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Morphological Characterization of Sunflower Under Organic Fertilization and Seed Oil Content and Yield Pie

Sunflower production under organic fertilization

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Abstract: This study aimed to evaluate the morphology of sunflower productivity and oil content of seeds and sunflower cake, cv. Helium 250, subjected to doses of organic manure on dryland. The design was a randomized block with six treatments and four blocks and nine observations. Treatments consisted of manure levels: T1 - without adding manure, T2 – 7.5 t ha^{-1}, T3 – 15 t ha^{-1}, T4 – 22.5 t ha^{-1}, T5 – 30 t ha^{-1}, T6 – 37.5 t ha^{-1}. For morphological evaluation noted the diameter of the chapter, plant height and number of leaves. We estimated the yield of achenes from the weight of 100 seeds, and productivity of oil and cake from seed production. The oil content of the seed was determined by nuclear magnetic resonance at the Laboratory of Technology (LATEC) Embrapa Cotton, while the pie by ether extraction determined in the Laboratory of Animal Nutrition of the Center for Agricultural Sciences, Federal University of Paraíba. The plant height

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and head diameter of sunflower were positively influenced ($P < 0.05$) by the dosage of manure compared to treatment without manure. The cattle manure fertilization promotes increased sunflower productivity, reflecting directly on grain production, as well as in the production of oil and pie. It was possible to obtain average 127.37 kg ha^{-1} Mass crude oil sunflower cultivar Helium 250. The maximization of grain and pie production can be achieved with organic manure of bovine in 37.5 t ha^{-1}, what means a fertilization with 352.5 kg N ha^{-1}.

Keywords: coproduct, cattle manure, *Helianthus annuus*, morphogenesis, agroindustrial residue

Introduction

The Northeast region of Brazil, especially the semi-arid areas, is characterized by irregularity of rainfall, which is concentrated in a few torrential rains, raining over three or four months in the year, which does not favor farming and extensive livestock farming becoming a natural choice (Bakke, 2005). One of the main problems is to find a source of perennial food during the dry periods to meet even the maintenance requirements, without the animals losing weight in the face of food shortages. The search for alternative foods that meet the demands of the herds and that still promote weight gain, either in critical periods or throughout the year, may reduce the grazing pressure on the pastures and ensure their sustainability over the years.

Another relevant aspect is the growing use of coproducts from the vegetable oil processing industries, such as biodiesel, which has been increasingly strengthened by the federal government and has provided different opportunities by the highest energy components for alternative formulations for animal feed. Thus, the planting of oilseeds in Brazil is increasing, seeking not only the production of oils, the main product, but the use of its co-products, such as the residual cake from oil extraction (Abdalla *et al.*, 2008).

In this context, sunflower cake is a great alternative to meet the demand of livestock production in semi-arid as it is a still underutilized and with excellent prospects for the region coproduct, by representing a protein food and energy low cost. Thus, animals from a planned with the vision of "ecological livestock" system may have higher added value on their products in addition to this practice contribute to the sustainable exploitation of the Brazilian semiarid region. It is also important to consider the possible benefits among the different industries through the exchange of services, such as the use of animal manure in the organic fertilization of the sunflower plantations, reducing the cost of correcting nitrogen fertilization to recover soil fertility.

The subtraction of the savanna, native vegetation in semiarid regions of the Northeast, coupled with long periods of drought, caused severe physical, chemical and biological degradation. In this context, it is important that the soil quality anthropized this environment is restored (Souto *et al.*, 2005). One of the most viable alternatives to restore soil quality due to the ease of obtaining and relatively low cost is the adoption of organic fertilization (Noble *et al.*, 2010). Moreover, enhancement of mineral fertilization caused the farmer to seek organic fertilization, and the use of manure usually discarded on the property, your solution as modifier of physical and chemical soil conditions and raising the level of fertility, since in the case of organic fertilizers, animal manure is the most important, is its composition, relative availability or benefits of applying (Souto *et al.*, 2005). This solid organic waste generated and accumulated by animals can become an alternative to increasing the productivity and quality of forage (Araujo *et al.*, 2011).

The benefits of using animal manures go beyond improvements in soil physical properties, improving its texture, and the supply of nutrients, increase soil organic matter, promoting soil microbes, because they improve infiltration and water retention, as well how to increase the cation exchange capacity (Hoffman *et al.*, 2001).

Thus, the organic manuring is a viable option to keep both fertility levels, reduce costs, increase productivity, improve soil physical and chemical properties as well as reduce pollution and increase efficiency of use and quality nutrition on production systems.

The objective of this study was to evaluate the effect of organic fertilization with different doses of application of manure in rainfed condition on the growth of sunflower, as well as to analyze the influence of the dosage of manure on the content and oil yield seed and sunflower cake, Helio 250 farming in Cariri Paraiba.

Material and methods

The experiment was conducted at the Experimental Station Lagoa Bonita National Institute for Semi-Arid (INSA), located in rural zone of Campina Grande (PB), 16 Km from the city of Campina Grande, entering Paraiba Cariri in the eastern part of the Plateau of Borborema at an average altitude of 547.56 meters above sea level, with geographical coordinates 7°22′45″ S and 36° 31′47” W.

The total area, rural and urban zones, of the Campina Grande covers 599.6 km ^{2} and is distant about 125 km from João Pessoa, capital of Paraíba state. The city is included in the geographical area covered by the Brazilian semiarid region, but has tropical climate of altitude. The maximum temperatures during the year are around 30° C in summer and 18° C in winter, and the minimum between 20° C in summer and 13° C in winter. The rainy season begins

in May and ends in August. The average annual rainfall series (1911–2009), Campina Grande, PB, was 768.8 mm with a standard deviation of 215.2 mm, ie a dispersion of 28.0 % average. Its location between the coast and the hinterland, provides a less arid climate that prevails in the state (semi-arid equatorial climates). The altitude also influences the climate, it ensures more mild temperatures throughout the year, with relative humidity between 75–82 %.

The field trial began on April 6 and ended on May 4, 2011, during the rainy season, as the box rainfall (Figure 1).

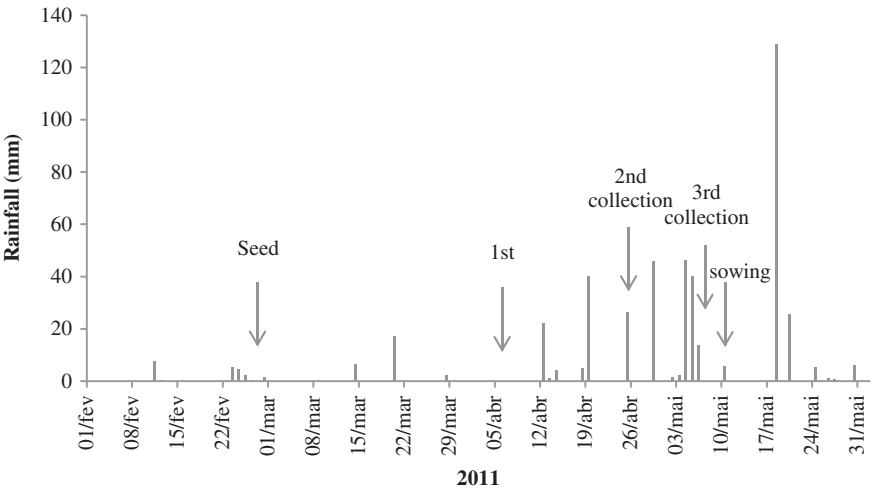

Figure 1: Daily rainfall measured during the experimental period, Campina Grande – PB.

The soil type of the study area is Quartzipsamment soil, according to the new classification of Embrapa (2006). The physical and chemical soil (Tables 1 and 2) analyzes were performed at the Laboratory of Soil and Water (LASAG) of the Federal University of Campina Grande, Campina Grande. The

Table 1: Chemical characteristics of the soil of the field for planting sunflower, Campina Grande – PB.

pH	OM	P	Ca	Mg	K	Na	H + Al	T	V
$CaCl_2$ 0,01 M	g cm^{-3}	g cm^{-3}	——————————-cmolc dm^{-3}——————————						
4,5	4,4	15,3	1,7	0,9	0,2	0,8	2,0	5,6	64,1

Notes: OM = organic matter; P = phospor; Ca = calcium; Mg = Magnesium; K = Potassium; N = sodium; H + Al = Potential acidity; T = Cation exchange capacity at pH 7.0; V = Saturation by CTC Bases at pH 7.0.

Table 2: Physical characteristics of the soil of the field for planting sunflower, Campina Grande – PB.

GRANULOMETRY			TEXTURAL CLASS	C.C.*	P.M.P**	DENSITY	
g kg^{-1}				%	%	g cm^{-3}	
SAND	SILT	CLAY	Frank sand	19,7	8,9	Global	Particle
820	80	100				1,4	2,5

Notes: *Field capacity
Permanent wilting point

corrections were made following soil chemical and physical analysis of the soil, making the correction of pH by liming (Lira *et al.*, 2009) throughout the experimental area.

The chemical analysis of manure (Table 3) was performed at the Laboratory of Chemistry and Soil Fertility Center of Agrarian Sciences, Federal University of Paraíba (CCA /UFPB). The content of nitrogen (N) found in cattle manure was 9.4 g kg^{-1} organic matter. The manure was applied manually in pits during sowing.

Table 3: Chemical characteristics of manure.

N	ORG. C.	ORG. M.
——————————g kg^{-1}——————————		
9,4	122,6	211,4

Notes: N = nitrogen; ORG. C. = organic carbon;
ORG. M. = organic matter.

The sowing of sunflower (*Helianthus annus*), Helio 250 farming (Helianthus Brazil), was held on February 28, 2010, made by hand in plots of 10 m2. Each plot had five rows with row spacing of 50 cm between rows and 80 cm. Weeds were controlled by hand weeding. The staging area was conventional. The planting followed a randomized block design (RBD), consisting of six treatments and four blocks, for a total of 24 plots. In each plot-sampled, nine plants, with 216 sampled plants, in which the effect of six doses of manure as organic fertilizer: T1 – control without addition of manure, T2 – 7.5 t ha^{-1}, T3 – 15 t ha^{-1}, T4 – 22.5 t ha^{-1}, T5 – 30 t ha^{-1}, T6 – 37.5 t ha^{-1}.

The growth of sunflower, in each treatment was evaluated by the number of leaves (NL), plant height (PH), head diameter (DC) at 20, 40 and 50 days after emergence (DAE). In general, it is known that the higher sunflower presents growth of the sixth to the ninth week. Sunflower was harvested manually at 55 DAE.

This evaluation of the oil content of the seed and sunflower cake (Helianthus annus), cv. Helium 250 was conducted in two stages, in which the procedures the oil content of the seeds were performed at the Laboratory of Technology (LATEC) Embrapa Cotton, while oil content of the pie, ether extract, was determined in the Laboratory of Animal Nutrition (LANA) of the Center for Agricultural Sciences, Federal University of Paraíba, according to methodology described by Silva and Queiroz (2002). The evaluation followed the treatments with three replications. The oil content of the seeds was determined by Nuclear Magnetic Resonance (NMR) spectrometer with Oxford MQA7005 – Oxford Instruments. Previously made up the calibration curve of the instrument with standard material. After calibration, weighed 35 g of seeds, with three replicates of each treatment, and finally made the reading of the oil content. Oil extraction was made by cold pressing. For this, we used a hydraulic jack, bottle type, with capacity of 5 ton, the Vonder brand. The extraction followed the next gear: weighing 180 g of seeds for drying at 60 °C for 10 min, followed by pressing for oil extraction and storage in a cold chambre. After oil extract we got the sunflower cake.

Data were subjected to the following statistical tests: Regression Analysis, represented by the regression equation (trend line) and the coefficient of determination (R2), and analysis of variance (ANOVA).

Results

Under rainfed conditions, the cattle manure fertilization on sunflower did not affect ($P > 0.05$) the number of leaves per plant (Figure 2). On the other hand, the organic fertilization increase in plant height, resulting in increases in plant height (PH) and in Chapter diameter (DC), as can be seen in Figures 3 and 4.

In treatment 4 (22.5 t ha manure), equivalent to 211.5 kg ha^{-1} of nitrogen, we obtained the highest average of leaves (32), with observations reaching 50 sheets. In the aspect of the sunflower plant growth, expressed by plant height, it is observed that even at the lowest dose of manure already was sufficient to promote a significant response in the plant at 20, 40 and 50 days after emergence (Figure 3). There was a positive linear effect between doses of manure and plant height, verifying a maximum height of 117.4 cm at 50 days after emergence with 37.5 t ha^{-1} of manure.

Regardless of the dose of manure used, the average height of sunflower at 50 days after emergence was 89.96 cm and the average of 61.12 cm of treatment without addition of organic fertilizer.

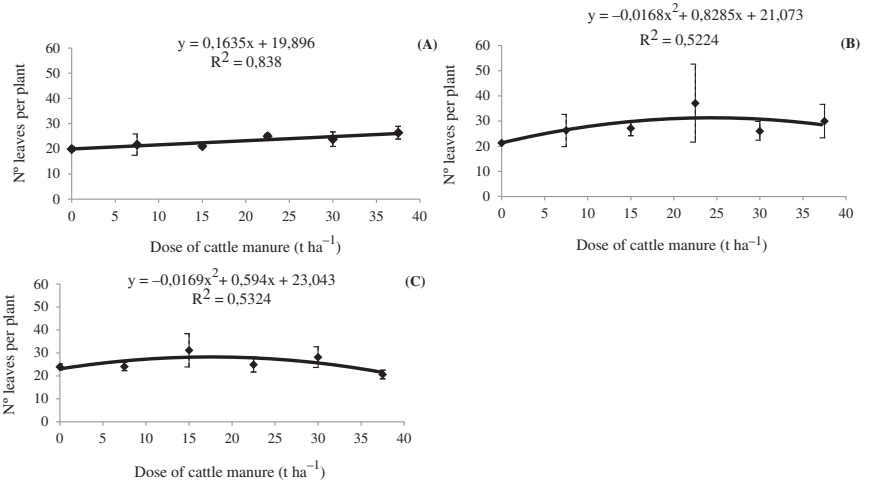

Figure 2: Effect of dosage of manure on the number of leaves per plant of sunflower cultivar Helium 250, at 20 (A) and 40 (B) days after emergence and number of leaves (C). Vertical bars represent the standard deviation.

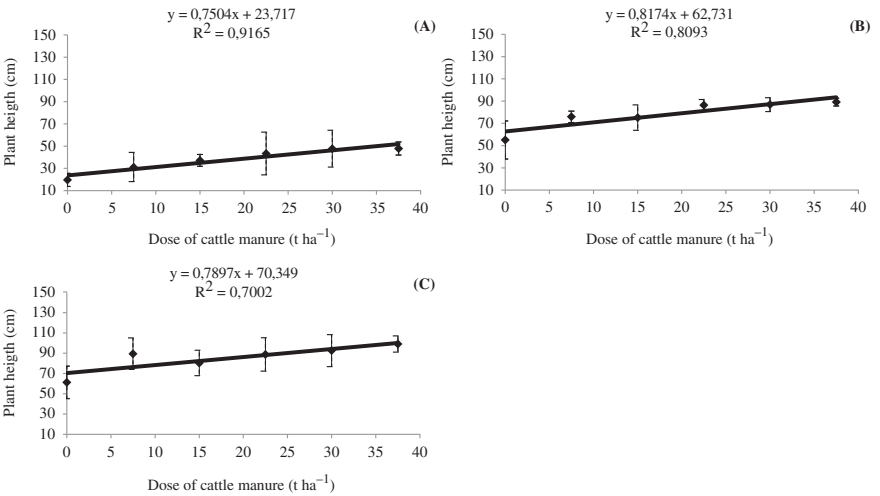

Figure 3: Effect of dosage of manure on plant height of sunflower cultivar Helium 250, at 20 (A), 40 (B) and 50 (C) days after emergence. Vertical bars represent the standard deviation.

With respect to the diameter of the head (DC), it was found that there was no significant difference ($P > 0.05$) between doses of manure used, but all treatments were superior to the control, with averages of 17.2 and 11,5 cm head diameter,

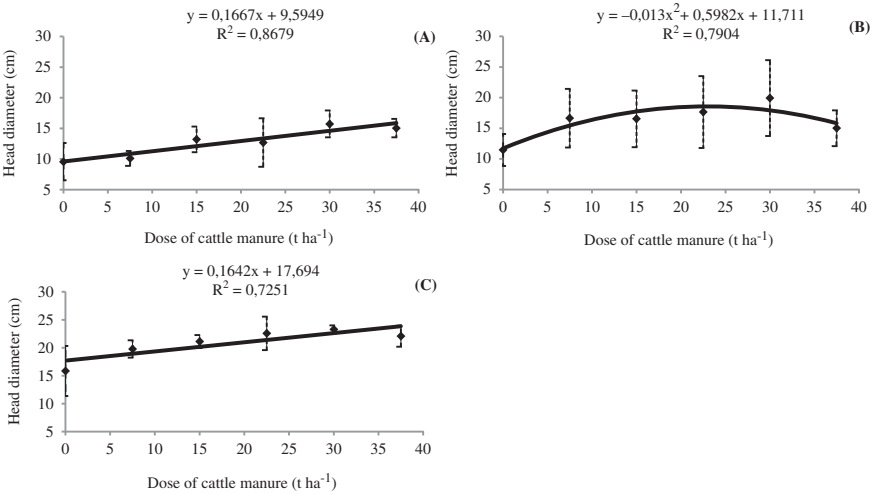

Figure 4: Effect of dosage of cattle manure on the head diameter of sunflower cultivar Helium 250, at 20 (A), 40 (B) and 50 (C) days after emergence and the rate of distension capitulate (D). Vertical bars represent the standard deviation.

respectively for fertilized and unfertilized. Head diameter increased linearly with increasing dose of manure in 20 and 50 days after emergence. At 40 days after emergence there was a tendency for a quadratic effect for this variable (Figure 4).

The grain yield was significant for the inclusion of cattle manure with no difference between the doses applied (Figure 5). You can assign the same statement for estimated pie and oil yields, despite the increasing visual effect due to the gradual inclusion of manure in the soil. With the mechanical extraction process, it was possible to obtain average 127.37 kg ha^{-1} Mass crude oil sunflower cultivar Helium 250 (Figure 5).

There was no effect ($p > 0.05$) of cattle manure on the oil content of the seed, consequently on the content in sunflower cake (Figure 6), results also found by Carvalho and Pissaia (2002). However, there is a tendency to reduce the oil content of achenes by increasing the dose of nitrogen up to 100 kg of N ha^{-1} (Calarota and Carvalho, 1984; Zagonel and Mundstock, 1991).

Discussion

The sunflower presents a wide variation in the phenotypic characteristics of plants with heights ranging from 50 to 400 cm, stems from 15 to 90 mm in diameter, leaves with 8 to 50 cm in length were observed and 8 to 70 leaves

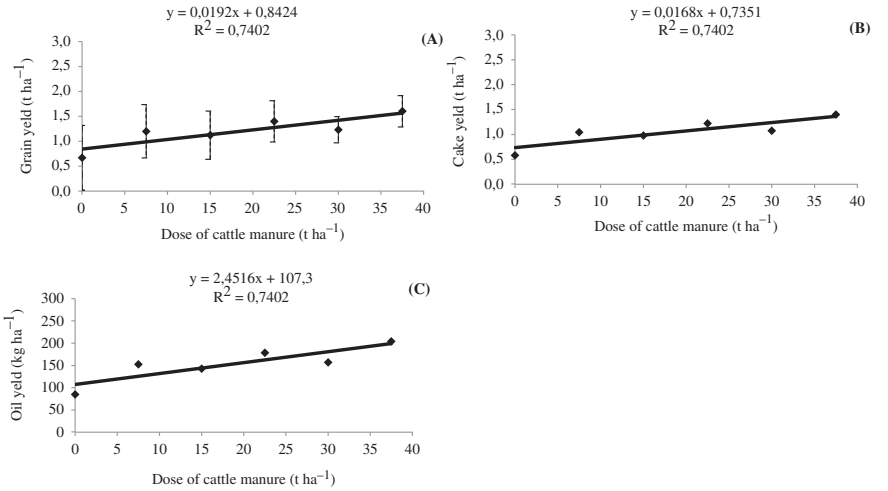

Figure 5: Effect of dosage of manure on grain yield (A), estimated yield of pie (B) and oil (C) the culture of sunflower cultivar Helium 250. Vertical bars represent the standard deviation.

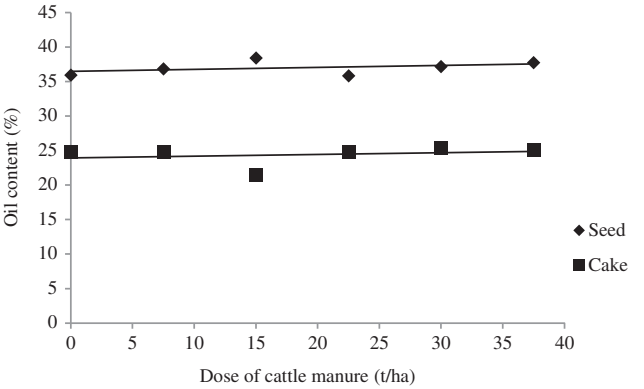

Figure 6: Effect of dosage of cattle manure on seed oil content and pie, Sunflower farming Helium 250.

per stem, chapters with diameters from 6 to 50 cm, containing 100 to 8000 flowers. Plant characteristics, such as height, size and girth chapter, vary according to the genotype and the environmental conditions (Castiglioni *et al.*, 1994).

The potential use of organic materials as fertilizer for crops is attributed to its chemical composition and its C /N relation. Mineralization of manure occurs sharply in the first weeks after application with the formation of $NH4^+$ in the

soil. In a period of 120 days, that the presence of $NH4^+$ decreases to 50 % of the initial $NH4^+$ and nitrate released to the soil in the early days undergoes grounding, but mineralization remains continuous over time with more release nitrate (Araujo *et al.*, 2011).

For Rossi (1998), cattle manure provides significant increases in production in years with adequate rainfall and soil moisture for growing sunflower. However, according to Oliveira *et al.* (2012), large amounts of manure can provide nutritional imbalance in the soil, and consequently, reduction in development and final production of sunflower.

Regarding fertilization of sunflower, it has been observed that culture accumulates large amounts of nutrients, especially nitrogen, phosphorus and potassium (Santos and Grangeiro, 2013). Among the nutrients that make up the manure, nitrogen stands out play an important role in metabolism and nutrition of sunflower, and its deficiency causes a nutritional disorder, and this is the nutrient that most limits its production while the excess causes a decrease in the percentage of oil, and high doses may increase the incidence of pests and diseases, affecting grain production (Biscaro *et al.*, 2008). The sunflower has a deep root system, giving you greater exploration and helps in better utilization of soil fertility and fertilization of previous crops, absorbing nutrients from deeper layers (Grangeiro and Santos, 2013). However, Santos *et al.* (2010) warns that boron is a nutrient found in low concentrations in the plant and is essential for plant development and its deficiency often causes nutritional problems in sunflower cultivation. Note that the nutritional requirement of sunflower crop varies with the stage of development in which it is (Villalba, 2008).

The Nitrogen (N) is a mineral element required in greater amounts by plants and that most limits growth. It is part of proteins, nucleic acids, and many other important cellular components, including membrane and various plant hormones (Lobo *et al.*, 2011). For the sunflower crop, nitrogen is the second most required nutrient, which absorbs 41 kg of N per 1000 kg of grain produced, either from fertilization and through crop residues, exporting 56 % of the total absorbed (Castro and Oliveira, 2005).

According to Lobo *et al.* (2011), the recommendations of nitrogen topdressing on sunflower vary from 40 to 80 kg ha^{-1}. According to the authors, this nutrient is extracted from the culture in large quantities and has no direct effect on residual soil. The expected yield is an important component for defining the doses. Experimental evaluations indicate that the maximum yield of sunflower is achieved with 80 to 90 kg ha^{-1} of N, however, with the application of 40 to 50 kg ha^{-1} N is obtained 90 % of maximum relative output corresponding to the amount of the nutrient economically more efficient (Smiderle *et al.*, 2002). Oliveira *et al.* (2012), warns that the interaction between the 80 kg ha^{-1} dose of

N and the 100 % water available level was the most adequate for the best results of sunflower biomass production.

The nitrogen constituent of proteins accumulated in the achenes, is about half of the total extracted soil and exported to the seeds, and has a negative interaction with the deposition of oil, then high doses of nitrogen reduce the oil content in achenes (Calarota and Carvalho, 1984; Zagonel and Mundstock, 1991). For each ton of sunflower seeds are produced 400 kg of oil, 250 kg and 350 kg peel pie (Heckler, 2002). Is observed that sunflower accumulates a total of 41 kg of N, 17.1 kg of P_2O_5 and 171 kg K_2O to produce one ton of grain. Finally, the period extends until the end of grain filling, is characterized by intense translocation of mainly nitrogen and phosphorus of the vegetative to the reproductive organs, demonstrating a high export, which is approximately 56–70 % of the total accumulated (Castro and Oliveira, 2005).

Considering that there were no limitations on water availability, especially in the reproductive stage, when rainfall was above average for the period, it can be stated that the size of the leaves should be associated with the cattle manure. The leaves, as you know, are of fundamental importance in physiological processes that define plant growth, it is where it gives the assimilation of assimilates (Jacome *et al.*, 2003).

At 20 days after emergence (DAE), one sees a gradual increase in the number of leaves, as shown in the equation of the line in Figure 2, confirming the results of Costa *et al.* (2010), who found the same effect by increasing nitrogen rates. Possibly, this response is related to that proposed by Villalba (2008), who explains that, until 30 days after emergence, sunflower few assimilates nutrients from the soil and keeps slower growth.

While Castro and Oliveira (2005), explain that higher absorption of nutrients and water and, consequently, further development occurs from that time until the full flowering stage R5. Of 28 to 56 days after emergence, it is considered the period of greatest nutritional requirement of sunflower. What can explain why the maximum number of leaves occurred at 40 days after emergence in all treatments, reflecting the faster growth of the plant (Figure 4) during this phase. However, at 50 days after emergence was observed that had already started to leaf abscission, resulting in reduction in the number of leaves. Still, the number of leaves observed at 50 days after emergence was similar to the maxima found by Wanderley *et al.* (2012) at 30 days after sowing (DAS) with doses between 25 and 50 t ha^{-1} of manure. This stage (50 DAE) was marked by the completion of the reproductive cycle of the material used, demonstrating a certain precocity since, between 56 and 84 days, represent the stages of flowering and early grain filling (R5, R6 and R7), occurring a gradual reduction in the rate of absorption of nutrients when it reaches the

maximum level of accumulation in varying amounts for each nutrient (Castro and Oliveira, 2005).

Regarding the influence of nitrogen on the number of leaves (NL), Costa *et al.* (2010) found that increasing nitrogen levels provide increased number of leaves, and the dose of 64.2 kg ha^{-1} provided the greatest response in the number of leaves (14), while Biscaro *et al.* (2008) obtained a mean of 29.2 leaves with 80.0 kg ha^{-1} of nitrogen.

However, Favarão *et al.* (2009) observed that higher doses of mineral nitrogen to 30 kg ha^{-1} did not promote an increase in height of the sunflower plant, which suggests that other nutrients contained in the organic fertilizer were responsible for the slight increase. It is worth noting also that Wanderley *et al.* (2012) used doses higher than 50 t ha^{-1} manure and concluded that there was no influence of organic fertilization on plant height.

Importantly, the emergence at 30 days (from flower bud appearance), growth, according to Castro *et al.* (1997), is slow, requiring little water and nutrients, with susceptibility to weed competition. Also mention that from that period until the end of flowering, growth is rapid, increasing consumption of water and nutrients.

For Dias *et al.* (2007), the addition of nitrogen by the application of the residue probably promotes plant growth. In this context, taking into account the current experiment has an amount of nitrogen four times that of industrial sludge used by Dias *et al.* (2007), it appears that the lowest dose of manure is sufficient to promote a significant increase in plant height of sunflower (Figure 3).

Assessing the effect of bovine manure on vegetative growth of corn, Paiva *et al.* (2011) found that the use of 30 t ha^{-1} of manure gave better vegetative growth compared to the other treatments. However, Santos and Grangeiro (2013) found the maximum growth of sunflower (plant height = 138 cm) lower in cattle manure (8.69 t ha^{-1}). These conflicting results allow the conclusion that organic and mineral fertilization on the availability of soil water, ie, the effect of fertilizer on the crop depends on the water conditions of the medium. It is noteworthy that, possibly because of seeding have occurred at the time of incorporation of organic fertilizer, which did not allow the complete mineralization of nutrients, the plants reached heights not consistent with the standards of farming.

Smirdele and Lima (2009) evaluated the production of different cultivars of sunflowers, found an answer for plant height well above that found in this experiment, reaching an average of 148.3 cm. RioS *et al.* (2009) found for the Helium 250 height 165 cm, however, in previous work, Resende *et al.* (2008) observed for the same cultivar height of 168 cm, indicating a certain stability of growth.

The average score for the fertilization treatments exceeded 15 cm in diameter found the chapter by Resende *et al.* (2009), while Grangeiro and Santos (2013) have found maximum diameter fertilization chapter 9 t ha^{-1} of manure. Although the conclusion that cattle manure positive influence on head diameter, the results vary with the studied variety and soil moisture.

The results found for head diameter in treatment 2 was consistent to that presented by Smirdele and Lima (2009). Pereira *et al.* (2008) compared the effects of bovine manure and mineral fertilization on head diameter, found that the dose of 20 t ha^{-1} of manure provides greatest chapters in sunflower. The results obtained for the diameter of the section once again prove that this variable is one of morphological characteristics more affected by nitrogen addition, as disclosed Biscaro *et al.* (2008), who found increases with even small doses of nitrogen (25 kg ha^{-1}), however, this increase was not continuous with the increment of nitrogen.

The same ratio was found for the oil and pie yield due to the fact that the grain yield and yield of plantain and oil are directly proportional.

The effect of the increased productivity was not as promising, however with lower cattle manure was achieved above the national average and consistent with the States with the highest rates of production (Conab, 2013) average values. Nevertheless, recent studies have achieved still higher values with cultivars Hélio 250 and Hélio 251 (Lobo *et al.*, 2007; Andrade *et al.*, 2009; Smirdele and Lima, 2009), there seen that Resende *et al.* (2008) achieved a productivity around 3 t ha^{-1} against 2 ton achieved by the best accesses this study.

The number of achenes per share is a reflection of the nitrogen in the critical stage of flower differentiation that occurs in the early stages of development of the sunflower and the potential number of flowers is given too early and affects the number of achenes per result also affects the head diameter (Zagonel and Mundstock, 1991). The growth patterns can help compare plant development with that of other regions, allowing adjust planting dates, expected harvest and other information.

Still, the results presented here also was indeed positive. In another study on the effect of cattle manure on productivity of sunflower, Pereira *et al.* (2008) obtained results below 1.0 t ha^{-1} in all treatments, ranging from 15 to 30 t ha^{-1}. A possible explanation of the low productive performance Sunflower in this work may have been due to the consortium with the beans.

Concerning the productivity of sunflower cake, the results were equivalent to that found by Andrade *et al.* (2009) found that the amount of pie produced and supplemental feeding during the dry season an excellent choice for animal feed.

In general, the average found for the oil content of the grain was similar to that shown by Andrade *et al.* (2009) and Ungaro (2000). However, the same authors, to estimate the oil content in the cake, did not take into account that the same is still an amount of residual oil, which in this study achieved an average of 25 % (Figure 6). The mechanical extraction process took to an average 127.37 kg ha^{-1} Mass crude oil sunflower lower than that achieved by Andrade *et al.* (2009), who obtained an average of 750 kg ha^{-1} with the same cultivar Helium 250.

On the efficiency of sewage sludge as a nitrogen source in the culture of sunflower cv. Helium 250, Lobo *et al.* (2005) concluded that the inclusion of nitrogen does not influence the oil content of achenes, but according to the authors, has a significant correlation with the number of achenes, which means that it directly affects the productivity of the plant.

Conclusions

Rainfed, the number of leaves of sunflower cv. Helium 250, is not associated ($p > 0.05$) at the dosage of manure.

Compared to the treatment without manure, the height and the diameter of the chapters of sunflower cv. Helium 250 increases ($p < 0.05$) at a dosage of manure;

The addition of manure in the cultivation of sunflower cv. 250 helium increases the productivity of seed, without observing effects of doses, provided there are no limitations of water in the soil.The cattle manure fertilization has no effect on the oil content of the seeds obtained nor pie, but led to an increase in the productivity of oil and consequently the pie. The maximization of grain and pie production can be achieved with organic manure of bovine in 37.5 t ha^{-1}, what means a fertilization with 352.5 kg N ha^{-1}

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