Effect of Seed activation on viability and vigour seed of Some Wheat Varieties

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Abstract

A laboratory experiment was conducted in the germination laboratory in the Department of Seed Inspection and Certification, Babel Abu Gharq branch(2022-2023) It was done for the purpose of knowing the effect of cultivars and activation on the laboratory traits of wheat seeds. It included two factors, the first factor: included four of wheat cultivars (IPA 99 - bohouth 22 - Babylon 113 - Mawadah) and the second factor, activation by soaking with cytokinin (0-100-200-300 mg.L $^{-1}$) ,. The experiment was conducted according to the arrangement of factorial experiments with two factors and according to a completely randomized design (CRD) with two replicates. The results showed significant differences between the cultivars, where the cultivar IPA 99 was significantly excelled in the standard laboratory germination trait (94.75%). The bohuth 22 variety was excelled in trait of radical length (8.24 cm), and the Babylon 113 variety was superior in the trait of plumule length (9.43 cm) and seedling dry weight (10.08 mg), and the Mawadah variety was excelled in germination strength index (17.48%). Activation also had a significant effect, where the treatment 100 mg.L^{-1} was significantly excelled the standard laboratory germination rate (96.15%). The treatment 300 mg.L^{-1}was also significantly excelled on the trait of the plumule length (9.57 cm) the Radical length (8.42 cm), germination strength index (18.41%) and seedling strength index (17.60%). As for the interaction, the treatment Mawadah and concentration 300 mg.L^{-1} was significantly excelled in the plumule length (10.17 cm), and in The radical length trait was significantly excelled on the treatment bohuth 22 and concentration 200 mg.L^{-1} with an average of (9.30 cm), while the treatment IPA 99 and concentration 300 mg.L^{-1} was superior in seedling dry weight (11.27 mg). The treatment (babylon 113 and concentration 300 mg.l^{-1}) was significantly superior in terms of germination strength index (19.44%) and seedling vigor index (18.52%).

Keywords: bread wheat, seed stimulants, plant hormones, genetic structures**.**

introduction:

Wheat (Triticum aestivum L.) is an agricultural crop of great economic importance, where it is considered one of the main strategic crops in most countries of the world. Wheat ranks first globally in terms of cultivated area, reaching 265 million hectares [7]Wheat production in Iraq was estimated at about 4.234 thousand tons for the governorates included in the winter season of 2021, with a decline in productivity by 32.1% compared to 2020. The average production per hectare was estimated at about 1.789 tons/ha,Based on the cultivated area of 1.000 dunums [6], As a result of the continuous increase in population, increasing wheat productivity has become an urgent necessity to ensure food security in the future.Seed vigor and viability checks are an essential element of seed checks that cannot be overlooked, as they provide a predictable indicator of plant performance. In addition, it is a vital criterion for seed quantity and seed depth during planting operations. Seed vigor is defined by a set of characteristics that determine the behavior of the seed under various environmental conditions. It is also known as the ability of a seed to germinate in unfavorable or suboptimal conditions.Seed

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viability is an aspect of seed quality, defined as the ability of the seed to germinate or produce a normal seedling according to a standard germination test. It is also defined as the degree to which the seed is biologically active and shows the effectiveness of enzymes in accelerating the biological reactions that lead to germination [3]

Techniques related to seed activation have proven effective and efficient in several countries around the world to improve crop performance and increase production under normal conditions, as well as to reduce the time required for germination [9].This technology can be used to Good field establishment in terms of seedling emergence, and improve Its growth and flowering, and the effect on increasing yield and its components [2] ,Seeds are activated before planting (through the seed soaking process) to obtain homogeneous germination and a high seed emergence rate under a wide range of environmental conditions, which reflects positively on increasing yield and its components [8].The researchers found that growth regulators can be used to stimulate seeds, as plant growth is controlled by hormones and the plant's interaction with its environment, which leads to achieving a balance that reflects positively on the final outcome [5]. Benzyl adenine (synthetic cytokinin) is one of the best growth regulators that has been used to stimulate seeds, increase the vitality and strength of seeds, and has a positive effect on some yield traits [13].The reason for this is the unique chemical structure that makes it more effective than other natural or synthetic cytokinins .This experiment was conducted to turn the idea of seed revitalization into economic feasibility, by addressing invisible losses in wheat yield. Since the wheat is not grafted, there will be a loss in the crop as a result of a decrease in the germination rate. By revitalizing the seeds, this loss can be overcome.The viability and strength of seeds in their germination depends on the nature of the cultivars and their genetic differences, and is an important indicator of the quality and type of seeds, which affects field establishment and the final yield. Since cultivars are genetically distinct in multiple traits, these differences must be studied and the best cultivars among them must be approved [12], The study aimed to find out :

1. effect of seed activation on the viability of wheat seeds.
2. Response of wheat cultivars to seed activation.

MATERIALS AND METHODS

The experiment was conducted in the germination laboratory of the Seed Inspection and Certification Department in the Babylon branch - Abu Gharq (2022-2023) according to the Arrangement of factorial experiments with a completely randomized design (CRD), where the factorial experiments were arranged with two replicates and two factors. The first factor was the Viability treatments, which included four concentrations of synthetic cytokinin (100,200,300 mg.L^{-1}) with a control treatment. The second factor was represented by four types of wheat (IPA 99 , bohuth 22 , Babylon 113 , Mawadah). The seeds were soaked in the prepared concentrations for 12 hours, and after this period ended, the seeds were filtered and ensured they were completely air dried for 6 hours. For each treatment, 100 seeds were selected and folded onto rolled-towel test paper, then the samples were placed in a sterile plastic bag and germinated at a temperature of 23°C and approximately 95% relative humidity [10].The seeds were then left to germinate until the end of the 10-day examination period. After that, the studied traits were measured.

A 1000 mg L^{-1} standard solution of synthetic cytokinin ($C_{12}H_{11}N_5$) was prepared by dissolving 1 g of it in 200 ml of distilled water. Next, supplement the volume to 1 L with distilled water. It is noteworthy that the synthetic cytokinin used in this experiment is produced by HIMEDIA and is of Indian origin. The required parameters were prepared by diluting this standard solution to reach the concentrations required in the experiment.

STUDIED TRAITS:

standard laboratory germination (%)

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Ten days after planting, the total number of natural seedlings was calculated and converted to a percentage using the following equation [10].

Standard laboratory germination rate = (number of natural seedlings after 10 days / total number of seeds) x 100.

The plumule and radical length in the laboratory germination test (cm)

At the end of the standard laboratory germination test period of 10 days, ten normally growing seedlings were taken randomly, and plumule length was measured after separating it from its point of contact with the seed, as well as the length of the petiole after separating it from its point of contact with the middle embryonic peduncle. The measurement was made using a graduated ruler [11].

seedling vigor index %

The seedling strength index was calculated according to the following equation: [16]

Seedling vigor index = (radical length cm + plumule length cm) x germination rate %.

Germination strength index %

The germination strength index was calculated according to the following equation: [14]

Germination strength index = (radical length cm + plumule length cm)/germination percentage %.

RESULTS AND DISCUSSION:

Standard laboratory germination (%)

Table 1: The effect of Viability , cultivars, and the interaction between them on the standard laboratory germination trait (%)

concentrations ($mg.L^{-1}$) Viability					cultivars
average	300	200	100	0	
95.75	97.50	99.50	98.00	88.00	IPA 99
91.62	93.50	92.50	95.50	85.00	bohouth 22
94.25	95.00	93.00	97.00	92.00	babylon 113
91.37	95.50	89.00	94.00	87.00	Mawadah
	95.37	93.75	96.15	88.00	average
L.S.D (0.05)					
interaction		Viability		cultivars	
N.S		1.81		1.81	

The results of Table 1 show a significant difference in the percentage of standard laboratory germination between wheat cultivars (IPA 99 - bohuth 22 - Babylon 113 - Mawadah). The seeds of the two cultivars, IPA 99 and Babylon 113 , were significantly excelled in trait of the highest standard laboratory germination rate. It reached 95.75% and 94.25% , respectively. While the averages for the two cultivars, Bahouth 22 and Mawadah, were 91.62% and 91.37% , respectively. These results are consistent with previous studies conducted by [4,13].

The reason for the difference is the difference in the genetic capability of the cultivars and their adaptation to the surrounding environment, in addition to the difference in external conditions before planting that affect the seeds, such as the duration of storage and the method of storage, which plays an important role in the vitality and strength of the seeds. The results in the same table also indicate that there are significant differences between the cytokinin Viability treatments in the standard laboratory germination rate.The stimulating treatments 100, 200 and 300 $mg.L^{-1}$ achieved averages of 96.15%, 93.75% and 95.37% in the standard laboratory germination rate, respectively, while the control treatment averaged (88.00%). The reason for this is due to the role of cytokinin in the germination process and the extent of its effectiveness through a cycle in the physiological processes

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of the seed during the germination stage. Its effect on the permeability of membranes makes the imbibition process occur easily, in addition to it interacting cooperatively with gibberellin to complete the germination process and inhibit the action of inhibitors of that process in seeds [1] . the interaction between two factors was no significant

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plumule length (cm)

Table 2: The effect of viability , types, and the interaction between them on the trait of plumule length (cm)

Viability concentrations ($mg.L^{-1}$)					cultivars
average	300	200	100	0	
8.46	9.44	8.34	8.80	7.25	IPA 99
8.47	8.64	9.37	8.24	7.65	bohouth 22
9.43	10.03	9.38	9.27	9.04	babylon 113
9.41	10.17	9.16	9.83	8.48	Mawadah
	9.57	9.06	9.03	8.10	average
L.S.D (0.05)					
interaction		Viability		cultivars	
1.05		0.52		0.52	

From the results of Table 2 , a significant difference appears in trait of the plumule length of the wheat cultivars (IPA 99 , Bohuth 22 , Babylon 113 and Mawadah).The seeds of the Babylon 113 and Mawada cultivars were significantly excelled in trait of the highest average plumule length, reaching 9.43 cm and 9.41 cm , respectively, while the IPA 99 variety gave the lowest average for the trait, reaching (8.46 cm). These results are consistent with previous studies conducted by [4,13,15]. These differences are due to the difference in genetic genes responsible for this trait in the seeds of different wheat cultivars.The results in the same table show that there are significant differences between the Viability parameters. The two treatments 300 $mg.L^{-1}$ and 200 $mg.L^{-1}$ were significantly excelled in giving the highest averages for the trait, reaching 9.57 cm and 9.06 cm, respectively, compared to control treatment, which achieved the lowest average for the trait, which reached 8.10 cm. The reason for these differences is due to the effective role of cytokinin in the process of cell division by increasing the translation rate of DNA. As a result, the rate of protein synthesis increases due to cytokinin, and these proteins are either enzymes or synthetic proteins that the cell needs in the process of mitosis [1] .The results also showed a significant effect of the interaction between the two study factors, as the treatment Mawadah variety and concentration 300 $mg.L^{-1}$ achieved a significantly excelledin the highest average of the petiole length characteristic in the standard laboratory germination test, reaching (10.17 cm). While the treatment IPA99 and concentration 0 $mg.L^{-1}$ achieved the lowest average for the trait, amounting to (7.25 cm).

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Radical length (cm)

Table 3: The effect of Viability , cultivars, and their interaction on radical length (cm)

Viability concentrations ($mg.L^{-1}$)					cultivars
average	300	200	100	0	
7.24	8.23	7.27	7.16	6.29	IPA 99
8.24	8.43	9.30	7.50	7.74	bohouth 22
7.38	8.94	7.49	6.61	6.50	babylon 113
7.38	8.11	7.06	7.37	6.99	Mawadah
	8.42	7.78	7.16	6.88	average
L.S.D (0.05)					
interaction		Viability		cultivars	
1.34		0.67		0.67	

The results of Table 3 show a significant difference in radical length for wheat cultivars (IPA 99 , bohuth 22 , babylon 113 , Mawadah). Seeds of the Bohuth 22 variety were significantly excelled by giving the highest average of 8.24 cm on the rest of the cultivars, while the IPA 99 variety gave the lowest average of the radical length trait of 7.24 cm. These results are consistent with the findings of [4,13] .

The results in the same table show that the two treatments 300 and 200 $mg.L^{-1}$ were significantly excelled, giving the two highest averages for the trait, which were 8.42 cm and 7.78 cm compared to the other Viability treatments. While control treatment achieved the lowest average 6.88 cm. The reason for the significantly excelled of the two treatments (300 and 200 mg.L-1) is attributed to directing growth towards radical formation as a result of Viability by controlling auxin levels [1] .The results also showed a significant effect of the interaction between the two study factors on radical length as well. The treatment (bohouth 22 and concentration 200 $mg.L^{-1}$) achieved significant superiority over the rest of the treatments, as it reached the highest averages for the trait (9.30 cm). While the treatment (IPA 99 and concentration of 0 mg.L-1) achieved the lowest average of the trait, was 6.29 cm.

germination strength index

Table 4: The effect of Viability , cultivars, and the interaction between them on the germination strength index (%)

Viability concentrations (mg.L-1)					cultivars
average	300	200	100	0	
16.01	17.88	15.65	16.10	14.39	IPA 99
17.48	17.66	19.42	16.09	16.75	bohouth 22
17.26	19.44	17.43	16.08	16.11	babylon 113
17.48	18.66	17.09	17.67	16.51	Mawadah
	18.41	17.40	16.48	15.94	average
L.S.D (0.05)					
interaction		Viability		cultivars	
2.30		1.15		1.15	

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From the results of Table 4, it appears that there are significant differences between the cultivars (IPA 99 , bohuth 22 , babylon 113 , Mawadah) in terms of germination strength. The Mawadah variety significantly excelled by giving the highest average for the trait, reached to 17.489% , and it did not differ significantly from the two cultivars, Buhouth 22 and Babylon 113, as their averages reached 17.48% and (17.26%), respectively. Compared to the lowest average for IPA 99, which was (16.01%). The reason for excelled of the Mawadah variety is due to its excelled in trait plumule length (Table 2) and radical length (Table 3).

The results in the same table indicate that there are significant differences between the cytokinin Viability treatments. The two treatments 300 and 200 $mg.L^{-1}$ excelled significantly by giving the highest average for the trait, amounting to (17.40%) and (18.41%), while the control treatment achieved the lowest average for the germination strength index, was 15.94%, due to their excelled in the length of the plumule and radical, as they were given 9.43 cm and 9.41 cm in radical length, respectively. 8.42 cm and 7.78 cm in radical length, respectively.(table 2and 3) .

The effect of the interaction between the two factors of the study (cultivars and Viability treatments) gave significance to the trait of germination strength index. The treatment Babylon 113 and a concentration of 300 $mg.L^{-1}$ achieved the highest average of (19.44%). This exceled may be due to the excelled of this treatment in radical length (Table 3), while the treatment IPA 99 and a concentration of 0 $mg.L^{-1}$ The lowest average for the trait was (14.39%).

seedling vigor index %.

Table 5: The effect of viability , cultivars, and their interaction on the seedling vigor index (%)

Viability concentrations ($mg.L^{-1}$)					cultivars
average	300	200	100	0	
15.19	17.46	15.57	15.81	11.91	IPA 99
16.03	16.52	17.97	15.40	14.22	bohouth 22
16.39	18.52	16.34	15.68	15.02	babylon 113
16.17	17.92	15.44	16.75	14.56	Mawadah
	17.60	16.33	15.91	13.93	average
L.S.D (0.05)					
interaction		Viability		cultivars	
2.03		1.01		1.01	

From the results of Table (5), it appears that there are significant differences between wheat cultivars (IPA 99 - bohuth 22 - babylon 113 - Mawadah) in the seedling vigor index. The seeds of the Babylon 113 variety were significantly superior, giving the highest average for the trait, which amounted to 16.39%, compared to the IPA 99 variety, which gave the lowest average for the trait, index of seedling vigor, which amounted to 15.19% . It did not differ significantly with the two cultivars bohuth 22 and Mawadah, as they gave an average for the trait of (16.03% and 16.17%), respectively. The reason for this is attributed to their superiority in the length of the Plumule (Table 2), as well as in the standard laboratory germination trait (Table 1).

The results in the same table indicate that the treatment 300 $mg.L^{-1}$ was significantly excelled by giving the highest average for the trait, which amounted to 17.60% , while the control treatment achieved the lowest average for the seedling vigor index, which amounted to 13.93%. This is due to the excelled of the treatment 300 $mg.L^{-1}$ in each of the following traits: standard laboratory germination rate (Table 1), plumule length (Table 2), and radical length (Table 3).

The interaction effect between the two study factors treatments (cultivars and viability) was significant in terms of seedling vigor

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index. The treatment babylon 113, concentration 300 mg.L^{-1} achieved the highest average of 18.52% , and did not differ significantly from the treatments Mawadah, concentration 300 mg.L^{-1}, IPA 99, concentration 300 mg.L^{-1}, bohuth 22 and concentration 200 mg.L^{-1} with averages reaching 17.92%, 17.46%, and 17.97% , respectively. The treatment IPA99% and concentration of 0 mg.L^{-1} achieved the lowest average for the trait, amounting to 11.91%.

CONCLUSIONS

The difference in cultivars has a clear effect on the strength and vitality of the seeds and is an important factor in the performance of the variety. Environmental factors can reduce their impact on the seeds to a large extent by, for example, choosing a suitable planting date or adding nutrients. However, genetic nature cannot change it through these processors. Cytokinin has an effective role in the vitality and strength of wheat seeds and thus influencing wheat productivity in general. It is noted from the results an important role for activation in important characteristics of wheat plants, such as germination rate and field establishment, which are considered among the main characteristics tested in order to evaluate vitality and strengt seeds .

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