

Original Research Article

The performance of Capsicum seed germination in different micronutrients treated
substrate

1. Abstract

The use of chilli pepper (*Capsicum frutescens*) in cooking is common, however, the increase in the use of family farming also as a defensive, has led, in the coastal region of Alagoas, to an increase in the cultivation of this condiment, both on the north coast and on the southern coast of the state. In the latter, the cultivation by the small producers is so intense that the local cooperative has embraced the initiative and assumed the responsibility of transferring all production of such raw material to a processing plant located in the neighboring state. With such influence and increased production, he began to perceive some seed issues that could hinder his production in the field, such as fungus susceptibility and lack of some essential micronutrients due to nutrient poverty on the Alagoan coast. In observing this, the commercialization companies already treat the seeds with fungicides, however, the lack of nutrition still needs to be overcome. An alternative is treatment of the substrate with micronutrients, which in this assay has proven effective in meeting such need.

Index terms: Chilli pepper, Micronutrients in seeds, Seed treatment, Zinc.

2. Introduction

25

26 The need for more vigorous commercial plantings has made fertilizer
27 improvement research a vast and at the same time repetitive subject with comparisons
28 and doses of certain assets found in rural areas.

29 The lack of economic and efficient options has led small farmers to get into
30 debt by trying to compete in a disloyal and struggling market that is growing and
31 devastating those who do not adapt to it.

32 Long before Columbus arrived in the Americas, peppers were already widely
33 used in Central and South America, the Caribbean, and Mexico. The oldest records of
34 pepper cultivation are found at archaeological sites in Tehuacán, Mexico, and date back
35 to about 9,000 years. The fruits of Capsicum were used by the Aztecs to flavor a cocoa-
36 based drink, tchocoatl, the precursor of chocolate (BARBIERI and STUMPF, 2009).

37 It is cultivated in regions of tropical climate with rainfall variable from 600 to
38 1,200 mm and an average temperature around 25 ° C. Temperatures lower than 15 ° C
39 impairs the vegetative development of the plant. The more soil recommended is the one
40 that presents light texture with pH between 5.5 to 6.0 with good drainage. The harvest is
41 done manually, from 100 to 120 days after planting. The average yield per ha varies
42 from one cultivar to another. The chilli produces 10 t^{ha}. Harvesting in the first year is
43 always bigger, many planters prefer to renew their cultures (FRAIFE FILHO, 2017).

44 Thinking about it, researchers around the world have mobilized to
45 economically and affordably try to bring inexpensive options to those who can not
46 afford genetically modified products so that they can adapt to cultural management
47 simply by incrementing, in a simple way, some product that will improve the
48 performance of your harvest.

49 According to BRASIL et al., 1999, plants have specific nutrient needs,
50 requiring the supply in the right quantity and in the proper form. Framed in this way, are
51 also the micronutrients that are little perceived, but their absence is quite noticed.

52 Within this context, we find chilli pepper, which has been growing in
53 commercial interest within the state of Alagoas, replacing large areas where sugar cane
54 monoculture was once imperative, uniting small producers in favor of a change not only
55 of paradigms, but of life.

56 The initial proposal is to insert a micronutrient at the moment of
57 transplantation of the seedling into the pit that reduces the susceptibility of the plant to
58 attack of pathogens and that participates in processes essential in the metabolisms of the
59 plant. According to KIRKBY and RÖMHELD (2007), there is increasing evidence that
60 Zn, by maintaining the structure and integrity of the membrane and controlling
61 permeability, also protects the plant from various pathogens. In plants deficient in this
62 micronutrient, the membranes become permeable, such that carbohydrates and amino
63 acids are released, attracting pathogens and insects to both roots and shoots.

64 Zinco is also required for generative growth and the viability of pollen is
65 highly dependent on an adequate supply of this nutrient (SHARMA et al., 1990). It is
66 deduced that the lack of this micronutrient can make all the difference between the exit
67 from the vegetative state to the reproductive to the adult plant.

68 Zn is the most limiting micro-nutrient to crop productivity in Brazil. Your
69 most common way in the soil solution is a Zn camera Zn^{2+} that moves in the ground by
70 diffusion, walking a favor gradient of concentration, that is, a region of concentration to
71 one of lower concentration (MALAVOLTA, 2006).

72 Zinc is absorbed by plants predominantly as Zn^{2+} ; in that same form is
73 transported long distances, from the roots to the shoot by the xylem (MALAVOLTA,
74 2006). Some nutrients may have interactions with Zn, affecting the absorption of the
75 same by the plants. Interactions of the type 6 competitive relationships between P-Zn
76 (BOAWN & LEGGET, 1963; ADRIANO et al., 1971; OLSEN, 1972); Ca-Zn
77 (BERTON et al., 1997); Fe-Zn (SOUZA & FERREIRA, 1988; PAULA et al. 1999;
78 PRADO et al., 2007) and Zn-Cu (ARZOLLA et al., 1955/1956). As regards Zinc
79 redistribution, it is known that it presents low mobility in the phloem, and its greater or
80 lesser translocation depends on its availability in the vegetative part (MARSCHNER,
81 1995).

82 An experiment conducted by VIÉGAS et al (2013), showed that in the long
83 pepper the lack of some nutrients, including Zinc, promote the occurrence of visual
84 symptoms of deficiency accompanied by reduction in the foliar content of their
85 respective nutrients. This reduces the ability of photosynthesis, which can be fatal to the
86 plant.

87 The aim of study is determination of the right choice of treatment of the
88 substrate rather than the seed contributes to the absence of reaction of the chemical
89 compounds found in the seeds treated with fungicide.

90

91 3. Materials and Methods

92

93 The tests were carried out at the Plant Propagation Laboratory of the Department
94 of Plant Production at the Agricultural Sciences Center of the Federal University of

95 Alagoas (UFAL) located at 9° 29' 45" South Latitude and 35° 49' 54" . Two lots of chilli
96 pepper seeds (*C. frutescens* L.) and three treatments besides the control were used.

97 Four replicates of four pre-tests were carried out with two different batches of
98 chilli pepper to arrive at the best dosage to be applied in the official tests.

99 Two untreated seed lots were used for each substrate.

100 Four replicates were performed for each batch of each treatment.

101 The substrate used was treated blotting paper, placed in gerbox-type boxes,
102 submitted to alternating temperature 20° - 30° C and 8 hours light, controlled in a BOD
103 (Biochemical Oxygen Demand) type incubator. The 32 gerboxes were identified
104 following this model: Lot 1: Treatment 1: Repetition 1 = 1.1.1. The control was
105 identified as Treatment 4. According to:

Treatment 1	12 hours submerged in 1 ml solution of pure zinc with 52 ml of distilled water
Treatment 2	12 hours submerged in 1 ml solution of Zinc + Molibdenium with 52 ml of distilled water
Treatment 3	12 hours submerged in 1 ml solution of Zinc + Molybdenum + Copper with 52 ml of distilled water
Treatment 4 (Control)	12 hours submerged in distilled water

106

107 The first count was made at 7 days and the last count at 14 days, as taught by
108 RAS (Rules for Seed Analysis), to record the IVG (Speed Index Germination),
109 according to the methodology described: Germination speed index - daily counts of
110 seedlings emerged up to 14 days after sowing, and IVG was calculated according to
111 Maguire's formula (1962):

$$IVG = \frac{G_1}{N_1} + \frac{G_2}{N_2} + \dots + \frac{G_n}{N_n}$$

112

113 Where:

114 G1, G2, Gn: number of seeds germinated in the first, second, until the last count;

115 N1, N2, Nn: Number of days after sowing in the first, second, until the last day;

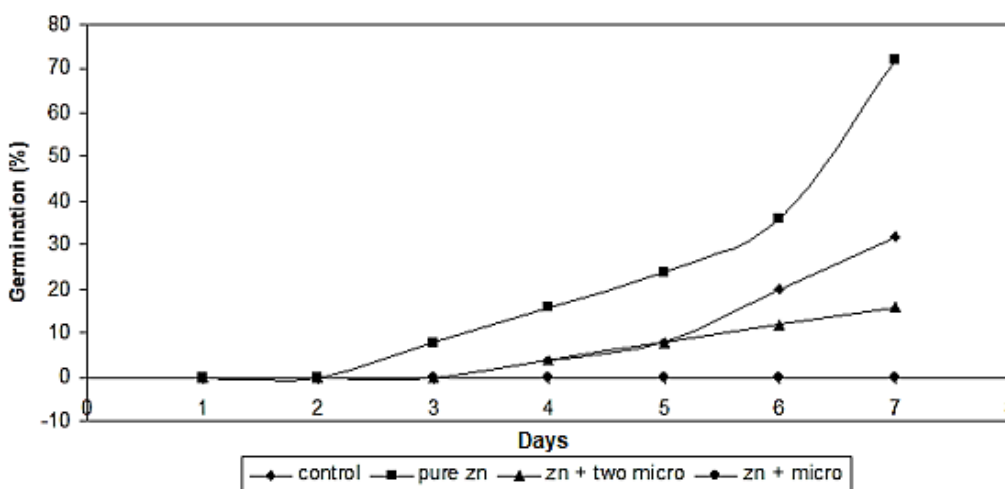
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117 4. Results and Discussion

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119 The first count was done seven days after the germination test, as explained in
 120 the RAS (Rules for Seed Analysis). It was observed in Figure 1 that treatments 2 and 3
 121 were not as good as the control, however, treatment 1 exceeded the expectation,
 122 demonstrating that the application of this micronutrient to the pit, in the form of direct
 123 fertilization, during the transplant period, can supply the initial need for molting,
 124 making it more vigorous and increasing the vigor of this seed by up to 38% in relation
 125 to no treatment.

Figure 1: First count of the germination speed index



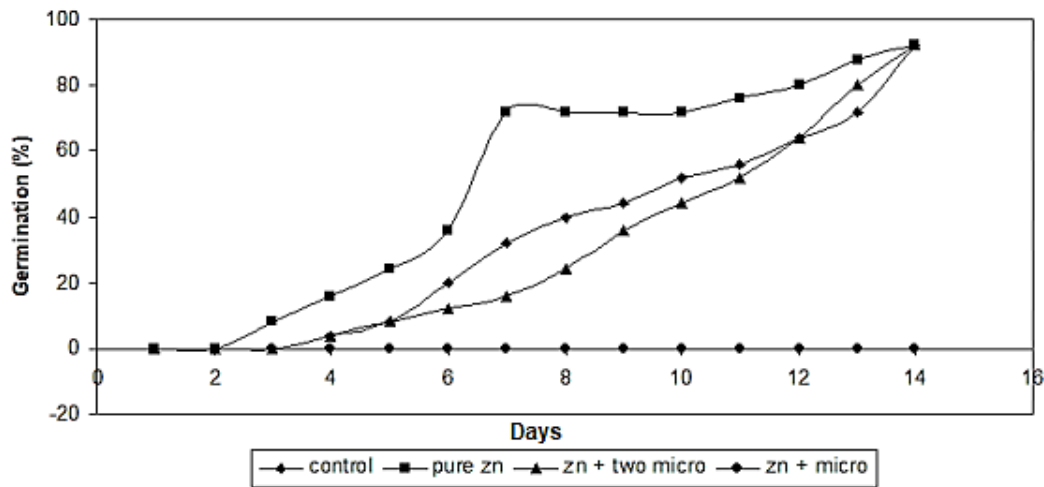
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The treatment with zinc surpassed the control

127 Zinc is absorbed by plants predominantly as Zn^{2+} ; in that same form is
128 transported long distances, from the roots to the shoot by the xylem (MALAVOLTA,
129 2006). Some nutrients may have interactions with Zn, affecting the absorption of the
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133 PRADO et al., 2007) and Zn-Cu (ARZOLLA et al., 1955/1956). As regards Zinc
134 redistribution, it is known that it presents low mobility in the phloem, and its greater or
135 lesser translocation depends on its availability in the vegetative part (MARSCHNER,
136 1995).

137 In Figure 2, where we can see the final count of the germination speed test,
138 although the treatment 1 was always highlighted and showing a better vigor, the
139 germination rate in the final count was the same for the treatment with pure zinc with
140 zinc + molybdenum + copper and the control. It is also observed that the treatment with
141 Zinc and Molybdenum did not obtain any response to the chilli pepper culture when
142 applied to the substrate.

Figure 2: Germination Speed Index and final count



At the end of the fourteen days it can be seen that the percentage of germination was the same, although the treatment of pure zinc stood out during the whole process of germination speed, demonstrating greater vigor in relation to the other treatments.

143

144 When applying the Tukey test at 5% propolis, by the SISVAR program, the high
 145 vigor that Zinc provides in the planted seeds is observed, differentiating, statistically,
 146 both the treatment 3 and the control. Treatment 2, which consists of Zn + Mo, did not
 147 respond, demonstrating that this treatment, applied to the substrate at the time of
 148 planting the chile pepper seed should not be used as it slows the germination or makes
 149 the seed unfeasible.

150 An experiment conducted by VIÉGAS et al (2013), showed that in the long
 151 pepper the lack of some nutrients, including Zinc, promote the occurrence of visual
 152 symptoms of deficiency accompanied by reduction in the foliar content of their
 153 respective nutrients. This reduces the ability of photosynthesis, which can be fatal to the
 154 plant.

155 Based on this experiment, we can also say that the small farmer can be
 156 considered in a positive way, since the essential micronutrient "zinc" is not expensive
 157 and, when applied at the time of transplant, reduces costs. The application of zinc

158 reduces the susceptibility of seeds or seedlings to the entry of pathogens and also
159 increases the likelihood of uniformity in reproductive capacity.

160 The use of Zinc in the substrate at the time of sowing of the chilli pepper or in
161 the pit at the moment of the transplant of the seedlings of this pepper, increases the
162 speed of the germination, making the seedling more vigorous and without losses in the
163 quality.

164 Zinc is also required for generative growth and the viability of pollen is
165 highly dependent on an adequate supply of this nutrient (SHARMA et al., 1990). It is
166 deduced that the lack of this micronutrient can make all the difference between the exit
167 from the vegetative state to the reproductive to the adult plant.

168

169 5. CONCLUSION

170

171 The use of pure zinc or associated with two more micronutrients, such as
172 Molybdenum and Copper, demonstrates that the response is favorable and successful.
173 Already the use of Zinc with Molybdenum proves to be an interaction that did not work.
174 Based on this information, the use of this last interaction is not indicated.

175 The use of Zn, Cu and Mo is indicated for the accumulation of
176 micronutrients, although it showed a lower result than the control in the first count, but
177 showing a good result along the IVG, indicating an increase in vigor.

178 Finally, pure Zn, which from the beginning demonstrates improvement in the
179 performance of pepper germination, increasing the vigor from the first count. In a
180 fertilization recommendation for seedling formation, the use of this last source would be
181 the most indicated.

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