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Effect of Seeds Priming and Sowing Dates on Some Yield Characteristics of Two Soybean Cultivars.

Mohsen, M. S.*[1], Saudi, A. H.
Department of Field Crop, College of Agricultural Engineering Sciences, University of Baghdad

ABSTRACT

A field experiment was conducted to investigate the effect of seed priming and planting dates on the growth of two soybean cultivars. The study was carried out during the summer seasons of 2022 and 2023 in the fields of Agricultural Engineering Sciences - University of Baghdad, using a randomized complete block design (RCBD) within split-split plot arrangement, with three replications and three factors. The main factor included seeding dates (June 1st, June 15th, and July 1st), the sub-plot included two soybean cultivars (Lee 74 and Shaimaa), and the sub-sub plot included seed priming treatments (gibberellic acid, KCl, and seaweed extract) along with two control treatments (soaking in distilled water and dry seeds). The results showed superiority of the June 15th planting date, which achieved the highest average for seed count per pod, 100-seed weight (grams), and total seed yield (kg ha^{-1}). The Shaimaa cultivar exhibited the highest average in all mentioned traits above. The seaweed extract seed priming treatment excelled in seed count per pod and 100-seed weight, while the KCl treatment outperformed in total seed yield. Overall, the June 15th planting date along with the Shaimaa cultivar showed superiority, along with the seaweed extract seed priming treatment.

Keywords: seaweed extract , seed vigor, Wide environmental range.

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INTRODUCTION

Soybean (*Glycine max* L.) is a leguminous crop cultivated for its seeds, which are important as a human food source due to their high protein content (36-40%) and oil content (14-26%). This makes it superior to other crop seeds in terms of nutritional value. Its importance has increased greatly on the global level due to its high content of unsaturated fatty acids, especially linoleic and linolenic acids, in addition to its seeds containing most of the essential amino acids and some important vitamins. It also contains nutrients, phenols, antioxidants, and flavonoids. The protein content in soybeans increases day by day (Awoda,2015, Hossain *et al*,2019, Kristin, et al,2010). Despite the importance of this crop, its cultivation faces several challenges, especially in dry and semi-dry regions (including Iraq). Among these challenges is the problem of reduced seed germination capacity, which hinders seedling emergence, uniform growth, and development. All of these issues negatively impact the field establishment of the plant and the final yield of this strategic crop (Al-Baldawi and Hamza,2017, Shihab and Hamza,2019). Therefore, many researchers have directed their efforts towards conducting numerous studies using various methods to improve soybean cultivation. Agricultural technologies, including seed priming, have been employed as more economical options. Seed priming is a common practice aimed at reducing the time between seed planting and seedling emergence, thereby accelerating and homogenizing plant growth and field emergence. This positively affects field establishment (achieving optimal plant density) under a wide range of environmental conditions (Al-Haidary *et al*,2018, Cheyed and Al-Rawi, 2018 , Mustafa *et al*,2020). Moreover, seed priming is cost-effective and highly efficient. This technique can be applied by soaking the seeds in various nutrient solutions It can be implemented through several methods, including seed priming with water only (Hydro priming), priming with

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hormones and plant growth regulators (Hormonal priming), priming with solutions containing osmotic substances (Osmo priming), or treating seeds with high or low temperatures (Thermo priming), among other methods of seed pre-treatment. These techniques mostly work to increase both germination and field establishment rates under natural environmental conditions and stress conditions. Moreover, they are crucial for achieving uniform seedling emergence, growth, and crop harvest simultaneously (Hamza *et al*,2019). In recent years, various plant growth regulators have been extensively used to narrow the gap between laboratory germination rates and field emergence .These regulators also enhance plants' tolerance to different environmental stresses by regulating their response to such stresses through controlling various physiological processes, including drought, salt, heat, and water stress, among others. Additionally, they can accelerate or delay germination, growth, flowering, and maturation, which positively impacts growth rates and yields (Al-Jaf, 2022). The current trend worldwide is towards finding natural alternatives to chemical fertilizers, such as using seaweed extract in seed priming technology to enhance plant growth and yield. Seaweed extracts are characterized by their non-toxicity, environmental friendliness, and low cost. They contribute to many important physiological functions of any crop as they are rich in plant hormones such as auxins, gibberellins, and cytokinins, as well as macro and micro nutrients. Additionally, they contain some essential amino acids and vitamins. Seaweed extracts play a crucial role in regulating cell components, enhancing resistance to biotic and abiotic stresses, and increasing chlorophyll content in leaves, thereby improving the efficiency of both carbon assimilation and respiration processes (Al-Maleky,2013, Hussain and AL-Rawi, 2023). The appropriate planting date is considered a significant factor in the various stages of plant growth and development, as well as in improving yield components. This is a result of increasing crop efficiency in utilizing available climatic conditions during the season, including temperature, relative humidity, light intensity, and others, which positively impacts yield increase. Additionally, the choice of cultivars is equally important as determining the most suitable timing for crop growth. It forms one of the foundations for the success of soybean cultivation, especially when some farmers opt to advance or delay planting dates under certain conditions, as it is linked to suitable temperatures for successful germination, seedling growth, and development, as well as its impact on plant growth stages and yield (Al-Muaini, and Al-Obaidi. 2018). This was study aimed to investigate the effect of seed priming and seeding dates on some yield traits of two soybean cultivars.

MATERIALS AND METHODS

Field experiment was conducted at the fields of the College of Agricultural Engineering Sciences - University of Baghdad during the summers of 2022 and 2023, using a randomized complete block design (RCBD) within split-split plot arrangement, with three replications and three factors. The main plot included planting dates (June 1st, June 15th, and July 1st), the sub-plot included two soybean cultivars (Lee 74 and Shaimaa), and the sub-sub-plot included seed priming treatments, which were gibberellic acid (GA3) at a concentration of 300 mg L^{-1}, potassium chloride (KCl) at a concentration of 30 g L^{-1}, and Seaweed Extract (Acazon) at a concentration of 3 ml L^{-1}, along with two control treatments (soaking in distilled water and dry seeds). The bio-stimulant Acazon was obtained from Al-Joud Company, a subsidiary of the Holy Shrine of Imam Abbas (AS). The seeds were soaked in solutions of the priming treatments for 24 hours and then air-dried for 12 hours. The preparation of the experimental field included plowing, smoothing, and leveling before planting. Subsequently, the field was divided into three replications with a distance of 1 meter between each replication. The area of each experimental unit was 6 square meters, with dimensions of 3 meters by 2 meters. Each plot included four furrows with a spacing of 75 cm between furrows and 20 cm between plants within each furrow. Urea fertilizer (46% N) was added at a rate of 225 kg ha^{-1} in three equal doses (the first dose at

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full emergence, the second dose at the beginning of flowering, and the third dose at the beginning of pod formation). Additionally, triple superphosphate fertilizer (46% P_2O_5) was applied at a rate of 120 kg ha^{-1} as a single dose before planting, after soil preparation and before preparing the plots for planting. It was mixed with the soil (Ali, 2012). **Statistical Analysis**: The data for the studied traits were statistically analyzed using the analysis of variance method to compare the mean values of the treatments at a significance level of 5% probability (Steel and Torrie,1981).

RESULTS AND DISCUSSION

Number of seeds per pod: The results of Tables (1 and 2) indicate a significant effect of different seeds priming treatments, planting dates, cultivars, and their interactions on the number of seeds per pod. The second planting date, June 15th, showed a significant superiority with the highest mean, at 2.339 and 2.374 seeds pod^{-1} for both seasons, respectively. On the other hand, the third planting date, July 1st, recorded the lowest mean at 2.236 and 2.207 seeds pod^{-1} for both seasons, respectively. The superiority of the second planting date, June 15th, could be attributed to the longest period from planting to full maturity, which provided the longest possible opportunity for cell division and elongation. This, in turn, led to an increase in vegetative growth and the number of pods per plant, resulting in an increases in the number of seeds per pod (Bin Shuaib, 2004). These results are consistent with those found by Al-Jumaili (2007), who observed a significant increases in the number of seeds per pod within the June 15th planting date. The results indicated a significant differences in the effect of cultivars on seeds per pod. The Shaimaa cultivar showed a significant superiority with the highest mean at 2.349 and 2.343 seeds pod^{-1} for both seasons, respectively. On the other hand, the Lee 74 cultivar achieved the lowest mean at 2.245 and 2.240 seeds pod^{-1} for both seasons, respectively. The increases in the number of seeds per pod could be attributed to the genetic nature of the cultivars, which positively responded to environmental conditions, leading to an increase in the rate of cell division and elongation, resulting in an increase in this trait. These results also align with those of Awoke (Awoke, 2022) and Dawood and Jaddoa (2023). The results of the seeds priming treatments had a significant effect, as the treatment with marine algae extract achieved the highest means at 2.704 and 2.734 seeds pod^{-1} for both seasons, respectively. These means did not differed significantly from the treatment with potassium chloride, which recorded means of 2.660 and 2.695 seeds pod^{-1} for both seasons, respectively. The dry seed treatment recorded the lowest mean at 1.836 and 1.769 seeds pod^{-1} for both seasons, respectively. The superiority of the seeds priming treatments with marine algae extract may be attributed to its essential role in increasing cellular metabolic activity due to the presence of some substances that act as growth promoters within its composition, such as indole acetic acid, in addition to the presence of gibberellins, cytokinins, some micronutrients, vitamins, and amino acids. These results are consistent with those found by Mathur *et al.* (2015) and Pacholczak *et al.* (2016), and they align with the findings of Begum *et al.* (2018) regarding the important physiological role of marine extracts in plants to improve crop performance and productivity Al-Fahdawi and Mustafa (2023).The results from Tables (1 and 2) indicate significant interaction effects between the cultivars and treatments. The treatment of seeds priming with marine algae extract excelled, particularly for the Shaimaa cultivar, with the highest average of 2.788 and 2.780 seeds pod^{-1} for both seasons respectively. This did not significantly differed from the treatment of seeds priming with potassium chloride for the same cultivar, which recorded 2.722 and 2.753 seeds pod^{-1} for both seasons respectively. Additionally, the treatment of seed priming with marine algae extract outperformed for the Lee cultivar in the second season only, with an average of 2.688 seeds pod^{-1} compared to the dry seed treatment, which recorded the lowest average at 1.807 and 1.693 seeds pod^{-1} for both seasons respectively. Similarly, the dry seed treatment for the Shaimaa cultivar recorded the lowest average at 1.866 seeds pod^{-1} for the first season only. The results from Tables (1 and 2) indicate a significant

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interaction between the planting dates and cultivars. The second planting date, June 15th, for the Shaimaa cultivar achieved the highest average of 2.406 and 2.439 seeds pod^{-1} for both seasons respectively. This did not significantly differed from the first planting date, June 1st, for the Shaimaa cultivar, recording an average of 2.375 and 2.371 seeds pod^{-1} for both seasons respectively. While, the third planting date, July 1st, recorded the lowest average at 2.208 and 2.195 seeds pod^{-1}for both seasons respectively. The results indicated that the interaction among planting dates and treatments was significant Tables (1 and 2). The priming treatment with seaweed extract for the second planting date, June 15th, outperformed with highest of 2.790 and 2.817 seeds pod^{-1} for both seasons respectively, which did not differed significantly from the priming treatment with potassium chloride. The latter recorded an average of 2.724 and 2.795 seeds pod^{-1} for both seasons respectively. Additionally, the priming treatment with seaweed extract for the first planting date, June 1st, achieved an average of 2.750 seeds pod^{-1} for the second season only, compared to the dry seed treatment for the third planting date, July 1st, which yielded the lowest average at 1.755 and 1.662 seeds pod^{-1} for both seasons respectively. The results from Tables (1 and 2) indicate significant three-way interaction. The priming treatment with seaweed extract outperformed in the second planting date for the Shaimaa cultivar, with the highest average of 2.903 and 2.907 seeds pod^{-1} for both seasons respectively, which did not differed significantly from the priming treatment with potassium chloride, as it yielded an average of 2.830 and 2.870 seeds pod^{-1} for both seasons respectively. Additionally, the priming treatment with seaweed extract for the first planting date also outperformed, with an average of 2.730 and 2.770 seeds pod^{-1} for both seasons respectively, which did not differed significantly from the priming treatment with potassium chloride at 2.720 and 2.740 seeds pod^{-1} for both seasons respectively. Compared to the dry seeds treatment for the Shaimaa cultivar in the first planting date, which yielded the lowest average of 1.727 seeds pod^{-1}, and the lowest average recorded by the dry seeds in the first planting date for the Lee cultivar at 1.750 seeds pod^{-1} for the first season only. Additionally, the dry seeds treatment for the third planting date for the Lee cultivar recorded the lowest average of 1.600 seeds pod^{-1} for the second season only.

Table 1. Effect of seeds priming, planting dates, and their interaction on seeds per pod for the season 2022

Cultivar	Treatments	Planting dates June 1st	June 15th	July 1st	Cultivar x Treatments
Shaimaa	Gibberellin	2.407	2.380	2.350	2.379
	Dist. water	2.060	2.007	1.897	1.988
	seaweed	2.730	2.903	2.730	2.788
	KCL	2.720	2.830	2.617	2.722
	Dry	1.960	1.910	1.727	1.866
lee	Gibberellin	2.270	2.343	2.350	2.321
	Dist. water	1.977	1.840	1.820	1.879
	seaweed	2.650	2.677	2.533	2.620
	KCL	2.623	2.617	2.553	2.598
	Dry	1.750	1.887	1.783	1.807
Lsd 5%			0.234		0.069
Cultivar			Cultivar x date		Cultivar mean
Shaimaa		2.375	2.406	2.264	2.349
lee		2.254	2.273	2.208	2.245
Lsd 5%			0.081		0.047**
Treatments			Treatments x planting dates		Treatments mean
Gibberellin		2.339	2.362	2.350	2.350
Dist. water		2.019	1.924	1.859	1.934
seaweed		2.690	2.790	2.632	2.704
KCL		2.672	2.724	2.585	2.660
Dry		1.855	1.899	1.755	1.836
Lsd 5%			0.073		0.065**
Planting date mean		2.315	2.339	2.236	

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Lsd 5%	0.056*

Table 2. Effect of seeds priming, planting dates, and their interaction on seeds per pod for the season 2023

Cultivar	Treatments	Planting dates June 1st	June 15th	July 1st	Cultivar x Treatments
Shaimaa	Gibberellin	2.427	2.370	2.317	2.371
	Dist. water	2.077	2.077	1.737	1.964
	seaweed	2.770	2.907	2.663	2.780
	KCL	2.740	2.870	2.650	2.753
	Dry	1.840	1.973	1.723	1.845
lee	Gibberellin	2.223	2.260	2.273	2.252
	Dist. water	1.883	2.037	1.867	1.929
	seaweed	2.730	2.727	2.607	2.688
	KCL	2.557	2.720	2.630	2.636
	Dry	1.680	1.800	1.600	1.693
Lsd 5%			0.338		0.092
Cultivar			Cultivar x date		Cultivar mean
Shaimaa		2.371	2.439	2.218	2.343
lee		2.215	2.309	2.195	2.240
Lsd 5%			0.097		0.062**
Treatments			Treatments x planting dates		Treatments mean
Gibberellin		2.325	2.315	2.295	2.312
Dist. water		1.980	2.057	1.802	1.946
seaweed		2.750	2.817	2.635	2.734
KCL		2.649	2.795	2.640	2.695
Dry		1.760	1.887	1.662	1.769
Lsd 5%			0.087		0.079**
Planting date mean		2.293	2.374	2.207	
Lsd 5%			0.069**		

Weight of 100 seed (g): The results of Tables (3 and 4) indicat a significant effects among different seeds priming treatments, planting dates, and cultivars, as well as significant interactions between them, on the 100-seeds weight (grams). However, the interaction between planting dates and cultivars, as well as the three-way interaction, were not significant for both seasons. The planting date of the second, 15th of June, showed a significant superiority with highest average seeds weight at 14.490 and 14.820 grams for both seasons respectively, while the third planting date recorded the lowest average at 13.767 and 14.092 grams for both seasons respectively. The superiority of the second planting date could be attributed to the increased crop efficiency to take advantage of the available climatic conditions during that period, such as temperature, relative humidity, light intensity, duration of photoperiod, and others (Al-Muaini and Al-Obaidi,2018). The data in Tables (3 and 4) also indicat a significant differences between cultivars in their effect on this trait. The cultivar "Shaimaa" achieved a significant superiority with the highest average weight, at 14.125 and 14.437 grams for both seasons respectively, while the cultivar "Lee 74" recorded the lowest average at 13.956 and 14.012 grams for both seasons respectively. The reason for this superiority could be attributed to the rates of metabolic compounds and other raw materials transferred from the mother plant to the seeds, which control this genetic trait, in addition to the possibility of genetic dominance within the seed itself (Al-Jumaili, 2014, Elsahooki and Chiyad,2023, Ngalamu *et al*,2013). The results of the priming treatments had a significant effects . The treatment of seeds priming with seaweed extract achieved the highest averages at 15.218 and 15.571 grams for both seasons respectively, which did not significantly differed from the treatment of seeds priming with potassium chloride for the first season, as it achieved an average of 15.131 grams. Compared to the control treatment of seeds priming with distilled water only, which recorded the lowest average at 12.600 and 13.158 grams for both seasons respectively, there was no significant differences with the treatment of dry seeds for the second season, which recorded an average of 13.223 grams. The superiority of the seaweed extract could be attributed to its content of nutrients such as iron, copper, zinc, cobalt, molybdenum,

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manganese, nickel, as well as growth regulators like auxins, gibberellins, cytokinins, and various vitamins and amino acids. Additionally, it enhances the plant's ability to absorb mineral nutrients from the soil, positively impacting the yield components (Cheyed and Al-Rawi, 2018, Okasha *et al*,2016). emphasizing the significant role of the components present in seaweed extract. This makes it more efficient in receiving solar radiation and converting it into nutrients. Overall, this positively affects the produced dry matter and the seed yield, which together constitute the biological yield of the crop. The results revealed a significant interaction between cultivars and treatments. The seaweed extract priming treatment for the Shaimaa cultivar outperformed all others with highest average of 15.430 and 15.934 g for the two seasons, respectively. This was not significantly different from the potassium chloride seeds priming treatment for the same cultivar, which was 15.339 g for the first season only. In comparison, the control treatment of dry seeds for both cultivars and the water-priming seeds only for the Lee cultivar recorded the lowest average of 12.760, 12.797, and 12.567 g for the first season. While, the control treatment of water-priming seeds only for the Shaimaa cultivar and the dry seeds treatment for the Lee cultivar recorded the lowest average at 12.992 and 13.277 g for the second season only. The results indicate that the interaction between the planting dates and treatments was significant. Treatment with seaweed extract for the second planting on June 15th showed the highest average, at 15.590 and 16.383 grams for both seasons respectively. This did not significantly differed from the treatment with potassium chloride, which recorded an average of 15.464 grams for the first season. In comparison to the dry seeds treatment and seeds treated with distilled water only for the first and third planting dates (12.350, 12.353, 12.325, 12.234, 13.184, 13.072, 12.800, and 13.132 grams), for two seasons respectively.

Table 3. Effect of seeds priming, planting dates, and their interaction on 100 seed weight (g) for the season 2022

Cultivar	Treatments	Planting dates June 1st	June 15th	July 1st	Cultivar x Treatments
Shaimaa	Gibberellin	14.427	14.700	14.457	14.528
	Dist. water	12.317	13.233	12.150	12.567
	seaweed	15.263	15.937	15.090	15.430
	KCL	15.130	15.807	15.080	15.339
	Dry	12.530	13.437	12.313	12.760
lee	Gibberellin	14.317	14.683	14.263	14.421
	Dist. water	12.333	13.250	12.317	12.633
	seaweed	14.943	15.243	14.833	15.006
	KCL	14.880	15.120	14.770	14.923
	Dry	12.507	13.490	12.393	12.797
Lsd 5%			N.S.		0.199
Cultivar			Cultivar x date		Cultivar mean
Shaimaa		13.933	14.623	13.818	14.125
lee		13.796	14.357	13.715	13.956
Lsd 5%			N.S.		0.047**
Treatments			Treatments x planting dates		Treatments mean
Gibberellin		14.372	14.692	14.360	14.475
Dist. water		12.325	13.242	12.234	12.600
seaweed		15.103	15.590	14.962	15.218
KCL		15.005	15.464	14.925	15.131
Dry		12.352	13.464	12.353	12.724
Lsd 5%			0.244		0.141
Planting date mean		13.865	14.490	13.767	
Lsd 5%			0.132		

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Table 4. Effect of seeds priming, planting dates, and their interaction on 100 seed weight (g) for the season 2023

Cultivar	Treatments	Planting dates June 1st	June 15th	July 1st	Cultivar x Treatments
Shaimaa	Gibberellin	14.420	15.193	14.280	14.631
	Dist. water	12.313	13.433	13.230	12.992
	seaweed	15.520	17.083	15.200	15.934
	KCL	15.190	16.153	15.040	15.461
	Dry	13.070	13.443	12.993	13.169
lee	Gibberellin	14.367	14.913	14.313	14.531
	Dist. water	12.484	13.653	12.033	13.324
	seaweed	14.977	15.683	14.963	15.208
	KCL	14.993	15.267	14.717	14.992
	Dry	12.293	13.383	12.153	13.277
Lsd 5%			N.S.		0.327
Cultivar			Cultivar x date		Cultivar mean
Shaimaa		14.103	15.061	14.149	14.437
lee		13.824	14.580	13.643	14.013
Lsd 5%			N.S.		0.143
Treatments			Treatments x planting dates		Treatments mean
Gibberellin		14.394	15.053	14.297	14.581
Dist. water		12.800	13.543	13.132	13.158
seaweed		15.249	16.383	15.082	15.571
KCL		15.092	15.710	14.879	15.227
Dry		13.184	13.413	13.072	13.223
Lsd 5%			0.400		0.231
Planting date mean		14.143	14.820	14.092	
Lsd 5%			0.224		

Total seeds yield (kg ha^{-1}): The results in Tables (5 and 6) indicate a significant effect among different seeds priming treatments, planting dates, cultivars, and their interactions on the total seeds yield in kilograms per hectare. The second timing on June 15th showed a significant superiority, with the highest average of 2.480 and 2.591 kg ha^{-1} for both seasons respectively. While, the third timing on July 1st recorded the lowest average, at 2.123 and 2.194 kg ha^{-1} for both seasons respectively. The reason for the superiority of the June 15 planting date in this trait could be attributed to the early planting dates from early May to mid-June, which excelled in most growth and yield traits, consequently leading to superior total seeds yield (Muhammad, 2008, Umburanas *et al*, 2019). The results in Tables (5 and 6) indicate a significant difference among cultivars on seeds yield. The Shaimaa cultivar produced a significant superiority with the highest average of 2.378 and 2.466 kg ha^{-1} for both seasons respectively. On the other hand, the Lee 74 cultivar yielded the lowest average at 2.283 and 2.346 kg ha^{-1} for both seasons respectively. The significant differences between cultivars in their laboratory and field performance could be attributed to the influence of genetic or environmental factors, and the impact of this differences could be observed in their response to the study factors as noted by Habib (Habib, 2017). The results also indicated a significant effects of seeds priming treatments, as the treatment with potassium chloride achieved the highest average at 2.738 and 2.870 kg ha^{-1} are for both seasons respectively. Interestingly, this did not differed significantly from the treatment with seaweed extract, which recorded an average of 2.708 and 2.755 kg ha^{-1} for both seasons respectively. Compared to the control treatment with dry seeds, which yielded the lowest average at 1.757 and 1.882 kg ha^{-1} for both seasons respectively. The reason for the superiority in this trait may be attributed to the role of potassium chloride and its positive effect on increasing cell division and elongation. This led to the production of strong shoots that grow and develop better, resulting in increased accumulation of nutrients in the seedling tissues, which positively reflected on

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their vegetative growth and yield components (Saudi, 2017). These results are consistent with findings by Goudarz et al. (2012) and Sadeghi *et al.* (2011), who confirmed that soybean seeds activated with potassium chloride solution achieved the highest averages for seeds yield. The results from Tables (5 and 6) indicate a significant interaction between the cultivars and treatments. The treatment of seeds priming with potassium chloride for the Shaimaa cultivar exhibited the highest average for seed yield, at 2.814 and 3.039 kg ha^{-1} for both seasons respectively, which did not differed significantly from the treatment of seed priming with marine algae extract for the same cultivar. It was recorded an average of 2.796 kg ha^{-1} for the first season only, compared to the dry seeds treatment for both cultivars, which produced the lowest average for ranging from 1.777 to 1.884 kg ha^{-1} for both seasons respectively, which did not differed significantly from the treatment of priming with distilled water only for the Lee cultivar, recording an average of 1.969 kg ha^{-1} for the second season only. The results from Tables (5 and 6) indicate a significant interaction between the planting dates and cultivars. The second planting date, 15th of June, for the Shaimaa cultivar, achieved a significant superiority with the highest average of 2.556 and 2.699 kg ha^{-1} for both seasons respectively. While, the third planting date for the Lee cultivar recorded the lowest average of 2.103 and 2.133 kg ha^{-1} for both seasons respectively. This did not differed significantly from the third planting date for the Shaimaa cultivar, which recorded 2.143 kg ha^{-1} for the first season only. The results demonstrate a highly significant interaction between the planting dates and different priming treatments. The treatment of seeds priming with potassium chloride surpassed in significance for the second planting date, providing the highest average, at 2.925 and 3.182 kg ha^{-1}. This did not differed significantly from the treatment of seed priming with potassium chloride for the first planting date, with an average of 2.914 kg ha^{-1} for the first season only. In comparison to the dry seed treatment for the first and third planting dates, which yielded the lowest averages (1.737, 1.727, 1.850, and 1.795 kg ha^{-1}) for both seasons respectively, there was non significant differences from the treatment of priming with distilled water only for the third planting date, recording an average of 1.842 and 1.837 kg ha^{-1} for both seasons respectively. The result indicates a significant three-way interaction between planting dates, cultivars, and different priming treatments in second season only,. The treatment of seeds priming with potassium chloride in the second planting date for the Shaimaa cultivar showed superiority with highest average of 3.510 kg ha^{-1} This is compared to the dry seeds treatment for three dates and for both cultivars, which recorded the lowest averages ranging from 1.860 to 2.010 kg ha^{-1}, and 1.770 to 1.993 kg ha^{-1}, respectively. These averages did not significantly differ from the treatment of priming with distilled water only for the third planting date and for both cultivars, with an average of 1.867 and 1.807 kg ha^{-1}, respectively.

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Table 5. Effect of seeds priming, planting dates, and their interaction on Total seed yield (kg ha^{-1}) for the season 2022

Cultivar	Treatments	Planting dates June 1st	June 15th	July 1st	Cultivar x Treatments
Shaimaa	Gibberellin	2.627	2.683	2.327	2.546
	Dist. water	1.893	2.113	1.863	1.956
	seaweed	2.887	3.140	2.360	2.796
	KCL	3.057	3.003	2.383	2.814
	Dry	1.707	1.840	1.783	1.777
lee	Gibberellin	2.570	2.613	2.303	2.495
	Dist. water	1.880	2.000	1.820	1.900
	seaweed	2.723	2.783	2.353	2.620
	KCL	2.770	2.847	2.367	2.661
	Dry	1.767	1.777	1.670	1.738
Lsd 5%			N.S.		0.095**
Cultivar			Cultivar x date		Cultivar mean
Shaimaa		2.434	2.556	2.143	2.378
lee		2.342	2.404	2.103	2.283
Lsd 5%			0.081		0.045**
Treatments			Treatments x planting dates		Treatments mean
Gibberellin		2.599	2.648	2.315	2.521
Dist. water		1.887	2.057	1.842	1.928
seaweed		2.805	2.962	2.357	2.708
KCL		2.914	2.925	2.375	2.738
Dry		1.737	1.809	1.727	1.757
Lsd 5%			0.117**		0.067**
Planting date mean		2.388	2.480	2.123	
Lsd 5%			0.092**		

Table 6. Effect of seeds priming, planting dates, and their interaction on Total seed yield (kg ha^{-1}) for the season 2023

Cultivar	Treatments	Planting dates June 1st	June 15th	July 1st	Cultivar x Treatments
Shaimaa	Gibberellin	2.667	2.740	2.107	2.505
	Dist. water	2.000	2.260	1.867	2.042
	seaweed	2.883	2.977	2.740	2.867
	KCL	2.813	3.510	2.793	3.039
	Dry	1.860	2.010	1.770	1.880
lee	Gibberellin	2.583	2.737	2.280	2.533
	Dist. water	2.063	2.037	1.807	1.969
	seaweed	2.777	2.797	2.353	2.642
	KCL	2.847	2.853	2.403	2.701
	Dry	1.840	1.993	1.820	1.884
Lsd 5%			0.249		0.144
Cultivar			Cultivar x date		Cultivar mean
Shaimaa		2.445	2.699	2.255	2.466
lee		2.422	2.483	2.133	2.346
Lsd 5%			N.S		0.117
Treatments			Treatments x planting dates		Treatments mean
Gibberellin		2.625	2.739	2.194	2.519
Dist. water		2.032	2.149	1.837	2.006
seaweed		2.830	2.887	2.547	2.755
KCL		2.830	3.182	2.598	2.870
Dry		1.850	2.002	1.795	1.882
lsd5%			0.176		0.067**
Planting date mean		2.433	2.591	2.194	
Lsd 5%			0.079		

CONCLUSION

From this study, ar could be that the second planting date, June 15th, achieved a significant improvement in all study traits. Furthermore, the soybean seed priming with seaweed extract at a concentration of 3 ml per liter has

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enhanced the traits of yield components and seed vigor. It is also evident that the studied cultivars varied in all the studied traits under different priming treatments. It became clear that the Shaimaa cultivar achieved the highest averages in all yield traits and seed vigor compared to the Lee 74 cultivar. Therefore, cant suggest the possibility of cultivating the Shaimaa cultivar with seeds priming using seaweed extract before planting. Additionally, can be suggest conducting further studies to determine the effect of priming soybean seeds with other concentrations of seaweed extract, along with conducting analytical studies on the resulting plants to understand the physiological and biological changes that occur in the plant due to seeds priming with seaweed extract and its effect on the nature of plant growth and final yield.

REFERENCES

Al-Awda, A. A. S., M. L. Hadid, & Y. Nimr. (2009). Oil and Sugar Crops and Its Technology. Faculty of Agricultural Engineering, Damascus University: 225-310. https://www.google.com/search

Al-Baldawi, M. H. K., & J. H. Hamza. (2017). Seed priming effect on field emergence and grain yield in sorghum. Journal of Central European Agriculture 18(2): 404–423. https://doi.org/10.5513/JCEA01/18.2.1

Al-Fahdawi, S. A., and S. B. I. Mustafa. (2023). The combined effect of bio-stimulants and antioxidants on the qualitative, chemical characteristics on essential oil of soybean. IOP Conference Series: Earth and Environmental Science 1(262): 052004. https://doi.org/10.1088/17551315/1262/

Al-Haidary, H.K.M.A. & et al. (2018). Effect of seed priming on grain growth rate and effective filling period in bread wheat' (*Triticum aestivum* L.) cultivars. Indian Journal of Agricultural Research, 52(6), pp. 612–618. http://dx.doi.org/10.18805/IJARe.A-35

Ali, N. S. (2012). Technical of Fertilizers and Their Using. Coll. of Scientific Research and High Education, Iraq. pp: 203. https://www.iasj.net/iasj/pdf/f1ac0577b3

Al-Jaf, H. T. F. (2022). Hormonal and Nutritional Regulation of Seedling Growth and Ear Development in Three Varieties of Bread Wheat. Ph.D.Dissertation College of Agricultural Engineering Sciences. Department of Field Crops.pp:40 - 52. https://scholar.google.com

Al-Jumaili, I. A. S. (2014). Growth, yield and Quality of Soybean Varieties under the Influence of Cycocel and Foliar Feeding with Nitrogen and Boron. Ph,D, Dissertation, College of Agriculture, University of Baghdad.pp:163. https://www.iasj.net/iasj/article/99518

Al-Jumaili, J. M. A. (2007). The effect of nitrogen, phosphate and potassium fertilization on the growth and yield of soybeans. Anbar Journal of Agricultural Sciences 5 (2): 135-140. https://www.iasj.net/iasj/article/36436

Al-Maleky, A. H. Q. (2013). Effect of biozyme TF on growth and yield of two cultivars of cabbage cultured in desert region south of Iraq. J. of Basrah Researches Sci. 39(4): 88-97. https://iraqjournals.com/article_89315

Al-Muaini, A. H. A. & M. A. Al-Obaidi. (2018). Scientific Principles for Management, Production, and Improvement of Field Crops. Ministry of Higher Education and Scientific Research. https://academics.su.edu.krd/public

Al-Nuaimi, S. Z. A. (2020). The Effect of Iron and Boron Spraying Stages on the Growth, Yield, and Seed Quality of Soybeans. M.Sc. Thesis. College of Agricultural Engineering Sciences - University of Baghdad.pp:180-187. https://www.iasj.net/iasj/article/177329

Awoda, S. J. A.(2015). Effect of Ascorbic and Salicylic Acid on Growth and Yield of Soybean (*Glycine max* L.). M.Sc. Thesis. Dept. of Field Crop, Coll. Of Agric., Univ. of Baghdad.pp:57-69. https://library.alkafeel.net/dic/details/211

Awoke, T. (2022). Performance Evaluation of Soybean (*Glycine max* L.) Varieties for Growth, Yield and Yield Components under Irrigation at Lowland Area of South Omo Zone, Southern Ethiopia. Journal of Agriculture and Aquaculture 4(2):2652-9718. https://escientificpublishers.com/JAA-04-0041

Begum, M., B. C. Bordoloi, D. D. Singha, & N. J. Ojha. (2018). Role of seaweed extract on growth, yield and quality of some agricultural

Iraqi Journal of Agricultural Sciences –2026:57(7):1880-1892
P-ISSN: 0075- 0530 /E-ISSN: 2410-0862
DOI: https://doi.org/10.36103/se6a4159

crops. Agricultural Reviews 39(4): 321-326. https://doi.org/10.18805/ag.R-1838
Bin Shuaib, R. (2004). The Effect of Heat Accumulation and Planting Dates on the Yield and Quality of Different Varieties of Soybean *Glycine max* (L.) Merrill. Ph.D.Disseration, Field Crops Department, Faculty of Agriculture, Baghdad University.pp:82-91. https://library.alkafeel.net/dic/print/pag
Cheyed, S. H. & A. S.M. Al-Rawi, (2018) . Effect of seed priming of organic. biochemical and mineral fertilizers on seed vigor of sorghum. Int. J. Agricult. Stat. Sci. Vol. 14, Supplement. 1. pp. 239-244. https://www.academia.edu
Dawood, A. A., & K. A. Jaddoa. (2023). Effect of embryo weight and seed priming on seedling characteristics of different maize cultivars. IOP Conference Series: Earth and Environmental Science 1(225): 012079. https://doi.org/10.1088/17551315/1225/1/012079
Elsahooki, M. & S. H. Chiyad. (2023). Seed Growth Relationships. Ministry of Higher Education and Scientific Research.SN.978.9.9289910.6.1.pages:18-34. https://www.researchgate.net/publication
Goudarz, A., F. Soleimani, B. Saadatian, & M. Pouya. (2012). Effect of seed priming with potassium nitrate on germination and emergence traits of two soybean cultivars under salinity stress conditions. American-Eurasian J. Agric. And Environ. Sci. 12(6): 769-774. https://doi.org/aejaes/jaes12(6)12/13
Habib, M. I. 2017. Improving the Performance of Sunflower Seeds (*Helianthus annuus* L.) Using Priming Treatment. M.Sc. Thesis. Department of Field Crops - Faculty of Agriculture - University of Anbar.pp:79-81.https://www.researchgate.net
Hamza, H .J., M. Jewad, & W. S. K Al-Taweel,. 2019. Seed weight effect on germination properties and seedling growth of some cultivars of lupine. Journal of Physics: Conference Series, 1294(9), 09201 . https://iopscience.iop.org/article/10.108
Hossain, M.S. , M.A.A. Mamun, Q.A. Khaliq, Q.A. Higuchi, Nawata H., & M.A. Karim, (2019). Waterlogging induced changes in morpho-physiology of soybean . Res. Trop. Agric. 1: 53–54. https://www.researchgate.net/publication
Hussain, A. M. & A. S. M. AL-Rawi, (2023) . Response of soaking with (Acadian) on seed vigor of wheat under salt stress. Iraqi. J. of Market Research.15(1): 184-192. http://dx.doi.org/10.28936/jmracpc15.1.2023.(16)
Kristin, B., M. B . Ratnaparkhe & C. Kole. (2010). Genetics, genomics and breeding of soybean . pp:350. https://www.routledge.com
Mathur, C., S. Rai, N. Sase, S. Krish & M.A. Jayasri. (2015). Enteromorpha intestinalis derived seaweed liquid fertilizers as prospective biostimulant for Glycine max. Brazilian Archives of Biology and Technology, 58: 813-820. https://doi.org/10.1590/S1516891320150603
Muhammad, A. (2008). Effect of planting date and storage on yield and quality of indigenous land races and improved varieties of soybean. Pakistan Res. Repository. 164-169. https://api.semanticscholar.org/CorpusID:111634309
Mustafa, A.S., N.F. Shajai, F.F. Saleh,. and J. H. Hamza, (2020). Effect of soaking with bread yeast extract on sorghum seed germination under salt stress conditions. Plant Archives. 20(1): 3111–3116. http://plantarchives.org/20-1/3111-3116
Ngalamu, T., M. Ashraf & S. Meseka. (2013). Soybean (Glycine *max* L.) genotype and environment interaction effect on yield and other related traits. Amer. J. of Exper. Agric . 3(4) : 977 – 987 . https://cgspace.cgiar.org/items/fe07b61e
Okasha, A. M., M. M. Abbelhameed, & O. M. Elshayb, (2019). Improving rice grain quality and yield of Giza 179 rice cultivar using some chemical foliar spray at late growth stages under salt stress. Journal of Plant Production, 10(9), 769-775. https://jpp.journals.ekb.eg/article
Pacholczak, A., W. Szydlo, E. Jacygrad, & M. Federowicz. (2016). Effect of auxins and the biostimulator algaminoplant on rhizogenesis in stem cuttings of two dogwood cultivars (cornus alba 'AUREA' and 'Elegantissima'). Acta Sci Pol Hortorum Cultus 11: 93–103. https://bibliotekanauki.pl/articles/11542342.pdf

Iraqi Journal of Agricultural Sciences –2026:57(7):1880-1892
P-ISSN: 0075- 0530 /E-ISSN: 2410-0862
DOI: https://doi.org/10.36103/se6a4159

Sadeghi, H., F. Khazaei, Yari Leila & S. Sheidaei. (2011). Effect of seed osmopriming on seed germination behavior and vigor of soybean (Glycine max L.). ARPN J. of Agric. and Biological Science. 6(1). https://www.researchgate.net/publication

Saudi, A.H.(2017). Effect of seeds priming treatments in viability and vigor of soybean (*Glycine max* L.) seeds under salinity stress. Anbar. Jou. of Agri.Sci.15 (1):111-130. https://www.iasj.net/iasj/article/129078

Shihab, M. O., & J. H. Hamza. (2019). Seed priming of sorghum cultivars to tolerate salt stress. IOP Conference Series: Earth and Environmental Science 388(1): 012044. https://doi.org/10.1088/17551315/388/1/012044

Sousa, C. L. M., M. O. Sousa, L. M. Oliveira, & C. R. Pelacani. (2014). Effect of priming on germination and salt tolerance in seeds and seedling of *Physalis peruviana* L. African J. of Biotechnology 13(19): 1955-1960. https://doi.org/10.5897/AJB2013.13549

Steel, R. G. D., & J. H. Torrie. (1981). Principles and Procedures of Statistic. McGraw-Hill Book Co., Inc. N.Y. pp. 485. https://www.scirp.org/reference

Umburanas,R.C., A. H. Yokoyama, L. Balena, D. Dourado-Neto, W.F. Teixeira, R.K. Zito, and K. Reichardt, & J. Kawakami .(2019). Soybean Yield in Different Sowing Dates and Seeding Rates in a Subtropical Environment. Inte. Jou. of Plant Production. Pages: 117-128. https://link.springer.com/article

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تأثير تنشيط البذور ومواعيد الزراعة في بعض صفات الحاصل لصنفين من فول الصويا

*مثنى سالم محسن، أحمد حميد سعودي
قسم المحاصيل الحقلية - كلية علوم الهندسية الزراعية - جامعة بغداد

المستخلص

أجريت تجربة حقلية لمعرفة تأثير تنشيط البذور ومواعيد الزراعة في حاصل صنفين من فول الصويا. أجريت الدراسة خلال الموسمين الصيفيين 2022 و2023 في حقول علوم الهندسة الزراعية - جامعة بغداد، باستعمال تصميم RCBD بترتيب الألواح المنشقة - المنشقة بثلاثة مكررات وبثلاثة عوامل تضمن العامل الرئيسي مواعيد الزراعة (1 / 6 و 15 /6 و 1/7) والعامل الثانوي صنفين من فول الصويا (Lee 74 و شيماء) والعامل تحت الثانوي معاملات تنشيط البذور (حامض الجبرلين، KCl، ومستخلص الطحالب البحرية فضلا عن معاملتي المقارنة (نقع بالماء المقطر والبذور الجافة). أظهرت النتائج تفوق موعد الزراعة 15 حزيران حيث حقق أعلى متوسط لعدد البذور قرنة $^{-1}$ و وزن 100 بذرة (غم) والحاصل الكلي للبذور كغم هـ$^{-1}$. أظهر صنف الشيماء أعلى متوسط في جميع الصفات المذكورة في أعلاه . تفوقت معاملة تنشيط البذور بمستخلص الطحالب البحرية في عدد البذور قرنة $^{-1}$ و وزن 100 بذرة غم، بينما تفوقت معاملة KCL في الحاصل الكلي للبذور كغم هـ$^{-1}$. وبشكل عام، أظهر موعد زراعة 15 حزيران وصنف الشيماء تفوقاً، بالإضافة إلى معاملة تحفيز البذور بمستخلص الطحالب البحرية.

الكلمات المفتاحية: مستخلص الطحالب البحرية، قوة البذور، المدى البيئي الواسع.