Effect of Halopriming along with Hydropriming on Germination of Wheat (*Triticum aestivum* L.) Seeds.

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Abstract

Biotic and abiotic stress effects the crop yield badly every year. In the abiotic factors the drought, heat and salinity are the major stress for crops which are cultivated in Pakistan. Cultivated area are decreasing rapidly because the construction of new buildings, towns and population food demand increasing. There is only one way to fulfill the requirements of population by development stress tolerance genotypes. Two different varieties of wheat (*Triticum aestivum* L. with AABBDD genome and 6x= 42) i.e. Faisalabad 2008 and Galaxy 2013 were used to evaluate the effect of halopriming along with hydropriming to observe germination parameters and early growth stages. The experiment was conducted in factorial structured treatments design with three replications at Department of Seed Science and Technology, University of Agriculture Faisalabad. For halopriming seeds were soaked in 0.5% ~~KCL~~KCl, 1% ~~KCL~~KCl, 1.5% ~~KCL~~ KCl and in distilled water for 6-8 hours. The results showed that final emergence percentage of priming seeds with 1% ~~KCL~~ KCl of Faisalabad 2008 had higher percentage of germination than other treatments~~s~~. However, for time to start germination there was no ~~any~~ difference among ~~KCL~~ KCl priming and hydropriming for both the varieties. For mean germination time, priming seeds with 1.5% ~~KCL~~ KCl of Faisalabad 2008 showed maximum time. Seeds priming with 1% ~~KCL~~ KCl of Galaxy 2013 took maximum time to complete 50% germination (T50). Overall, Faisalabad 2008 priming with ~~KCL~~ KCl proved best in most of parameters.

Keywords: Wheat; Halopriming; Hydropriming; Germination parameters

1.Introduction

Wheat (*Triticum aestivum* L.) is top ranked crop among cereal crops in whole world. Moreover, it is a staple food for most of the countries including Pakistan. Wheat is a rich source of carbohydrates and its raw material can be used for human beings as well as for animals [1]. Most of the crops face many biotic and abiotic stresses that limits their growth and yield attributes, wheat has to face drought, fluctuation in temperature and salinity etc., which retards its germination [2]. In all over the world high salt concentrations in the soils causes great fall in crop production [3]. Salinity has adverse effects on crops which limits quality of crops and their germination parameters like time to start germination, final emergence percentage and mean germination time [4]. Seed priming is gradually considered a better

approach for enhancing rapid and uniform emergence and to achieving high seedling vigor and better yields in olericulture, floriculture, and some field crops [5]. Seed priming is a valuable technology to enhance rapid and uniform emergence and to achieve high vigour, leading to better stand establishment and yield [6]. A number of seed priming techniques have been developed which include hydro-priming, halo-priming, osmo-priming and hormonal priming etc. Hydro priming mostly enhances seed germination and seedling emergence. Hydropriming is described as soaking of seeds in water [7]. Halopriming is a soaking of seeds in salt solutions before sowing. It enhances germination and seedling emergence uniformly under poor environmental conditions and normal condition. Salinity hinders the onset stage of germination, reduces the rate and increases the dispersion of germination characteristics thus resulting in reduced plant growth and final crop yield [8]. Patade reported that increases salinity treatments lead to reduction of growth. Also, it reduces germination percentage and seedling weight [9]. Ansari and Sharif Zadeh reported that stress conditions lead to reduction of growth and plant developments [10]. Various seed treatment techniques are known to enhance germination characteristics are an efficient method for increasing seed vigor and germination uniformity, as well as the growth of seedlings of many crops under stress conditions [11, 10]. Ansari reported that seed priming can be taken to reduce the adverse effects of different abiotic stresses [10]. Salinity can be overcome by halopriming, priming of seeds before germination into salt solution for certain period of time [12]. Salinity can be overcome by many techniques which include halopriming and hydropriming and it should be reduce because of its effects which changes patterns of growth, nutrient imbalance and ion toxicity [13]. Hydropriming soaking of seeds into distilled water for certain period of time to soften the seed coat for more imbibition then air dry for longer storage [14]. Priming is controlled hydration process in which lag phase increases which provides metabolic repair and enhance germination percentage [15]. Poor germination and crop stand may be due to several reasons and these can be minimized by many seed vigor enhancements techniques which improve germination and vigor [16].

Seed priming is not much laborious, inexpensive have no high risks to adopt it, it mainly enhances germination percentage and germination rate and other parameters of growth for many cereal crops including wheat. These priming techniques including hydropriming, osmopriming and halopriming etc. [17]. Hussian compared hydropriming and halo priming and suggested that both priming with water and NaCl resulted in lower time taken to 50% emergence and mean emergence time (MGT) and more final emergence, energy of emergence, more plant population, achene yield and yield contributing factors and achene proteins [18]. Hydropriming and halopriming have positive effect on germination and early growth stages of wheat [19]. Pre-farming seed treatments including seed priming makes seed enable to grow rapidly and in uniform way which improve its performance under stress conditions [20]. Seeds which become dormant due to unfavorable environmental conditions during storage, their dormancy can be broeakken through several seed enhancements techniques like seed priming which include hydration and dehydration treatments [21]. Several seed invigoration techniques improve crop stand, early growth stages and make suboptimal conditions favorable [22]. Among seed enhancements techniques seed priming considers to be more effective technique to enhance the performance of seeds including wheat under stress conditions [23]. Halopriming

induces biochemical changes which make seed to grow better with vigorously [24]. The harmful effects of great absorption of salts for plants because the osmotic retention of water and specific ionic effects on the plant cell. Water is osmotically seized in salted solutions, when the salt concentration increased water less available to the plant. At the end pPoor germination and seedling develops in saline soil. It is a huge problem harmfully upset growth and development and at less agricultural production [19].

Previous work clearly indicates that hydropriming as well as halopriming greatly improve germination percentage, time to starts germination and other parameters. The aim of present study was to enhance germination rate and evaluate the effect of halopriming along with hydropriming on two different wheat varieties.

2. MATERIAL AND METHODS

2.1 SEED SOURCE: Seeds of two varieties of wheat (*Triticum aestivum* L.), Faisalabad 2008 and Galaxy 2013 were obtained from Ayyub Agriculture Research Institute Faisalabad, Pakistan. Seeds were surface sterilized with 1% Sodium Hypochlorite solution for three min, then air dried to keep moisture content at optimum level.

2.2 EXPERIMENTAL DESIGN: The experiment was conducted in controlled conditions at Seed Science and Technology department, University of Agriculture Faisalabad Pakistan. Experiment was performed in Completely Randomized Design (CRD) with three replications and two factors which are given below

- **FACTOR 1.** KCL KCl concentrations.

I. 0.5% KCL KCl Solution
II. 1% KCL KCl Solution
III. 1.5% KCL KClSolution
IV. Control (KCL KCl 0%)

- **FACTOR 2.** Varieties

i. Faisalabad 2008
ii. Galaxy 2013

This experiment was conducted to find the effect of KCL KCl on different parameters of seeds of two varieties of wheat which included, time to start germination (TSG), final emergence percentage (FEP), and mean germination time (MGT).

$$\text{MGT (D)} = \sum(DN)/\sum N$$

Where D is the number of days from the start of germination test and N is the number of seeds germinated/day.

And to calculate time to complete 50% germination (T50)

$$T50 = ti + [(N/2 - ni)(ti - tj)] / ni - nj$$

Where N is the final number of emergence and ni and nj cumulative respectively when $ni < N/2 < nj$.

Four hundred seeds of each variety were taken for the germination test. Three solutions of 200 ml were prepared in beakers by using KCL KCl and distilled water having concentrations 0.5% KCLKCl, 1% KCLKCl, 1.5 % KCLKCl. One beaker contained distilled

water for the purpose of hydropriming. One hundred seeds of wheat variety Faisalabad 2008 were soaked in each beaker for a time period of 6-8 hours and the beakers were carefully covered to avoid contamination. The same process was repeated for wheat variety Galaxy 2013. After 6-8 hours, primed seeds were collected from beakers and sown in petri dishes. For this purpose, 24 petri dishes were taken, washed and dried to avoid contamination. Afterwards, filter papers were placed in each petri dish, wetted slightly with distilled water. Ten seeds were sown in each petri dish. ~~The experiment was conducted in CRD with three replications.~~ Experiment was observed on daily basis and data were collected. To determine significance of variance ($P<0.05$) factorial structured treatments design used by using R statistical software.

3. Results and Discussion

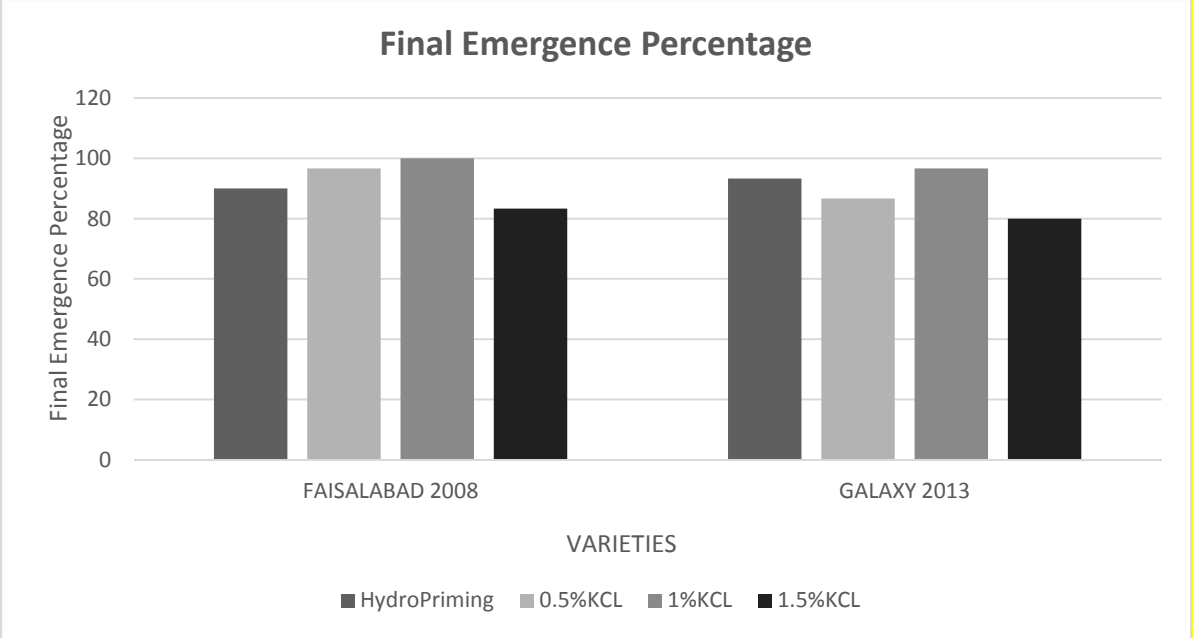
To check significance, the analysis of variance was done. Significant differences observed among varieties and priming levels. For interaction, the F_{cal} = 0.76, 1.11 and 2.76 for FEP, MGT and T50 respectively which are less than F_{tab} =3.24. So, interaction (V×P) is non-significant indicating thereby that main effect has meanings. For priming levels F_{cal}=4.85, 0.70 and 4.81 for FEP, MGT and T50 respectively. So, for FEP and T50 they are significant because, F_{tab} =3.24 and for MGT is non-significant. For varieties F_{cal} =1.14, 0.53 and 0.12 which are non-significant as F_{tab}=224.58. For treatments T50 is significant, FEP and MGT are non-significant as F_{tab}=2.91. Moreover, for time to start germination there is significant ($p<0.05$) difference for time to start germination.

Table 1:

SOV	**DF**	**MSS**			**F_{cal}**		
		FEP	MGT	T50	FEP	MGT	T50
Treatments	7	150	1.77	1.24	2.57	2.69	3.26*
V	1	66.67	0.35	0.046	1.14	0.53	0.12
P	3	283.34	0.46	1.83	4.85*	0.70	4.81*
V×P	3	44.44	0.7273	1.05	0.76	1.11	2.76
Error	16	58.33	0.6564	0.38			

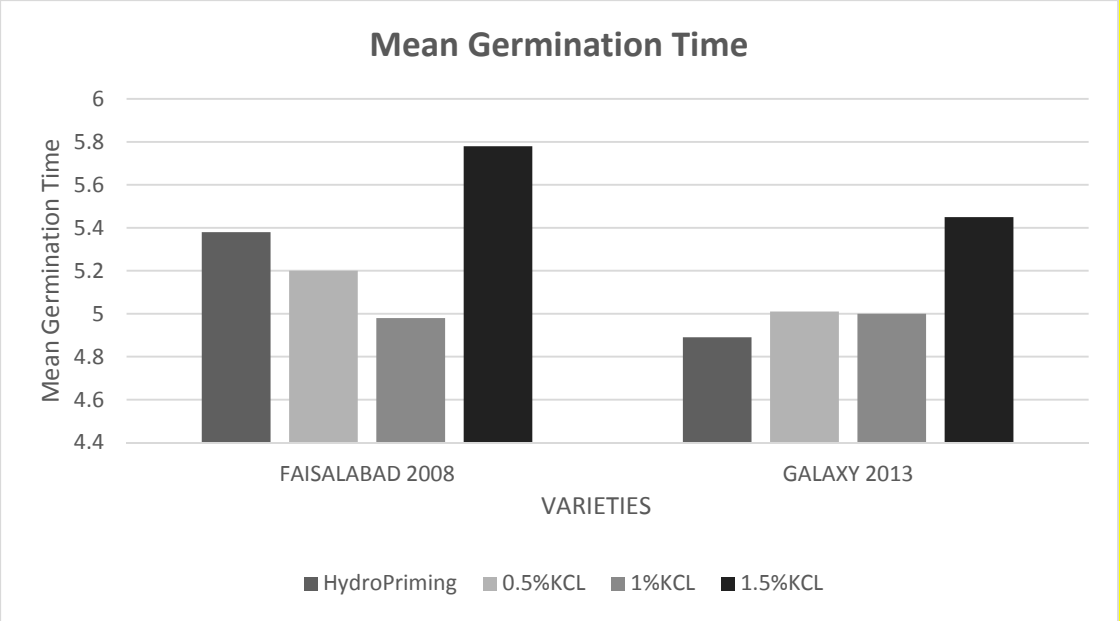
Total	23						

3.1 Final Emergence Percentage. Following graph ~~shows~~ showed that seeds priming with 1%~~KCL~~ KCl of Faisalabad 2008 variety have higher final emergence percentage of about 100% following by seeds primed with 1%~~KCL~~ KCl of Galaxy 2013 variety. The minimum final emergence percentage are showed by seeds primed with 1.5%~~KCL~~ KCl of Galaxy 2013 variety about 80% following by 83% of Faisalabad 2008 variety primed with 1.5%~~KCL~~KCl.



change KCL into KCl in legend

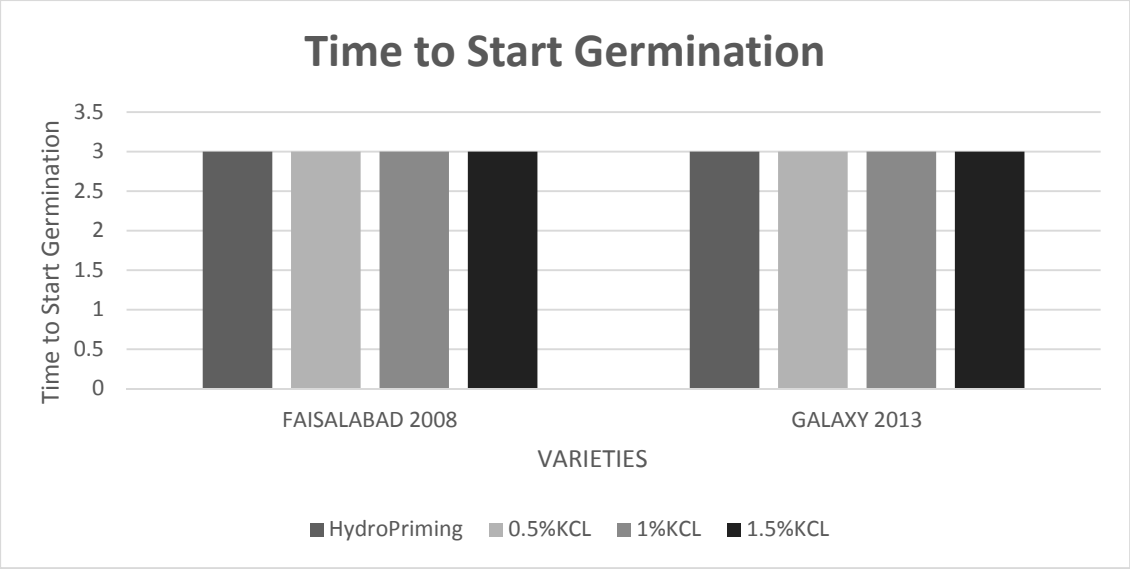
3.2 Mean Germination Time. The graph illustrates that seeds primed with 1.5%~~KCL~~ KCl of Faisalabad 2008 variety showed higher Mean Germination Time about six days following by seeds primed with 1.5%~~KCL~~ KCl of Galaxy 2013 variety about five days. The minimum mean germination time showed by seeds priming with Galaxy 2013 seeds treated with hydropriming about less than four days and followed by Faisalabad 2008 seeds treated with hydropriming about just four days.



change KCL into KCl in legend

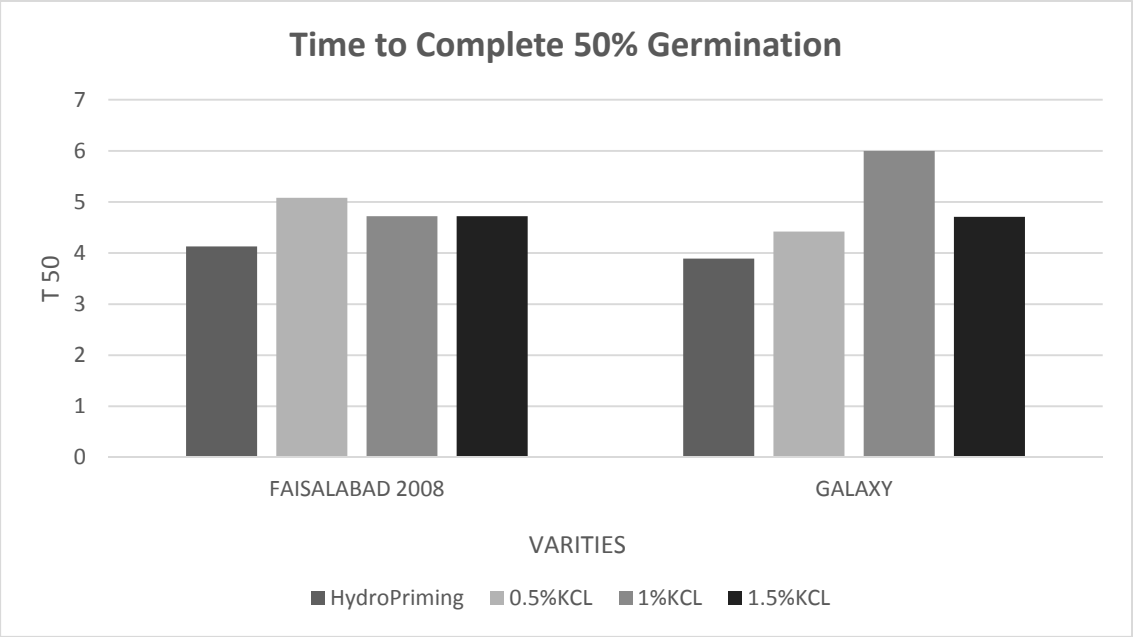
3.3 Time to Start Germination

There ~~is~~was no variation among both varieties which ~~are~~ were primed with different concentrations of ~~KCL~~ KCl along with hydropriming. Both varieties showed about three days to start germination. Hence, different KCL concentrations have no effect on time to start germination.



change KCL into KCl in legend

3.4 Time to Complete 50% Germination. Seeds primed with 1% ~~KCL~~ KClof Galaxy 2013 variety took maximum days to complete 50% germination about six days following by seeds primed with 0.5% KCL of Faisalabad 2008 variety about five days.



change KCL into KCl in legend

The minimum time taken by seeds of Galaxy 2013 primed with hydropriming about less than four days followed by seeds primed with hydropriming of Faisalabad 2008 about just more than four days.

4. CONCLUSION

It ~~is~~ was concluded that germination characteristics in primed seeds increased as compared to unprimed. Halopriming with different KCl concentrations on Faisalabad 2008 ~~enhances~~ enhanced final emergence percentage and other germination parameters in wheat. Soaking of seeds in salts is advantages to enhance seedling emergence.

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