Chapter 113

Seed vigor and initial growth of coriander, rupincin and parsley seedlings with different fertilizations

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ABSTRACT
Coriander vegetables (Coriandrum sativum L.), arugula (Eruca sativa Mill.) and parsley (Petroselinum sativum Hoffm.) are important as healthier food sources. Coriander belongs to the Apiaceae family and is widely used in Brazilian cuisine, mainly leaves and branches. Parsley is a condiment originating in Europe and the arugula is rich in mineral salts and vitamins A and C, appreciated for its spicy taste and pleasant and pronounced smell. Demand for vegetables has increased in recent years, and it is necessary to seek ways to increase agricultural production. The objective of this work was to determine germination, seed vigor and initial growth of coriander, arugula and parsley seedlings. The experiments were carried out at the Seed AnalysisLaboratory and greenhouse of Embrapa Roraima. Seeds of lots of vegetables were characterized. Germination test in two lots of parsley, after 24 immersion in water in two environments. Electrical conductivity test of seeds with readings in 3, 6, 9, 12 and 24 hours of immersion. In greenhouse seeds of the three vegetables in trays with sand to evaluate the emergence. The average mass data of 100 parsley seeds obtained were between 0.018 g and 0.019 g, arugula 0.022 g and coriander 0.16 g. In an experiment to evaluate the germination of parsley seeds in two environments at seven days, it was obtained: germination of seeds of lot 1 in environment 1 was 68% and in environment 2 of 78%, for lot 2 in environment 1 was 75% and in environment 2 of 78%. For the control, germination of 53% was found in environment 1 and 75% in environment 2. Immersion in water for 24 hours increased the germination of parsley seeds. At14 days, lot 1 presented 52.1% of seeds with radicle greater than 1.5 cm at 23ºC and 54.2% at 28ºC. For lot 2 it was 52.1% and 57.1% in these environments. Immersion increased radicle vigor in relation to the control (19.2% and 29.8%) for temperatures of 23ºC and 28ºC, respectively. The values obtained for electrical conductivity in coriander seeds were 184.3 µS cm-1 g-1, for arugula 127.4 µS cm-1 g-1 and 498.2 µS cm-1 g-1 for parsley. The germination percentages of these seeds were 69%, 86%, 80% for coriander, arugula and parsley, respectively. In the germination in sand determined at 12 days it was verified for coriander 34%, of the arugula 59% and of the parsley 53%. The immersion of parsley seeds in water for 24 hours before germination increases germination and increases seedling vigor. In a greenhouse environment, the germination of vegetables behaved differently to the laboratory.

Keywords: Coriandrum sativum; Petroselinum sativum; Eruca sativa; mineral nutrition

1 INTRODUCTION

A balanced diet with vegetables can reduce the risk of cardiovascular diseases and some types of cancer (Jaime et al., 2009). Currently the vegetable market receives a growing influence of the consumer in seeking food intended for fresh consumption. This interest drives the increase in the cultivation of a large number of species or new cultivars of vegetables of European or North American origin (Junqueira et al., 2000). The vegetables worked were *coriander (Coriandrum sativum* L.), parsley (*Petroselinum sativum* Hoffm.) and arugula (*Eruca sativa* Mill.).

Coriander is an annual herbaceous vegetable belonging to the apiaceae family, native to the Mediterranean Sea basin (Silva et al., 2012) is widely used in Brazilian cuisine, mainly its leaves and branches (Melo et al., 2003). In the North and Northeast regions of Brazil, favorable conditions are found with regard to climate, enabling cultivation throughout the year (Silva et al., 2012). Also, coriander is used as anantipyretic, anthelmintic and analgesic in the treatment of joint pain and reumatismo (Ishikawa et al., 2003).

Parsley or parsley (*Petroselinum crispum*), a leafy vegetable of the Apiacean family, is considered a condiment much appreciated by the Brazilian population. According to Bertatti (2002), parsley is a fundamental component in the composition of seasonings for the preparation of the most different dishes, be they cold (salads) or hot (meat or fish), as well as for the ornamentation of them.

Parsley is a condiment originating in Europe, which in its first year of cultivation produces leaves and in the second year blooms and produces seeds, being thus annual and biannual (Franz et al., 2015).

The arugula (*Eruca sativa*), a vegetable of the Brassicaceae family, originated in southern Europe and western Asia. The culture has stood out in the world scenario mainly for its nutritional and phytotherapeutic properties, besides being rich in omega 3 (Filgueira, 2000), potassium, sulfur, iron and vitamins A and C (Trani e Passos, 2005). The arugula is a vegetable rich in mineral salts and vitamins A and C, is appreciated for the spicy taste and pleasant and pronounced smell. It belongs to the Brassicfamilyto cea. The vegetables of this family have important substances for healthmaintenance (Melo et al., 2016).

Among the modern concepts of vegetable production, success begins with the production of quality seedlings, since it depends on the final performance of plants in the production sites, both from the nutritional point of view and from the time requiredto produce (Filgueira, 2003).

As for substrates, it is common understanding that this product directly influences the productivity of several plants, as it provides beyond its main function that is to serve as a support for plants, adequate suppressingwater and air (Klein, 2015).

Any variation in its composition implies germination, since substrates with poor structure, aeration, as well as water retention capacity, allows greater propensity to infestation by pathogens, resulting inpoor foration of plants (Klein, 2015).

In most countries with advanced horticulture, one of the techniques widely employed and which has provided substantial increases in the quality of seedlingsis the use of substrates.

Numerous substrates in their original or combined constitution are currently used for propagation of species, via seeds or vegetatively. In choosing a substrate, it is necessary to observe, mainly its physical and chemical characteristics, the species to be planted, in addition to the economic aspects, such as low cost and availability (Fonseca, 2001).

In general, the substrate is one of the main factors for germination together with water and temperature, serving as a nutritive medium for plants, in addition to maximizing antioxidant functions in plants with beneficial reflexes to human health, substrates should provide adequate dry matter production in plants for commercialization(Santos et al., 2017).

Thus there is the possibility of using organic substrates for the production of vegetables, as they are rich in organic matter. Organic matter allows the development of beneficial microorganisms, increasing the availability of nutrients over the culture cycle time, however, these changes depend on the quantity and quality of the residues used in the fabrication (Caldeira et al., 2012).

The properties of substrates are variable according to their origin, production method or obtaining, proportions of their components, among other characteristics (Klein, 2015). As it is not easy to find pure materials that could present the ideal characteristics for a good substrate, other materials or products are added to these, improving them physically and chemically, integrating the mixture and functioning as conditioners (Santos et al., 2000).

In search of a healthier diet, the demand for vegetables has increased comparatively in recent years, and it is necessary to seek ways to increase and increase agricultural production.

The objective of this work was to determine germination, seed vigor and initial seedling growth of vegetables coriander, arugula and parsley with fertilization.

2 MATERIAL AND METHODS

The experiments were carried out in the Seed Analysis Laboratory and in a greenhouse of Embrapa Roraima. First, seeds of lots of vegetables were characterized. The characterization was performed from the weighing of the seed lots, to determine the seed mass. For the characterization of coriander, 100 large fruits and 100 small fruits were separated. The seeds were subsequently removed. These seeds were separated, characterized andunder-submitted to germination tests.

Germination test in two lots of parsley. 40 seeds of each batch were packed in plastic cups containing water, the seeds were immersed in the 24-hour period in two environments with different temperatures, with the temperature of the environment 1 of 23ºC and of environment 2 of 28ºC. After the immersion period the seeds were distributed on wet paper and placed in a germination chamber. The test witness wasn't immersed. After 7 days, germination and vigor of the emergence of the radicle and main root were evaluated according to Brazil (2009). Seeds with radicle greater than 1.5 cm were separated from seeds with radicle less than 1.5 cm.

For the electrical conductivity test, 50 seeds were separated from each vegetable. The seeds were weighed and immersed in distilled water, with the aid of the conductive meter, electrical conductivity readings were made after 3, 6, 9, 12 and 24 hours of immersion. After the last reading, the seeds were placed to germinate on wet paper to determine the germination percentage of the seeds. Germination was evaluated at 7 days and the vigor of radicle emergence was evaluated at 14 days.

In a greenhouse, the vegetables were sown in sand at 80% moisture to determine the germination in sand and evaluate the growth response of seedlings after applications of doses of liquid biofertilizer extracted in the carbonization of dried and crushed soybean plants (*Glycime max*). The parsley seeds were immersed 24 hours in the Seed Analysis Laboratory before being sown. In the experiment, 40 seeds of each vegetable were used for each replication, and two doses of liquid fertilizer were used and one control that did not receive application. Germination and number of leaves were evaluated weekly. The final evaluation of the plants occurred at 100 days, coriander plants were already in phase dand flowering and fruiting.

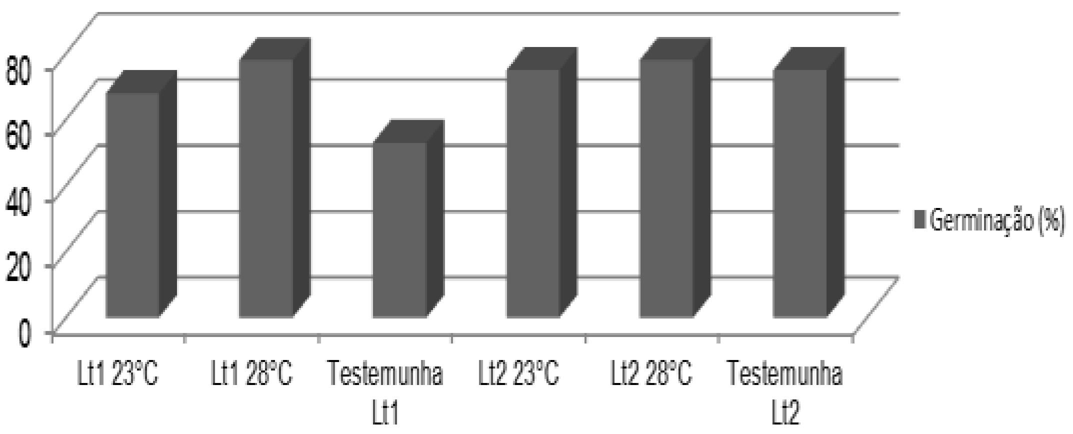
The plants were removed from the sand, the roots were washed and separated from the aerial part, were weighed obtaining fresh mass and dry mass of the plants. The means obtained were compared by the Tukey test at the level of 5% probability.

3 RESULTS AND DISCUSSION

In the characterization of seeds of the lots the average values obtained for the mass of 1000 parsley seeds were 0.18g for lot 1 and 0.19 g for lot 2, for arugula 0.22 g and coriander 1.6 g. For the classification by the size of the coriander fruits, 91% of the large fruits presented 2 seeds, while 90% of the small fruits presented 2 seeds. It was verified both in fruits classified as large and as small the presence of a seed and even empty fruits.

Figure 1 shows the effect of immersion treatment of parsley seeds in two distinct lots. Both lots showed higher germination percentage when submitted to immersion in the 28°C environment. Lot 1 showed germination of 68% and 78% at temperatures of 23 and 28°C, respectively. While the control showed only germination of 53%. Lot 2 showed germination of 75% and 78% at temperatures of 23 and 28°C, respectively. The control of the lot showed germination of 74%. The effect of immersion of parsley seeds was more evident for lot 1, in which it presented physiological quality and vigor lower than lot 2 as a poto be verified in Figure 2.

Figure 1: Visualization of mean germination percentage values obtained for seeds of two lots of parsley immersed for 24 hours in two environments.



After embebition, enzyme activation occurs, embryo growth initiation, integument disruption, seedling emergence (Galindo, 2006). Parsley germination is slow and uneven, requiring an adequate level of hydration, which allows the reactivation of metabolism and consequent growth of the embryonic axis, and the greater the amount of water available, the faster the absorption (Rodrigues et al., 2009).

Figure 2. Mean values of emergence force of seeds of two lots of parsley submitted to immersion in water for 24 hours, as a function of the main root length.

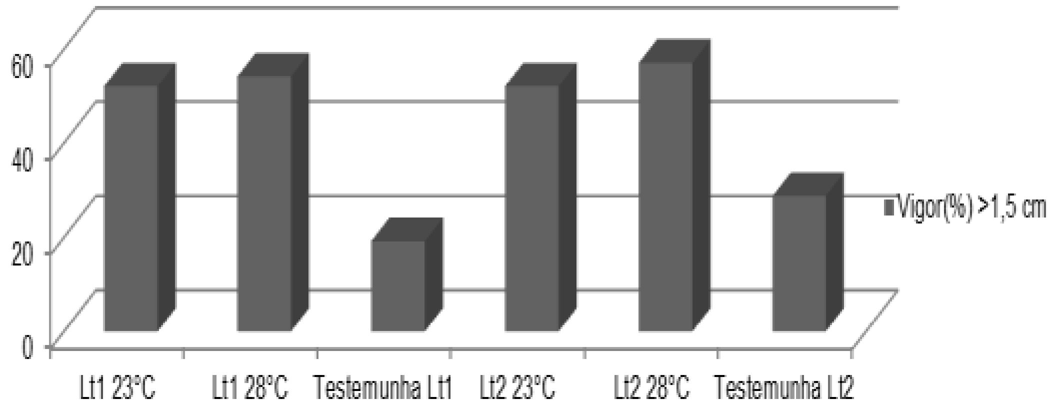
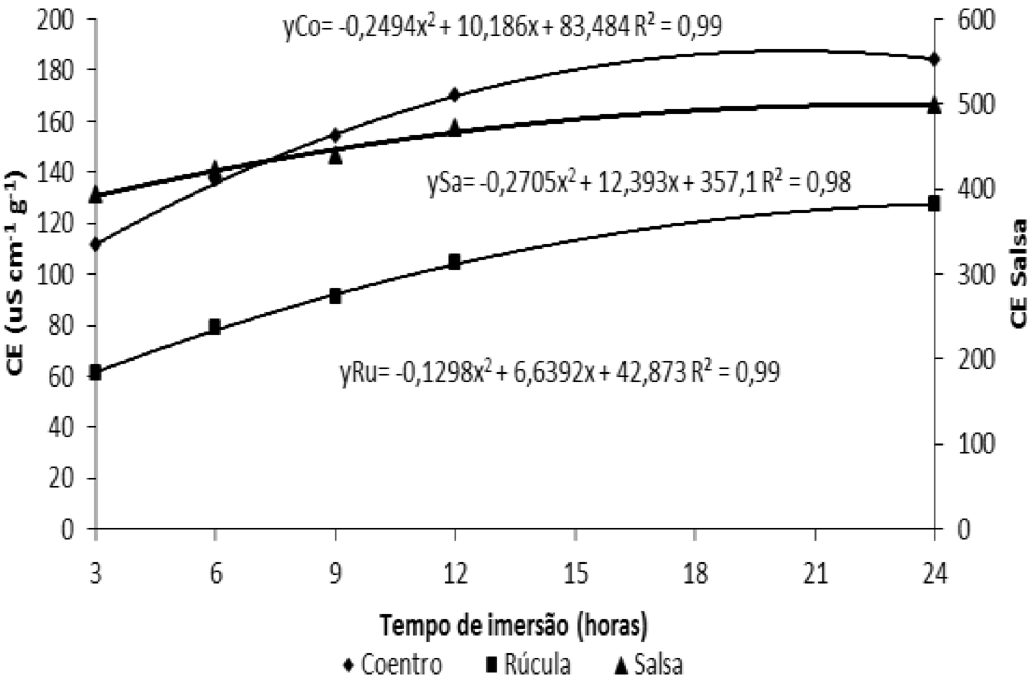


Figure 2 shows the response of vigor to immersion. The ambient temperatures positively influenced the vigor, and for lot 1 at 28°C, 54.2% of the germinated seeds presented radicle greater than 1.5 cm. While at 23°C, 52.1% of the germinated seeds presented radicle greater than 1.5 cm. For the control only 19.2% tinham radicle greater than 1.5 cm.

In lot 2, seed vigor was influenced more than observed for germination percentage. Where the control presented vigor of 29.8% being lower than the treatments that were 52.1% and 57.1% for the temperatures of 23 and 28°C, respectively. In this ites is the innovation of this work, when when the immersion of the seeds of two lots of parsley seeds was verified the expansion of the vigor of the seeds and especially the standardizationof the germination process.

Regarding electrical conductivity (Figure 3), it is directly related to the soluble salt content, which can negatively affect the development of seedlings. The electrical conductivities of the seeds were 184.3 μS $^{cm-1\ g-1}$ for coriander, 127.4 μS $^{cm-1\ g-1}$ for arugula and 498.2 μS $^{cm-1\ g-1}$ for parsley. The germination percentages of seeds from electrical conductivity were 69%, 86%, 80% for coriander, arugula and parsley, respectively. This is indicative that these values are acceptable for arugula and parsley in view of the germination values obtained in the seeds. For coriander, even though the obtained value was not high, the seeds germinated below 70%.

Figure 3. Average values of electrical conductivity obtained in seeds of three vegetables during 24 hours of immersion in water.



In greenhouse, the germination of the vegetables was lower than the laboratory tests. There was 34% germination for coriander, arugula 59% and parsley 53%. All the values obtained fell short of what was desirable. As for the effect of the application of liquid fertilizer on seedlings, important results were obtained in which they already signal advances in the greenhouse cultivation technology of these three vegetables. The dry mass obtained in the treatments was higher than the values found in the control, without the application (Table 1).

Table 1. Average values of green mass (g), dry mass (g) of shoots, roots and plants of parsley, arugula and coriander at 100 days

PARSLEY	Green mass	Aerial MS	MS root	MS plant
Dose 1	0,502	0,072	0,053	0,124
Dose 2	0,716	0,098	0,051	0,150
Witnessha	0,030	0,005	0,005	0,010
ARUGULA	Green mass	Aerial MS	MS root	MS plant
Dose 1	1,326	0,083	0,033	0,116
Dose 2	1,740	0,130	0,045	0,174
Witnessha	0,302	0,022	0,007	0,029
CORIANDER	Green mass	Aerial MS	MS root	MS plant
Dose 1	0,192	0,090	0,020	0,111
Dose 2	0,233	0,095	0,016	0,111
Witnessha	0,024	0,014	0,002	0,016

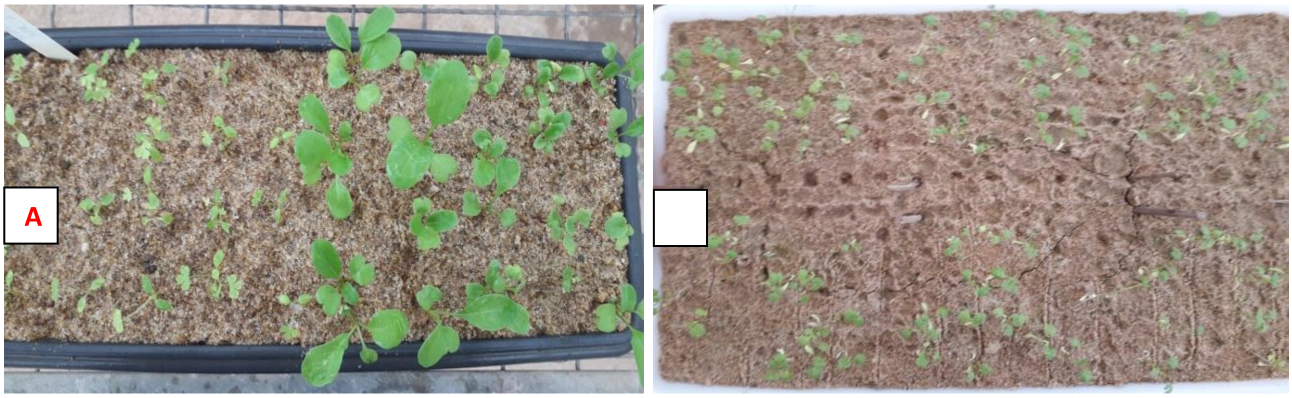


Figure 4: Visualization of the emergence of parsley (A-left) and arugula (A-right) seedlings; (B) emergence of coriander seedlings in trays with sand.

Figure 5: Visualization of arugula samples with and without fertilizer application at 60 days.

Figure 6: Visualization of parsley samples with and without fertilizer application at 60 days

The results obtained are indicative that the application (doses) of liquid fertilizer extracted from the carbonization of soybean plants allowed an increase in plant mass productivity in the three vegetables evaluated using as medium sand substrate, conducted inside the vegetation.

4 CONCLUSION

The immersion of parsley seeds in water for 24 hours increases germination and increases seedling vigor;

Germination d andcoriander, arugula and parsley in a greenhouse is lower than the obtgone in the seed laboratory;

Soybean biofertilizer (liquid) may be an important alternative for cultivation ofh ortaliças in a greenhouse.

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