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Original Research

Influence of different priming treatments on the germination and seedling growth of *Phlomis cancellata*

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ABSTRACT:

In order to study the effects of different methods of priming on germination and seedling growth of *Phlomis cancellata*, a completely randomized design with six treatments (control, soaking, KNO_3 (2%), GA_3 250, GA_3 500 and GA_3 750 ppm) and three replications were conducted. Results showed that highest germination percentage, germination rate and seed vigor were recorded by GA_3 at 250 ppm. Minimum rate and germination percentage were observed in the control and KNO_3. Gibberellic acid treatments had the greatest influence on growth indexes than other treatments. Among growth parameters, the maximum seedling length, dry and fresh weight were observed in GA_3 at 250 ppm. From these results and developmental research about the effect of different priming techniques, a better understanding can be obtained of seed germination and seedling growth of *Phlomis.*

Keywords:
GA_3, KNO_3, priming, seed germination, seed vigor.

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INTRODUCTION

Poor germination in laboratory or field conditions is one of the main problems of medicinal plants. Therefore, identifying factors affecting on seed dormancy and creating optimum conditions for germination in order to have extensive cultivation of medicinal plants, especially in a sterile laboratory conditions are necessary. Germination is one of the critical and important stage in the life cycle of plants, and it is a key process in seedling emergence and final yield. This stage of development is strongly influenced by environmental factors, especially temperature and soil moisture (Najafi *et al.,* 2006). Priming is one of the seed treatments before planting. Today, using of certain substances as pretreatment has been suggested to stimulate germination and reducing the time between sowing and emergence of seedling, synchronicity emergence, and germination under unfavorable environmental conditions (Hejazi and Sedghi, 2000; Khui, 1996). Different plant species need different conditions for germination. Chemical conditions around the seed can be a determining factor to inhibit or stimulate germination (Chiwocha *et al.,* 2005; Joudy and Sharifzadeh, 2004). Studies showed that many plant hormones such as gibberellins, cytokinin, ethylene and abscisic acid may be controlling the plant growth, which they contribute in stimulating germination or dormancy (Gonzlez-Benito *et al.,* 2004; Ritchie and Gilroy, 1998). It is generally accepted that GA_3 has a strong stimulating effect on germination and breaking seed dormancy (Fathi and Esmailpour, 2000; Dunand, 1992; Kepczynski and Groot, 1989).

Taxonomically *Phlomis* belong to the Lamiaceae family has 70 species, which is limited to the parts of Asia, such as Iran, Afghanistan, Turkmenistan and Iraq (Bellamy and Pfister, 1992). 70 species of this genus is native to Iran and grows wild in some areas (Rechinger, 1982). *Phlomis* is a perennial plant. It has impressive distribution in the range of Khorasan, Golestan and Mazandaran. Despite it has very high medicinal value and less attention has been paid so far (Akhlaghi and Kakh'ky, 2010). The seeds of *Phlomis* have dormancy and low viability. Therefore the aim of this study was to investigate various methods of priming to improve germination and seedling growth.

MATERIALS AND METHODS

In order to evaluate the effect of seed priming on germination of *Phlomis cancellata* completely randomized design with six treatments and three replications were done in Torbat-e-Jam University. The treatments included soaking at KNO_3 (2%) and different concentrations of GA_3 (250, 500 and 750 ppm). Sample seeds were collected from Bakharz area in Khorasan Razavi Province. After collecting healthy seeds were selected for the germination test. The seeds were disinfected by sodium chloride (2%) for 2 minutes, and then the seeds were placed in different priming solutions. After 24 hours, 25 seeds of each treatment were placed in different petri dishes containing whatman paper for each replication. All petri dishes were put in germinator. The seeds were germinated in darkness (16 hours) at 24ºC and relative humidity 70% for 14 days. Germinated seeds were counted every day. In this experiment, Germination Percentage (GP) (Camberato and Mccarty, 1999), Mean Germination Time (MGT), seed vigor index (Agraval, 2995), germination rate (Maguirw, 1962), seedling length, stem and root length and dry and fresh weight of seedlings were measured.

1. $GP = 100(n/N)$

n: number of germinated seeds on the n^{th} day – N: total number of seeds

2. $MGT = \sum(n_i/d_i)$

n_i: number of germinated seeds – d_i: day of counting

3. Seed vigor index = GP × seedling length

Analysis of variance was carried out using SAS software and Duncan's multiple range test calculated at 5% level of probability.

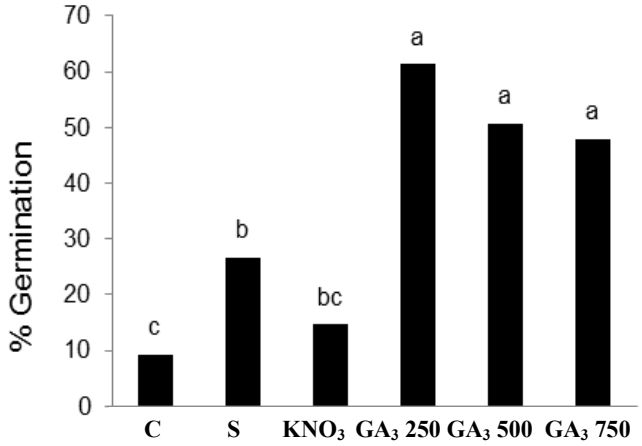

Figure 1. Effect of different treatments on germination percentage

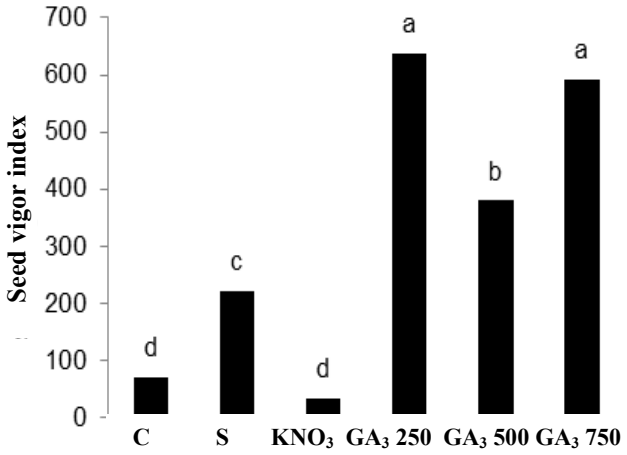

Figure 2. Effect of different treatments on seed vigor index

RESULTS AND DISCUSSION

Germination percentage and seed vigor index

Results showed that GA_3 treatments had the greatest effect on germination parameters. The maximum germination percentage and seed vigor index was seen in GA_3 treatments and the minimum germination percentage and seed vigor index was recorded in control and KNO_3 (Figure 1 and 2). Also "Pasalar" (1991), showed that KNO_3 had no significant effect on germination and breaking dormancy of seed *Chenopodium album*.

Mean germination time and germination rate

In this experiment, it was found that KNO_3 had negative effect on MGT than control, but all GA_3 treatments decreased MGT than other treatments (Figure 3). These results were in agreement with Bhatt *et al.* (2005) and Penalosa *et al.* (1993). The maximum and minimum germination rate was in GA_3 250 ppm and KNO_3 respectively (Figure 4).

Root, shoot and seedling length

Mean compartion of results showed that GA_3 250 ppm had maximum effect on seedling and root length (Figure 5 and 6). Minimum length of seedling and root were recorded in KNO_3. Tavili and Saberi (2010) studied different treatments on germination of *Artemisia sieberi* and reported GA_3 250 ppm had the most effect on germination percentage, root and seedling length. The lowest shoot length (Figure 7) was observed in KNO_3 treatment, but there was not significant difference between other treatments.

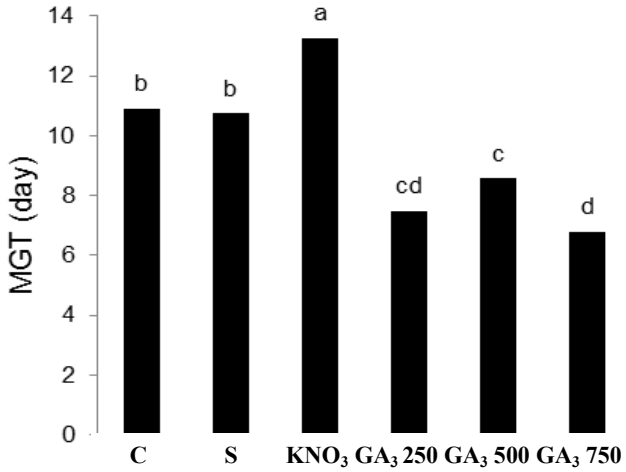

Figure 3. Effect of different treatments on MGT

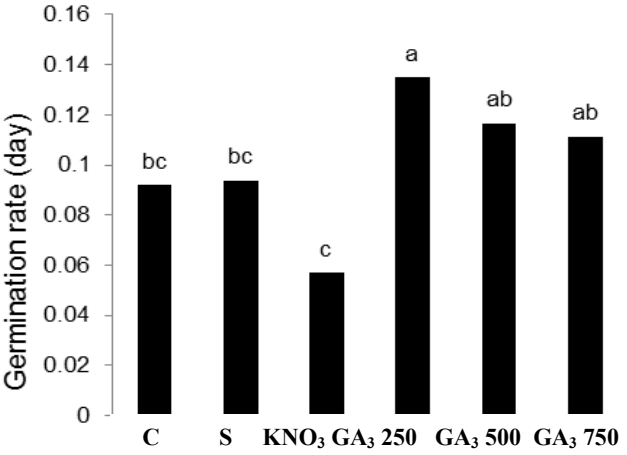

Figure 4. Effect of different treatments on germination rate

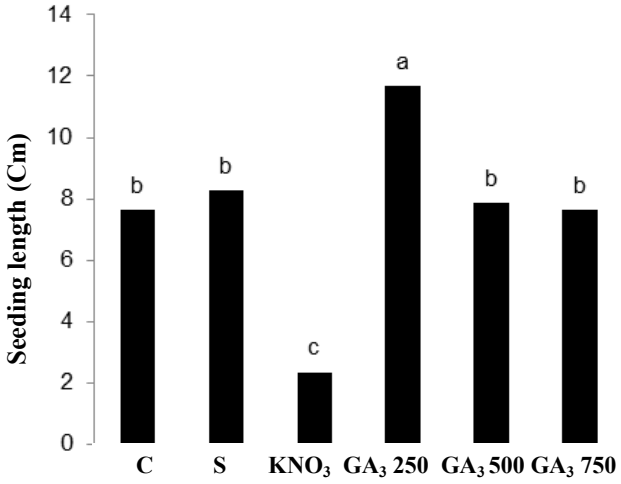

Figure 5. Effect of different treatments on seeding length

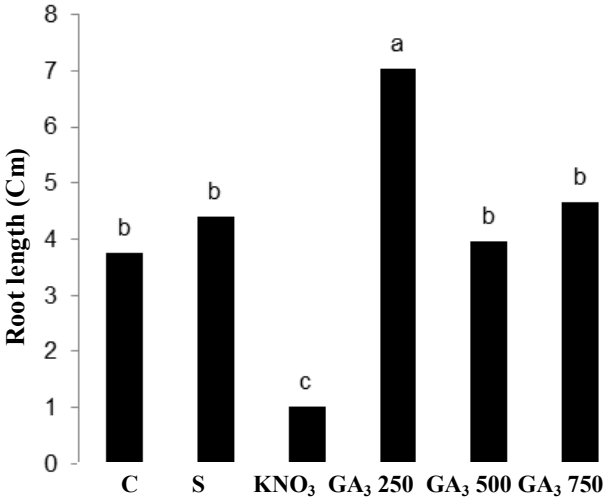

Figure 6. Effect of different treatments on root length

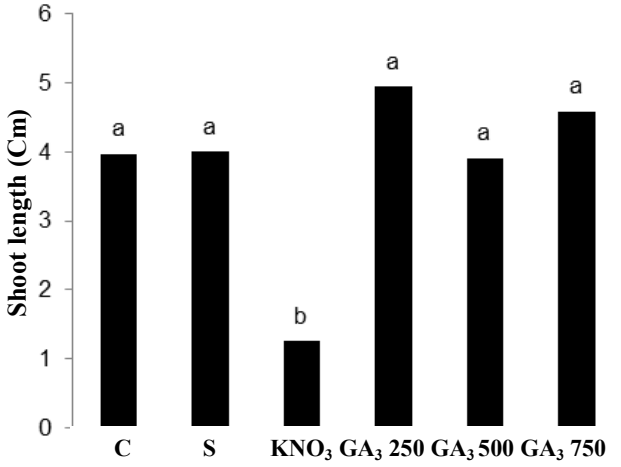

Figure 7. Effect of different treatments on shoot length

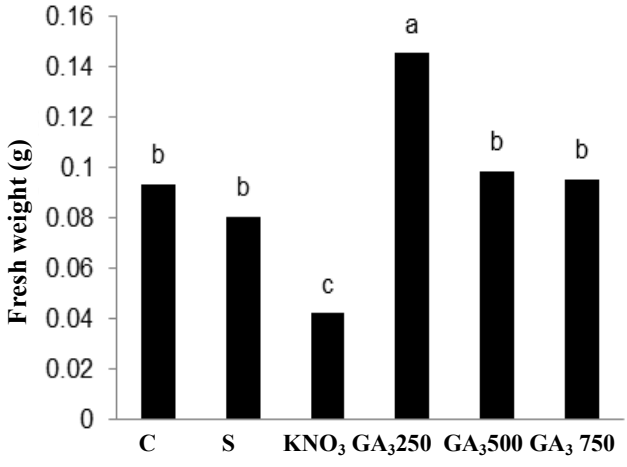

Figure 8. Effect of different treatments on fresh weight

Fersh and dry weight of seedling

Figures 8 and 9 showed the effect of different treatments on fersh and dry weight of seedlings. Results showed that maximum and minimum fresh and dry weight were in GA_3 250 ppm and KNO_3 treatments respectively. Seed germination is a sensitive and important step of plant growth and development. It plays an important role in the establishment of seedling and production process. Seed priming is a method of improving seedling establishment, especially in unfavorable environment conditions. Plant hormones such as gibberellic acid play a very important role in germination process and plant growth. Gibberellic acid is made at the time of germination and through the hydrolysis of food storage, it is involved in plant growth. External application of gibberellic acid can be caused to break dormancy and seedling establishment.

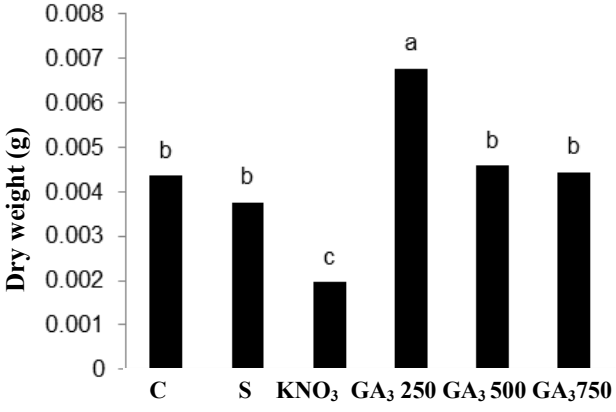

Figure 9. Effect of different treatments on dry weight

CONCLUSION

In this study, it was found that the response of traits to different priming was different. Therefore, paying attention to a factor which represents a set of characteristics of seeds and seedlings is necessary. In this regard, seed vigor index (GP × seedling length) seems more appropriate. In this experiment, it was found that GA_3 250 ppm had significant effect on germination parameters such as seed vigor and seedling growth. According to the results, we can say GA_3 250 ppm is more suitable to break dormancy and seedling establishment in *Phlomis cancellata*.

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