



Effect of Soaking Time with Cumin Extract on The Growth and Yield of Rehan Barley (*Hordeum vulgare* L.)

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Abstract

The research was conducted in the Department of Plant Production Techniques / Agricultural Technical College / Mosul to study the effect of the soaking period with cumin extract on the growth and yield of barley cultivar Rehan. The research included two factors, the first is the duration of soaking at two levels (6 and 12) hours, and the second factor is cumin extract as well as the comparison treatment (distilled water). The research was carried out using the method of factorial experiments and the randomized complete block design (RCBD). At the end of the research, the data were recorded and analyzed statistically according to the SAS program, and the averages were distinguished by an alphabetical letter according to Duncan's multi-range test at the level of probability (0.05%), and the results were as follows: The soaking period exceeds (12) hours significantly over a period of (6) hours in all studied traits. Also, the cumin extract was significantly superior to the comparison treatment in all studied traits. The interaction between the soaking period (12) hours and cumin extract achieved a significant superiority in all studied traits.

Keywords: soaking seeds, cumin extract, barley cultivar, Rehan

Introduction

Barley is one of the most important field crops that are used in the field of fodder, whether these fodders are green or coarse (seeds), and the process of soaking barley seeds in water before spreading them in the germination trays is one of the most important reasons for the production of high-quality green fodder (Al-Zubadia et al., 2014), and many researches, including what was mentioned by Al-Janabi and Al-Ani, (2017) indicate that the process of soaking barley seeds in water for a period of (24) hours achieved a significant increase in many Traits of the forage produced from the barley cultivar. Hayawi and Taha (2021) added that increasing the duration of soaking the barley seeds with water from (12-24) hours caused a significant increase in the growth Traits and yield of the forage produced from the barley cultivar. Cumin (*Cuminum cyminum* L.) is one of the limited-growing herbaceous plants belonging to the Apiaceae family, which is characterized by a somewhat bitter taste and a distinctive aromatic aroma. It is one of the oldest medicinal herbs that many studies and researchers in many countries of the world have focused on to show its vital effectiveness the addition of some medicinal herbs to animal diets contributed to improving the health and productivity of farm animals, in addition to being used as growth stimulants (Greathead, 2003). The addition of plant growth regulators to the diet of farm animals contributed to an increase in the ability to reproduce and an increase in the number of births, as well as the speed of growth, which in turn leads to the frequency of the number of births during one year (Ibrahim et al., 2009). Durranim and Fenugreek (2007) mentioned that the excessive use of antibiotics in animal diets is one of the most important causes of health damage to humans through their accumulation in their products. Accordingly, an effective way must be found to preserve the environment from pollution, which will reflect positively on the human being and his health through natural and healthy food produced through plants and fresh natural fodder. Numerous studies have proven the importance of adding these plants as natural antioxidants (Mossa and Jaber, 2008). In addition to this it contains effective substances such as alkaloids, glycosides, saponins, volatile oil, many other substances as alternatives to chemicals that cause many health prob-



lems resulting from their addition due to their toxicity (Farkas et al., 2003). *Hordeum vulgare* L. is one of the important field crops belonging to the Poaceae family that is grown in order to obtain seeds that are provided as concentrated feed for animals to obtain green fodder through irrigating animals (Hayawi et al., 2021), and the cultivated barley varieties are distinguished in the regions of the Mediterranean Basin. The medium is characterized by its ability to grow rapidly in the early stages of its life cycle, which causes it to completely cover the soil surface (Waqas, 2006). The research aims to identify the importance of soaking barley seeds before planting in cumin extract.

Materials and Methods

The research was carried out in the fields of the Department of Plant Production Technologies / Agricultural Technical College - Mosul during the agricultural season 2021-2022. The research included two factors, the first is the duration of soaking barley seeds in two days (6 and 12) hours, and the second is cumin extract, in addition to the comparison treatment. The research was applied according to the factorial experiments and by designing the complete randomized sectors with three replications, as the number of the experimental units reached (12) unit area, each of which is (2) square meters. On (4/12/2022), the seeds were sown on lines with a distance of (15) cm between one line and another, at a rate of (100) kg. ha⁻¹. The aqueous extract of cumin was prepared by grinding (50) grams of the seeds and mixing it with (100) ml of distilled water. It was left on the heater for (5) hours with continuous stirring at a temperature of (80) degrees Celsius. Then the extract was filtered and filtered with Watman 1 filter paper in a vacuum device. After that, the process of lyophilization and disposal of the water was carried out using a lyophilizer, and then it was placed in a dark bottle in the refrigerator until use (Deshmukh, 1975). After converting the extract into a powder, the cumin extract was prepared at a concentration of (50) % by dissolving (2) grams in (40) ml of water (Miladinovic and Miladinovic, 2000, Sultan et al., 2020a, and Sultan et al., 2020b). Barley seeds were soaked in the extract for (6 and 12) hours, then the seeds were air dried, in addition to soaking with distilled water (Control). At the end of the season, the following characteristics were recorded: plant height (cm), number of tillers bearing spikes, number of grains per spike, weight of 1000 grain (gm) and Grain Yield (gm.m⁻²). Was analyzed according to the SAS program, and the different averages were distinguished by different letters of the alphabet according to Duncan's multi-range test at a probability level of 0.05.

Results and Discussion

Plant height (cm):

The results of the statistical analysis in Table (1) indicate the significant superiority of the soaking period (12) hours over the period (6) hours in the traits of plant height, with an increase of (6.69) %. Increasing the conversion of soluble nutrients in seeds into easily absorbed substances, is reflected in the rate of seedling growth, which ultimately leads to an increase in plant height (Hayawi and Taha, 2021). The results of the statistical analysis in the same table show that the cumin extract was significantly superior to the comparison treatment in the plant height traits, as the mean height of the plants was (53.00 and 62.50) cm for the two treatments, respectively, with an increase of (15.2) %, and the reason for this may be attributed to the behavior of the active compounds. Present in the cumin extract, which acts as growth regulators, increases plant height, and this is confirmed by many researchers (Greathead, 2003). The results of the interaction between the two factors showed that the interaction between the soaking period (12) hours and the cumin extract was significantly superior to the rest of the interactions in the trait of plant height, as the height reached (65.00) cm, while the interference between the soaking period (6) hours and the comparison treatment had the lowest height (51.50) cm. We also note from the table that the cumin extract was significantly superior to the comparison treatment at the soaking times (6 and 12) hours, which indicates that the first effect in this capacity was for the extract, followed by the effect of the soaking period.

**Table (1) Effect of soaking period and cumin extract and the interaction between them on plant height (cm)**

Treatments	Soaking time (hour)		Mean of Cumin extract
	6	12	
Control	51.50 d	54.50 c	53.00 b
Cumin extract	60.00 b	65.00 a	62.50 a
Mean of Soaking time	55.75 b	59.75 a	

The values followed by the same letter are not significantly different from each other at the probability level of 0.05

The number of effective tillers. m^{-2} :

The data in Table (2) shows that the number of effective carriers per square meter increased significantly when the treatment of soaking for a period of (12) hours compared with the treatment of soaking for a period of (6) hours. The activity present in it behaves in its work as a growth regulator, which causes regular growth, which is reflected positively in the number of active tillers (Mossa and Jaber, 2008). And that the cumin extract was significantly superior to the comparison treatment in terms of the number of active tillers, with an increased rate of (4.02)%. As for the interaction between the two factors, the results indicate that the interaction between the soaking period (12) hours and the cumin extract caused the achievement of the highest number of effective tillers per square meter, and thus it was significantly superior to the rest of the interventions, as the number of effective tillers reached (284.33) effective tillers. m^{-2} , while the interaction between the soaking period (6) hours and the control treatment recorded the lowest number of effective tillers, which amounted to (262.33) effective tillers. m^{-2} .

Table (2) Effect of soaking period and cumin extract and the interaction between them on the number of effective tillers. m^{-2}

Treatments	Soaking time (hour)		Mean of Cumin extract
	6	12	
Control	262.33 c	269.66 b	265.99 b
Cumin extract	270.00 b	284.33 a	277.16 a
Mean of Soaking time	266.16 b	276.99 a	

The values followed by the same letter are not significantly different from each other at the probability level of 0.05

Number of grains in a spike:

The results of the statistical analysis in Table (3) show that the difference in the soaking period did not have any significant effect on the characteristic of the number of grains in the ear. While the cumin extract caused a significant increase in the number of grains in the spike, as the number of grains in the two treatments reached (34.49 and 39.99) grains per spike, and the reason for this may be attributed to the association of this characteristic with the number of effective tillers (Table 2). The results of the interaction between the two factors indicated that the cumin extract was significantly superior to the comparison treatment at the two soaking periods, and that the highest number of spikes was achieved when the interaction between the soaking period (12) hours and the cumin extract reached (41.33) grains per spike. While the interaction between the two periods of soaking and the comparison treatment recorded the lowest number of grains per spike, as it reached (34.66 and 34.33) grains per spike for the two periods, respectively.

Table (3) Effect of soaking period and cumin extract and the interaction between them on the number of grains per spike

The values followed by the same letter are not significantly different from each other at the probability level of 0.05

Treatments	Soaking time (hour)		Mean of Cumin extract
	6	12	
Control	34.66 c	34.33 c	34.49 b
Cumin extract	38.66 b	41.33 a	39.99 a
Mean of Soaking time	36.66 a	37.83 a	



Weight of 1000 grains (gm) :

The data in Table (4) show the significant superiority of the soaking period (12) hours over the period (6) hours in the weight of 1000 grains, as the weight reached (29.99 and 33.66) grams for the two treatments, respectively. And that the cumin extract was significantly superior to the control treatment in terms of the weight of 1000 grains, as the weight reached (30.16 and 32.99) gm. for the two treatments, respectively, and the reason for this may be due to the association of this characteristic with the number of effective harrows and the number of grains in the spike (Tables 2 and 3).. As for the interaction between the two factors, the results indicate that the cumin extract was significantly superior to the comparison treatment at the two soaking periods (6 and 12) hours, which means that the first effect was for the cumin extract and the second effect was for the soaking period. And that the interaction between the soaking period (12) hours and the cumin extract achieved the highest weight of 1000 grains, reaching (34.66) gm, and thus significantly superior to the rest of the interactions, while the interference between the soaking period (6) hours and the comparison treatment recorded the lowest weight of 1000 grains, reaching (28.66) gm.

Table (4) Effect of soaking period and cumin extract and the interaction between them on the weight of 1000 grains (gm)

Treatments	Soaking time (hour)		Mean of Cumin extract
	6	12	
Control	28.66 c	31.66 b	30.16 b
Cumin extract	31.33 b	34.66 a	32.99 a
Effect of Soaking time	29.99 b	33.16 a	

The values followed by the same letter are not significantly different from each other at the probability level of 0.05

Grain Yield (gm.m⁻²):

The results of the statistical analysis in Table (5) indicate that the increase in the grain yield when the seeds were soaked for a period of (12) hours did not reach the level of significance compared with the yield when the seeds were soaked for a period of (6) hours. And that the cumin extract was significantly superior to the comparison treatment in terms of grain yield, with an increase of (26.34) %, and the reason for this may be due to the association of this characteristic with the number of effective tillers. As for the interaction between the two factors, the data shows that the highest grain yield was achieved when the overlap between the soaking period (12) hours and the cumin extract reached (249.67) g. m⁻², while the overlap between the soaking period (6) hours and the comparison treatment caused the recording of the lowest yield, which amounted to (163.67) grams. m⁻², and the interaction between the soaking period (6) hours and the comparison treatment, as well as the interaction between the same period and cumin extract, did not show any significant effect on grain yield.

Table (5) Effect of soaking period and cumin extract and the interaction between them on grain yield (gm.m⁻²)

Treatments	Soaking time (hour)		Mean of Cumin extract
	6	12	
Control	163.67 b	170.00 b	166.83 b
Cumin extract	203.33 ab	249.67 a	226.50 a
Mean of Soaking time	183.50 a	209.83 a	

The values followed by the same letter are not significantly different from each other at the probability level of 0.05

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تأثير مدة النقع بمستخلص الكمون في نمو وحاصل الشعير ربحان (*Hordeum vulgare* L.)
فاطمة إبراهيم سلطان جاسم عبدالله حياوي محمد أحمد إبراهيم
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أجري البحث في حقول قسم تقنيات الإنتاج النباتي / الكلية التقنية الزراعية / الموصل لدراسة تأثير مدة النقع بمستخلص الكمون في نمو وحاصل صنف الشعير ربحان , تضمن البحث عاملين الأول مدة النقع وبمستويين (٦ و ١٢) ساعة , العامل الثاني مستخلص الكمون فضلاً عن معاملة المقارنة (ماء مقطر) , نفذ البحث بأسلوب التجارب العاملية وبتصميم القطاعات العشوائية الكاملة (RCBD) وفي نهاية البحث سُجلت البيانات وحللت إحصائياً على وفق برنامج الـ SAS , وميزت المتوسطات بحرف هجائية حسب اختبار دنكن المتعدد المدى عند مستوى احتمال (٠.٠٥) % , وكانت النتائج كما يلي : تفوق مدة النقع (١٢) ساعة معنوياً على المدة (٦) ساعة في صفة إرتفاع النبات , عدد الاضطاء الفعالة ووزن ١٠٠٠ حبة . تفوق مستخلص الكمون معنوياً على معاملة المقارنة في الصفات إرتفاع النبات , عدد الاضطاء الفعالة , عدد الحبوب في السنبله , وزن ١٠٠٠ حبة و حاصل الحبوب . حقق التداخل بين مدة النقع (١٢) ساعة ومستخلص الكمون تقوفاً معنوياً على بقية التداخلات في جميع الصفات المدروسة.