Use biofertilizer of agronomic performance cultivars Allium ascalonicum in edafoclimatic conditions of the Brejo Paraibano-Brazil

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Abstract

Allium ascalonicum originate from the Mediterranean, aliácea of great economic importance, due to its wide acceptance by the market characteristics as soft, sweet and pleasant taste. Currently it has expanded organic agriculture the cultivation of these species, with the use of organic fertilizer, which is responsible for development of the plant increasing productivity. Therefore, this study aimed to evaluate the use biofertilizer of agronomic performance cultivars A. ascalonicum in edafoclimatic conditions of the Brejo Paraibano-Brazil. The experiment was carried out on farmer Pitiá Areia-Paraiba-Brazil, which was soil preparation done, incorporated 30 kg ha⁻¹ of manure, then sowing onions Shallot White and Brown plat spacing 0,20 x 0,10 m. After 15 days of cultivation the biofertilizer was applied (50% fresh manure and 50% water) at doses 0,0 and 3,0% in leaves of A. ascalonicum. Harvest was done to seventy after planting days, the fruits were transported to Seed Technology Laboratory at CCA/UFPB-Area-Paraiba/Brazil, where the following evaluations were performed: bulb diameter, bulbils number per bulb, average bulb weight, dry matter bulb and productivity. The experimental design was completely randomized with four treatments (two biofertilizer doses of 0,0 and 3,0%), (two varieties Shallots White and Brown) and four replications. The data submitted to ANOVA, means were compared by Tukey test at 5%, SISVAR®. The biofertilizer doses did not influence the evaluated characteristics, except dose of 3,0% that favored increased productivity of onions Shallots White and Brown.

Key-words: Shallot, Organic system, Productivity

Introduction

Allium ascalonicum is from Central Asia, belonging to the family Aliaceae (Ceylan and Alic, 2015), this plant is rich in two chemical groups that are thought to provide benefits to human health: flavonoids and alk(en)yl cysteine sulfoxides, besides owning bulbous and edible plant with white, purple and brown colors. It has too an oval shape, green stem and long leaves, a sweet, sweet and pleasant taste, the shallots have stood out due to the acceptance by the consumer market mainly in the use of seasoned salads, tolerance to various diseases and longer shelf life seasonings, because they present high concentration of zinc and iron and compounds from onions have a range of such as anticarcinogenic, antiasthmatic and antidiabetic (Salgado et al., 2011).

Currently organic agriculture of vegetable species has increased its production through
technologies appropriate to local reality of production without the use of agrochemicals (Embrapa, 2017), as an example the use of biofertilizers, which contains in its composition nutritional elements such as proteins, enzymes, antibiotics, vitamins, toxins, phenols, esters, acids (Carvajal-Muñoz and Carmona-Garcia, 2012) that are directly responsible for performance of metabolism, development and balance of the plants, increasing productivity also contributing to high quality food, without polluting the environment without causing harm to man (Ghumare et al., 2014).

Organic onion cultivation has expanded in several regions of Brazil, but it still has some limitations, of which the most relevant are the lack of organic fertilizers that provide necessary nutrients for plant growth and phytosanitary control (Vidigal et al., 2010). According to Gonçalves and Wamser (2007), organic onion production can reach lower production costs, but with high levels of productivity, with lower input use and nutritional requirements on fertilization, climatic conditions and the genetic pattern, for example Costa et al. (2008) evaluated the performance of different onion cultivars in the organic system under edaphoclimatic conditions of the São Francisco Valley-Pernambuco-Brazil, obtaining commercial yields higher than 17 t ha⁻¹.

Therefore, the present work aimed to evaluate use biofertilizer of agronomic performance cultivars *Allium ascalonicum* in edaphoclimatic conditions of the Brejo Paraibano-Brazil.

### Material and methods

The experiment was carried out in Pitiá farm, city of Areia-Paraiba-Brazil (6°58′12″S and 35°42′15″W), microwe region of Brejo Paraibano-Brazil. According to the classification of Köppen, annual rainfall of this microregion is 1,400 mm, average temperature around 25 °C, average relative humidity 81%. The soil was characterized as Yellow Red Argissol (Embrapa, 2006) and in order to meet the nutritional requirements of the crop, the chemical analysis of soil and cattle manure was carried out, according to Table 1.

| Description | pH | P (mg dm⁻³) | K (mg dm⁻³) | Na (mg dm⁻³) | H⁺⁺Al³⁺ (cmolₑ dm⁻³) | Al³⁺ (cmolₑ dm⁻³) | Ca²⁺ (cmolₑ dm⁻³) | Mg²⁺ (cmolₑ dm⁻³) | SB | CEC | V (%) | M (%) | OM (%) | g dm⁻³ |
|-------------|----|-------------|-------------|-------------|----------------------|------------------|------------------|------------------|----|-----|------|------|-------|-------|
| Soil        | 6  | 1.37        | 40.2        | 0.1         | 2.31                 | 0                | 1.9              | 0.8              | 2.95| 5.26| 56.1 | 0    | 10.65 |       |
| Cattle manure | 7  | 1252        | 252         | 0.5         | 2.97                 | 0                | 9.4              | 8.05             | 18.66| 21.6| 86.2 | 0    | 109.9 |       |

| pH | C.E. | Ca²⁺ | Mg²⁺ | Na⁺ | K⁺ | SO₄ | HCO₃⁻ | Cl⁻ | RSA | Classification |
|----|------|------|------|-----|----|-----|-------|-----|-----|----------------|
| 6.6| 4.38 | 2.3  | 10.2 | 29.94| 21.32| 4.08 | 7.2  | 2.3 | 11.98| Ca₄S₃       |

Soil preparation was done, incorporating 30 kg ha⁻¹ of cattle manure, the irrigation used was by microsprinkler. Afterwards, the seedlings Shallots (2 seeds/planting hole) were planted with approximately 5 cm of depth, spacing used at site of 0.20 x 0.10 m. It is worth noting that management of the invasive plants was done during the entire crop cycle (approximately 60 days).

The biofertilizer (anaerobic) was composed of 50% fresh cattle manure and 50% water, remaining in the biodigester for period of 30 days (time required to obtain the product with dark green coloration and mild odor) and then the chemical analysis was performed, according to Table 2.

Fifteen days after planting, the foliar application with the biofertilizer was done in the

### Table 1. Chemical analysis of soil and cattle manure (UFPB, Areia-Paraiba-Brazil, 2016).

### Table 2. Chemical analysis of biofertilizer (UFPB, Areia-Paraiba-Brazil, 2016).
following doses: 0.0 and 3.0%. Five applications are made throughout the crop cycle.

The seedlings were transported to the Seed Technology Laboratory belonging to the CCA/UFPB-Areia-Paraiba-Brazil, where the following evaluations were carried out: Bulb diameter (BD) (cm), Bulb number (NB) (Und), Average bulb weight (ABW) (g), Bulb dry mass (BDM) (g) was obtained by drying in forced circulation oven for 72 hours at temperature of 65 °C until reaching constant weight. And productivity (PROD) (kg ha\(^{-1}\)) was calculated according to the recipe described by Silva (2012).

The experimental design was completely randomized with four treatments (two doses of biofertilizer 0.0 and 3.0%), (two varieties Shallots White and Brown) and four replications, totaling an experimental unit with 16 plants. The data were submitted to analysis of variance and the means were compared by the Tukey test, 5% probability in the SISVAR® program (Ferreira, 2008).

**Results and discussion**

No statistical difference was observed in the treatments, when the following evaluations were made: bulb diameter, bulb number, average weight and bulb dry mass at 3.0% in White and Brown Shallots (Table 3). Diameters of the bulbs of the two varieties Shallots obtained in the present work varying from 31.28 to 32.64 mm, respectively (Table 3), corroborating with the classification described by Krontal et al. (2000) when evaluating the diameter of commercially available onions, showed that this cultivar obtained bulb diameter around 30.00 to 40.00 mm.

**Table 3.** Evaluation of agronomic performance: Bulb diameter (BD) (cm), Bulb number (NB) (Und), Average bulb weight (ABW) (g), Bulb dry mass (BDM) (g) and Productivity (PROD) (kg ha\(^{-1}\)) in two onion cultivars Shallot White (SW) and Shallot Brown (SB) using two concentrations of biofertilizer (BIO). UFPB, Areia-Paraiba-Brazil, 2016.

| Trat | BD (cm) | NB (Und) | ABW (g) | BDM (g) | PROD (kg ha\(^{-1}\)) |
|------|---------|----------|---------|---------|-----------------------|
| 0.0% | BIONSW  | 1.56 a   | 5.36 a  | 27.34 a | 18.94 a               | 10.66 b                |
| 3.0% | BIONSW  | 1.63 a   | 4.10 a  | 28.23 a | 19.89 a               | 13.75 a                |
| 0.0% | BIONSB  | 1.61 a   | 4.77 a  | 28.06 a | 19.93 a               | 12.36 a                |
| 3.0% | BIONSB  | 1.58 a   | 4.68 a  | 27.51 a | 18.90 a               | 12.06 a                |
| C.V.%| 9.176   | 23.266   | 16.064  | 16.647  | 17.598                |

Means followed by different letters in the same column differed by Tukey’s test (p <0.05).

The number of bulb presented on Shallots on all treatments ranged from 4.10 to 5.36 per bulb (Table 3), also according to Krontal et al. (2000) found that onion Shallot produces on average 2 to 20 bulbs per bulb. However, it can be stated that amount of bulb per bulb obtained in the present study is within average of production for these two varieties. However, the average weight varied from 27.34 to 28.23 g and the dry mass of 18.89 to 19.93 g of the bulbs on Shallots onions (Table 3), however, it was verified that these results were higher than the average weights and dry mass of Shallot bulbs found by Santos et al. (2015) when using 100 L ha\(^{-1}\) biofertilizer biurine (cow urine), verified variations from 11.90 to 15.90 g and 7.1 to 8.1 g, respectively.

It can be stated that the biofertilizer favored accumulation of substrates such as glucose, fructose, sucrose and series of oligosaccharides known as fructan (Darbyshire and Henry, 1978) in Shallots onion plants, which may have influenced weight gain and mass of the bulbs, becoming an appreciable olive grove, corresponding to the requirements consumer market.

There were statistical differences in the treatments that were used the biofertilizer in the dose of 3.0% for the onion Shallot White and at the doses of 0 and 3.0% of the Shallot Brown, obtained productivities 13.75; 12.36 and 12.06 kg ha\(^{-1}\) respectively, presenting higher results when compared to the treatment using the biofertilizer at 0.0% dose and Shallot White (Table 3).

These results corroborate the behavior of Shallots onion productivity observed by Santos et al. (2015) when using Biourine biofertilizer, verified that yields ranged from 10.9 to 12.9 kg ha\(^{-1}\). This fact can be explained by Sumarni et al. (2012) when they stated that use of organic fertilizers, observed increase the absorption of nutrients and influence the yield of onions Shallots.

Biofertilizers have been used in organic agriculture because they contain microorganisms responsible for the decomposition of organic matter, production of salts and the addition of organic and inorganic compounds, source of nutrients, especially nitrogen, phosphorus, sulfur, copper and zinc (Sediyama et al., 2014) that may have promoted favorable effects on vegetative development.

According to the chemical analysis (Table 1) calcium accumulation around 2.3 mole L\(^{-1}\) was
observed in the biofertilizer, which may have favored the absorption of this element by the plant since it is a component of the cell wall indispensable for maintaining the structure of cell membranes. Magnesium also showed significant expression of 10.2 molc L$^{-1}$ in the biofertilizer, since this element is present in the chlorophyll molecule, being important activator of several enzymes, participating in the processes of photosynthesis, respiration, synthesis of organic compounds, ionic absorption and mechanical work, such as deepening and root expansion. Potassium also had an expressive concentration around 21.32 molc L$^{-1}$, which reinforces the performance in osmotic processes, the synthesis of proteins and the maintenance of their stability, in the opening and closing of the stomates, and proves that the macronutrients are essential to plant development as well as to increased productivity (Trani et al., 2014).

It was verified that in treatments that were not used biofertilizer, the effects were negative in the plants all the analyzes evaluated in present work, that is, there was no favorable development in the physiological responses in the varieties of White and Brown Shallots when compared with treatments that biofertilizer at the concentration of 3.0% was added. According to Resende and Costa (2014) the absence of positive responses in treatments that did not use the doses of biofertilizers indicates that studies on the cultivation of onion species in organic systems should be directed to the fertilization of the soil by the use of cover crops/green manure, associated with fertilization of base and partial coverage with organic materials (solids or liquids) on the soil, tanned manure or compound, aiming to adapt the supply of nutrients to the demand of the plants and, in this way, making them more productive.

However, doses of the biofertilizer did not influence the bulb diameter, number of bulbs, average weight and dry mass of bulbs of Shallots White and Brown onions. Only the 3.0% dose favored the increase of the productivity of the Shallots White and Brown onions.

**Conflict of interest:** All authors declare no conflict of interest.

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