STUDY OF FENNEL SEED GERMINATION
(FOENICULUM VULGARE VAR. AZORICUM)

Neacșu Valeria Ioana*, A. S. Apahidean, Anca Mariana Husti, Raluca Cicevan
University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, 3-5 Manastur Street,
Cluj-Napoca, Romania; *Corresponding author: ioana_neacsu@ymail.com

Abstract. Fennel (Foeniculum vulgare) is a flowering plant species in the celery family Apiaceae or Umbelliferae. It is a hardy, perennial herb with yellow flowers and feathery leaves, indigenous from the shores of the Mediterranean, widely naturalized in many parts of the world, especially on dry soils near the sea-coast and on riverbanks. Florence fennel Foeniculum vulgare Azoricum is a cultivar group with inflated leaf bases which form a bulb-like structure. This experiment aimed the germination fennel seed, as a result of qualitative and quantitative processes, which determine the transition of seed from latent life to active life, resulting in development of a new plant. Seed germination depends on both internal and external conditions. Germination is epigeal and fennel seed normally germinates in 10-14 days depending mainly on the weather following sowing. The experiences made that the preparation SM (produced by Research and Development Center for Biostimulators “BIOS” Cluj-Napoca) in concentration of 0.05%, in case of treating seeds for 3 h, has a positive influence on seeds germination, compared to untreated water control.

Keywords: Foeniculum vulgare, germination, seeds, substances biostimulating

INTRODUCTION

Fennel is one of the important medicinal and spice plants of the world (Omidbaigi R 1997) and has become one the most economical medicinal plants in the Mediterranean region (Kandil MA (2002). Fennel is traditionally used for medicinal and culinary purposes. The entire plant is valuable in the medicinal industry its enlarged base is used as a vegetable; its leaves are used for culinary purposes and its seeds as a spice and for essential oil extraction. The flowers and leaves are also used to make yellow and brown dyes (Malhotra SK 2012). Seeds are an efficient means of transmitting pathogens, often introducing them into previously noninfected areas. The presence of pathogens can reduce the physiological quality of the seeds; the integration of tests for the health and physiological quality of the seeds is therefore recommended (Lazarotto et al., 2013). Germination in the laboratory is the development from seed embryo, of those essential structures that shows the plant ability to grow into a normal plant, with favorable conditions, for analyzed species Foeniculum vulgare is one of the most popular plants in the world for its aromatic seeds, which are used for culinary purposes. It is grown on a 19.81 thousand hectares, with a production of 28.20 thousand tons (Tiwari and Agarwal, 2004). In this experiment was watched the fennel seed germination as a result of qualitative and quantitative processes which determine the transition of seed from latent life to active life, resulting in the development of a new plant

MATERIALS AND METHODS

For the experiment were used fennel seeds, germinators, filter paper with a porous texture, to ensure good humidity conditions for seed germination. The water used for wetting the substrate was free of organic or inorganic impurities. Biostimulatory SM preparation was also used for wetting of seeds in different concentrations, experience was
trifactorial untreated water factor 1, factor 2 solution SM in a concentration of 0.005 % and factor 3 solution SM in a concentration of 0.05 % with fill wetting time of one hour and three hours. As experiment result, were formed 6 experimental variants in 2 repetitions, using 50 seeds per repetition. Data were collected for germination percentage, germination rate, time means of germination, radicle length, plumule length, seed vigor, and allometry ratios. Periodical observations have been made on the seeds germination, with measurements of the root, stems and leaf lengths (Fig. 3). The germination percentage was recorded every two days. Rate of germination was estimated using modified Timpson’s index of germination velocity (Khan and Ungar, 1984). Mean Germination Time (MGT) was calculated in order to assess the rate of germination (Ellis and Roberts, 1981).

$$MGT = \sum D \times N / n$$

Where: 
- $N=$ the number of seeds which in D day grow,
- $n=$ the total number of seeds grown and
- $D=$ is the number of days from the date of germination.

**RESULTS AND DISCUSSION**

The seeds were germinated at the date of 13.02.2014 and began to germinate after 7 days. The germination with wetting time of 1 hour, in untreated water is much weaker than the other two versions (see figure 2). Regarding the variants using biostimulatory substances, we can see that the solution SM with concentration of 0.05%, when treating seed for 1 h, has a positive influence on germination, resulting in greater height differences, compared to the witness when using untreated water.

According to the data in Figure 1 germination of seeds is influenced by biostimulative solutions called SM. As it originates in the figure, in comparison with the untreated water in which the seeds were soaked for one hour (Mt), wherein the proportion of germination was 7.33 %, after 6 days from the start of germination, the seeds soaked for one SM 0.05 % solution hour, germinate much better, leading to a percentage of germination of 25.25 %. Seeds of humectant in the raw water for 3 hours (24.42 %) and 0.005 % SM soaked for 1 hour (23.42 %) were germinated as a percentage higher than the control (untreated water hour). The seeds soaked in SM 0.005 % for three hours had a procentataj after 6 days of germination (7.42 %) percentage approached the witness. Instead seeds soaked in MS 0.05 % for three hours after 6 days had a much lower...
A lower concentration of the SM solution, 0.005%, causes a lower germination of fennel seeds, when wetting is time greater. The less germination percentage (0.5 %) than the control, in this case shows that the solution biostimulative acted as an inhibitor.

**Fig. 2.** Evolution of fennel seeds

- a – appearance secondary root of 7 days
- b – appearance secondary root of 9 days
- c – appearance secondary root of 11 days
- d – appearance secondary root of 13 days
- e – appearance secondary root of 14 days

**Fig. 3.** (a) the length of the roots; (b) the length of the stem; (c) the length of the leaf

Figure 3 (a) is clearly observed a significant increase in the MC of the seeds of plants which have been soaked for three hours in 0.05 % SM (3.5 cm), compared with the untreated water had been wetted seeds of such three-hour (3.1 cm). On the other hand the length of the seedlings MC of seeds which have been soaked in 0.005 % SM solution for three hours (2.6 cm) is less than the length of the seeds to control plants (untreated water for three hours). Looking at Figure 4, note that the length of the seeds to seedlings of which the seeds were soaked in SM 0.05 % and 0.005 % is low compared with the untreated water for one hour. According to the figure 3 (b) have the same length of hypocotyl your plants whose seeds were soaked for three hours in 0.05 % SM solution for three hours, and the seedlings of which seeds were soaked in water for three hours Untreated (4.1 cm). The length of the seedlings strains 0.005 % SM soaked in the solution, has a value less than (4 cm) than the length stalk control plants (untreated water for three hours). According to the figure (4b) the length of the hypocotyl of plants which have been kept in 0.05 % SM solution (4 cm) is less than the length of hypocotyls untreated plants kept in water for one hour (3 cm). The length of the hypocotyl of plants 0.005 % SM kept for one hour has a value less than the length of the hypocotyl of plants kept in the raw water for one hour.

Looking at figure 3 (c), note that the length of the cotyledons is larger plants from 0.05 % SM kept in the solution for 3 hours (2.4 cm) and the slope is less than 0.005 % SM kept in the solution for three hours (2 cm) compared with untreated seedlings stored in water for three hours (2.2 cm). The length of the cotyledons in plants kept in SM solution 0.05 % (1 hour) and 0.005 % SM (1 hour) is higher than the length of leafs undrawn plants kept in water for one hour. A lower concentration of the SM solution, 0.005%, causes a lower germination of fennel seeds, when wetting is time greater. The less
concentrated SM solutions do not give satisfactory results, regardless of wetting time of the seeds.

**CONCLUSIONS**

This study led to the following conclusions: using biostimulatory substances, in concentration of 0.05%, when treating seeds for 1h, has a positive influence on seeds germination and also on growth of the entire plant. Seed germination is a complex physiological mechanism by which the embryo resumes growth after a period of inactivity and new seedlings. Based on the results obtained from studies conducted following conclusions: biostimulatory substance used at a concentration of 0.05% seed treatment for one hour, has a positive influence on seed germination. It can be seen that the seeds wetted in 0.05% solution helped to better plant development (the length of the roots, the length of the stem, the length of the leaf are higher. Also, the untreated seeds wetted in water and solution of 0.005%, inhibited plant growth.

**Acknowledgements:** This paper was published under the frame of European Social Fund, Human Resources Development Operational Program 2007-2013, project no. POSDRU/159/1.5/S/132765.

**REFERENCES**