Test mean values for Flower Fresh Weight - FFW (g), Stem Fresh Weight (g) - SFW, Root Fresh Weight (g) - RFW, and Total Fresh Weight (g) - TFW, submitted to different doses of Bovine Manure and Humoativo.

TREATMENTS	FFW	SFW	RFW	TFW
T1: 0% BM and 0% H.A	3.96 a	2.87 a	2.20 a	9.03 a
T2: 25% BM and 75% H.A	5.83 a	13.33 a	2.08 a	21.23 a
T3: 50% BM and 50% H.A	9.03 a	6.41 a	2.82 a	18.26 a
T4: 75% BM and 25% H.A	11.14 a	11.01 a	1.80 a	23.95 a
T5: 100% BM and 0% H.A	2.22 a	8.07 a	1.33 a	11.62 a
T6: 0% BM and 100% H.A	9.75 a	10.14 a	2.83 a	22.71 a

Column means followed by the same letter do not differ from each other at the 5% probability level by the Tukey test.

Caldeira et al. (2012), working with different proportions of biosolids in the production of timbó seedlings (*Ateleia glazioveana Baill*), found that the relation between the dry mass of the aerial part and the root did not present significant results.

When analyzing Table 07, it is observed that for plant height, flower stalk height, number of flower stalks, diameter, and number of primary branches larger than 10 cm, both exposure to different organic compounds and different sampling times presented significance at the 1% probability level by the F test.

Table 7: Analysis of variance (ANOVA) summary for Plant Height - PH (cm), Floral Stem Height (cm) - FSH, Number of Flower Stems (cm) - NFS, Flower Diameter (cm) - FD, and Number of Primary Branches – NPB, (ns: No significancy at the 5% probability level; ** and * significant at the 1 and 5% probability level by the F test).

Mean Square - MS

Change Source	GL	PH	FSH	NFS	FD	NPB
Total	311					
Total reduction	77	1303.819**	1957.161**	20.49334**	1.333190**	7.08919**
Treatment (T)	5	1173.662**	2214.162**	53.06667**	2.497508**	17.02628**
Era (E)	12	7192.122**	9980.200**	70.65171**	5.555719**	26.04754**
T x E	60	137.0051**	331.1364**	7.747222**	0.392195**	2.469338**
RESIDUE	234	69.11813	145.3377	2.305556	0.1999759	0.9305555
CV (%)		32.787	79.385	107.67	104.24	111.06

Santos et al. (2013), working with doses of cattle manure in sunflower cultivation, evaluated plant height, plant collar diameter, head diameter, head mass, and sunflower grain yield. The bovine manure showed significant effects by the F test ($P<0.01$).

The height of the plant was positively correlated with the height of the flower stem (0.93**), in other words, the greater development of the flower stem favored a greater height of the plant. As well, the diameter of the flower showed a positive correlation with the number of branches primary (0.92**) presenting a higher number of primary branches and flower development.

The comparative analysis of the means through the Tukey test shows that the Plant Height (PH) variables, in all evaluated periods, increased with the doses of Bovine Manure and Humoativo, however, the treatments did not differ in relation to Plant Height (Table 8, 9, 10).

Table 8: Comparisons by Tukey Test mean values for Plant Height - PH (cm), Floral Stem Height (cm) - FSH, Number of Flower Stems (cm) - NFS, Flower Diameter (cm) - FD, submitted to different doses of Bovine Manure and Humoativo, (Equal letters in the column do not differ from each other, at the level of 5% probability by Tukey test).

	Sampling	Time 0		
TREATMENTS	**PH**	**FSH**	**NFS**	**FD**
T1: 0% BM and 0% H.A	7.20 a	0.00	0.00	0.00

T2: 25% BM and 75% H.A	9.62 a	0.00	0.00	0.00
T3: 50% BM and 50% H.A	10.60 a	0.00	0.00	0.00
T4: 75% BM and 25% H.A	9.05 a	0.00	0.00	0.00
T5: 100% BM and 0% H.A	10.37 a	0.00	0.00	0.00
T6: 0% BM and 100% H.A	8.22 a	0.00	0.00	0.00
	Sampling	**Time 7**		
TREATMENTS	**PH**	**FSH**	**NFS**	**FD**
T1: 0% BM and 0% H.A	7.38 a	0.00	0.00	0.00
T2: 25% BM and 75% H.A	9.45 a	0.00	0.00	0.00
T3: 50% BM and 50% H.A	11.28 a	0.00	0.00	0.00
T4: 75% BM and 25% H.A	10.20 a	0.00	0.00	0.00
T5: 100% BM and 0% H.A	10.50 a	0.00	0.00	0.00
T6: 0% BM and 100% H.A	8.45 a	0.00	0.00	0.00

Table 9: Comparisons by Tukey Test mean values for Plant Height - PH (cm), Floral Stem Height (cm) - FSH, Number of Flower Stems (cm) - NFS, Flower Diameter (cm) - FD, submitted to different doses of Bovine Manure and Humoativo, (Equal letters in the column do not differ from each other, at the level of 5% probability by Tukey test).

	Sampling	**Time 14**		
TREATMENTS	**PH**	**FSH**	**NFS**	**FD**
T1: 0% BM and 0% H.A	7.85 a	0.00	0.00	0.00
T2: 25% BM and 75% H.A	10.88 a	0.00	0.00	0.00
T3: 50% BM and 50% H.A	12.23 a	0.00	0.00	0.00
T4: 75% BM and 25% H.A	10.35 a	0.00	0.00	0.00
T5: 100% BM and 0% H.A	10.88 a	0.00	0.00	0.00
T6: 0% BM and 100% H.A	8.95 a	0.00	0.00	0.00
	Sampling	**Time 21**		
TREATMENTS	**PH**	**FSH**	**NFS**	**FD**
T1: 0% BM and 0% H.A	10.73 a	0.00	0.00	0.00
T2: 25% BM and 75% H.A	11.90 a	0.00	0.00	0.00
T3: 50% BM and 50% H.A	14.13 a	0.00	0.00	0.00
T4: 75% BM and 25% H.A	12.40 a	0.00	0.00	0.00
T5: 100% BM and 0% H.A	11.68 a	0.00	0.00	0.00
T6: 0% BM and 100% H.A	9.90 a	0.00	0.00	0.00

Table 10: Comparisons by Tukey Test mean values for Plant Height - PH (cm), Floral Stem Height (cm) - FSH, Number of Flower Stems (cm) - NFS, Flower Diameter (cm) - FD, and Number of Primary Branches – NPB submitted to different doses of Bovine Manure and Humoativo, (Equal letters in the column do not differ from each other, at the level of 5% probability by Tukey test).

		Sampling	**Time 28**		
TREATMENTS	PH	FSH	NFS	FD	NPB
T1: 0% BM and 0% H.A	12.50 a	0.00 a	0.00 a	0.00 a	0.00 a
T2: 25% BM and 75% H.A	14.13 a	4.75 a	0.25 a	0.44 a	0.25 a
T3: 50% BM and 50% H.A	16.50 a	7.00 a	0.25 a	0.50 a	0.25 a
T4: 75% BM and 25% H.A	14.13 a	0.00 a	0.00 a	0.00 a	0.00 a
T5: 100% BM and 0% H.A	12.48 a	0.00 a	0.00 a	0.00 a	0.00 a
T6: 0% BM and 100% H.A	10.95 a	0.00 a	0.00 a	0.00 a	0.00 a
		Sampling	**Time 35**		
TREATMENTS	PH	FSH	NFS	FD	NPB
T1: 0% BM and 0% H.A	12.60 a	0.00 a	0.00 a	0.00 a	0.00 a
T2: 25% BM and 75% H.A	15.38 a	5.00 a	1.50 a	0.37 a	0.75 a
T3: 50% BM and 50% H.A	18.00 a	7.00 a	1.75 a	0.43 a	1.00 a
T4: 75% BM and 25% H.A	15.05 a	0.00 a	0.00 a	0.00 a	0.00 a
T5: 100% BM and 0% H.A	13.93 a	0.00 a	0.00 a	0.00 a	0.00 a
T6: 0% BM and 100% H.A	13.05 a	0.00 a	0.00 a	0.00 a	0.00 a
		Sampling	**Time 42**		
TREATMENTS	PH	FSH	NFS	FD	NPB
T1: 0% BM and 0% H.A	12.95 a	0.00 a	0.00 a	0.00 a	0.00 a
T2: 25% BM and 75% H.A	15.68 a	5.13 a	1.50 a	0.38 a	0.75 a
T3: 50% BM and 50% H.A	24.88 a	17.00 a	1.75 a	0.88 a	2.00 a
T4: 75% BM and 25% H.A	22.93 a	0.00 a	0.00 a	0.00 a	0.00 a
T5: 100% BM and 0% H.A	15.15 a	0.00 a	0.00 a	0.00 a	0.00 a
T6: 0% BM and 100% H.A	15.38 a	0.00 a	0.00 a	0.00 a	0.00 a
		Sampling	**Time 49**		
TREATMENTS	PH	FSH	NFS	FD	NPB
T1: 0% BM and 0% H.A	13.53 a	0.00 a	0.00 a	0.00 a	0.00 a

T2: 25% BM and 75% H.A	14.18 a	0.00 a	0.00 a	0.00 a	0.00 a
T3: 50% BM and 50% H.A	31.08 a	23.08 a	2.25 a	1.30 a	1.75 a
T4: 75% BM and 25% H.A	36.08 a	25.75 a	1.00 a	0.38 a	0.50 a
T5: 100% BM and 0% H.A	16.60 a	0.00 a	0.00 a	0.00 a	0.00 a
T6: 0% BM and 100% H.A	25.33 a	9.00 a	0.50 a	0.45 a	0.50 a

Flower Stem Height (FSH), Number of Flower Stems (NFS), Flower Diameter (FD) at all times evaluated were practically zero, as the plants were still in the development stage. The evaluations began after 28 days for the variables FSH, NFS, and FD, before that there was no emission of flower stalks. Even so, for no sampling time, the height of the flower stem was statistically different, demonstrating that regardless of the age of the plant, the height of the stem does not influence so much when compared to the number of the flower stem, flower diameter and the number of primary branches.

From the 56th time, as observed in Table 11, the plants already showed high growth, and flower stalks began to appear, making it possible to measure the diameter of the flowers and the number of primary branches when subjected to two treatments (T3 and T4). In addition, they did not differ statistically for the number of flower stalks, nor the height of flower stalks. Analyzing time 56 yet, it is possible to verify that when 100% Humoativo was applied, the NFS was lower (2.50) when compared to the proportion 50% BM and 50% H.A (6.75), with an increase of 170%.

The diameter of the flowers was greater than those found by Wachowicz et al. (2006) who, evaluating the morphology of *Gypsophila paniculata L*. cultivated with alkalinized sewage sludge and phosphate fertilization, obtained floral diameter values of 0.7 and 0.9 cm at the time of the harvest.

For season 70, there was a statistical difference for the number of flower stalks in the doses in the doses 50% of bovine manure and 50% of Humoativo and 75% of bovine manure, and 25% of Humoativo. And for the number of primary branches, there was a statistical difference in the dose 75% of bovine manure and 25% of Humoativo. For season 77, there was a statistical difference in the doses 75% of bovine manure and 25% of Humoativo. The other times there was no difference between them, at the level of 5% probability by Tukey test.

The number of floral ramifications was between the applied treatments, statistically equal in practically all sampling times, except for times 70 and 77 days after transplant - DAT. During this period, the treatments with no HA, the number of branches was smaller. Comparing treatments T4 and T5 with 77 DAT, it was observed that when 25% of HA was added, there was an increase of 657% in the number of floral ramifications, a parameter that is related to commercialization and is also considered indicative of quality for the studied species.

For all times, the plant height did not show a statistical difference when the baby's breath was subjected to different proportions of organic compounds. In the last sampling (84 days after transplanting - DAT) - the treatment without addition of the compounds - the height of plant showed a greater increase, while from the 56 DAT season the baby's breath when subjected to treatment 100% BM and 0% H.A presented lower height. In other words, the presence of the Humoativo, even in small proportions, positively influenced the morphology of culture.

Table 11: Comparisons by Tukey Test mean values for Plant Height - PH (cm), Floral Stem Height (cm) - FSH, Number of Flower Stems (cm) - NFS, Flower Diameter (cm) - FD, and Number of Primary Branches – NPB submitted to different doses of Bovine Manure and Humoativo, (Equal letters in the column do not differ from each other, at the level of 5% probability by Tukey test).

		Sampling	**Time 56**		
TREATMENTS	PH	FSH	NFS	FD	NPB
T1: 0% BM and 0% H.A	13.73 a	0.00 a	0.00 b	0.00 a	0.00 a
T2: 25% BM and 75% H.A	17.63 a	0.00 a	0.00 b	0.00 a	0.00 a
T3: 50% BM and 50% H.A	37.50 a	32.00 a	6.75 a	1.33 a	2.25 a
T4: 75% BM and 25% H.A	42.00 a	37.50 a	5.00 ab	0.95 a	2.25 a
T5: 100% BM and 0% H.A	17.95 a	0.00 a	0.00 b	0.00 a	0.00 a
T6: 0% BM and 100% H.A	33.83 a	29.33 a	2.50 b	1.08 a	1.75 a
		Sampling	**Time 63**		
TREATMENTS	PH	FSH	NFS	FD	NPB
T1: 0% BM and 0% H.A	28.05 a	0.00 a	0.00 a	0.00 a	0.00 a
T2: 25% BM and 75% H.A	29.55 a	9.50 a	0.25 a	0.40 a	0.25 a
T3: 50% BM and 50% H.A	47.75 a	38.75 a	5.75 a	1.53 a	2.75 a
T4: 75% BM and 25% H.A	49.50 a	42.00 a	5.75 a	1.15 a	4.00 a
T5: 100% BM and 0% H.A	18.50 a	0.00 a	0.00 a	0.00 a	0.00 a
T6: 0% BM and 100% H.A	43.50 a	28.50 a	2.75 a	0.75 a	1.75 a

Table 12: Comparisons by Tukey Test mean values for Plant Height - PH (cm), Floral Stem Height (cm) - FSH, Number of Flower Stems (cm) - NFS, Flower Diameter (cm) - FD, and Number of Primary Branches – NPB submitted to different doses of Bovine Manure and Humoativo, (Equal letters in the column do not differ from each other, at the level of 5% probability by Tukey test).

		Sampling	**Time 70**		
TREATMENTS	PH	FSH	NFS	FD	NPB
T1: 0% BM and 0% H.A	47.75 a	15.00 ab	0.25 b	0.50 a	0.25 ab
T2: 25% BM and 75% H.A	39.75 a	35.25 ab	1.00 ab	1.28 a	1.00 ab
T3: 50% BM and 50% H.A	53.50 a	53.50 a	7.00 a	1.63 a	3.50 ab
T4: 75% BM and 25% H.A	56.50 a	56.25 a	6.50 a	1.63 a	4.50 a
T5: 100% BM and 0% H.A	27.75 a	0.00 b	0.00 a	0.00 a	0.00 b
T6: 0% BM and 100% H.A	56.25 a	43.25 ab	3.75 ab	1.15 a	3.00 ab
		Sampling	**Time 77**		
TREATMENTS	PH	FSH	NFS	FD	NPB
T1: 0% BM and 0% H.A	58.00 a	58.00 a	2.00 a	1.80 a	1.50 ab
T2: 25% BM and 75% H.A	44.50 a	44.50 a	3.50 a	1.18 a	3.00 ab
T3: 50% BM and 50% H.A	58.25 a	58.25 a	6.75 a	1.50 a	3.50 ab
T4: 75% BM and 25% H.A	59.75 a	59.75 a	6.50 a	1.53 a	5.00 a
T5: 100% BM and 0% H.A	35.25 a	35.25 a	0.75 a	0.68 a	0.75 b
T6: 0% BM and 100% H.A	58.75 a	58.75 a	4.50 a	1.53 a	3.5 ab
		Sampling	**Time 84**		
TREATMENTS	PH	FSH	NFS	FD	NPB
T1: 0% BM and 0% H.A	64.75 a	64.75 a	2.00 a	1.28 a	1.50 a
T2: 25% BM and 75% H.A	50.25 a	50.25 a	4.25 a	1.03 a	3.00 a
T3: 50% BM and 50% H.A	57.50 a	57.50 a	5.00 a	1.15 a	3.00 a
T4: 75% BM and 25% H.A	62.75 a	62.75 a	5.75 a	1.33 a	3.00 a
T5: 100% BM and 0% H.A	49.50 a	49.50 a	5.25 a	1.15 a	2.50 a
T6: 0% BM and 100% H.A	60.75 a	60.75 a	6.75 a	1.05 a	2.50 a

Seasons 0, 7, and 14 did not differ from each other for plant height (PH) when no organic compost was applied to the baby's breath, as well as seasons 70, 77, and 84 days after harvest (Table 13) and seasons 77 and 84 days after transplanting, FSH presented an increase of 700 and 800% in relation to season 0, respectively. When 25% BM and 75% HA were applied, depending on the different times, there was no statistical difference (Table 13).

Table 13: Comparisons by Tukey Test mean values for Plant Height - PH (cm), Floral Stem Height (cm) - FSH, Number of Flower Stems (cm) - NFS, Flower Diameter (cm) - FD, and Number of Primary Branches – NPB submitted to different doses of Bovine Manure and Humoativo, (Equal letters in the column do not differ from each other, at the level of 5% probability by Tukey test).

	Treatment	**01**

EP	PH	FSH	NFS	FD	NPB
0	7.20 c	0.00 b	0.00 a	0.00 a	0.00 a
7	7.38 c	0.00 b	0.00 a	0.00 a	0.00 a
14	7.85 c	0.00 b	0.00 a	0.00 a	0.00 a
21	10.7 bc	0.00 b	0.00 a	0.00 a	0.00 a
28	12.5 bc	0.00 b	0.00 a	0.00 a	0.00 a
35	12.6 bc	0.00 b	0.00 a	0.00 a	0.00 a
42	12.9 bc	0.00 b	0.00 a	0.00 a	0.00 a
49	13.5 bc	0.00 b	0.00 a	0.00 a	0.00 a
56	13.7 bc	0.00 b	0.00 a	0.00 a	0.00 a
63	28.1 abc	0.00 b	0.00 a	0.00 a	0.00 a
70	47.8 ab	15.0 ab	0.25 a	0.50 a	0.25 a
77	58.0 a	58.0 a	2.00 a	1.80 a	1.50 a
84	64.8 a	64.8 a	2.00 a	1.28 a	1.50 a
		Treatment	**02**		
EP	**PH**	**FSH**	**NFS**	**FD**	**NPB**
0	9.63 b	0.00 a	0.00 a	0.00 a	0.00 a
7	9.95 b	0.00 a	0.00 a	0.00 a	0.00 a
14	10.9 b	0.00 a	0.00 a	0.00 a	0.00 a
21	11.9 ab	0.00 a	0.00 a	0.00 a	0.00 a
28	14.1 ab	4.74 a	0.25 a	0.44 a	0.25 a
35	15.4 ab	5.00 a	1.50 a	0.38 a	0.75 a
42	15.7 ab	5.13 a	1.50 a	0.38 a	0.75 a
49	14.2 ab	0.00 a	0.00 a	0.00 a	0.00 a
56	17.6 ab	0.00 a	0.00 a	0.00 a	0.00 a
63	29.6 ab	9.50 a	0.25 a	0.40 a	0.25 a
70	39.8 ab	32.3 a	1.00 a	1.28 a	1.00 a
77	44.5 ab	44.5 a	3.50 a	1.18 a	3.00 a
84	50.3 ab	50.3 a	4.25 a	1.03 a	3.00 a

For the treatment 50% BM and 50% HA in seasons 77 and 84, plant height was higher than the other seasons, differing statistically from seasons 0 to 42 days after planting. For FSH, the values were higher in the final seasons (77 and 84 DAT) (Table 14).

The 75% bovine manure and 25% Humoativo treatment showed the greatest statistical difference at distinct times (Table 14). Thus, there was an increase in PH and FSH at times 63, 70, 77, and 84 DAT. For season 63 DAT, there was an increase in PH greater than 440% compared to season 0. For season 70 the PH value was 522% higher compared to season 0, for season 77 DAT there was an increase greater than 660%, and for season 84 the value was higher than 590% for the variable PH.

Table 14: Comparisons by Tukey Test mean values for Plant Height - PH (cm), Floral Stem Height (cm) - FSH, Number of Flower Stems (cm) - NFS, Flower Diameter (cm) - FD, and Number of Primary Branches – NPB submitted to different doses of Bovine Manure and Humoativo, (Equal letters in the column do not differ from each other, at the level of 5% probability by Tukey test).

		Treatment	**03**		
EP	PH	**FSH**	**NFS**	**FD**	**NPB**
0	10.60 c	0.00 b	0.00 a	0.00 a	0.00 a
7	11.28 c	0.00 b	0.00 a	0.00 a	0.00 a
14	12.13 c	0.00 b	0.00 a	0.00 a	0.00 a
21	12.2 bc	0.00 b	0.00 a	0.00 a	0.00 a
28	16.5 bc	7.00 ab	0.25 a	0.50 a	0.25 a
35	18.0 bc	7.00 ab	1.75 a	0.43 a	1.00 a
42	24.9 bc	17.0 ab	0.75 a	0.88 a	2.00 a
49	31.1 abc	23.8 ab	2.25 a	1.30 a	1.75 a
56	37.8 abc	32.0 ab	6.75 a	1.33 a	2.25 a
63	47.8 abc	38.8 ab	5.75 a	1.35 a	2.75 a
70	53.5 ab	53.5 ab	7.00 a	1.63 a	3.50 a
77	58.8 a	58.3 a	6.75 a	1.50 a	3.50 a
84	57.5 a	57.5 a	5.00 a	1.15 a	3.00 a
			Treatment	**04**	

EP	PH	FSH	NFS	FD	NPB
0	9.05 d	0.00 b	0.00 a	0.00 a	0.00 a
7	10.2 d	0.00 b	0.00 a	0.00 a	0.00 a
14	10.4 d	0.00 b	0.00 a	0.00 a	0.00 a
21	12.4 cd	0.00 b	0.00 a	0.00 a	0.00 a
28	14.1 cd	0.00 b	0.00 a	0.00 a	0.00 a
35	15.1 cd	0.00 b	0.00 a	0.00 a	0.00 a
42	22.9 bcd	0.00 b	0.00 a	0.00 a	0.00 a
49	36.1 abcd	25.8 ab	1.00 a	0.38 a	0.50 ab
56	42.0 abcd	37.5 ab	5.00 a	0.95 a	2.30 ab
63	49.5 abc	42.0 ab	5.75 a	1.15 a	4.00 ab
70	56.3 ab	56.3 ab	6.50 a	1.63 a	4.50 ab
77	59.8 ab	59.8 ab	6.50 a	1.53 a	5.00 a
84	62.8 a	62.8 a	5.75 a	1.33 a	3.00 a

The treatment with the presence of 100% of the bovine manure, just the 84 DAT season presented statistical difference for the Plant Height variable. When 100% of the Humoativo was applied, both plant height and plant stem height were higher in the final times (77 and 84 DAT). Regardless of the treatments, the last sampling times for the analyzed variables were those with the highest values as the plant grows and develops over time.

Table 15: Comparisons by Tukey Test mean values for Plant Height - PH (cm), Floral Stem Height (cm) - FSH, Number of Flower Stems (cm) - NFS, Flower Diameter (cm) - FD, and Number of Primary Branches – NPB submitted to different doses of Bovine Manure and Humoativo, (Equal letters in the column do not differ from each other, at the level of 5% probability by Tukey test).

		Treatment	05		
EP	PH	FSH	NFS	FD	NPB
0	10.4 b	0.00 a	0.00 a	0.00 a	0.00 a
7	10.5 b	0.00 a	0.00 a	0.00 a	0.00 a
14	10.9 b	0.00 a	0.00 a	0.00 a	0.00 a
21	11.7 ab	0.00 a	0.00 a	0.00 a	0.00 a
28	12.5 ab	0.00 a	0.00 a	0.00 a	0.00 a
35	13.9 ab	0.00 a	0.00 a	0.00 a	0.00 a
42	15.2 ab	0.00 a	0.00 a	0.00 a	0.00 a
49	16.6 ab	0.00 a	0.00 a	0.00 a	0.00 a
56	17.9 ab	0.00 a	0.00 a	0.00 a	0.00 a
63	18.5 ab	0.00 a	0.00 a	0.00 a	0.00 a
70	27.8 ab	0.00 a	0.00 a	0.00 a	0.00 a
77	35.3 ab	35.3 a	0.75 a	0.68 a	0.75 a
84	49.5 a	49.5 a	5.25 a	1.15 a	2.50 a
		Treatment	**06**		
EP	**PH**	**FSH**	**NFS**	**FD**	**NPB**
0	8.23 b	0.00 b	0.00 a	0.00 a	0.00 a
7	8.45 b	0.00 b	0.00 a	0.00 a	0.00 a
14	8.95 b	0.00 b	0.00 a	0.00 a	0.00 a
21	9.90 b	0.00 b	0.00 a	0.00 a	0.00 a
28	10.9 b	0.00 b	0.00 a	0.00 a	0.00 a
35	13.1 b	0.00 b	0.00 a	0.00 a	0.00 a
42	15.4 b	0.00 b	0.00 a	0.00 a	0.00 a
49	25.3 ab	9.00 ab	0.50 a	0.45 a	0.50 a
56	33.8 ab	29.3 ab	2.50 a	1.08 a	1.75 a
63	43.5 ab	28.5 ab	2.75 a	0.75 a	1.75 a
70	56.25 a	43.3 ab	3.75 a	1.15 a	3.00 a
77	58.8 a	58.8 a	4.50 a	1.53 a	3.50 a
84	60.8 a	69.8 a	6.75 a	1.05 a	2.50 a

Column means followed by the same letter do not differ from each other at the 5% probability level by the F test.

Bezerra et al. (2015), using wastewater and biosolids in the cultivation of colored cotton applying comparative analysis using the Tukey test, verified that the variables plant height (PH), stem diameter (SD), and leaf area (LF) increased with the dose of sewage sludge in all periods evaluated. Moreover, the highest

values of PH, SD, and LF were obtained when the cotton plant was irrigated with treated wastewater.

CONCLUSIONS

Morphologically, the baby's breath responds better when 50% BM and 50% HA, as well as 75% BM and 25% Humoativo are added. The higher dry weight of the flower, which is the part of the plant that is commercially more interesting, as well as the higher total dry weight of the plant, is higher when the baby's breath is submitted to 75% BM and 25% Humoativo treatment. Even if to a lesser extent, the presence of the Humoativo is essential for better crop growth. It is viable to grow baby's breath under organic fertilization in cultivation with bovine manure and Humoativo, as it allows to obtain good agronomic responses to the cultivars.

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