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The Effects of Seed's Size and Removal Testa Treatment on Germination Ratio and Period of Faba Bean Stored Seeds (*Vicia faba* Var. Ecuadelje)

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Abstract: The research was conducted at – Sulaimani Polytechnic Universit (SPU), Bakrajo Technical Institute in Sulaymaniyah city, Iraq in begging of 2018. Three different sizes and varieties Ecuadelje of bean seeds were used and treated. Water-soaking, dilute acid soaking, and dilute base with scarification soaking. They were distributed in 36 pots by using CRBD with three replicates. The results showed the significant differences only with the effect of seeds size from sowing to germination. The small size seeds had significant differences compare to the others. But the effect of removal of testa (seed coat) was highly significant in all studied parameters. Seeds which socked with diluted base and diluted acid had significant differences compare to other treatments from initial to final stage of seeds germination. The interaction between seed size and testa removal treatment showed significant differences among small size seeds which treated with diluted HCl during the initial and final stage, and the large size seeds treated with diluted NaOH. Seeds scarification treatment did not show any positive effects on both of the germination periods, but showed significant differences in initial and final germination percentage. We suggested to sock the broad bean seeds in one of diluted bases or diluted acids and scarification of seed treatment in order to stimulate germination percentage reduce of the germination period and develop broad beans stored seeds germination.

Key words: Faba Beans · Seeds Size · Removal testa treatments · Seeds germination period · Seeds scarification

INTRODUCTION

The *Faba bean* (L.) is a major legume in Iraq, because of the high nutritional value which contains many chemical components such as proteins, carbohydrates, vitamins and some mineral elements [1]. Seeds of many bean varieties are associated with germination problems due to an impermeable seed coat [2, 3]. Therefore, we believed that pre-treat seeds are encouraging to solve such kind of problems. The effect of seed size on the production of dried seeds were studied by Wensveen who used four bean seeds sizes (large, medium, small and very small). Wensveen concluded that there were significant differences in the yield of dry grains. Sowing large and medium seeds sizes produced higher yield than small and very small seeds sizes [4].

The main reasons, of testa in faba bean stored seeds, are hardness of the seeds cover; decrease in water content of the seeds, produced some inhibitors substances such as Absisic Acid (ABA) or Hydrogen Cyanamid (HCN) or one of cupper compounds such as cupper sulphate CuSO4), low seed's content of carbohydrate compounds and others. Using of certain plant growth regulators such as Indol Acetic Acid (IAA), Naphthalene Acetic Acid (NAA), Benzoic Acid (BA), Salsalic acid (SA) or others remove the testa [5]. These growth regulators activated the glucoamylase (a-glucosidase) enzyme action during germination [6], the works of this enzyme is to convert starch into glucose sugar whatever such works because the degradation of cellulose in the solid crust of faba bean seeds was studied by Metzger who used different concentration (0.5, 1, 1, 5,

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2, 2.5 and 3 ml/L distilled water and both of HCL and Ca(OH)2. Metzger found that HCL concentrated 2 ml/L water and Ca(OH)2 concentrated 1ml/L water achieved better result in the removal of the testa. Metzger concluded that the bases better than the acids in breaking the peptide bonds that link the cellulose molecule in the cells walls [7].

Enneking and Narbon studied the effect of hydrogen peroxide on popcorn *Zea maize* (old stored seeds germination). They used six transactions to soak seeds (0, 50, 100, 200, 300, 400, 500ppm) comparing with soaked with distilled water. They found that soaking seeds with hydrogen peroxide concentrate 0, 50, 100, 200, 300 and 400ppm respectively stimulated the seeds germination percentage from 41.7% to the 82.1%, 74.5%, 66.8%, 55.1% and 46.9% respectively [8]. Agarwal and his colleagues used two acids *viz.* Absisic Acid (ABA) and Salsalic Acid (SA), one alkaline Calcium hydroxide Ca(OH)2 and hydrogen peroxide H2O2, to removal of the testa from the stored wheat seeds. The concentrations of those four solutions were 0.1%. Agarwal and his colleagues found that ABA had significant effect the removal of the testa on the germination period, followed by the treatment with H2O2 which is better than the others compounds [9]. Scarification of hard skin stored seeds let to increase the germination percentage. The reason for this is due to the increases of water intake through cracks that occur in those seeds [1].

Although the water enters through the cracks lead to breakdown of complex sugar into simple sugars, as utilized through the development of the embryo seed [10].

MATERIALS AND METHODS

The materials used in this research were three different sizes of bean seeds, large (127gm/100 seeds), medium (79gm100 seeds) and small (53gm/100 seeds), 36 seeds were used for each size, 36 plastics pots, with 30cm in diameter. Soil culture consisting of sand and peat moss (2:1). Diluted HCl acid (concentrated 0.1%), diluted NaOH (concentrated 0.1%), distilled water and a Knife were used to make scratches in the crust of the seeds and Plastic labels to write the number of experimental units. Three sizes of seeds were selected (a1, a2, a3) from one kg Ecuadelje variety dried bean seeds [11]. Four treatments were used (soaking 8 hours with distilled water b0, dilute HCl b1, dilute NaOH b2 and scarification b3) for all sizes of those seeds. After treating of seeds, they were then sown in the pots, with Complete Randomized Block Design (CRBD) in the Factorial Experiments, whereas factor (A) for the sizes (a1, a2, a3), factor (B) for the soaking and scarification treatments (b0, b1, b2, b3) and AB for interactions. At the beginning of seeds germination, data recorded about the different germinations. Statistical analysis was done, ANOVA test was used, the averages of differences compared with the LSD at the level of 0.05 [12].

RESULTS AND DISCUSSION

Initial Germination Period: Table 1 demonstrates that there were no significant differences within 3 seeds sizes of bean. Removal testa (seed coat) treatments showed that short initial germination period achieved when seeds soaked with diluted HCl acid and diluted NaOH compared with soaking in distilled water. This indicates that soaking in acids and bases leads to a softer crust of solid seeds and reduce the germination period; this result is in agreement with the findings of Weber and his colleagues [13]. Scarified seeds showed no significant differences compared with socking with distilled water. Interaction between seeds sizes and removal testa treatments showed minor differences between medium seeds soaked with diluted HCl and large seeds soaked with diluted NaOH.

Final Germination Period: Table 2, shows that large seeds size got significant differences compared with small seeds size. While removal testa treatments, showed that there were significant differences, when seeds soaked with dilute (HCl) or (NaOH) compared with soaking in water. Scarification did not show any significant differences comparing with soaking in water. Interaction between seeds sizes and removal testa treatments showed that large and medium seeds treated with (HCl) and (NaOH) caused significant differences in the period from sowing until final germination. These results indicated that HCl and NaOH breaking the peptide bonds that link the cellulose molecules in the cell walls better than scarification and soaking with water as mentioned by Metzger [8].

Initial Germination Percentage: Table 3 shows that there were non-significant differences within the three seeds sizes on initial germination percentage. The seeds soaked with NaOH, HCl, and scarification got significant differences comparing with soaking in water, this is due to cracks in seeds walls and the water entry through those cracks.

Table 1: Initial germination period for Ecuadelje variety with different seeds size and removal testa treatments

	Removal testa treatments (B)				
Seeds Size (A)	b0	b1	b2	b3	Mean (A)
a1	18.7	12.7	12.3	15.7	14.85
a2	18.3	11.3	13.0	14.7	14.32
a3	17.3	12.3	10.7	15.7	14.00
Mean (B)	18.1	12.1	12.0	15.4	
L.S.D0.05 (A) = 6.348					
L.S.D0.05 (B) = 5.122					
L.S.D0.05 (A X B) = 2.867					

a1 = Large seeds size a2 = Medium seeds size a3 = Small seeds size b0 = Seeds soaking with water b1 = Seeds soaking with diluted Hcl b2 =Seeds soaking with diluted NaOH b3 = seeds scarification

Table 2: Final germination period for Ecuadelje variety with different seeds size and removal testa treatments

	Removal testa treatments (B)				
Seeds Size (A)	b0	b1	b2	b3	Mean (A)
a1	30.7	22.3	22.0	33.7	27.18
a2	33.7	23.7	22.3	32.0	27.93
a3	29.7	21.0	19.3	31.7	33.67
Mean (B)	31.37	22.33	21.20	32.47	
L.S.D0.05 (A) = 5.794					
L.S.D0.05 (B) = 3.168					
L.S.D0.05 (A X B) = 2.616					

a1 = Large seeds size a2 = Medium seeds size a3 = Small seeds size b0 = Seeds soaking with water b1 = Seeds soaking with diluted HCl b2 =Seeds soaking with diluted NaOH b3 = seeds scarification.

Table 3: Initial germination percentage for Ecuadelje variety with different seeds size and removal testa treatments

	Removal testa treatments (B)				
Seeds Size (A)	b0	b1	b2	b3	Mean (A)
a1	16.6	37.5	72.0	32.0	39.53
a2	13.3	40.0	52.3	32.0	34.40
a3	13.3	72.5	58.3	40.3	46.10
Mean (B)	14.4	50.0	60.9	40.0	
L.S.D0.05 (A) = 38.693					
L.S.D0.05 (B) = 21.158					
L.S.D0.05 (A X B) = 17.472					

a1 = Large seeds size a2 = Medium seeds size a3= Small seeds size b0 = Seeds soaking with waterb1 = Seeds soaking with diluted HCl b2=Seeds soaking with diluted NaOH b3 = seeds scarification.

Soaked seeds with NaOH, Showed relatively superiority in the seeds germination percentage than HCl, and scratched seeds, but those superiorities were not significant. Interaction between seeds sizes and removal testa treatments, defined that big seeds sizes treated with HCl and small seeds size treated with NaOH, obtained higher significant differences than others. These results corresponded with the findings of Srivastava and his colleagues [14].

Table 4: Final germination percentage for Ecuadelje variety with different seed's sizes and different removal testa treatments

	Removal testa treatments (B)				
Seeds Size (A)	b0	b1	b2	b3	Mean (A)
a1	23.6	52.8	80.3	44.4	50.28
a2	16.2	54.1	72.7	45.9	47.23
a3	17.3	79.4	75.2	51.6	55.87
Mean (B)	19.03	62.10	76.07	47.30	
L.S.D0.05 (A) = 28.432					
L.S.D0.05 (B) = 15.547					
L.S.D0.05 (A X B) = 12.873					

a1 = Large seeds size a2 = Medium seeds size a3 = Small seeds size b0 = Seeds soaking with water b1 = Seeds soaking with diluted HClb2 =Seeds soaking with diluted NaOH b3 = seeds scarification.

Final Germination Percentage: Table 4 demonstrates that there were non-significant differences within seeds sizes on final germination percentage. While for treats of removal testa, seeds soaked with NaOH attained superior significant differences than those soaked with HCl, and this treatment got significant superiority in germination percentage than seeds scratching. On the other hand treatment of scratching seeds was significantly outperformed than soaking seeds with water. These results confirmed that it is possible to evolve the germination percentage of the stored seeds by soaking with NaOH, HCI or at least scratching the seed shells. The same results were obtained by the Agarwal and his colleagues [15] but for the development of barley seeds by soaking with GA3 (concentrated 100 ppm). Interaction between seeds sizes and removal testa treatments indicated that, large seeds soaked with NaOH, small seeds soaked with HCl, medium and small seeds soaked with NaOH, were superior significant in germination percentage than soaked with diluted water. We concluded that soaking treats either in NaOH or HCl were better than scarification.

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