The Osmopriming Improved Germination Parameters of Water Deficit Stress Drived Soybean Seeds in Low Temperature Condition

*Dehghani[1], F., M. Aghaalikhani[1]., J. Daneshian[2] and E. Rahmati[1]

[1]M.Sc. student, Assistant Prof and M.Sc. Student Faculty of Agriculture, Tarbiat Modares University, Tehran, Iran respectively

[2]Assistant Prof. Seed and Plant Improvement Institute, Karaj, Iran

Tarbiat Modares University (TMU)

Tropentag, October 5-7, 2011, Bonn
"Development on the margin"

Introduction

In arid and semi-arid areas of the world, water requirements of soybean should be met by irrigation. In most areas which may no rain during the most critical stages of growth, i.e. flowering and seed filling, soybean fields may influenced by drought stress. In such a challenging condition this question will arise that whether these seeds produced by mother plants influenced by drought stress could have an acceptable field emergence in the next season?

In addition farmers who fear of rain or the occurrence of frost during harvest, pick it up with the early cultivation of plants exposed to adverse environmental factors during the flowering of plant pests and diseases of the late season to avoid. In these conditions, low temperature stress, is the most common environmental stresses during germination, so the cold and wet soils are causes poor seedling establishment most crops in the field.

The cold test is used widely to determining the vigor of soybean, corn and sorghum seeds (Tekrony, 1983; Ferguson, 1990; Hampton, 1992). *Osmopriming* is one of the techniques of seed vigor improvement, uniform germination and better initial growth of horticultural and field crops and priming the most vigorous seed results in the maximum number of normal seedlings and the most rapid growth (Farooq *et al*., 2006). Main purpose = Evaluation the effect of osmopriming on germination parameters and the initial growth of seedlings of water deficit stress drived soybean seeds under low temperature condition.

Materials and methods

Treatments were arranged in a factorial experiment on the basis of randomized complete blocks with four replications. Factors consisted of:

- soybean cultivars (including DPX, Telar and 032)
- water deficit stress on mother plants including irrigation after 50, 100 and 150 millimeters evaporation from evaporation pan class A, representing as control, mild stress and severe stress respectively.
- osmotic pre-treatment in five levels includes non-priming, osmopriming with solutions of PEG_{6000} with osmotic potentials -5, -10, -15 and -20 bar.

After planting (as BP) the seeds were carried out in a phytothron in conditions of seven days at 10 ° C and four days in condition of 16/8 h (day/night) with 30/20 °C temperature. They were observed daily and the number of germinated seeds was recorded. At the end of testing the number of rotten seeds, normal and abnormal seedlings were determined. Ten seedlings were selected randomly among normal seedlings and the attributes such as length of seedling, length of primary root and primary shoot and their dry weight were assayed. Also cultivated seeds were observed daily to determine the velocity and time of germination and the number of germinated seeds were recorded. By counting the number of germinated seeds daily, some germination indices related to seed vigor and seedling were calculated as follows:

1. Mean time to germination $$MTG = \frac{\Sigma(nd)}{\Sigma n} \quad (1)$$

2. Coefficient of velocity of germination $$CVG = \frac{G_3 + G_2 + \cdots + G_n}{(1 \times G_1) + (2 \times G_2) + \cdots + (n \times G_n)} \quad (2)$$

3. Mean daily germination $$MDG = \frac{FGP}{D} \quad (3)$$

Where n is the number of seed, which were germinated on day D, D is the number of days counted from the beginning of germination, G_1-G_n is the number of seed, which were germinated from the first day until the end of test and FGP is final germination percentage.

Result and discussion

The results showed osmoprimed seeds with PEG_{6000} have increased final germination percentage, normal seedlings percentage, CVG, MDG, length and dry weight root and shoot compared with control (non-priming) in terms of low temperature. Osmotic pre-treatment has also reduced abnormal seedlings percentage and MTG. So that the pre treated seeds with -20 bar solution had the highest germination percentage (92.8%) (fig 1).

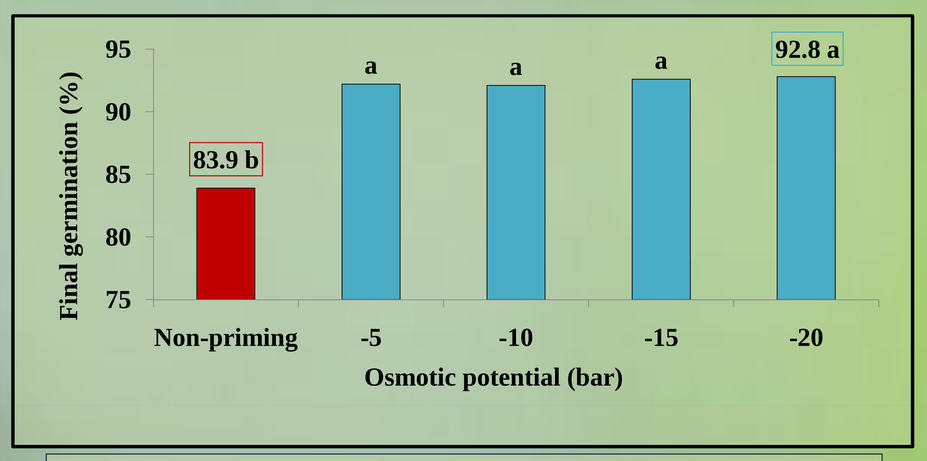

Figure 1- Effect of osmopriming on seed soybean germination in cold test

Most normal seedlings (87.6%) were observed in pre treated Telar seeds with -10 and -20 bar solutions (fig 2). The maximum percentage of abnormal seedlings in all three cultivars was observed in seeds were not treated by osmopriming (non-priming) and osmopriming decreased significantly the percentage of abnormal seedlings (fig 3). The lowest abnormal seedlings (8.23%) were obtained in osmoprimed seeds of 032 cultivar, with -20 bar solution.

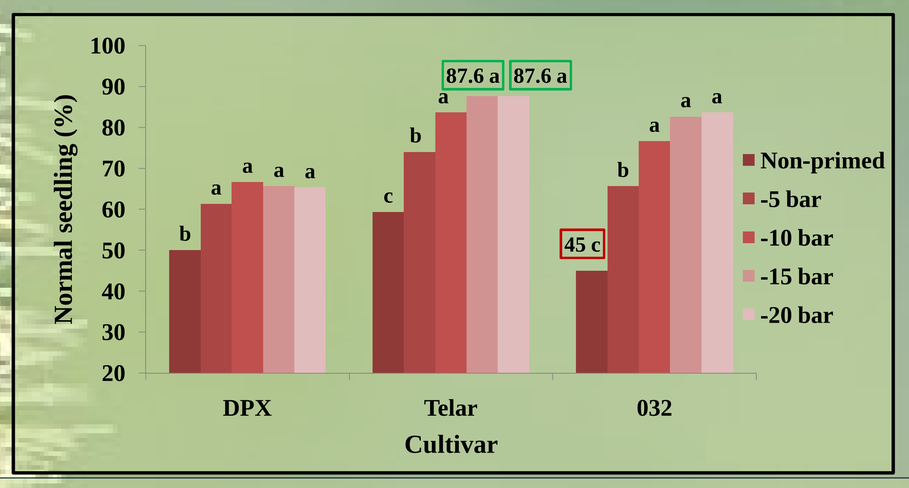

Figure 2- Effect of different treatments osmopriming on normal seedling percentage in three soybean cultivars

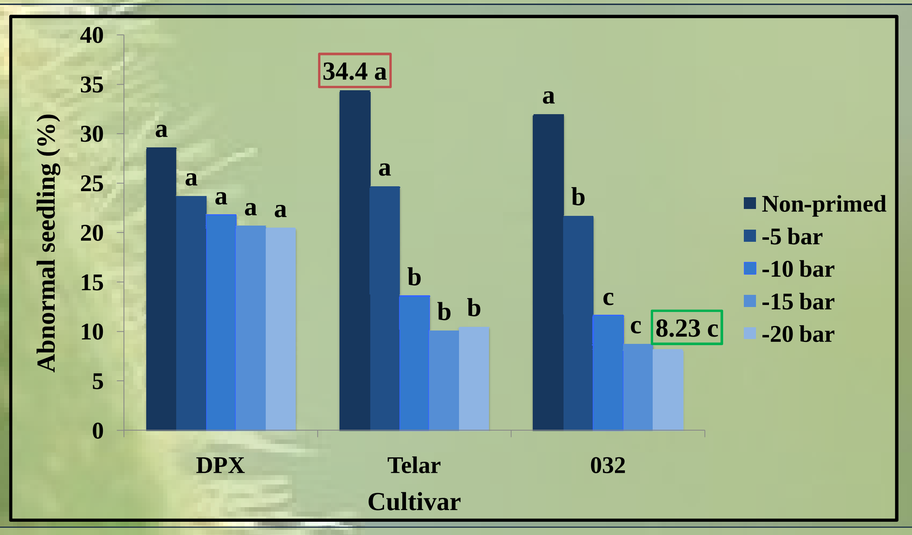

Figure 3- Effect of different treatments osmopriming on abnormal seedling percentage in three soybean cultivars

The longest root (14 cm) and shoot (9.94 cm) were observed in seeds pretreated with -10 bar solution and the shortest in non primed seeds. The pre-treated Telar seeds with -10 bar solution had the most dry weight root (14.6 mg) and shoot (20.91 mg) compared with control (non-primed).There are many reports based on the positive effect priming in increasing the germination rate. In an experiment, it was shown that sorghum of seed priming is an appropriate method for increasing germination rate and germination percentage under low temperature conditions (Foti *et al*., 2002). Also reported that priming four species of grass seeds led to successive germination under low temperature (Hardegree and Van Vactor, 2000). According to our findings in early sowing date which there is the possibility occurrence of low temperature, osmoprimed seeds would be strengthened and achieve acceptable emergence guarantee.

References

Ferguson, J. 1990. Report of seed vigour subcommittee. Journal of seed Technology. 14: 182-184.

Hampton, J. G. 1992. Vigour testing within laboratories of the International Seed Testing Association: a survey. Supplement to Seed Science and Technology. 20: 199-203.

Tekrony, D. M. 1983. Seed vigour testing. Journal of Seed Technology. 8: 55-60.

Farooq, M., Basra, S. M. A. and Rehman, H. U. 2006. Seed priming enhances emergence, yield and quality of direct- seeded rice. Crop management and physiology. 31(2): 42-44.

Foti, S., Cosention, L., Patane, C. and Agosta, D. 2002. Effect of osmoconditioning upon seed germination of sorhum (*Sorghum bicolor* (L.) Moench) under low temperatures. Seed Science and Technology. 30(3): 521-533.

Hardegree S.P. and Van Vactor S. S. 2000. Germination and emergence of primed grass seeds under field and simulated-field temperature regimes. Annals of Botany. 85: 379–390.