ARTICLE / INVESTIGACIÓN

Wheat seed deterioration stimulated by plant extracts

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Abstract: During 2019-2020, the experiment was conducted in the laboratory of the Department of Field Crop Sciences, Faculty of Agricultural Engineering Sciences - Baghdad University, to investigate the impact of soaking wheat seeds produced during the 2016 agricultural season with three plant extracts (licorice root extract 2%, 4% and 6%, Acadian and Humic(500, 1000, & 1500 mg L^{-1}). Aside from the two control treatments (soaking in distilled water with dried seeds). The results show that the soaking treatment with licorice root extract outper-formed the other therapies in conventional laboratory germination, root length, and seedling vigor index (95 percent and 3.42 cm 1207) compared to the two control treatments (soaking with distilled water and dry seeds). While all the Humic and Acadian soaking treatments at the concentrations (500 and 1000) mg L^{-1} did not significantly differ with the distilled water soaking treatment.The characteristics of standard laboratory germination percentage, root length, coleoptile length and seedling vigor index. Thus, we conclude that soaking wheat seeds with high concentrations of Acadian (more than 1000 mg L^{-1}) leads to a deterioration in the vitality of the seeds. While soaking with licorice root extract enhances the vibrancy and ac-tivity of wheat seeds compared to the other extracts used. As a result, we propose soaking the somewhat old and low-vital wheat seeds in a concentration of at least 2% licorice root ex-tract.

Key words: Radicle dry weight, Seedling vigor, seed germination, seed storage.

Introduction

Regarding nutritional, industrial, and economic importance, planted areas, and overall output, wheat is the first cereal crop in Iraq and the globe. However, Iraqi production of this crop is modest compared to world production and does not meet the country's needs. The reason for this may be due to poor management as well as environmental conditions during the growing season. Because of this, it is necessary to search for suitable means that may help raise the productivity of this vital crop, starting with the seed and field establishment, because of its great importance in establishing the final seed yield. Seed priming technology is one of the most important ways to improve the vitality of seeds and give solid and homogeneous seedlings, and then a good and early field establishment[1]. Soaking the seeds with plant extracts can stimulate growth as a result of containing several natural compounds that encourage vegetative and flowering growth and yield characteristics[2,3]. In addition, it is cheap, readily available, easy to use and does not pollute the environment; the most important of these extracts is licorice (*Glycyrrhiza glabra L.*)[4]. The behavior of licorice root extract is similar to that of gibberellin because it contains the primer of gibberellin biosynthesis (the intermediate lion compound of mevalonic acid), which stimulates an increase in germination rate and aids cell division and elongation. This increases the size of the vegetative system and improves flowering and yield characteristics[5]. Wheat seeds were irrigated with three concentrations of licorice root extract (1, 3 and 5%) in addition to the control treatment (distilled water), and a beneficial effect on viability and germination vigor was found[1]. Priming the seeds of three types of bread wheat (Abu Ghraib 3, IPA 99 and Al-Fath) by soaking them with concentrations of growth regulators and plant extracts, including licorice root extract, which improved the vitality and activity of seedlings of wheat cultivars compared to the control treatment. Seaweed extracts have many benefits for plant growth in general and enhance growth characteristics, as they improve the seed germination process and emergence in the early stages of growth[6]. Most extracts of medicinal plants, including marine plants, include chemicals that can activate the proteinase enzyme, which works to break down proteins during the onset of germination[7].

Furthermore, soaking crop seeds, particularly wheat, in aqueous solutions containing seaweed extracts improve the physiological processes within the seed. This adds to the success of seed germination and field emergence by shortening seed germination time and producing vigorous seedlings[8-10]. Among the most critical materials used in the seed priming process are organic nutrients such as Humic[11,12]. The importance of priming seeds with humic acid in achieving the highest germination rate and speed of germination d may be due to their absorption of the nutrients present in the organic solution), which provides a rapid source of energy and materials needed in the vital construction of the developing embryo. This helps the embryo inside the seed to rush from the heterotrophic to the autotrophic stage. Patil 201013 found a significant relationship between the amount of humic used, germination percentage, coleoptile and radicle length. As a result, this study aimed to investigate the

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effect of seed priming of degraded wheat seeds using certain plant extracts on the vegetative characteristics of wheat germ.

Materials and methods

During 2019-2020, the experiment was carried out in the Seed Technology Laboratory of the Department of Field Crop Science, College of Agricultural Engineering Sciences - University of Baghdad, to study the effect of seed priming of wheat (IPA 99) produced in 2016 with three types of organic extracts (Acadian, Humic and Licorice Root Extract), as well as two control treatments (soaking with distilled water, and dry seeds). The experiment was carried out using a complete randomized design (CRD) with four replications.

To make licorice root extract, 200 gm of root powder was soaked in one liter of water for 24 hours, then the extract was filtered using filter paper, and the filtrate was diluted to prepare three concentrations of the extract, namely (2, 4 and 6%). Three concentrations of acadium (500, 1000 and 1500) mg L-1 were also prepared, and three concentrations of humic (5, 10 and 15) mg L-1. Wheat seeds were steeped in the extracts and concentrations described above for 12 hours before germinating in plates in four replications with 50 seeds per replicate using the germinator at 25°C and 85 percent humidity for ten days.

Characters studied

Standard laboratory germination (%): The number of normal seedlings was calculated on the tenth day of the examination, and the percentage of standard laboratory germination was calculated using the following equation[14]:

$$\text{Standard laboratory germination (\%)} = \frac{\text{Number of normal seedlings}}{\text{Total number of seeds}} \times 100$$

On the tenth day of the examination, ten normal seedlings were taken from each experimental unit, and the following characteristics were measured:

•Germination Speed: The following law was used to compute the rate of germination[15].

$$\text{Germination Speed} = \frac{\sum \text{(The number of seeds germinated in each count x the number of the day)}}{\text{Germination rate at the end of the examination period}}$$

Radicle and coleoptile length, radicle and coleoptile dry weight

The radicle and coleoptile were removed from their contact regions with the seed and dried in a dry-ing oven at 65 °C for 72 hours before being weighed using a four-decimal sensitive scale to compute the dry weight of each of the radicle and coleoptile.

Seedling vigor index

The Seedling vigor index was determined using the equation below[16].

The data for the examined qualities were statistically analyzed using a completely randomized design (CRD). The averages were compared using the least significant difference (LSD) test at a threshold of significance of 5% using the Genstat v12.1 software.

Results and discussion

Most of the seed quality characteristics show substantial changes among the treatments, according to the data (Table 1); in the laboratory standard germination rate, the licorice root extract soaking treatment was outperformed with a germination rate of 95%, while the Acadian soaking gave the lowest laboratory standard germination rate of 74.58%, which were not statistically different from the two control treatments (distilled water soaking and dry seeds). For germination speed rate and radicle length rate, the results showed no significant variations among treatments. The results showed that soaking with the extracts resulted in a considerable increase in the mean coleoptile length compared to the two control treatments (distilled water wash and dry seeds), which resulted in the lowest mean coleoptile length of 8.44 cm and 8.22 cm, respectively. While the Humic soaking treatment resulted in the most extended average coleoptile length (9.35 cm), it did not differ substantially from the licorice root extract and Acadian soaking treatments.

Compared to the other treatments, the soaking with Humic worked much better, with the root's most significant average dry weight (3.45 mg). While the two soaking treatments of licorice root extract and Acadian were not substantially different from the control treatments (soaking with distilled water and dry seeds). While the Acadian and Humic soaking treatments were considerably superior in terms of the coleoptile average dry weight (7.38 mg and 7.31 mg, respectively), they did not vary significantly. When compared to the two control treatments, the soaking treatment with licorice root extract did not substantially increase the average dry weight of the coleoptile. Regarding seedling vigour index, the soaking treatment with licorice root extract yielded the highest rate of 1207, followed by the wet treatment with Humic, which produced 1073. This might be because Acadian has the most significant standard laboratory germination rates. Still, the data show that soaking with Acadian had no signifi-cant changes compared to the two control treatments[17,18].

The results show considerable changes in the percentage of laboratory germination across treatments (Table 2). When compared to the two control treatments (soaking with distilled water and dry seeds) and the rest of the soaking treatments with Acadian and Humic, all soaking treatments with licorice root extract were significantly superior and gave the highest rates of laboratory germination (93.75 percent, 96.25 percent, and 95.00 percent) for concentrations of 2%, 4%, and 6%, respectively. While soaking with Acadian at a dosage of 1500 mg L^{-1} resulted in the lowest average of the usual laboratory germination rate of 56.25 percent. Soaking treatments in Acadian at 500 mg L^{-1} and 1000 mg L^{-1} concentrations did not differ appreciably from the soaking treatment with purified water.

The analysis of variance results showed significant differences in germination speed between treatments. It is noted that the speed of germination increases with the concentration of Acadian, with the concentration of 1500 mg L^{-1} giving the highest rate of germination speed at 7.46 seedlings day^{-1}. The soaking treatment with Humic at a dosage of 1500 mg L^{-1} produced the lowest germination rate of 6.72 seedlings day^{-1}, which did not differ substantially from the dry seeds treatment. The findings also show no significant variations in average radicle and coleoptile length across treatments. The data also show that soaking in licorice root extract at 2% and Acadian at 500 mg L^{-1} resulted in a substantial decrease in radicle dry weight, which was 1.93 mg and 1.97 mg, respectively, as compared to the two control treatments (soaking with distilled water and dry seeds).

Treatments	Seed quality characters						
	Germination %	Germination speed (seedling day-1)	Radicle Length Cm	Coleoptile Length cm	Radicle Dry wt Mg	Coleoptile Dry wt mg	Seedling vigor index
Licorice root extract	95.00	3.58	3.42	9.29	2.65	5.50	1207
Acadian	74.58	3.51	3.31	9.02	2.68	7.38	893
Humic	84.59	3.53	3.29	9.35	3.45	7.31	1073
Distilled water	80.00	3.54	3.18	8.44	2.25	5.50	932
Dry seeds	75.00	3.41	2.88	8.22	2.08	5.18	833
LSD $_{0.05}$	5.48	N.S	N.S	0.67	0.58	0.67	118

Table 1. Soaking wheat seed in licorice root extract, Acadian, and Humic affects various quality attributes.

While increasing the concentrations of such extracts resulted in a considerable rise in the radicle's dry weight rates. Soaking with Humic raised the dry weight of the radicle at a rate of 4.40 mg at a concentration of 1000 mg L^{-1}. Subsequently, it dropped at a concentration of 1500 mg L^{-1}, yielding an average dry weight of the radicle of 2.38 mg with no significant differences between the two control treatments (soaking with distilled water and dry seeds).

The results also show that the average dry weight of the coleoptile behaved similarly to the average dry weight of the radicle due to the effect of soaking the extracts and their different concentrations, as the soaking treatment with licorice root extract at a concentration of 2% gave the lowest average dry weight of the coleoptile (4.28 mg). In contrast, the soaking treatment with Acadian gave the highest rate of 8.33 mg.

The seedling vigour index improved dramatically as the concentrations of licorice root extract increased, with the concentration of 6 percent producing the highest mean seedling vigour index of 1264 (without any significant differences between the concentrations). Whereas soaking with Acadian produced the maximum rate of seed-ling vigour index at a concentration of 500 mg L^{-1}, it dropped with increasing extract concentration to produce the lowest rate of seedling vigour index at a concentration of 1500 mg L^{-1}. It is also reported that soaking with Humic at doses (500 and 1000) mg L^{-1} increased the mean seedling vigour index to 1101 and 1139, respectively, as compared to the two control treatments (there is no significant differences between the two concentrations). However, increasing the concentration of Humic to 1500 mg L^{-1} resulted in a drop in seedling vigour index, which reached 979. There were no significant differences between the different concentrations of licorice extract and the two Humic (500 and 1000) mg L^{-1} doses.

Conclusions

This study shows that soaking degraded wheat seeds in storage with licorice root extract, Acadian and Humic significantly improved the percentage of standard laboratory germination, speed of germination and seedling vigor. However, high Acadian concentrations (over 1000 mg L^{-1}) negatively influenced wheat seed germination. When humic concentrations approach 1000 mg L^{-1}, the rates of wheat seed quality features to increase and then decline with growing attention.

Treatments		Seed quality characters						
Extract	Conc.	Germination %	Germination speed seedling) (day-1	Radicle Length Cm	Coleoptile Length cm	Radicle Dry wt mg	Coleoptile Dry wt mg	Seedling vigor index
licorice root extract	%2	93.75	7.24	3.43	8.66	1.93	4.28	1130
	%4	96.25	7.16	3.11	9.65	2.48	5.15	1228
	%6	95.00	7.08	3.74	9.56	3.55	6.80	1264
Acadian	500	85.00	6.74	2.74	9.29	1.97	5.85	1001
	1000	85.50	6.88	3.23	8.32	2.95	7.95	951
	1500	56.25	7.46	3.49	9.44	3.13	8.33	727
Humic	500	86.25	7.18	2.98	9.72	3.58	7.63	1101
	1000	85.00	7.26	3.54	9.85	4.40	8.10	1139
	1500	82.50	6.72	3.36	8.46	2.38	6.20	979
Distilled water		80.00	7.08	3.10	8.44	2.25	5.50	932
Dry seeds		75.00	6.82	2.88	8.21	2.08	5.18	833
LSD $_{0.05}$		6.97	0.24	NS	NS	0.66	0.86	167

Table 2. Soaking wheat seed in various doses of licorice root extract, Acadian, and Humic affects several quality characteristics.

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