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Effect of hydropriming and osmopriming on seed vigour and germination of Pea (*Pisum sativum* L.) seeds

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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 priming specific to pea. Four methods of priming *viz*., osmopriming, and hydropriming, priming were evaluated by screening a range of durations and concentrations *viz*., T_0 - Unprimed Control, T_1 - Distilled water hydration (for 12 hrs), T_2 - Distilled water (for 24 hrs), T_3–Mennitol (3%) hydration (for 12 hrs), T_4 – Mennitol (3%) hydration (for 24 hrs), T_5 –Glycrol (5%) hydration (for 12 hrs).T_6 –Glycrol (5%) hydration (for 24 hrs T_7 –Polyethylene Glycol 6000 (20%) hydration (for 12 hrs)T_8 – Polyethylene Glycol6000 (20%) hydration (for 24 hrs)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 $T_8$for PEG 6000 priming for 24 hrs. The study helps to improve the quality of seeds with the help of seed priming treatments which are cost effective and economic, non toxic, ecofriendly sources.

Keywords: Pea ***(****Pisum sativum* L), priming, Polyethylene $Glycol_{6000,}$ H_2O, Mennitol, Glycerol

Introduction
Pulse crops play an important role in Indian agriculture and India is the largest producer and consumer of pulses in the world. Pulses contain a high percentage of quality protein nearly three times as much as cereals. Thus, they are a cheaper source to overcome protein malnutrition among human beings. For vegetarian diet, pulses form the major source of protein. In fact, lysine is the most limiting essential amino acid in cereals which is very well supplemented by the protein of pulses. The field Pea is distributed in Asia, Africa, Europe, North America and Australia. China, Russian federation, Ukraine, India, France, Canada and U.S.A are the leading field Pea producing countries, contributing approximately 75% of the total production of 90 to 95 million tons. India ranks 5th after Russian federation, Ukraine, China and Canada in terms of production. In India, field Pea occupies 0.62 million hectares with an annual production of 0.56 million tons with an average productivity of 906 kilograms per hectare (Prasad, 2004) [10]. Seed priming is one of the methods of increasing yield in different crops including legume. This priming may be conducted by using water or some chemical substances increasing seed quality and germination. High germination percentage and simultaneous germination are two desired traits in mechanized agriculture. Complementary seed priming is a water balance dependent process which is conducted by soaking seeds in water for a certain time to accelerate their germination. The complementary seed priming stimulates many metabolic processes related to seed germination Rastin, 2013) [11]. The seed priming is a widely used technique to enhance seed performance, notably with respect to rate and uniformity of germination thereby enabling better crop establishment under a range of environmental conditions (Bradford, 1986) [2]. Several improved seed invigoration techniques are being used in many parts of the world to reduce the germination time, synchronize germination, improved germination rate and increase plant stand (Lee and Kim, 2000) [9].

Rapid germination and emergence is an important factor of successful establishment. It is reported that seed priming is one of the most important developments to help rapid and uniform germination and emergence of seeds and to increase seed tolerance to adverse environmental conditions (Harris *et al.* 2001) [7].

Hydro-priming is a controlled hydration by soaking seeds in solution of low water potential followed by re-drying that allows per germination metabolic activities to proceed but prevent radical emergence (Ashraf and Foodland, 2005) [1]. In simple words, Hydro-priming in its traditional sense, soaking of seeds in water before sowing, has been the experience of farmer.

India in an attempt to improve crop stand establishment but the practice was without the knowledge of the safe limit of soaking duration. Hydro-priming is the simplest form of priming which can be practiced on the farm itself and it is very useful for the farmers (Harris *et al*. 1999) [6], promoted a low-cost, low-risk technology called 'on-farm seed priming' that would be appropriate for all farmer, irrespective of their socioeconomic status. "Effect of hydropriming and osmopriming on seed vigour and germination of Pea (*Pisum sativum* L.) seeds" was carried out with the following objectives. To evaluate the effect of hydropriming, and osmopriming on the germination behavior and seed vigour in Pea. To standardize the optimum priming treatment favorable for Peaseed.

Materials and methods

The experiment was conducted in Post Graduate Laboratory of Department of Genetics and Plant Breeding, Sam Higginbottom University of Agriculture, Technology and science, Allahabad (U.P.) using pea Cv. Ajad. The treatments used at different concentrations for priming were T_0 – Untreated, T_1- Distilled water 12 hr, T_2- Distilled water 24 hr, T_3- Mennitol @ 3% for 12 hr, T_4- Mennitol @ 3% for 24 hr, T_5- Glycerol @ 5% for 12 hr, T_6- Glycerol @ 5% for 24 hr, T_7-Polyethylene glycol (PEG) @20% for 12 hr,T_8- Polyethylene glycol (PEG) @20% for 24 hr.

For the preparation of solution one gram of each chemical was taken in a beaker. These chemicals were added separately in 1000 ml. of distilled water with constant stirring. The volume of solution will finally constituted to one litter, then it become 1000 ppm stock solution of each chemical. The flasks containing chemicals was covered with muslin cloth to avoid any contamination. For the preparation of (Mennitol 3%) solution 30 (gm) Mennitol was taken in a measuring flask and made up to 1000 ml. distilled water, while for (5%) Glycerol solution 50 (gm) Glycerol salt was taken in a measuring flask and made up to 1000 ml with distilled water and (Polyethylene glycol 20%) solution 200 (gm) was taken in a measuring flask and made up to 1000 ml with distilled.

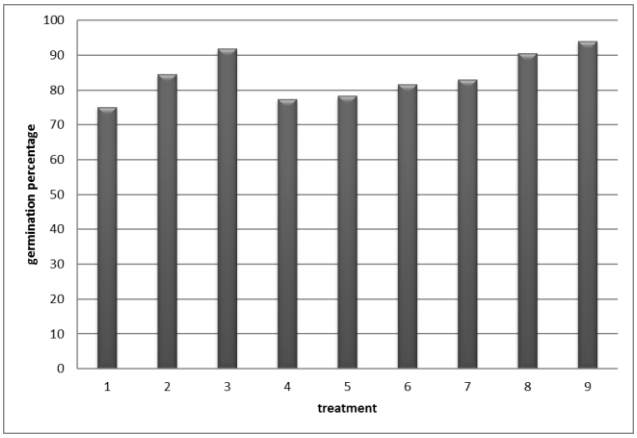
After preparation of solutions pea seeds were soaked of each solution separately for 12 hour at 25^0C temperature. After 12 and 24 hour of soaking the solution was drained out from the beaker and pre soaked air dried to original weight and then placed four replication in completely randomized design (CRD) in between paper method for germination in laboratory under controlled condition.

The observation on the characters *viz.*, Germination percent (ISTA 2004) [8], Speed of germination, Energy of emergence(%), Root length (cm), Shoot length (cm), Seedling length (cm), seedling Fresh weight (g), seedling dry weight (g), Seedling vigour index I^{st}, Vigor index II^{nd} (Baki and Anderson 1973) [4] were recorded. The experimental data recorded were subjected to statistical analysis for calculating analysis of variance, range, mean, critical difference and coefficient of variation (Fisher 1936) [3].

Result and discussion

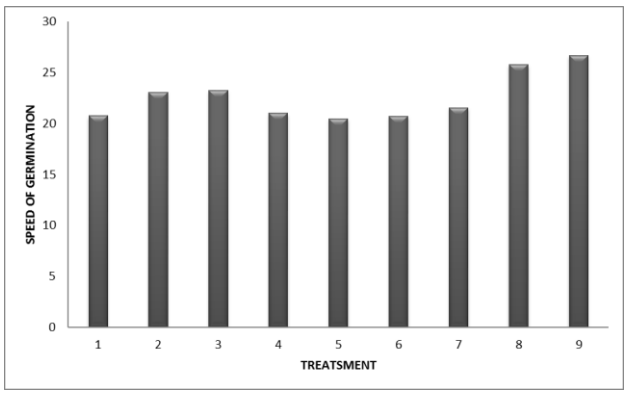
Seed germination

A critical analysis of mean different hydropriming and osmopriming treatments have significant effect.T_8- Polyethylene glycol (PEG) @20%, for 24 hr (93.70 %) shows significant effect on rest of the treatments while lowest with T_0 – Untreated (75.00 %).It is reported that the earlier and better-synchronized germination is associated with increased metabolic activities in the soaked seeds (Basra *et al.*, 2005) [3].



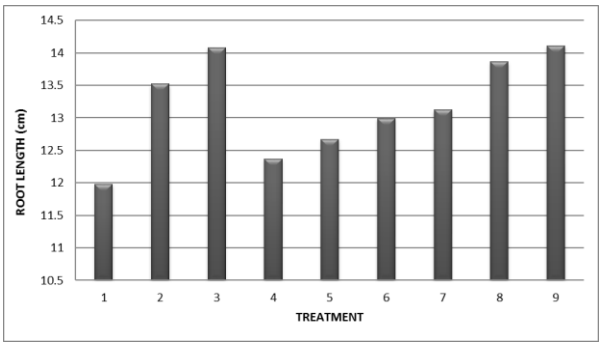
Speed of germination

A critical analysis of mean data different hydropriming and osmopriming treatments have significant effect. T_8- Polyethylene glycol (PEG) @20% for 24 hr (9.11) shows significant effect on rest of the treatments except T_7- Polyethylene glycol (PEG) @20% for 12 hr (8.92).



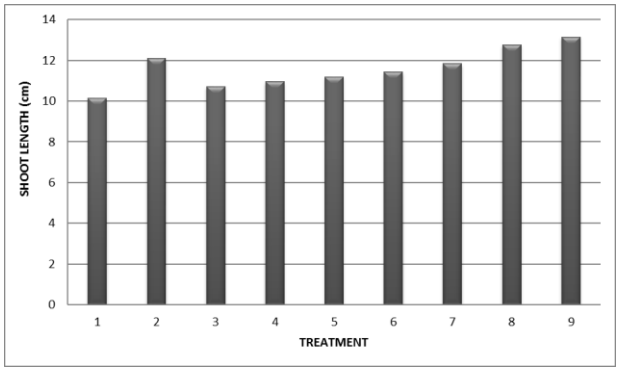
Root length (cm).

Citation of data significant effect of different hydropriming and osmopriming treatments on root length. T_8- Polyethylene glycol (PEG) @20% for 24 hr (14.11) shows significant effect on T_0 – Untreated (11.98), T_3- Menitol @ 3% for 12 hr (12.37), T_4- Menitol @ 3% for 24 hr (12,67) and T_5- Glycerol @ 5% for 12 hr (12.99) while at par with rest of the treatments.



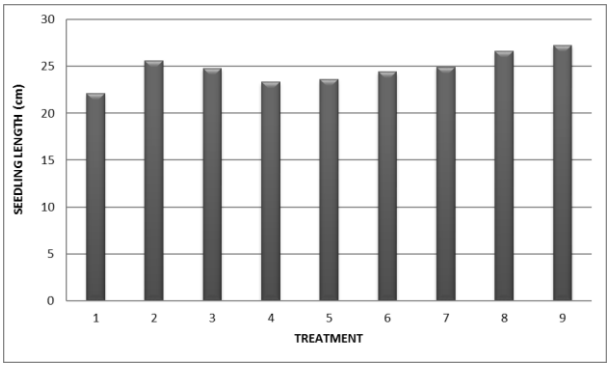
Shoot length (cm)

An appraisal of mean data significant effect of different hydropriming and osmopriming treatments on shoot length. T_8- Polyethylene glycol (PEG) @20% for 24 hr (13.14) shows significant effect on rest of the treatments except at par with T_1- Distilled water @100 ml for 12 hr (12.11) and T_7- Polyethylene glycol (PEG) @20% for 12 hr (12.77).



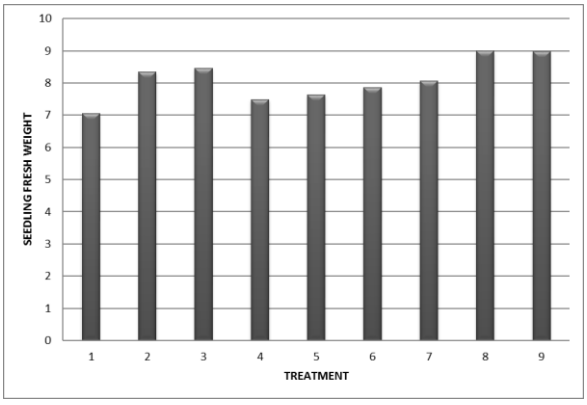
Seedling length (cm)

An appraisal of mean data significant effect of different hydropriming and osmopriming treatments on seedling length. T_8- Polyethylene glycol (PEG) @20% for 24 hr (27.90) shows significant effect on rest of the treatments except at par with T_7- Polyethylene glycol (PEG) @20% for 12 hr (26.53).



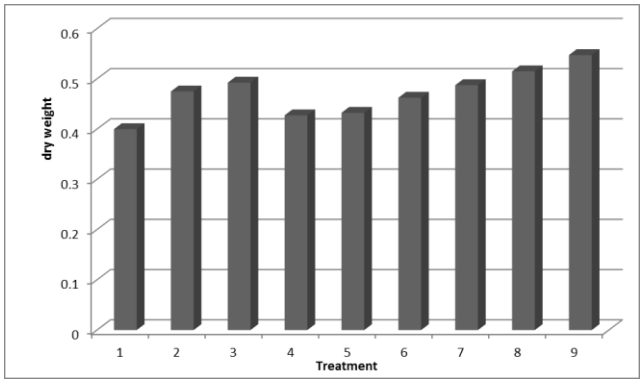
Fresh weight of seedling (gm)

Citation of data significant effect of different hydropriming and osmopriming treatments on root length. T_8- Polyethylene glycol (PEG) @20% for 24 hr (9.01) shows significant effect on T_0 – Untreated (7.05), T_3- Menitol @ 3% for 12 hr (7.09), T_4- Menitol @ 3% for 24 hr (7.64), T_5- Glycerol @ 5% for 12 hr (7.86) and T_6- Glycerol @ 5% for 24 hr (8.06) while at par with rest of the treatments.



Dry weight (gm)

Citation of data significant effect of different hydropriming and osmopriming treatments on root length. T_8- Polyethylene glycol (PEG) @20% for 24 hr (0.54) shows significant effect on T_0 – Untreated (0.40), T_3- Menitol @ 3% for 12 hr (0.44), T_4 Menitol @ 3% for 24 hr (0.43), T_5- Glycerol @ 5% for 12 hr (0.46) and T_6- Glycerol @ 5% for 24 hr (0.48) while at par with rest of the treatments.

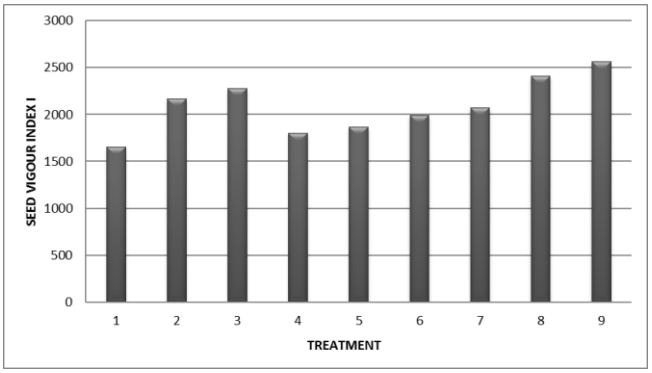


Dry weight (gm)

Citation of data significant effect of different hydropriming and osmopriming treatments on root length. T_8- Polyethylene glycol (PEG) @20% for 24 hr (0.54) shows significant effect on T_0 – Untreated (0.40), T_3- Menitol @ 3% for 12 hr (0.44), T_4 Menitol @ 3% for 24 hr (0.43), T_5- Glycerol @ 5% for 12 hr (0.46) and T_6- Glycerol @ 5% for 24 hr (0.48) while at par with rest of the treatments.

Seed vigour index (I)

A critical analysis of mean data different hydropriming and osmopriming treatments have significant effect. T_8- Polyethylene glycol (PEG) @20% for 24 hr (2563.32) shows significant effect on rest of the treatments except T_7- Polyethylene glycol (PEG) @20% for 12 hr (2407.59).



Seed vigour index (II)

A critical analysis of mean data different hydropriming and osmopriming treatments have significant effect. T_8- Polyethylene glycol (PEG) @20% for 24 hr (51.48) shows significant effect on rest of the treatments except T_7- Polyethylene glycol (PEG) @20% for 12 hr (46.58) and T_2- Distilled water @100ml for 24 hr (45.16).

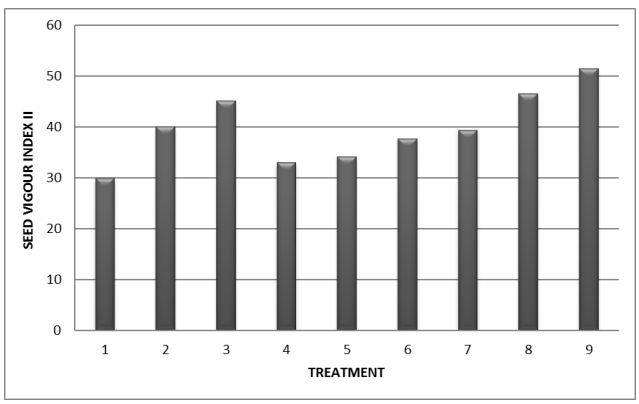


Table 1: Analysis of variance for seedling characters in pea.

Characters	Mean square	
	Treatments (df=6)	Error (df=21)
Germination Percentage	184.71	3.82
Speed of germination	21.02	0.88
Root Length cm	2.32	0.72
Shoot Length cm	3.79	0.72
Seedling Length cm	10.49	2.85
Seedling Fresh Weight gm	1.75	0.17
Seedling Dry Weight gm	0.00	0.00
Seed Vigour Index Ist	348345.69	23615.10
Seed Vigour Index IInd	195.13	13.31

Significant at 5% level of significance, respectively.

Table 1.2: Mean Comparison of Germination and Vigour Traits in pea.

Treatments	Germination Percentage	Germination index	Shoot length (cm)	Root length (cm)	Seedling length (cm)	Fresh weight (gm)	Dry seedling weight (gm)	Vigour index i	Vigour index ii
T_1(control)	75	20.74	10.41	11.98	22.11	7.05	0.40	1657.49	29.98
T_2	85.33	23.06	12.11	13.52	25.63	8.34	0.47	2166.75	40.10
T_3	91.3	23.23	10.72	14.08	24.79	8.46	0.49	2276.78	45.16
T_4	77.6	21.02	10.96	12.37	23.33	7.49	0.42	1801.88	33.01
T_5	79.52	20.48	11.19	12.67	23.61	7.64	0.43	1864.78	34.15
T_6	81.5	20.73	11.43	12.99	24.2	7.86	0.46	1990.63	37.69
T_7	83.6	21.54	11.83	13.12	24.94	8.06	0.48	2071.04	39.43
T_8	90.06	25.77	12.77	13.86	26.63	8.99	0.51	2407	46.58
T_9	93.70	26.64	13.14	14.41	27.25	8.98	0.54	2563.32	51.48
G.mean	84.14	22.58	11.58	13.18	24.74	8.09	0.47	2088.92	39.73
SEm±	0.43	0.09	0.56	0.59	0.59	0.10	0.24	78.76	16.11
C.D. at 5%	1.24	0.28	1.35	1.29	1.72	0.63	0.71	235.76	47.61
F test	S	S	S	S	S	S	S	S	S

Summary

Seed germination significantly affected by different hydropriming and osmopriming treatments. Higher seed germination was recorded under T_8- Polyethylene glycol (PEG) @20%, for 24 hr (93.70 %). Speed of germination significantly affected by different hydropriming and osmopriming treatments. Higher speed of germination was recorded under T_8- Polyethylene glycol (PEG) @20%, for 24 hr (9.11). Root length (cm) significantly affected by different hydropriming and osmopriming treatments. Higher root length (cm) was recorded under T_8- Polyethylene glycol (PEG) @20%, for 24 hr (14.11). Shoot length (cm) significantly affected by different hydropriming and osmopriming treatments. Higher Shoot length (cm) was recorded under T_8- Polyethylene glycol (PEG) @20%, for 24 hr (13.14). Seedling length (cm) significantly affected by different hydropriming and osmopriming treatments. Higher Seedling length (cm) was recorded under T_8- Polyethylene glycol (PEG) @20%, for 24 hr (27.90). Dry weight (gm) significantly affected by different hydropriming and osmopriming treatments. Higher Dry weight (gm) was recorded under T_8- Polyethylene glycol (PEG) @20%, for 24 hr (5.50).Fresh weight of seedling (gm) significantly affected by different hydropriming and osmopriming treatments. Higher Fresh weight of seedling (gm) was recorded under T_8- Polyethylene glycol (PEG) @20%, for 24 hr (9.01). Seed vigour index (length) significantly affected by different hydropriming and osmopriming treatments. Higher Seed vigour index (length) was recorded under T_8- Polyethylene glycol (PEG) @20%, for 24 hr (2602.18). Seed vigour index (mass) significantly affected by different hydropriming and osmopriming treatments. Higher Seed vigour index (mass) was recorded under T_8- Polyethylene glycol (PEG) @20%, for 24 hr (514.90).

Conclusion

On the basis of result obtained from the present experiment, following conclusions are drawn. Among all the hydropriming and osmopriming treatments, Polyethylene glycol (PEG) @20%, for 24 hr was found to be the best priming treatment followed by Polyethylene glycol (PEG) @20% for 12 hr treatment in all the recorded observations moreover different priming treatments have more pronounced influence on seed quality parameters in Pea. Since these data are based on the one year testing further research is needed to substantiate the results.

References

1. Asharf M, Foolad MR. Pre-sowing treatment- a shotgun approach to improve germination growth and crop yield under non-saline condition. Advance Agronomy. 2005; 88:223-271.
2. Bradford KJ. Manipulation of seeds water relations via osmotic priming to improve germination under stress conditions. Horticulture Science, 1986; 59(2):672-676.
3. Basra SMA, Farooq M, Tabassum R, Ahmad N. Physiological and biochemical aspects of seed vigor enhancement treatments in fine rice (Oryza sativa L.). Seed Science Technology. 2005; 33:623-628.
4. Baki A, Anderson JD. Vigor determination in Soybean seed by multiple criteria. Crop Science. 1973; 13:630-633.
5. Fisher RA. The correlation between relative on the supposition of genotypes grown. 1936, 44.
6. Harris D, Joshi A, Khan PA, Gothkar P, Sodhi PS. On-farm seed priming in semi-arid agriculture: development and evaluation in maize, rice and chick Pea in India using participatory methods. Experimental Agriculture, 1999; 35:15-29.
7. Harris D, Pathan AK, Gothkar P, Joshi A, Chivasa W,

Nyamudeza P. On farm seed priming: Using participatory methods to revive and refine a key technology. Agricultural Science Digest, 2001a; 69:151-164.
8. ISTA. International Seed Testing Association (2004) International rules for seed testing. ISTA, Zürich. 2004, 206.
9. Lee SS, Kim JH. Total sugar, a-amylase activity and germination after priming of normal and aged rice seeds. Korean Journal Crop Science. 2000; 44:108-111.
10. Prasad K. Improvement in seed germination of soybean varieties by pre-soaking treatments. Indian Journal of Agriculture Science. 2004; 43:546-550.
11. Rastin S. Effect of seed priming on red bean (Phaseolus calcaratus) growth and yield. Annals of Biological Research. 2013; 4(2):292-296.