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EFFECT OF OSMOPRIMING ON SEED GERMINATION BEHAVIOUR AND VIGOUR OF CHICKPEA (*Cicer arietinum* L.)

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ABSTRACT
The experiment was conducted in Post Graduate Laboratory, Department of Genetics and Plant Breeding, SHUATS, Allahabad, U.P. during *Rabi* (2016), in order to standardize the best method of Osmopriming specific to chickpea. One method of priming *viz*., osmopriming, on two duriations that is 6hrs and 12 hrs were evaluated by screening a range of durations and concentrations *viz*., T_0 - Unprimed Control, T_1–Polyethylene glycol (PEG) (for 6hrs & 12hrs), T_2 –Mannitol 4% (6hrs & 12hrs) T_3–Glycerol 5% (6hrs & 12hrs). It was found that all the priming methods showed significance difference with the control and the highest germination %, seedling length (cm), seedling fresh weight (gm), seedling dry weight (gm) and vigour index were observed in T_2 for PEG 6000 priming for 12 hrs. The study helps to improve the quality of seeds with the help of seed osmopriming treatments which are cost effective and economic, non toxic, eco friendly sources.

KEY WORDS: Chickpea *(Cicer arietinum* L), osmopriming, Polyethylene Glycol 6000, Mannitol , Glycerol.

INTRODUCTION

Pulses are the edible dry seeds of leguminous plants. They are of special nutritional and economic importance due to their contribution to the diets of millions of people worldwide. The importance of pulses lies primarily in their high protein content besides being a valuable source of energy. In addition, pulses also contain good amount of nutritionally rich essential minerals and vitamins such as calcium, phosphorus, iron and vitamin C. The use of pulses as food is concentrated in developing countries, which account for about 90 per cent of global human pulse consumption. Pulses have a special role in meeting protein requirement of predominantly vegetarian population of India. Pulses contain 20 to 25% protein on dry seed weight basis, which is nearly 2-3 times higher than that in cereals (Prasad, 2004).

Bengalgram, which is called chickpea or gram (*Cicer arietinum* L.) in South Asia, is one of the important pulses in developed world. It is a major pulse crop in India widely grown for centuries and accounts for nearly 40 % of the total pulse production. India is one of the major growing countries of the world, accounting for 62 % of the total world production (Reddy 2009). Bengalgram is widely appreciated as health food. It is a protein rich supplement to cereal based diets, especially to the poor in developing countries, where people are vegetarians or cannot afford animal protein. It offers the most practical means of eradicating protein malnutrition among vegetarian children and nursing mothers. It has a very important role in human diet in India. In India, It is grown in 5.65 m ha producing of 4.15 m t with productivity of 740 kg ha^{-1} (2006-07). In Andhra Pradesh, it is grown in 5.29 lakh ha with an annual production of 6.28 lakh tons and productivity of 842 kg ha^{-1} during 2006-07 (Ministry of Agriculture, 2009). Chickpea is one of the important crops of Andhra Pradesh. Though small seeded (*Desi*) type has been popular, the bold seeded (*Kabuli*) type is gaining the farmers interest due to its better consumer preference and high market price. *Kabuli* chickpea (*Cicer kabulium* L.) has a good demand for consumption due to high nutritive value and fairly free from antinutritional value. The cultivation of *kabuli* chickpea is rapidly expanding in Prakasam district of Andhra Pradesh for the last 3 or 4 years by replacing tobacco, cotton and other commercial crops in view of their eroding profitability. The chickpea crop is mainly raised on residual soil moisture and available relative humidity during winter season. The productivity of *kabuli* chickpea is poor, which may be attributed to the limited adoption of improved cultivation techniques and imbalanced nutrition.

Priming

This is also known as osmo-conditioning or osmotic conditioning. In this technique, seeds are soaked for a certain period in solutions of sugar, polyethylene glycol (PEG), glycerol, sorbitol, or mannitol followed by air drying before sowing. Osmopriming not only improves seed germination but also enhances general crop performance under nonsaline or saline conditions, osmo-conditioning of Italian ryegrass (Loliummultiflorum) and sorghum (Sorghum bicolor) seeds with 20% PEG-8000 for 2 days at 10ºC enhanced germination rate, water-stressed, waterlogged, cold-stress, or saline conditions (Hur, 1991). The low water potential of the treatment solution allows partial seed hydration so that pre-germination metabolic processes begin but germination is inhibited (Bennett *et al*., 1992; McDonald, 2000; Pill and Necker, 2001). When the primed seed are planted in the field, they usually exhibit rapid and uniform germination. Osmopriming not

only improves seed germination but also enhances general crop performance under non saline or saline conditions. Salehzade *et al*. (2009) conducted to enhance the germination and seeding growth of wheat (*Triticum aestivum* L.) seeds using different Osmopriming treatments. Seeds were osmoprimed with polyethylene Glycol (PEG-8000), solution for 12 h. The osmotic potential of the all solutions were -0.3,-0.6,-0.9 MPa. During Osmopriming operation all solutions aerated with aquarium pump. The control seeds were not treated. Osmopriming treatments improved germination and seedling vigor than that control. Priming with boric acid using lower concentrations significantly improved the seedling stand establishment parameters (Rehman *et al*., 2012). Shorrocks, (1997) reported that priming with boric acid showed both stimulatory and inhibitory effects on different crop plants. In papaya species the priming with boron increased the growth of all plants (Deb *et al*., 2010).

MATERIALS & METHODS

The laboratory experiments were conducted in the Department of Genetics and Plant Breeding, Sam Higginbottom University of Agriculture, Technology & Sciences (Naini Agricultural Institute) Allahabad, Uttar Pradesh, India, Year 2016-17 to find out "Effect of Osmopriming on seed germination behaviour and vigour of chickpea seeds". The details of materials used and methods followed during the course of investigation are described in this ahead. The research studies were carried out in the Post Graduate Laboratory Department of Genetics and Plant Breeding, Sam Higginbottom University of Agriculture Technology & Sciences, (Naini Agricultural Institute) Allahabad, Uttar Pradesh, India. Allahabad region is located in the north eastern part of Uttar Pradesh and has a subtropical climate with extremes of summer and winter. Winter season temperature is as low as 1°C while during the summer 48 to 50°C. The average rainfall in this area is around 1013.4 mm annually. The seeds of chickpea Variety Avrodhi was obtained from Sam Higgingbottom university of Agriculture Technology and Sciences, Allahabad, for conducting the experiment on different duriations *i.e*., 6 hours and 12 hours with four replications. The Chemicals were used *i.e*., Polyethylene Glycol 6000 (20%), Mannitol (4%) and Glycerol (5%). Observations recorded namely; Germination %, speed of germination, root length, shoot length, seedling length, fresh weight, dry weight, vigour index and vigour mass. The data collected from the experiments were analyzed statistically by the procedure prescribed by Panse and Sukhatme (1978).

RESULT &DISCUSSION

Germination %

The mean performance of germination percentage ranged from 87.75 to 95.25 with mean value of 91.67. Significantly highest percentage of germination (95.25) was reported in the T_2 PEG 20% and it was followed by T_4 (94.25) with Treatment of Mannitol 4%. Minimum germination percentage was recorded by T_0 (87.75) with control.

In case of osmopriming germination percentage was significantly higher in T2-PEG at 20% followed by T4-Mannitol 4% when compared with control. When the data regarding the germination percentage found best in T2-PEG at 20% among all the methods.

Speed of germination

The mean performance of speed of germination ranged from 45.75(control) to 78.25 with mean value of 62.96. Significantly highest percentage of speed of germination (78.25) was reported in the osmopriming with T_2 PEG 20% and it was followed by T_4 (71.50) with Treatment of Mannitol 4%. Minimum speed of germination was recorded by T_0 (45.75) with control.

In case of osmopriming speed of germination was significantly higher in T2-PEG 20% of 12 hrs seeds followed byT4- Mannitol 4% of 12 hrs when compared with control. When the data regarding the speed of germination found best in T2- PEG 20% among all the methods.

Root Length

The mean performance of seedling root length ranged from 15.38 cm to 23 cm with mean value of 18.78 cm. Maximum root length (23 cm) was recorded by T_2 with Treatment of PEG at 20% and it was followed by T_4 (22.07 cm) with Treatment of Mannitol 4%. Minimum root length was recorded by T_0 (15.38cm) with control.

In case of seedling root length percentage was significantly higher in T2- PEG (20%) seeds followed by T4-Mannitol 4% when compared with control. When the data regarding the seedling root length found best in T2-PEG 20% among all the treatments.

Shoot Length

The mean performance of seedling shoot length ranged from 8.12cm to 12.98cm with mean value of 10.90cm. Maximum shoot length (12.98 cm) was recorded by T_2 with Treatment of PEG at 20% and it was followed by T_4 (12.41 cm) with Treatment of Mannitol 4%.The shortest shoot length was recorded by T_0 (8.12cm) with control.

Seedling shoot length has recorded high in case of osmoprimed seeds than that of unprimed seeds in the experiment. Among different osmopriming treatments T2-PEG 20% found to be highest followed by T4-Mannitol 4% and control found to be lowest among the treatments.

Seedling Length

The mean performance of seedling length ranged from 23.51cm to 35.98cm with mean value of 29.54cm. Maximum seedling length (35.98cm) was recorded by T_2 with Treatment of PEG 20% and it was followed by T_4 (34.49cm) with Treatment of Mannitol 4%. Shortest seedling length was recorded by T_0 (23.51 cm) with control.

Seedling length is highest for T2-PEG 20% seeds of chickpea and all osmopriming methods are significantly different and statistically superior over the control, reveals the benefit of different osmopriming methods over control.

Fresh weight

The mean performance of seedling fresh weight ranged from 4.90gm to7.90 gm with mean value of 6.17 gm. Maximum seedling fresh weight (7.90 gm) was recorded by T_2 with Treatment of PEG and it was followed by T_4 (7.19gm) with Treatment of Mannitol 4% . Lowest value of seedling fresh weight was recorded by T_0 (4.90 gm) with control.

In case of osmopriming seedling fresh weight was significantly higher in T2-PEG 20% seeds followed by T4-Mannitol 4% when compared with control. When the data regarding the seedling fresh weight found best in T2-PEG 20% among all the treatments.

Dry weight

The mean performance of seedling dry weight ranged from1.02 gm to 1.59mg with mean value of 1.23mg. Maximum seedling fresh weight (1.59 mg) was recorded by T_2 with Treatment of PEG 20% and it was followed by T_4 (1.48gm) with Treatment of Mannitol 4%. Lowest value of seedling fresh weight was recorded by T_0 (1.02 gm) with control.

In case of seedling dry weight was significantly higher in T2-PEG 20% seeds followed by T4-Mannitol 4% when compared with control. When the data regarding the seedling dry weight found best in T2-PEG 20% among all the treatments.

Vigour Index Length

The mean performance of seedling vigour index length ranged from 89.29 to 150.95 with mean value of 113.03. Maximum seedling vigour index length (150.95) was recorded by T_2 with Treatment of PEG 20% and it was followed by T_4 (139.73) with Treatment of Mannitol 4%.Minimum seedling vigour index length was recorded by T_0 (89.29) with control.

Seed vigour index length has recorded high in case of osmoprimed seeds than that of unprimed seeds in the experiment. Among different osmopriming methods T2-PEG 20% found to be highest followed byT4- Mannitol 4% and control found to be lowest among the treatments.

Vigour Index Mass

The mean performance of seedling vigour index mass ranged from 2063.53 to 3428.09 with mean value of 2372.29. Maximum seedling vigour index mass (3428.09) was recorded by T_2 with Treatment of PEG 20% and it was followed by T_4 (3251.46) with Treatment of Mannitol 4%. Minimum seedling vigour index mass was recorded by T_0 (2063.53) with control.

Seed vigour index mass have recorded high in case of osmoprimed seeds than that of unprimed seeds in the experiment. Among different osmopriming treatments T2-PEG 20% found to be highest followed by T4- Mannitol 4% and control found to be lowest among the treatments.

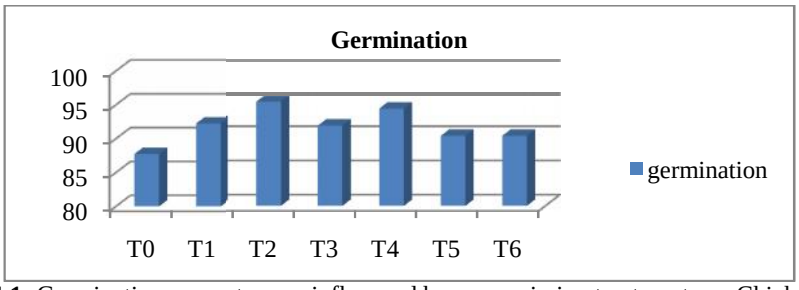

FIGURE 1: Germination percentage as influenced by osmopriming treatments on Chickpea seeds

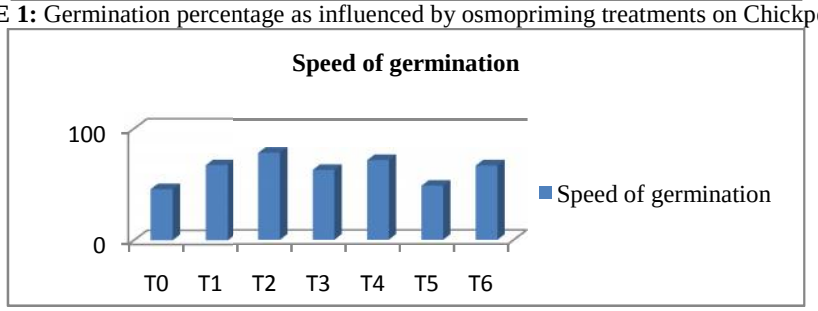

FIGURE 2: Speed of germination as influenced by osmopriming treatments on Chickpea seeds

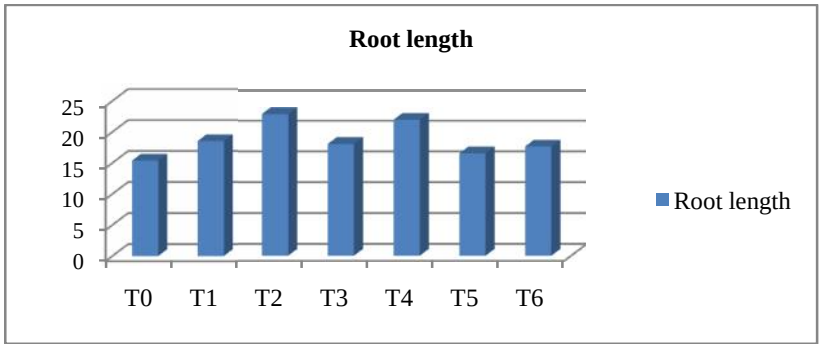

FIGURE 3: Seedling root length as influenced by Osmopriming treatments on Chickpea seeds

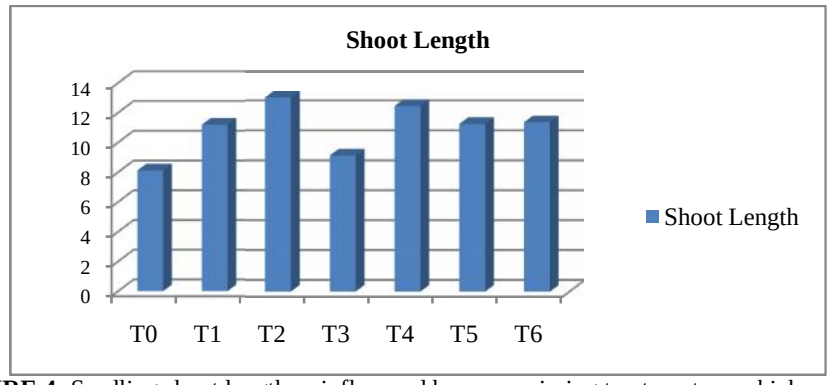

FIGURE 4: Seedling shoot length as influenced by osmopriming treatments on chickpea seeds

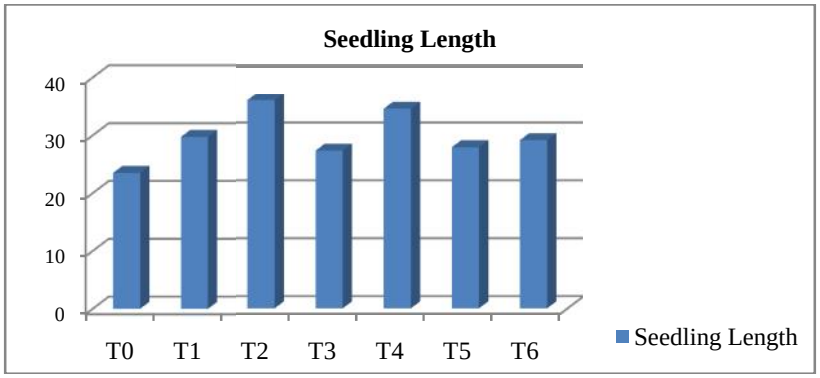

FIGURE 5: Seedling length as influenced by osmopriming treatments on chickpea seeds

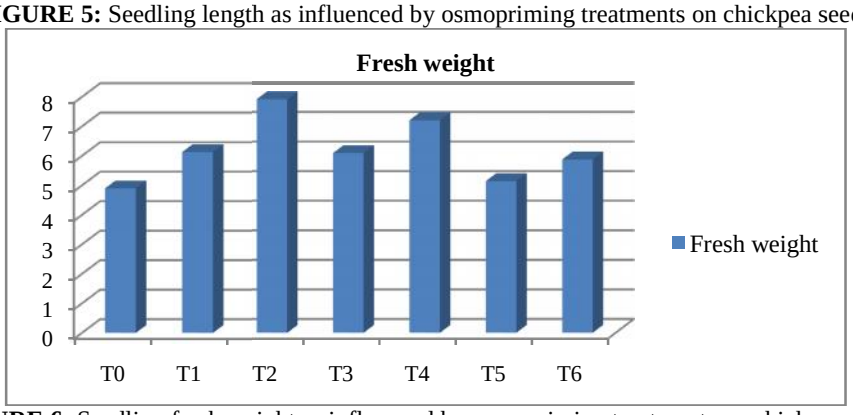

FIGURE 6: Seedling fresh weight as influenced by osmopriming treatments on chickpea seeds

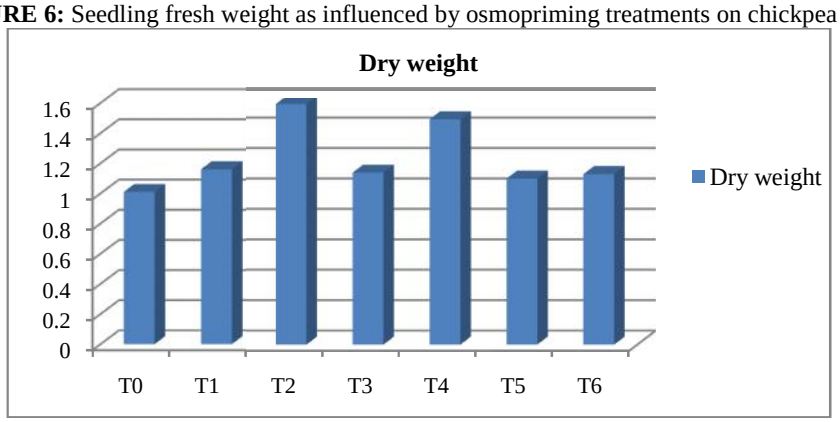

FIGURE 7: Seedling dry weight as influenced by osmopriming treatments on chickpea seeds

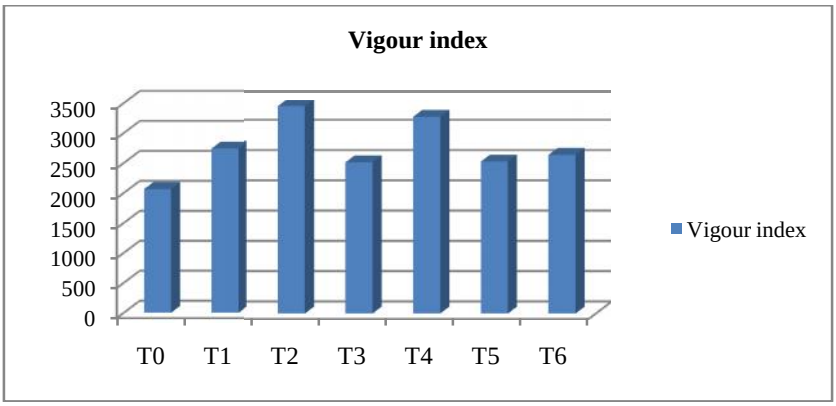

FIGURE 8: Seed vigour index length as influenced by osmopriming treatments on chickpea seeds

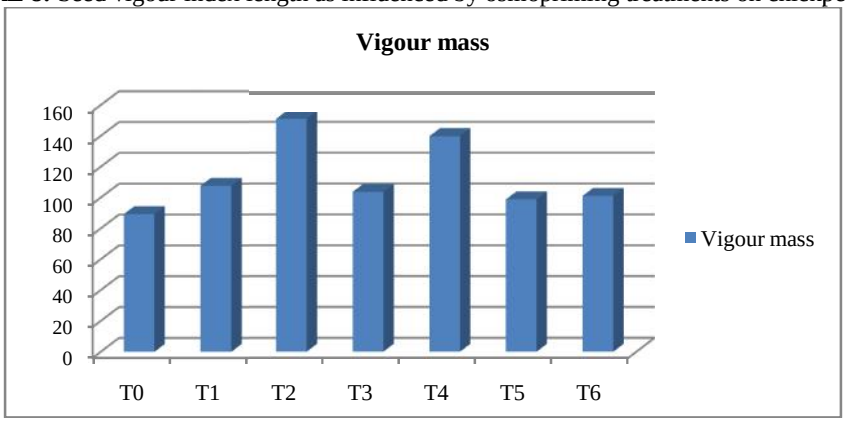

FIGURE 9: Seed vigour index mass as influenced by osmopriming treatments on chickpea seeds

CONCLUSION

Among all the osmopriming treatments, osmopriming PEG 6000 was found to be the best osmopriming treatment followed by Mannitol .Among all osmopriming treatments PEG 20% of 12 hrs was more responsive to all treatments moreover osmopriming treatments have more pronounced effect on germination behavior and vigour in chickpea.

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