

## Fixing of Optimal Concentration of PEG 6000 for induction of moisture stress in Coriander (*Coriandrum Sativum* L.)

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**ABSTRACT:** *Coriandrum sativum* L. commonly known as “Dhania” belongs to family Umbelliferae. PEG (Poly Ethylene Glycol) 6000 used to induce moisture stress. The artificial induction of drought was done using Poly Ethylene Glycol (PEG) as has been followed earlier in hot pepper and egg plant (Krishnasamy and Irulappan, 1994). In order to standardise the optimal concentration of PEG 6000 different formulations of PEG 6000 prepared as 5% (-0.05 MPa), 10% (-0.15 MPa), 15% (-0.30 MPa) and 20% (-0.49 MPa) alongwith distilled water as control. Based on the results attained for germination percentage and vigour index, a concentration of 10% (-0.15 MPa) has been fixed as optimum for coriander for further studies.

**Keywords:** Coriander, PEG 6000, stress, drought

### INTRODUCTION

*Coriandrum sativum* L. commonly known as “Dhania” belongs to family Umbelliferae. Coriander fruits are an important spice of many countries of Europe, Northern Africa, West, Central and South Asia. In India, it is cultivated in Rajasthan, Gujarat, Madhya Pradesh, Tamil Nadu, U.P., etc.

Jayawardhana *et al.* (1989) concluded that PEG solutions inhibit germination of sorghum seeds. Germination was decreased significantly at the lowest potential of -1.0 MPa. Polyethylene glycol was a satisfactory osmoticum for studying the direct effect of water potential on germination. Sorghum seed germinability under moisture stress imposed by PEG 6000 at -0.2 to -1.0 MPa was studied by Dighe and Rajurkar (1981).

Working with sorghum and other annual crops, Dart *et al.* (1992) used PEG 6000 and found that sorghum is more resistant to water potential and temperature increases than soybean and sunflower. The maximum germination of sorghum seed occurred in a range of 27 to 37° C at -1.2 MPa after 3 days. Germination under drastic conditions of water stress was inhibited, but was restored with an increase of water availability (Silva Ligia *et al.*, 2001).

The seeds germinated well until -0.3 MPa water potential. Germination percentage reduced from -0.5 MPa while the speed of germination was reduced from -0.3 MPa. The limit of tolerance to water stress in PEG-6000 of *C. quercifolius* seeds was between -0.7 and -0.9 MPa (Viégas *et al.*, 2005).

Leila Radhouane (2007) reported that mean germination percent of pearl millet (*Pennisetum glaucum* (L.) R. Br) for all provenances of Tunisia decreased about 73 per cent in -2.0 MPa compared to control (0 MPa) treatment. Decreases in the external osmotic potential induced decreased shoot growth while a slight increase in root length associate with the -1.0 MPa treatments was observed for some ecotypes. This reflects an adaptive response involving an increase in root length to reach deeper water in the soil.

### MATERIALS AND METHODS

The present investigation on Standardization of optimal concentration of PEG 6000 for induction of drought was carried out at Department of Spices and Plantation Crops laboratory, Horticultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore – 641003 during 2008.

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Poly ethylene glycol with a molecular weight of 6000 of analytical grade was used to induce stress conditions. Different concentrations of PEG 6000 were prepared as per the Michel and Kaufmann (1973) in order to fix the optimal concentration.

#### Treatment details

T<sub>1</sub>: Control (Distilled water)

T<sub>2</sub>: 5% PEG 6000 (-0.05 MPa)

T<sub>3</sub>: 10% PEG 6000 (-0.15 MPa)

T<sub>4</sub>: 15% PEG 6000 (-0.30 MPa)

T<sub>5</sub>: 20% PEG 6000 (-0.49 MPa)

The coriander variety CO (CR) 4 of coriander was employed for fixing the concentration of PEG 6000 for screening for drought tolerance in Completely Randomized design with 4 replications.

For fixing concentration, seeds of ruling variety CO (CR) 4 were taken and they were lightly pressed to separate inter mericarps and soaked in water for 16 hours (Padmapriya *et al.*, 2007). Twenty seeds were counted for each treatment and placed in separate petri dishes. All the petri dishes were kept uniformly in a germination chamber. One mL solution of PEG 6000 from each of the five concentrations was added to the petri dishes separately at regular intervals of 24 hours.

#### Observations recorded

##### Germination percentage

The number of seedlings emerged were counted fifteen days after sowing in each of the accession tested and the mean was expressed in percentage. Germination percentage was calculated as below

$$\text{Germination percentage} = \frac{\text{No. of seeds germinated}}{\text{No. of seeds sown}} \times 100$$

##### Shoot length

The height of the seedling was measured from the collar region to the top in each of the accessions and the mean value was expressed in centimeter (cm).

##### Root length

Root length was measured from the collar region to the tip of the primary root in each of the accessions and the mean was expressed in centimeter (cm).

##### Vigour index (%)

The vigour index was worked out as per the method of Abdul-Baki and Anderson (1970).

VI = Germination percentage × (Shoot length + Root length)

#### RESULTS AND DISCUSSION

The data related to fixing concentration for screening the coriander genotypes is furnished in Table 1.

With respect to germination percentage, the treatments exhibited a wide degree of variation for germination from 0 to 73.50 per cent. The germination percentage of CO (CR) 4 was significantly on the higher side in T<sub>1</sub> (73.50 %), followed by T<sub>2</sub> and T<sub>3</sub> with a germination of 57.00 and 17.50 per cent. No germination was recorded in T<sub>4</sub> and T<sub>5</sub> *i.e.*, 0 per cent.

Among the germinated treatments, the shoot length of the CO (CR) 4 under different treatments ranged from 4.62 to 7.35 cm. The shoot length was significantly higher in T<sub>1</sub> (7.35 cm) followed by T<sub>2</sub> (5.63 cm) and the lowest shoot length was recorded in T<sub>3</sub> (4.62 cm).

The root length of the germinated seedlings of CO (CR) 4 showed significant deviation ranging from 0.67 to 4.71 cm. The root length was significantly on the higher side in T<sub>1</sub> (4.71 cm), followed by T<sub>2</sub> (1.33 cm). The lowest root length (0.67 cm) was recorded in T<sub>3</sub>.

**Table 1**  
Effect of PEG 6000 on Germination, Shoot length, Root length and Vigour Index of Coriander cv. CO (CR) 4.

Treatments	Germination percentage	Shoot length (cm)	Root length (cm)	Vigour index
T <sub>1</sub>	73.50 (8.63)	7.35 (2.89)	4.71 (2.39)	883.04 (8.63)
T <sub>2</sub>	57.00 (7.62)	5.63 (2.57)	1.33 (1.52)	396.67 (7.62)
T <sub>3</sub>	17.50 (4.30)	4.62 (2.37)	0.67 (1.29)	92.13 (4.30)
T <sub>4</sub>	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)
T <sub>5</sub>	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)
Mean	29.60 (4.50)	3.52 (1.44)	1.34 (1.97)	274.37 (12.24)
S Ed.	0.2180	0.0611	0.0640	0.7548
CD (0.05)	0.4647**	0.1302**	0.1364**	1.6089**

\*\* - Significant at 1% level of significance, (Values in the parenthesis are square root transformed)

Vigour index of CO (CR) 4 was significantly differed and ranged from 92.13 to 883.04. High vigour index was noticed in the T<sub>1</sub> (883.04), whereas the treatment T<sub>3</sub> recorded low vigour index of 92.13.

Finally, the artificial induction of drought was done using Poly Ethylene Glycol (PEG) as has been followed earlier in hot pepper and egg plant (Krishnasamy and Irulappan, 1994). The artificial induction of drought using Poly Ethylene Glycol however is dependent on the concentration and varies with the crop and genotype. Under such circumstances, the study involved in itself a preliminary standardization of the concentration of PEG 6000. Based on the results attained for germination percentage and vigour index, a concentration of -0.15 MPa (10% PEG 6000) has been fixed as optimum for coriander for further studies involving screening for drought tolerance under laboratory condition.

## CONCLUSION

In order to standardise the optimal concentration of PEG 6000 different formulations of PEG 6000 prepared as 5% (-0.05 MPa), 10% (-0.15 MPa), 15% (-0.30 MPa) and 20% (-0.49 MPa) alongwith distilled water as control. Based on the results attained for germination percentage and vigour index, a concentration of 10% (-0.15 MPa) has been fixed as optimum for coriander for further studies.

## REFERENCES

Abdul - Baki, A.A. and J.D. Anderson. (1970), Viability and leaching of sugars from germinating barley. *Crop Sci.*, **10(1)**: 31-34.

Dart, I. K., B.M. Schafer and H.B. So. (1992), The effect of temperature and water potential on germination and

subsequent shoot growth of sorghum and other summer crops. *AIAS Occasional Publications* **268**:243-259.

- Dighe, R. S. and B. S. Rajurkar. (1981), Seed germinability in some cereals under moisture stress. *Punjabrao Krishi Vidyapeeth Research Journal* (Akola India) **1**:108-110.
- Jayawardhana, P. M., R. Ferraris and H. B. So. (1989), Effect of water potential and temperature on germination and emergence of sorghum in different media. *AIAS Occasional Publications* vol. **43**.
- Krishnasamy, V. and I. Irulappan. (1994), Germination response to water stress in the seeds of hot pepper and egg plant genotypes. *Seed Res.*, **13**: 1-9.
- Leila Radhouane. (2007), Response of Tunisian autochthonous pearl millet (*Pennisetum glaucum* (L.) R. Br.) to drought stress induced by polyethylene glycol (PEG) 6000. *African J. Biotechnology*. **6 (9)**: 1102-1105.
- Michel B.E. and M.R. Kaufmann. (1973), The osmotic potential of polyethylene glycol 6000. *Plant Physiol.* **51**: 914.
- Padmapriya, S., N. Chezhiyan, E. Vadivel, K. Rajamani, V.A. Sathiyamurthy and K. Kumanan. (2007), Evaluation of Coriander (*Coriandrum sativum* L.) germplasm for germination and vigour index through leaching method. *Production, Development, Quality and export of seed spices*. S.K. Malhotra and B.B. Vashishtha (Eds.). NRCSS, Ajmeer, pp. 365-369.
- Silva Lígia M. De. M., Ivor B. de Aguiar and Teresinha de J.D. Rodrigues. (2001), Seed germination of *Bowdichia virgilioides* Kunth, under water stress. *Revista Brasileira de Engenharia Agrícola e Ambiental*, **5(1)**: 115-118.
- Viégas, R. A., L. M. De. M. Silva, I. B. De. Aguiar and D. L. de. Morais. (2005), Water stress and osmotic conditioning on physiological quality of *Cnidocolus quercifolius* Pax & K. Hoffm seeds. *Revista Brasileira de Engenharia Agrícola e Ambiental*. **9(1)** : 66-72.

