EFFECT OF SEED PRIMING BY KH_2PO_4 AND DIFFERENT TEMPERATURE ON SEEDS GERMINATION BEHAVIOR OF OKRA (*Abelmoschus esculentus* L.)

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Abstract:

In order to evaluate the effect of seed priming techniques on seeds germination characteristics of Okra. an experiment was conducted at the Seeds obtained directly from the field of Babil governorate during the season of (2012-2013). Seeds were primed for 4 hours at two temperatures (25 and 30 Cº) in priming media (1.5% and 3% KH_2PO_4, and hydropriming, distilled water as control). Maximum seed germination percentage, germination speed index (GSI), seedling vigour index (SVI), was observed when the seeds primed by KH_2PO_4 3% for 4h and at 20 and 30 Cº. Relative growth rate and all seeds germination characteristics in this study also increasing with increased KH_2PO_4 concentration from 1.5 to 3% compared to control.

Introduction:

Okra (*Abelmoschus esculentus* L.) belongs to Family Malvaceae. It is originated in the Africa, and grown in the Mediterranean region. It is a popular summer crop; the young tender pods are cooked in curries, stewed and used in soaps. It is a good source of Vitamins A, B and C, and is also rich in protein, minerals and iodine. When ripe, the black or brown white-eyed seeds are sometimes roasted and used as a substitute for coffee. The stem of the okra plant provides fibre which is used in paper industry [1]. Seed priming is usually described as pre-sowing treatments in water or in an osmotic solution that permits the seed to imbibe water to proceed to the first step of germination, but avoids radical emergence through the seed coat. The most widely used priming treatments are osmo-priming and hydro-priming. In hydro-priming seeds are soaked in water overnight then surface dried and sowed at the same day.

While in osmo-priming seeds are soaked in osmotic solution followed by drying the seed before sowing [2]. Seed priming techniques have been employed to develop resistance against several a-biotic stresses in a wide range of field crops [3]. Priming improves germination and emergence of several seed species [4]. This approach has been proven to its effectiveness to improve crop establishment on saline soil [5]; [6]. Seed priming has been successfully demonstrated to improve germination and emergence in seeds of many crops, particularly seeds of vegetables and small seed grasses [7]. The beneficial effects of priming have also been demonstrated for many field crops such as wheat, sugar beet, maize, soybean and sunflower [8]; [9]. [10] Reported that priming treatment significantly affected growth parameters and recorded an increase in Leaf area index (LAI) and dry matter accumulation due to priming in canola. Many seed priming treatments have been used to reduce the damage of ageing and invigorate their performance in many crops [10]; [3]. Seed priming is a controlled hydration process followed by re-drying that allows seed to imbibe water and begin internal biological processes necessary for germination, but not allow the seed to germinate. [11] Found that priming of sunflower seed with $CaCl_2$, KH_2PO_4, NaCl, $ZnSO_4$, ascorbic acid and succinic acid improved its emergence and seedling growth. [12] found that rice osmo-hardening with $CaCl_2$ performed the best compared with all other salts treatments as indicated by lower values of time to start germination, Mean germination time (MGT), Time to 50% germination (T50) and Mean emergence time (MET) and higher values of final germination and emergence, speed and energy of germination, root and shoot length and seedling fresh and dry weight.

The main objective of this study was to evaluate the effects of KH_2PO_4 priming media at different temperature 25 and 30 C° on seed germination behaviour of Okra.

Materials and Methods:

Plant material:

This experiment was performed on one local Iraqi cultivar (*Abelmoschus esculentus* L.). The seed materials were obtained directly from the field of Babylon governorate in the season of (2012-2013). Seeds were surface sterilized using 5% sodium hypochlorite solution for 5 minutes and rinsed thoroughly in distilled water.

The seeds were dried at 25 Cº for 24 hours in the laboratory. As described for pea by [13], seed material was stored in dark plastic containers at 5C° until use.

Seed Priming Protocol:

For priming, okra seeds were subjected to hydro-priming (distilled water only) and priming with 1.5% and 3% of KH_2PO_4 for 4hr at 25Cº or 30Cº. Seed weight to solution volume ratio was 1:5 (w/v) [12].For seed priming; seeds were soaked in the respective solutions or water. Thereafter, seeds were removed, given three surface washings and re-dried with forced air near to its original weight. Untreated seeds were used as control treatment.

Germination test:

Three replicates, each of 25 seeds, were germinated in 9 cm diameter Petri dishes on Whatman NO.1 filter paper. Just enough distilled water (2.5 ml) to moisten the filter paper was provided initially. Moisture level was checked daily and topped-up as necessary. Percentage radical emergence and seed germination speed was recorded at 25 Cº after every 24 h time interval. Time for initial signs of radical emergence and maximum emergence was recorded after 7 days [14].

The germination speed index (GSI):

The (GSI) it may be defined as "number of germinated seeds per unit day" was calculated as described by Association of Official Seed Analysts (A.O.S.A) [15] by following formula:

$$\text{GSI}=\frac{\textbf{No.of germinated seed}}{\textbf{Days of first count}}+\cdots+\cdots+\frac{\textbf{No.of germinated seed}}{\textbf{Days of final count}}$$

Seedling vigour index (SVI):

Seedling vigour index (SVI) was calculated following modified formula of [16].

SVI = [seedling length (cm) × germination percentage]/100

Relative Growth Rate (RGR):

Seedlings of okra cultivar were transplanted into plastic trays filled with clean sawdust .Water was topped after 10 days of planting, seedlings were harvested from

trays. Root and shoot were separated, fresh and dry weights were determined, and shoot: root lengths were calculated [14].

Statistical test:

All treatments were determined by three replicates. Data were subjected to an analysis of variance, a completely randomized and LSD (least significant difference) was calculated at $P \leq 0.05$.

Results and discussion:

Germination test:

Seed priming had significant positive effect on different aspects of seed germination. The results in Fig (1) shown both hydro and KH_2PO_4 solution priming caused significant increase in seeds germination percentage compared the control. The highest germination percentage was observed in 3% KH_2PO_4 82% and 81.33% at 25 and 30 C° respectively. These results are in agreement with [17].

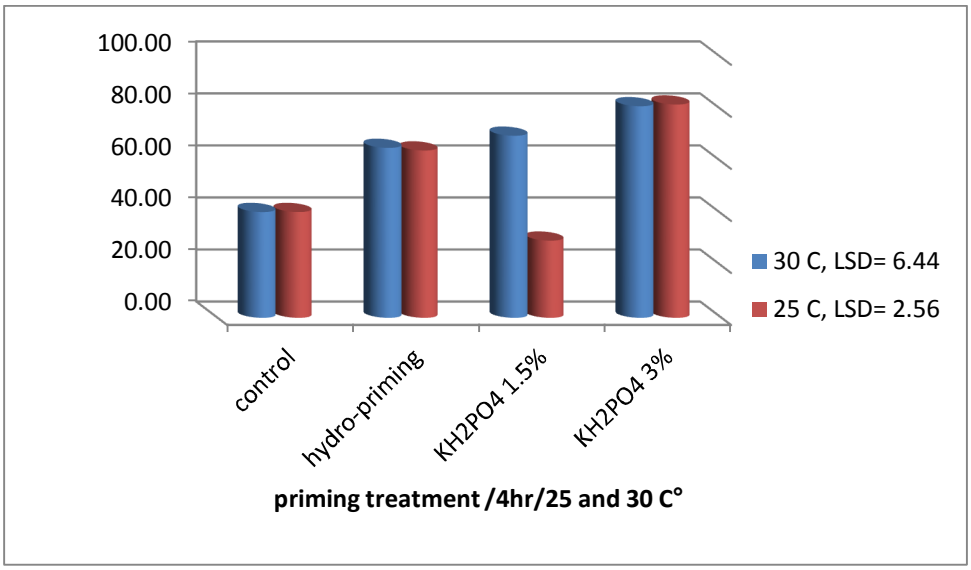

Fig (1) Effect of different level of seeds priming with KH_2PO_4 at 25 and 30 C° on seed germination%.

Germination speed index:

The highest germination speed index was obtained from seeds treated with 3% KH_2PO_4 solution at 25 and 30 C° respectively. Results in Fig (2) showed significantly increased (GSI) from 16.95 in control to 44.36 at 25 C° and 37.61 at 30 C° in 3% KH_2PO_4 treatment respectively.

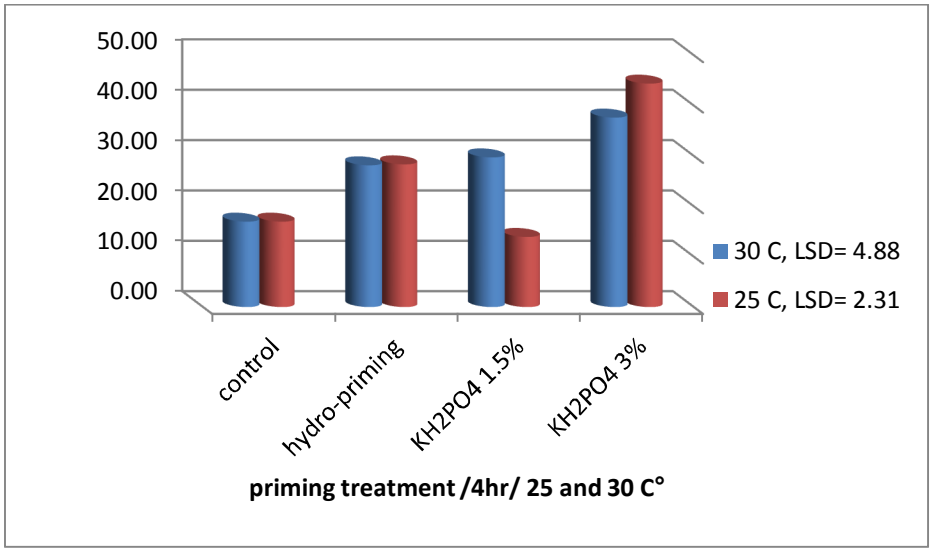

Fig (2) Effect of different level of seeds priming with KH_2PO_4 at 25 and 30C° on germination speed index (GSI).

Seedling vigour index (S.V.I):

The maximum seedling vigour index was obtained from seeds soaked in 3% KH_2PO_4 for both temperature 25 and 30 C°, Fig (3) results showed the high value of (S.V.I) reached 10.71 and 12 in 3% KH_2PO_4 with different temperatures 25 and 30 C° respectively compared to control were 2.19.

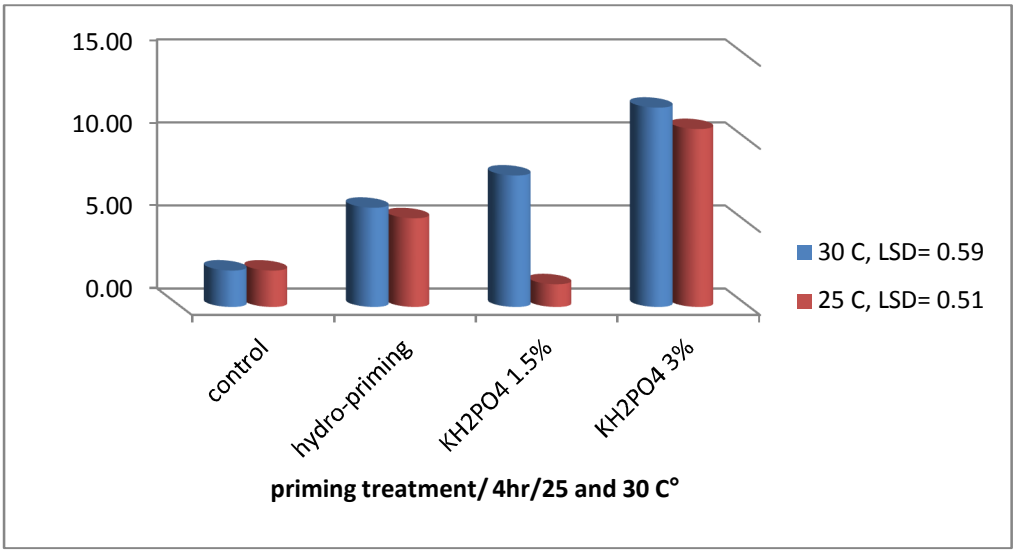

Fig (3) Effect of different level of seeds priming with KH_2PO_4 at 25 and 30 C° on seedling vigour index (S.V.I).

Relative Growth Rate (RGR):

Seed priming treatments with KH_2PO_4 increased relative growth rate at both 25 and 30 C° temperatures. Fig (4), (5) present that shoot and root length had been

significant increased with increasing KH_2PO_4 concentration from 1.5 to 3% compared to the control at both 25 and 30 C° temperatures.

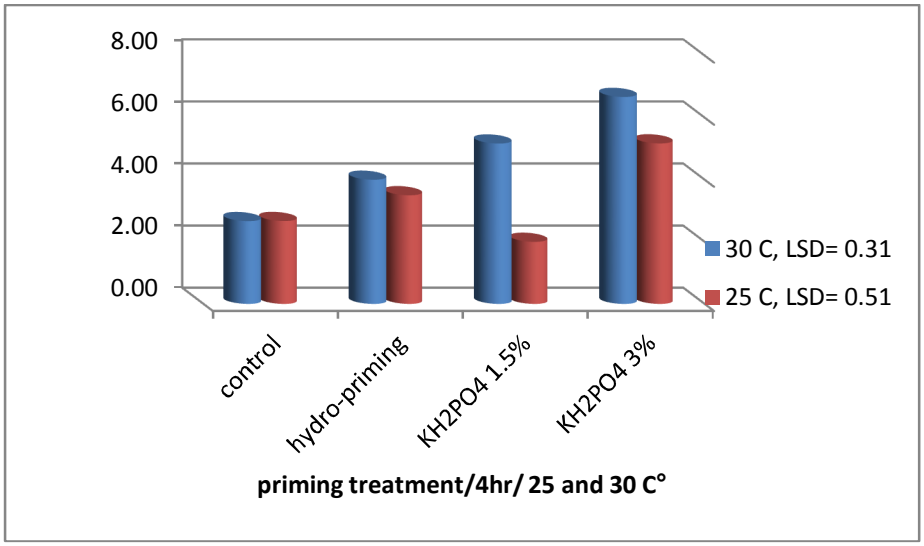

Fig (4) Effect of different level of seeds priming with KH_2PO_4 at 25 and 30 C° on Shoot length cm.

Fig (5) shows the effect of KH_2PO_4 seed priming on Okra root length at different temperature, root length increased significantly with increasing KH_2PO_4 concentration from 1.5% to 3% for both 25 and 30 C°, it reached 7.83 cm at 25 C° and 8.17cm at 30 C° in 3% KH_2PO_4 compared to the control it was 3 cm.

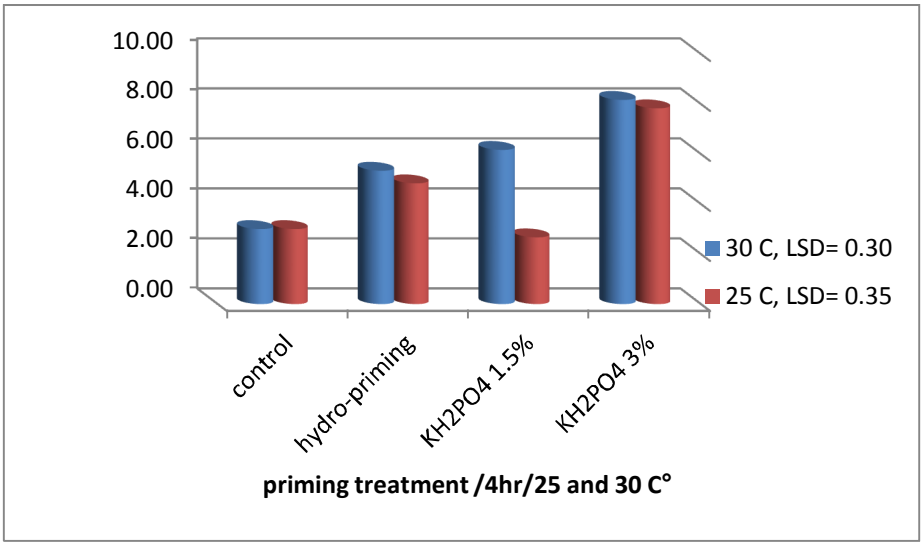

Fig (5) Effect of different level of seeds priming with KH_2PO_4 at 25 and 30 C° on Root length cm.

Seed priming caused significantly increase seedling growth, Fig (6). Increase osmo-priming concentration 3% KH_2PO_4 for both 25 and 30 C° temperatures produced highest seedling length 13, 14.83 cm respectively compared to the control 5.33 cm.

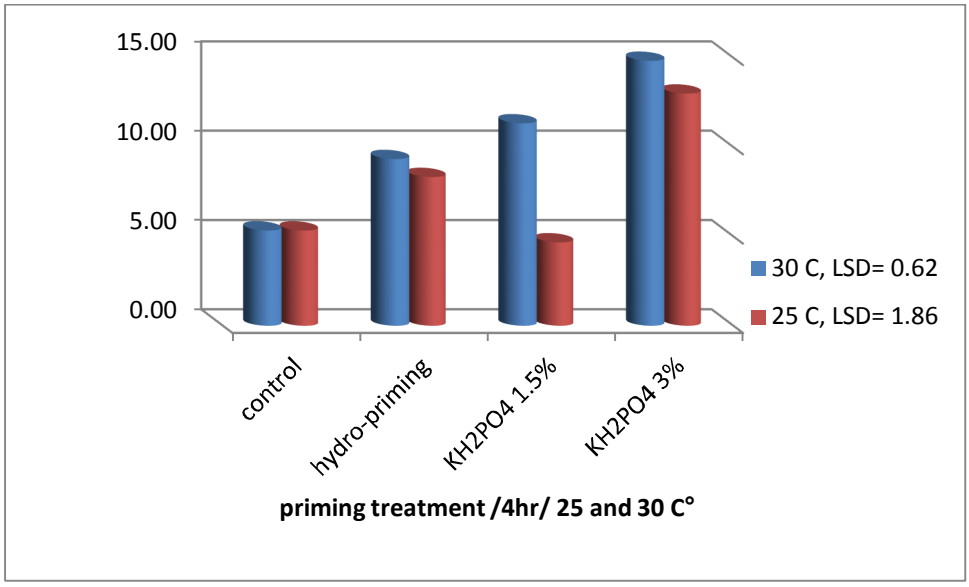

Fig (6) Effect of different level of seeds priming with KH_2PO_4 at 25 and 30 C° on Seedling length cm.

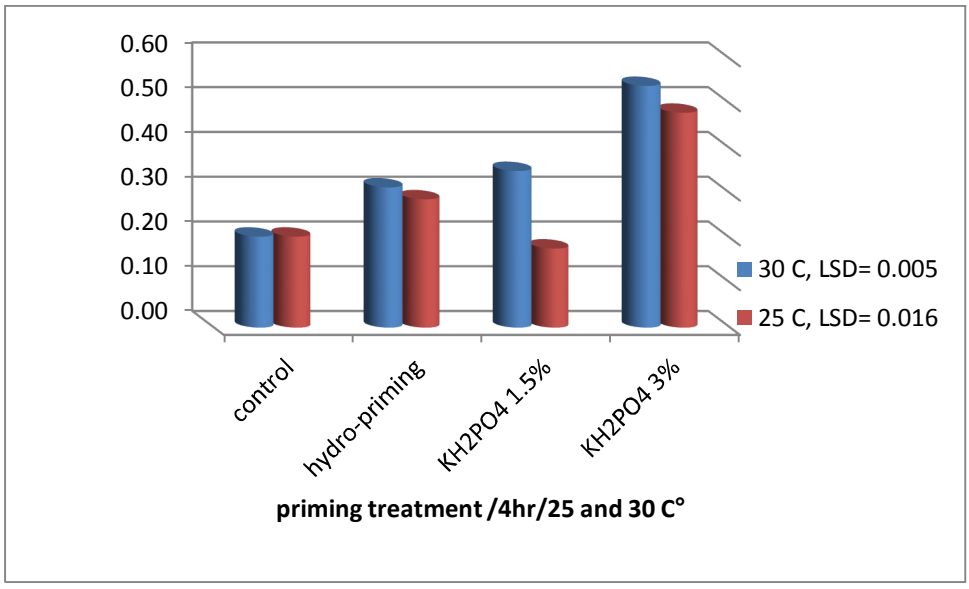

Fig (7) Effect of different level of seeds priming with KH_2PO_4 at 25 and 30 C° on Seedling fresh weight/g.

Results in Fig (7), (8), indicates that priming treatment of the Okra seeds with 3% KH_2PO_4 at 25 and 30 C° temperatures caused significantly increased fresh weight 0.48 g , 0.54 g at 25, 30 C° respectively and dry weight 0.0202 g , 0.0201 g at 25, 30 C° respectively , of seedling compared to the control. These results are in agreement with [18] that seed soaked with 0.5 to 1% solution of KCl or potassium sulphate K_2SO_4 significantly increased plant growth rate in wheat.

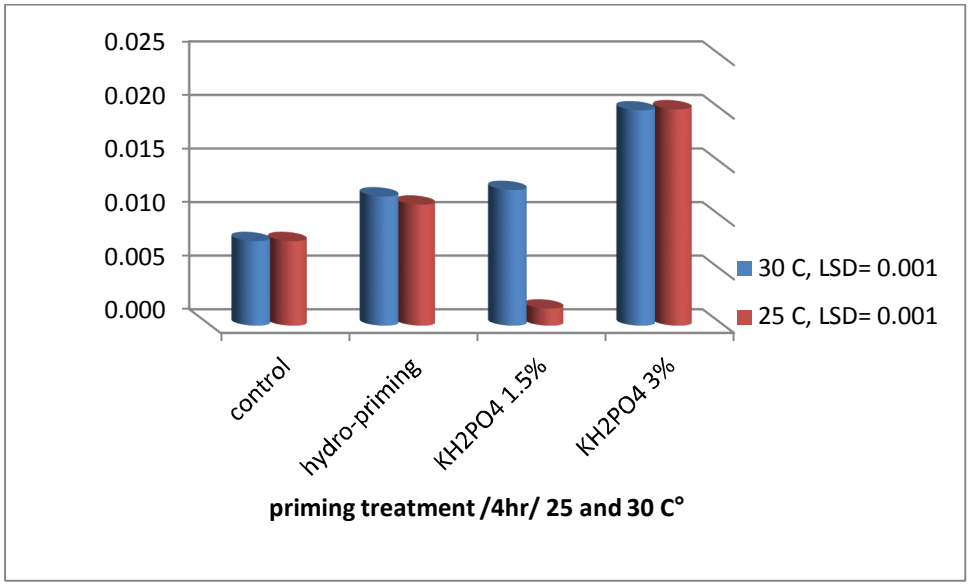

Fig (8) Effect of different level of seeds priming with KH_2PO_4 at 25 and 30 C° on Seedling dry weight/g.

[19] Reported that seed primed of tow cultivar of soya bean with KNO_3 (6) $g.L^{-1}$ caused a significant increase in germination and emergence percentage, radical and plumule length, seedling dry weight.

Results also showed that treating seeds in temperature of 25 Cº and 30 Cº improved germination characteristics in contrast to control. [20] Have also reported that vigour, radical and stem length in wheat seedling were significantly increased at 20 Cº than 10 Cº.

The results of the present study in Fig (1), (2), (3), are in agreement with observation of [17] who reported that wheat seed soaked in KH_2PO_4 resulted improve germination characteristics. [21] Found that priming corn seeds by poly ethylene glycol (PEG) or potassium salts (K_2HPO_4 or KNO_3) resulted in accelerated germination.

The three early phases in seed germination are (a) imbibition, (b) lag phase and (c) protrusion of the radical through the testa [22]. Priming affects the lag phase and causes early DNA replication [23], increased RNA and protein synthesis [24], greater ATP availability [25], faster embryo growth and repair of deteriorated seed parts [26]. However, osmo-priming has been shown to activate processes related to germination, through affecting the oxidative metabolism such as increasing SOD and POD [27] or through activating ATP_{ase} [25] acid phosphatase and RNA synthase [24].

Overall it could be concluded that suitable priming the Okra seeds for 4 hr in high concentration KH_2PO_4 at the temperature of 25 and 30 Cº resulted in higher germination percentage and seeds vigour.

تأثير المعاملة الاولية بفوسفات البوتاسيوم ودرجة الحرارة في سلوك أنبات بذور الباميا

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المستخلص:

لغرض تقييم تأثير تقنيات المعاملة الأولية للبذور بمحلول فوسفات البوتاسيوم في مواصفات الإنبات لبذور الباميا، نفذت التجربة على بذور تم الحصول عليها مباشرة من الحقل في محافظة بابل للعام 2012-2013 . تم نقع البذور لمدة 4 ساعات بمحلول فوسفات البوتاسيوم و بتراكيز (0 ،1.5 ،3 %) وعلى درجتي حرارة 25 و30 م° .أعلى نسبة أنبات و معدل سرعة أنبات وحيوية للبذور تم الحصول عليها عند معاملة البذور بتركيز 3% فوسفات البوتاسيوم لمدة 4 ساعات ولكلا درجتي الحرارة 25 و30م° . أيضا أعلى معدل للنمو النسبي وكل صفات الإنبات قيد الدراسة زادت بزيادة تركيز فوسفات البوتاسيوم من 1.5 ألى 3 % بالمقارنة مع معاملة السيطرة.

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