Performance of purslane biomass production (Portulaca oleracea) under different organic substrate concentrations

Desempenho na produção de biomassa de beldroega (Portulaca oleracea) sob diferentes concentrações de substrato orgânico

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Abstract
Objectives: To evaluate different concentrations based on cattle manure as an alternative in purslane production.
Methodology: The experiment was conducted in a greenhouse at the Center for Agricultural Sciences and Engineering of the Federal University of Espirito Santo in Alegre, ES/ Brazil. The experimental arrangement used was a completely randomized design (CRD) with 5 treatments and 6 replications. The treatments consisted of distinct dosages of the substrate based on cattle manure (0 mL; 125 mL; 250 mL; 500 mL and 1000 mL), which were applied in 5 L of soil, considered as an experimental unit. Root dry mass and aerial dry mass were evaluated.
Results: Application of 500 mL of cattle manure provided a higher accumulation of shoot dry mass (25 g/plant). For root dry mass, there were no statistically significant differences.
Conclusions: Under the conditions of the present work, it is concluded that the use of organic manure with cattle manure is viable.

Keywords: Organic fertilization, fertilization levels, cattle manure; dry weight.

Introduction
The purslane (Portulaca oleracea) is a plant belonging to the Portulacaceae family, well known for its rapid growth and tolerance to water deficit, having potential for food and medicinal use in the treatment of some diseases such as cardiovascular, diabetes, cancer, hypertension and others (Acedo et al., 2012). In addition, it is an excellent source of omega-3, containing more fatty acids than some fish oils, as well as high nutritional value and antioxidants (Uddin et al.,

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Weeds, either invasive or spontaneous, as they are popularly known in different regions, are those that interfere with the objectives of man in a given situation in an agroecosystem. It may be an indicator of the chemical and physical conditions of the soil (Gomes, 2008). Some species are indicative of soil fertility, such as *P. oleracea* which is indicative of fertile soils and a great ally of farmers in decision-making to adopt the most appropriate soil management (Gervazio et al., 2014).

The success of any crop depends, among other factors, on fertile soils, ensuring a good setting, resulting in reduced replanting costs, and promoting rapid initial plant growth. The solid residues generated by cattle stand out for presenting high concentrations of NPK and rapid mineralization, allowing greater availability of these nutrients to the plant. Thus, it has the potential to be used as a fertilizer, mainly by family farming (Silva et al., 2012).

With the purpose of developing knowledge about viable alternatives in the use of organic substrates, this work aimed to evaluate different concentrations based on cattle manure as an alternative in purslane production.

**Methodology**

The experiment was conducted in a greenhouse at Centro de Ciências Agrárias e Engenharias da Universidade Federal do Espírito Santo em Alegre – ES/Brazil, located at an altitude of 119 m, with geographic coordinates 20º45’2.3” south latitude and 41º29’17.7” west longitude (Nogueira et al., 2012).

The experimental arrangement used was a completely randomized design (CRD) with 5 treatments and 6 replications, totaling 30 experimental units. The treatments were the different dosages of bovine manure substrate (0 mL; 125 mL; 250 mL; 500 mL and 1000 mL), which were applied to 5 L volumes of soil from each experimental unit.

The purslane propagation occurred asexually, by cutting, planting small stem cuttings in 5-liter pots, which were arranged in a greenhouse, with cover in translucent material with somber mesh, and allocated on a platform located approximately 90 cm from the ground.

Substrate preparation was performed with the process of tanning the manure, with the purpose of eliminating seeds of spontaneous plants, pathogens, parasites, besides increasing the C/N ratio, in order to make it more balanced to the plants.

The evaluations took place at the end of the crop cycle in which the evaluated variables were: root dry matter (RDM) and shoot dry matter (SDM), with the removal of plants and subsequent cleaning by washing the roots and after this procedure, the root system and shoot were dried in a forced circulation oven at 60 °C for 48 hours. The statistical results obtained were subjected to analysis of variance by the “F” test and the means to Tukey test at 5% probability. All statistical analyzes were carried out with the aid of the R statistical software (R Core Team, 2018).

**Results and discussion**

According to the data obtained, it was verified that purslane when cultivated as a function of different concentrations of tanned manure, presented similar significant results in all treatments tested for the variable dry mass of the root. For the dry mass of the shoot, the treatment with 500 mL of cattle manure presented results significantly superior to the others, being significantly different statistically (Table 1).

According to Corrêa et al. (2003) the tendency of reduction of dry biomass from the maximum point of the organic fertilizer curve may be due to the excess of nutrients supplied to purslane, possibly affecting the root system and reducing nutrient absorption. This may explain why in the highest concentration of manure the response was similar to the treatment that received no dose of organic fertilizer. Note that the nutrient dosage must be balanced to obtain an optimal production, and deficiencies or excess nutrients cause disorders in plant growth.

Higher shoot dry mass values may possibly be explained by higher nutrient availability due to increased dosages, however, according
to Furtini-Neto & Tokura (2000) the excess of one nutrient in the soil reduces the efficacy of others and therefore it may decrease the yield of the crop if it occurred with the production of the dry mass of purslane shoots. In this sense, it is important to know the proper nutrient levels for fertilization in each species in order to reduce fertilization costs, maximize harvesting, and avoid phytotoxic effects.

**Conclusion**

Under the conditions of the present research, it is concluded that the use of organic manure with cattle manure is viable. Application of 500 mL of cattle manure provided greater accumulation of shoot dry mass (25 g/plant). For root dry mass, there was no statistically significant difference. However, research with the use of manure is of paramount importance to establish parameters for cultivation, dosages, and processing and utilization technologies that best suit the agricultural needs of this plant.

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**Table 1**

*Purslane root and shoot dry mass in response to different concentrations of cattle manure*

| Doses of cattle manure (mL/5 L soil) | Root dry matter (g/plant) | Foliage dry matter (g/plant) |
|-------------------------------------|---------------------------|-----------------------------|
| 0 mL (Control)                      | 4.00<sup>a</sup>          | 15.83<sup>b</sup>           |
| 125 mL                              | 4.00<sup>a</sup>          | 15.67<sup>b</sup>           |
| 250 mL                              | 3.83<sup>a</sup>          | 18.17<sup>b</sup>           |
| 500 mL                              | 4.00<sup>a</sup>          | 25.00<sup>b</sup>           |
| 1000 mL                             | 4.00<sup>a</sup>          | 17.83<sup>b</sup>           |
| CV (%)                              | 4.60                      | 7.56                        |

<sup>a,b</sup> Means followed by the same letter in the column, do not differ from each other (P > 0.05).
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