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Estimation of Some Genetic Parameter and Correlation at Several Genotypes of Bread Wheat (*Triticum Aestivum* L.) under the Effect of Levels of Spraying with Ascorbic Acid*

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Keywords
Bread Wheat, Triticum Aestivum L., Ascorbic Acid.

Abstract
This study was performed to estimation the genetic parameters and path analysis of the quantitative traits in bread wheat (Triticum aestivum L.) under the influence of spraying with ascorbic acid. The field experiment was carried out during the winter season (2019-2020) at the Agricultural Research and Experiments Station of the College of Agriculture at the University of Kirkuk. The split plot design was used, according to complete Randomized Complete Block Design (R.C.B.D) with three replications. Main plots included levels of foliar spray with ascorbic acid using three levels (0, 100 and 200) (mlg. L-1), while the sub-plots included (16) genotypes of bread wheat
The study results can be summarized as follows: The values of the variances and the phenotypic and genetic difference coefficients ranged between low and medium for all traits, so in the three spray levels (0, 100 and 200) mlg.L-1.The expected genetic improvement values were found as a percentage of the general average of the studied traits and under three levels of spraying with ascorbic acid (0, 100 and 200), as it is noticed that the values were high for all the studie studied traits and for all levels.The genetic and phenotypic correlation under three levels of spraying with ascorbic acid (0, 100 and 200) was positive and significant between grain yield and each of the biological yield in kg. ha -1, the number of total tillers (tiller.m-2), the number of spikes (m2) and the harvest index% at the spraying level (0 and 100) and the weight of 1000 grains at the level (0 and 200), while the ecological correlation was positive and significant between the grain yield and each of the physiological maturity at the level (0), plant height at the level (100) and the number of grains at level(200).

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1. Introduction

Wheat is the world's first cereal crop in terms of global consumption. It is the main food for most of the world's people. It is a source of carbohydrates because it contains a high percentage of starch. Ascorbic acid is one of the plant growth

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regulators that plays an important role in facing many obstacles, and ascorbic acid is a vitamin C (L-Ascorbic acid), a small molecule soluble in water and one of the antioxidants found in plants and works to determine the types of active oxygen As a reducing factor (Al-Wahaibi, 2009). High-end plants need it in small quantities to maintain their natural growth because it is an organic compound (Amin et al., 2008), and it is also related to the timing of flowering, as well as an increase in the yield as a result of its effectiveness as an antioxidant in stimulating protein formation and delaying aging (Barth et al., 2006) When preparing breeding programs to improve different traits, it is important to estimate genetic parameters, especially those associated with genetic, phenotypic, and environmental variations. As genetic variance is the effective tool affecting the efficiency of selection, addition, it is important to estimate the genetic, environmental, and phenotypic correlation coefficients, the genetic and phenotypic variation coefficients, the expected genetic improvement, and the degree of heritability. Variations are the basic breeder material on the basis of which the selection method is used to improve the declared characteristics, especially the grain yield, as well as the improvement of quantitative traits in terms of quality and productivity. The increase in yield is achieved as a result of a number of interrelated component. The genetic and phenotypic correlation must also be estimated to understand the relationship between plant traits and between the grain yield and its components and among other traits because the increase in one of these traits may be accompanied by an increase or decrease in other traits. and others, 2012).The aim of the study is to estimate the components of genetic and phenotypic variance, coefficients of variation, the degree of heritability in the wide range and the expected genetic improvement of the genotypes of bread wheat under different spray levels with ascorbic acid.

2. Materials and Methods

The field experiment was conducted at the Agricultural Research and Experiment Station in Al-Sayada area of the College of Agriculture/University of Kirkuk during the winter agricultural season (2019-2020).Random samples were taken from different areas of the field to study the physical and chemical properties. Soil and irrigation water samples were analyzed in the laboratories of the Kirkuk Agriculture Directorate, and their results are shown in Table (1).The experiment was applied according to the split-plot system within the Randomized Complete Block Design (RCBD) and with three replications, the cultivation was conducted on 7/11/2019. It included two factors, the first factor represented by foliar spraying on plants in the branching stage with ascorbic acid at three levels (0, 100 and 200) mg. L^{-1} and is symbolized by (A),The second factor included (16) genotype of bread wheat. Where the field was divided into three main plots for each replicate, and in the main plots the concentrations of ascorbic acid were placed, and the secondary plots included the genotypes, Each replicate contained (48) experimental units, to which the resulting treatments were distributed randomly among the study factors. Each experimental unit contained 4 lines with a length of 3 m. The distance between another line is 0.25 m, and using 120 kg.ha^{-1} seed quantity, the experiment field was fertilized with 320 kg.ha^{-1} DAP fertilizer, then 200 kg urea was added as a second batch in the branching stage.Random plants were taken to study the following traits, represented by the period from planting until the heading of the spikes (day), the period from planting to physiological maturity (day), plant height (cm), the number of tillers (tillers.m^{-2}) and the area of the flag leaf (cm^2).The number of spikes (m^2) and the number of grains. Spike^{-1}, weight of 1000 seeds (g), spike length (cm), grain yield (kg.ha^{-1}), biological yield (kg.ha^{-1}) and harvest index (%).Data were collected and analyzed statistically and genetically according to the split-plot system within the randomized complete block design (R.C.B.D) as well as with the help of Excel programs (Genes and SAS)

Genetic)$\sigma_G{}^2$), environmental)$\sigma_E{}^2$ (and phenotypic)$\sigma_P{}^2$ () variances were estimated by adopting the mean of the squares for the genotypes according to the method (Walter, 1975) according to the following:

$$\sigma_v{}^2 = \sigma_G{}^2 = \frac{Msg - Mse}{r}$$

$$\sigma_E{}^2 = Mse$$

$$\sigma_P{}^2 = \sigma_G{}^2 + \sigma_E{}^2$$

Then the values of the genetic coefficients of variation (G.C.V) and phenotypic (P.C.V) were calculated according to the method explained by Falconer (1981), and based on the ranges used by Agarwal and Ahmed (1982) less than 10% low, 10-30% medium and more than 30% high

Also, the broad-sense heritability was estimated according to the method of Hanson et al. (1956) and estimated genetic improvement (G.A) from the following equation:

The ranges explained by Muhammad (2000) were adopted, as the values of inheritance in the broad sense of less than 40% are considered low, 40-60% are

$$G.A = K \times H^2{}_{B.S} \times \sigma_P$$

$$G.C.V\,\% = \frac{\sigma_G}{X} \times 100$$

medium, and 60% or more are high. Where G.A = expected genetic improvement.

H2B.S = inheritance in the broad sense and σp = the phenotypic standard deviation of the trait and K = constant and equal to (1.76) at the intensity of selection (10%) of the genotypes and the amount of the expected genetic improvement as a percentage (G.A%) of the trait average, according to the method (Kempthorme, 1969). According to the following equation

$$G.A\% = \frac{G.A}{X} \times 100$$

The ranges suggested by Robinson (1966) and Agarwal and Ahmed (1982) were adopted for the expected genetic improvement limits, which are less than (10%) and low, between (10-30)% medium and more than (30%) high. One of the characteristics of the study The genetic (rG), environmental (rE) and phenotypic (rP) correlation coefficients between the studied traits of the genotypes were estimated as follows in the manner explained by (Al-Rawi, 1987:(

Gxσ is the standard deviation of the factor X and Gyσ is the standard deviation of the factor Y

$$rG = \frac{\sigma_{Gx.Gy}}{\sqrt{\sigma_{Gx.}{}^2 \sigma_{Gy}{}^2}}$$

$$rE = \frac{\sigma_{Ex.Ey}}{\sqrt{\sigma_{Ex.}{}^2 \sigma_{Ey.}{}^2}}$$

$$rP = \frac{\sigma_{Px.Py}}{\sqrt{\sigma_{Px}{}^2 . \sigma_{Py}{}^2}}$$

3. Results and Discussion

3.1. Variations and coefficients of genetic, environmental and phenotypic differences

This scale is used in calculating the Scattering and dispersion of the traits that vary in the units of control and measurement between them to identify the dispersion or the higher homogeneity of the samples or the traits.As their values varied according to the different spray levels and within the same genotype, the ranges suggested by Robinson (1966), Agarwal and Ahmad (1982) were adopted for the expected genetic improvement limits which are less than (10%) and low and between (10-30)% medium and more than (30) %) is high, so the values of the coefficients of variation ranged between low and medium for all traits.The values of the genetic and phenotypic differences were low in the three levels of ascorbic acid spray (0, 100 and 200) mg.L^{-1} for the time to heading spikes (day), duration to physiological maturity (day), plant height (cm) and weight of 1000 grains (gm). and the harvest index (%), as well as the traits of the number of spikes (m2) at the level (100) of spraying with ascorbic acid and the characteristic of the area of the flag leaf (cm) at the level (0), while in the number of total tillers (tillers.m^{-2}) and the biological yield (kg.ha^{-1}) were at the (100) and (200) levels for the genetic and phenotypic variation coefficients, While the values of the genetic and phenotypic differences were average for the three levels of ascorbic acid spraying (0, 100 and 200) mg.L^{-1} for spike length (cm) and number of grains. spike^{-1} and grain yield, as well as the trait of the number of total tillers(tillers.m-2) at level (0) and the number of spikes at levels (0 and 200).The area of the flag leaf (cm^2) at the levels (100 and 200) and the biological result at the level (0), and in general, the results for the values of genetic and phenotypic variation coefficients showed variations with different levels of ascorbic acid spraying, and this is due to the heterogeneity of the values of both genetic and phenotypic variance, which gives evidence on the importance of studying the interactions (genetics x environment),The high values of genetic variance give the plant breeder an opportunity to improve the traits and select the spike length (cm) and the number of grains. Spike^{-1} and grain yield (kg.ha^{-1}). This is consistent with what was found by many researchers, including Mohammed and others (2012), Hassan and Bektas (2014), Al-Daoudi and Al-Obaidi (2014) and other researchers.

3.2. The broad sense Inheritance

Heritability is expressed as the percentage of genetic variance to phenotypic variance and it is important in selection programs to improve quantitative traits, in addition to the fact that the estimation of in the broad sense heritability shows the extent to which all kinds of genetic and environmental influences contribute to the appearance of that trait, and depending on the ranges mentioned by Muhammad (2000) Less than (40%) is low, (40-60%) is medium, and more than (60%) is high. Table (3) shows that the heritability in the broad sense was high for the traits under study and under three levels of ascorbic (0, 100 and 200) mg.L^{-1}, as it is noted that the degree of heritability was high for the trait of duration to the heading of spikes amounted to (.9710 and 0. 992 and 0.992) and the duration to physiological maturity was (0.991, 70.99 and 0.983).The height of the plant amounted to (0.944, 0.961 and 0.924), the number of total stems amounted to (0.963, 0.991 and 0.991), the area of the flag leaf reached (0.894, 0.906 and 0.942), and the number of spikes reached (0.989, 0.979 and 0.993). The length of the spike amounted to (0.894, 0.906 and 0.942) and the number of grains. Spike^{-1} amounted to 0.983), 0.984 and 0.988), and the weight of 1000 grains amounted to (0.996, 0.997 and 0.992), and the grain yield amounted to 0.999), 0.999 and 0. 998), the biological yield reached (0.999, 0.999, and 0.999), and the harvest index reached (0.991, 0.998, and 0.992), respectively.The reason for the high values of the broad sense heritability the above-mentioned traits is due to the high values of genetic variance compared to environmental variance as shown in Table (2). et al (2017) and al-Bayati and al-Obaidi (2019).

3.3. Expected Genetic Improvement as a Percentage

The expected genetic improvement in the selection program depends on genetic variation in the main degree and on the method of selection by adopting those traits associated with the crop, as well as obtaining the inheritance of quantitative and qualitative traits of economic importance to the crop by achieving the expected genetic improvement in a short time and to determine the behaviors of the genes responsible for inheritance (Al-Assaf et al., 2012). According to the ranges suggested by (Agarwal and Ahmed, 1982) for the expected genetic improvement limits are if the values are less than (10)% low, between (10-30)% medium and more than (30%) high.Table (3) shows the expected genetic improvement values as a percentage of the general average of the studied traits and under three levels of ascorbic spray (0, 100 and 200) mg. L^{-1}, the values of the expected genetic improvement as a percentage were average at spray levels (0, 100 and 200) in the way of plant height amounted to (10.27, 14.06 and 10.68) % and the total number of vegtative amounted to (19.08, 15.80 and 17.25)) % The area of the flag leaf amounted to (15.56, 17.78 and 22.72) %, the number of spikes amounted to (20.73, 14.49 and 17.80) %, the length of the spike amounted to (22.78, 26.52 and 25.74) %, and the number of grains. Sunbulah-1 amounted to (23.33, 21.58, and 19.79)%, and the weight of 1000 grains amounted to (016.0, 14.08, 12.56) %, and the grain yield amounted to (21.84, 21.12, and 22.64)%, and the biological yield reached (17.72, 17.40, and 17). 04)% respectively and the harvest index at the levels (100 and 200) amounted to (12.04 and 10.00) % While the expected genetic improvement values as a low percentage at spray levels (0, 100 and 200) mg.l-1 in the description of the duration to the heading of the spikes were (8.50, 8.52 and 9.07) and the duration to physiological maturity (day) amounted to (6.28). and 7.04 and 3.86) and the harvest index at the level of (0) reached (9.67), respectively.We conclude from this that the values of response to selection (expected genetic improvement as a percentage) were low to medium in most of the studied traits, including the trait of the yield and its components, and this indicates the importance of selection for improving traits.The genetic improvement results from the occurrence of an increase in one or more of the main yield components because it results from the product of these components that make up it, as it is possible through selection that the improvement of traits will be significant (Biktas et al., 2000) and these results are consistent with what was found by many Researchers include Al-Moussawi (2005), Al-Saadi and Al-Jubouri (2016), Kumar et al. (2018), Al-Bayati and Al-Obaidi (2019) and Medb et al. (2019).

Table 1. Estimation of the variance components of the studied traits under the influence of spraying with ascorbic acid

genetic parameters					Ascorbic acid levels ($mg.L^{-1}$)	Studied traits
Phenotypic variance coefficient (%)	Genetic Variation Coefficient (%)	environmental variances	phenotypic variances	genetic variance		
4.97	4.90	0.92	31.86	30.94	0	Duration to heading the spikes (day)
4.87	4.85	0.24	30.17	29.930	100	
5.19	4.86	0.24	30.06	29.82	200	
3.60	3.58	0.35	39.48	39.12	0	Duration to physiological maturity (day)
4.01	4.01	0.15	50.37	50.22	100	
2.23	2.21	0.27	16.36	16.09	200	
6.18	6.16	1.60	28.60	27.00	0	plant height (cm)
8.31	8.28	2.09	53.71	51.62	100	
6.56	6.51	2.44	32.16	29.72	200	
11.25	11.04	79.64	2152.39	2072.76	0	Total number of tillers(m-2 pt.)
9.05	9.01	13.93	1547.83	1533.9	100	
9.89	9.84	17.02	1890.73	1873.72	200	
9.89	9.36	0.63	5.91	5.28	0	flag leaf area (cm2)
11.15	10.62	0.71	7.58	6.87	100	
13.71	13.28	0.61	10.49	9.88	200	
11.91	11.85	17.11	1555.09	1537.98	0	number of spikes (m2)
8.41	8.32	17.29	823.15	805.86	100	
10.19	10.15	8.37	1195.49	1187.12	200	
14.48	13.66	0.21	2.00	1.79	0	spike length (cm)
16.63	15.81	0.25	2.63	2.38	100	
15.53	15.11	0.13	2.26	2.13	200	
13.48	13.38	0.50	29.52	29.02	0	number of grains. spike-1
12.46	12.36	0.38	23.88	23.50	100	
11.37	11.30	0.23	19.49	19.26	200	
9.13	9.10	0.05	11.33	11.28	0	1000grain weight (gm(
8.03	8.03	0.03	8.95	8.92	100	
7.19	7.17	0.06	7.24	7.18	200	
12.42	12.41	364.37	364368.4	364004.0	0	Grain yield ($kg.ha^{-1}$)
12.01	12.01	353.32	353320.9	352967.5	100	
12.89	12.88	797.79	398895.7	398097.9	200	
10.08	10.07	1246.25	1246245	1244998.3	0	Biological yield ($kg.ha^{-1}$)
9.89	9.89	1259.64	1259635	1258375.7	100	
9.69	9.69	1196.27	1196274	1195078.1	200	
5.54	5.50	0.05	5.88	5.83	0	harvest index (%)
6.85	6.85	0.02	8.95	8.93	100	
5.72	5.70	0.05	6.16	6.11	200	

Table 2. Estimation of some genetic parameters of the studied traits under the influence of spraying with ascorbic acid

Expected genetic improvement %	Expected genetic improvement	broad sense heritability	Ascorbic acid levels (mg.L^{-1})	Studied traits
8.50	9.63	0.971	0	Duration to heading the spikes (day)
8.52	9.58	0.992	100	
9.07	10.20	0.992	200	
6.28	10.95	0.991	0	Duration to physiological maturity (day)
7.04	12.45	0.997	100	
3.86	7.01	0.983	200	
10.27	8.67	0.944	0	plant height (cm)
14.06	12.17	0.961	100	
10.68	8.94	0.924	200	
19.08	78.62	0.963	0	Total number of tillers(m-2 pt.)
15.80	68.61	0.991	100	
17.25	75.83	0.991	200	
15.56	3.82	0.894	0	flag leaf area (cm2)
17.78	4.39	0.906	100	
22.72	5.37	0.942	200	
20.73	68.63	0.989	0	number of spikes (m2)
14.49	49.43	0.979	100	
17.80	60.43	0.993	200	
22.78	2.23	0.894	0	spike length (cm)
26.52	2.58	0.906	100	
25.74	2.49	0.942	200	
23.33	9.39	0.983	0	number of grains. spike-1
21.58	8.47	0.984	100	
19.79	7.69	0.988	200	
16.00	5.91	0.996	0	1000grain weight (gm(
14.08	5.25	0.997	100	
12.56	4.70	0.992	200	
21.84	1061.32	0.999	0	Grain yield (kg.ha-1)
21.12	1044.59	0.999	100	
22.64	1108.81	0.998	200	
17.72	1962.81	0.999	0	Biological yield (kg.ha-1)
17.40	1973.32	0.999	100	
17.04	1923.06	0.999	200	
9.67	4.24	0.991	0	harvest index(%)
12.04	5.25	0.998	100	
10.00	4.33	0.992	200	

4. Genotypic Correlation

Table shows the genetic correlation coefficients between the studied traits and for three levels of spraying with ascorbic acid are (0, 100 and 200) mgL^{-1}, the harvest index was positively and significantly associated with the number of total tillers

(tillers .m^{-2}) at the level of Probability of 5% for the level (200) and with the number of spikes with positive and significant correlation at the 5% probability level for the level (0) and positive and high at the 5% probability level for the level (200) and with the grain yield with positive and significant correlation at the 5% probability level for the levels (0 and 100) Positive and highly significant at the 1% probability level for level (200),This means that the harvest index increases with the significant increase in the number of total tillers for the spraying level (200) and with the significant increase in the number of spikes for the non-spraying level and highly significant for the spraying level (200) and with the significant increase in grain yield for the non-spray level and the spraying level (100) and highly significant for the level of spraying (100). spraying (200), and the result agrees with Al-tabbal and Al-fraihat (2012) and Hassan and Bektas (2014) who found that harvest evidence was genetically and positively associated with grain yield.The biological yield (kg.ha^{-1}) was positively and significantly associated with the number of total tillers (tillers .m^{-2}) at the probability level of 5% for the spray level (0 and 100), and positive and highly significant at the 1% probability level for the level (200) and with weight 1000 grains with positive and significant correlation at 5% probability level for levels (0 and 200) and with number of spikes and grain yield with positive and highly significant correlation at 1% probability level for all levels.The biological yield increases with the significant increase in the number of total spores for the spraying level (0 and 100) and highly significant for the spraying level (200) and with the increase in the weight of 1000 grains significantly for the spraying level (0 and 200) and with the increase in the number of spikes (m^2)The grain yield is highly significant for all levels of spraying, that is, selection for these traits leads to an increase in the biological yield, and this result agrees with Al-tabbal and Al-fraihat (2012) and Hassan and Bektas (2014) who found a positive and high correlation between the trait of grain yield and biological yield.The grain yield (kg.ha^{-1}) was positively and highly significant with the number of total tillers (p.m-2) at the 1% probability level and for all spray levels and with the weight of 1000 grains with a positive and significant correlation at the 5% probability level and at the two levels (0 and 200).and with the number of spikes with a positive and highly significant correlation at the probability level of 1% and for all spray levels, this means that the grain yield increases in a highly significant with the increase in the number of total grains and the number of spikes.m2 for all spray levels and with an increase in the weight of 1000 grains significantly for the spray level (0 and 200),where the genotypic correlation is positive and high, the genetic improvement of one trait leads to an improvement of the other trait. The genotypic correlation is considered one of the most important associations because it is linked to the genes that control the quantitative trait compared to the rest of the associations. This result agrees with Jassem and Mahmoud (2015), who found a positive genetic correlation between grain yield, 1000 grain weight and the number of spikes. The traits of the number of spikes (m2) was correlated with a positive and significant correlation with plant height at the probability level of 5% and the level of spraying (200) and with the number of total tillers with a positive and highly significant correlation at the probability level of 1% and for all levels of spray and with the length of the spike with a positive correlation at the probability level of 5% for the level (100) and with the number of grains in the spike with negative and significant correlation at 5% probability for levels (0 and 200) and with the weight of 1000 grains with positive and significant correlation at 5% probability for level (0) and positive and highly significant at 1% probability for levels (100 and 200) , This indicates that the number of spikes (m^2) leads to a significant increase in plant height to the level of spraying (200) and that the number of spikes (m^2) increases with the increase in the number of total spikes and highly significant for all levels of spraying, and the length of the spike increases with the increase in the number of spikes (m^2) significantly to the level of Spraying (100) and the weight of 1000 grains increases with the increase in the number of spikes (m^2), significantly for the non-spraying level and highly significant for the spraying level (100, 200).While the increase in the number of spikes (m2) leads to a decrease in the number of grains in the spike and significantly to the level of non-spray (0) and the level of spraying (200), the positive genetic correlation of these traits is reflected positively on the characteristic of the number of spikes (m^2) and this result agrees with Al-Dawudi (2013), Al-Jubouri and others (2014) and Jassim and Mahmoud (2015), who all indicated a positive and highly significant genetic correlation between the trait of the number of spikes and the weight of 1000 grains.The grain yield ($kg.ha^{-1}$) was positively and highly significant with the number of total tillers (tillers $.m^{-2}$) at the 1% probability level and for all spray levels and with the weight of 1000 grains with a positive and significant correlation at the 5% probability level and at the two levels (0 and 200).and with the number of spikes with a positive and highly significant correlation at the probability level of 1% and for all spray levels, this means that the grain yield increases in a highly significant with the increase in the number of total grains and the number of spikes.m2 for all spray levels and with an increase in the weight of 1000 grains significantly for the spray level (0 and 200),there the genotypic correlation is positive and high, the genetic improvement of one trait leads to an improvement of the other trait. The genotypic correlation is considered one of the most important associations because it is linked to the genes that control the quantitative trait compared to the rest of the associations. This result agrees with Jassem and Mahmoud (2015), who found a positive genetic correlation between grain yield, 1000 grain weight and the number of spikes. The traits of the number of spikes (m^2) was correlated with a positive and significant correlation with plant height at the probability level of 5% and the level of spraying (200) and with the number of total tillers with a positive and highly significant correlation at the probability level of 1% and for all levels of spray and with the length of the spike with a positive correlation at the probability level of 5% for the level (100) and with the number of grains in the spike with negative and significant correlation at 5% probability for levels (0 and 200) and with the weight of 1000 grains with positive and significant correlation at 5% probability for level (0) and positive and highly significant at 1% probability for levels (100 and 200) ,This indicates that the number of spikes (m^2) leads to a significant increase in plant height to the level of spraying (200) and that the number of spikes (m^2) increases with the increase in the number of total spikes and is highly significant for all levels of spraying, and the length of the spike increases with the increase in the number of spikes (m^2) significantly to the level of Spraying (100) and the weight of 1000 grains increases with the increase in the number of spikes (m^2), significantly for the non-spraying level and highly significant for the spraying level (100, 200).While the increase in the number of spikes (m^2) leads to a decrease in the number of grains in the spike and significantly to the level of non-spray (0) and the level of spraying (200), the positive genetic correlation of these traits is reflected positively on the traits of the number of spikes (m^2) and this result agrees with Al-Dawudi (2013), Al-Jubouri and others (2014) and Jassim and Mahmoud (2015), who all indicated a positive and highly significant genetic correlation between the trait of the number of spikes and the weight of 1000 grains. The weight of 1000 grains was associated with the total number of tillers (tillers.m^{-2}) with a positive and highly significant correlation at the 1% probability level for levels (0 and 200) and positive and significant at the 5% probability level for the (100) and with the flag leaf area with a positive correlation at the probability level. 5% for level (0) and with spike length with positive and highly significant correlation at 1% probability level for level (0) and with number of grains in spike with negative and highly significant correlation at 1% probability level for all spray levels.This means that the weight of 1000 grains increases with the significant increase in the number of tillers for the spraying level (100) and highly significant for the spraying level (0, 200) and with the area of the flag leaf significantly for the non-spraying level and with the increase in the length of the spike in a highly significant manner for the non-spraying level as well, in When the weight of 1000 grains decreases with the increase in the number of grains in the spike, it is highly significant for all spray levels. This average that the selection for the trait of the weight of 1000 grains leads to an increase in the yield and this result agrees with Al-Jubouri and others (2014), who found a positive and high genetic correlation between the characteristic of the length of the spike, the number of total tillers , and the weight of 1000 grains.Associated with the adjective number of grains. Spike^{-1} with a highly significant negative correlation with the number of total tillers (tillers. m^{-2}) at a 1% probability level for level (0) and with the area of the flag leaf with a negative correlation at a 5% probability level for level (0), this means that the number of grains in the spike It decreases with the increase in the number of total shrapnel and in a highly significant manner for the non-spray level and with the increase in the area of the flag leaf and significantly for the non-spray level as well. This result agrees with the results of Al-Jubouri et al. (2014) who indicated that there is a negative and significant genetic correlation between the number of grains in the spike and the number of total tillers.While the trait of spike length was correlated with the heading of spikes with a negative and significant correlation at the 5% probability level and at the level (200) and with the plant height with a positive and significant correlation at the 5% probability level for the level (0) and with the number of total tillers (tillers. m^{-2}) with a positive correlation at the level of The probability of 5% for the level (0) and with the area of the flag paper with a positive and highly significant correlation at the 1% probability level for the levels (0 and 100) and positive and significant at the 5% probability level for the level (200),This means that the length of the spike decreases significantly with the increase in the duration of the spike to the level of spraying (200), while the increase in the length of the spike leads to an increase in the height of the plant and significantly to the level of non-spraying, and the length of the spike increases with the increase in the number of total spikes significantly for the non-spray level as well and with an increase The area of the flag leaf is highly significant for the spray level (0 and 100) and significantly for the spray level (200)The genetic improvement of this trait is positively reflected in the increase in yield and this result agrees with Hassan and Bektaş (2014), who found a positive and highly significant genetic correlation between the trait of spike length and the area of the flag leaf.The number of total tillers (tillers. m^{-2}) was correlated with the duration to the heading of the spikes with a negative and significant correlation at the 5% probability level for level (0) and with the plant height with a positive and significant correlation at the 5% probability level for the levels (100 and 200), which means that the number of The total heading increase with the short period of time to the expulsion of the spikes and significantly to the level of non-spraying, and that the increase in the number of total heading leads to an increase in the height of the plant and significantly to the level of non-spraying (100, 200),The positive value of the correlation in one trait leads to an increase in another trait and vice versa. This result agrees with Al-tabbal and Al-fraihat (2012), who found a positive correlation between the trait of the total number of tillers and the height of the plant.The plant height (cm) was negatively and significantly correlated with the duration to the heading of the spikes at the 5% probability level for the level (100), the Genotypic Correlation for a negative trait leads to a decrease in another trait, meaning that the plant height increases with the short time to expelling spikes and significantly to the level of spraying (100), and this result agrees with Hassan and Bektaş (2014) who found a negative genetic correlation between plant height and spike heading.

5. Environmental Correlations

Table shows the environmental correlation coefficients between the studied traits and for three levels of spraying with ascorbic acid are (0, 100 and 200) mgL^{-1}, as the trait of the harvest index was positively and significantly correlated with physiological maturity at the 5% probability level for the non-spray level. (0) and with the number of total straws (brush. 5% chance of level (100) and with the biological yield with a negative and highly significant correlation at the 5% probability level for the levels (0 and 200) and negative and significant and at the 1% probability level for the (100) level, the increase in a certain characteristic leads to an increase in the other trait in the positive moral environmental correlation and to a decrease in the other trait in Negative emotional correlation,The harvest index increases with the increase in the period to physiological maturity and significantly for the level of non-spraying and with the increase in the number of tillers and this result agrees with Mollasadeghi et al. (2011), who found a positive and significant environmental correlation between harvest index trait and grain yield.

While the traits of biological yield were associated with a positive and low significant correlation with the duration of the heading of the spikes at a probability level of 5% for the spray level (100) and with the total number of tillers (tillers.m^{-2}) with a negative and highly significant correlation at the probability level of 1% for the level of spraying (100),This average that the biological yield increases with the increase in the period to the heading of the spikes, and significantly to the level of spraying (100), but it decreases with the increase in the number of total tillers and in a highly significant excelled for the level of spraying (100) also, that the negative correlation of a particular trait leads to a decrease in the other trait.This result is consistent with the result obtained by Pandey and Singh (2010), who found a negative and significant correlation between the time to heading the spikes and the biological yield.The trait of grain yield was positively significant with duration to physiological maturity at 5% probability level for non-spray level (0) and with plant height with significant negative correlation at 5% probability level (100) and with the number of grains. spike-1 with positive and significant correlation at 5% probability level (200),This indicates that the grain yield increases with the increase in the period to physiological maturity and significantly to the level of non-spray and with the increase in the number of grains in the spike and significantly to the level of spraying (200),Whereas, the grain yield decreases significantly with the increase in the height of the plant to the level of spraying (200), and this result agrees with Al-Tabbal and Al-fraihat (2012), where a positive correlation was found between the trait of the grain yield and the number of grains in the spike.While the traits of the number of spikes (m^2) was associated with a negative and significant correlation with the height of the plant at the probability level of 1% and for the level (100) and with the number of total tillers with a positive and significant correlation at the probability level of 1% for the level (200) and with the number of grains in the spike with a negative and highly significant correlation at the probability level 1% and for all spray levels and with a weight of 1000 grains with a negative and significant correlation at the 5% probability level for the non-spray level (0),This means that the number of spikes (m^2) increases with the increase in the number of total tillers and in a significant manner to the level of spraying (200), while the increase in the number of spikes (m2) leads to a decrease in the height of the plant and in a highly significant manner to the level of spraying (100) and to a significant reduction in the number of grains in the spike and Significantly for all levels of spraying and to reduce the weight of 1000 grain.Significantly for the level of non-spraying, this result agrees with Al-Mousawi (2005), who found a negative and significant correlation between the traits of the number of spikes and the weight of 1000 grains.The trait of weight of 1000 grains was correlated with a negative and significant relationship with the number of grains in the spike at the 5% probability level for the level (200), the negative correlation of a particular trait leads to a decrease in the other trait, that is, the weight of 1000 grains decreases with the increase in the number of grains in the spike, and significantly to the level of spraying (200). This result agrees with Al-Zuhairi (2009), who found a negative and significant correlation between the trait of the weight of 1000 grains and the number of grains in the spike.

6. Phenotypic correlations

Table shows the phenotypic correlation coefficients between the studied traits for three levels of spraying with ascorbic acid are (0, 100 and 200) mg.L-1,The harvest index was correlated with the number of total tillers with a positive and significant correlation at the probability level of 5% for the level of spraying (200) and with the number of spikes with a positive and significant correlation at the probability level of 5% for the level (0) and positive and highly significant at the level of probability of 1% for the level of spray (200) and with Grain yield with positive and significant correlation at the 5% probability level for the levels (0 and 100) and positive and highly significant at the 1% probability level for the level (200),From this it becomes clear that the harvest index increases with the increase in the number of total straws for the spray level (200) and the number of spikes (m2) for the spray level (0 and 200) and the grain yield for all spray levels, and this is consistent with what was reached by Al-Daoudi (2013), who noticed a positive genetic and phenotypic correlation And high at the probability level of 5% and 1% for the characteristic of harvest index with number of spikes.m2 and grain yield.While the biological yield was associated with the number of total ribs (chole.m-2) with a positive and significant correlation at the 5% probability level for the levels (0 and 100) and positive and highly significant at the 1% probability level for the level (200) and with the weight of 1000 grains with a positive and significant correlation at the level (200). Probability of 5% for levels (0 and 200) and it was associated with the number of spikes and grain yield with a positive and highly significant correlation at the 1% probability level and for all levels.The biological yield increases with the increase in the number of total tillers , the number of spikes (m2) for all spray levels, the weight of 1000 grains for spray levels (0 and 200), and the grain yield for all spray levels. Selection for any of them contributes to an increase in the biological yield and thus leads to an increase in grain yield per unit area.This is in agreement with Al-tabbal and Al-fraihat (2012), who found that the phenotypic correlation was positive and significant at the 1% probability level between biological yield and 1000-grain weight.The grain yield (kg.ha-1) with the total number of tillers(tillers.m-2) was associated with a positive and highly significant correlation at the 1% probability level for all levels, and with the weight of 1000 grains with a positive and significant correlation at the 5% level for the two levels (0 and 200) It was associated with the number of spikes with a significant, positive and high correlation at the 1% level and for all spray levels.This average that the increase in the number of total grains and the two components of the yield (number of spikes (m2) and weight of 1000 grains) as a result of the positive and highly significant relationship with the grain yield of the level (100 and 200) leads to an increase in the grain yield per unit area, and this result is consistent with Al-Daoudi (2013), Al-Daoudi and Al-Obaidi (2014), Jassim and Mahmoud (2015), who found a positive and high phenotypic correlation between grain yield, 1000 grain weight and the number of spikes. While the trait of the number of spikes m-2 with the number of total tillers (tillers.m-2) was positively and highly significant at the 1% probability level and for all spray levels, and it was associated with spike length with a positive and significant correlation at the 5% probability level for the spray level (100) and with the number of spikes. The grains. spike-1 with negative and significant correlation at the 5% probability level for the levels (0 and 200) and with the weight of 1000 grains with positive and significant correlation at the 5% probability level for the level (0) and positive and highly significant at the level of 1% and for the two levels (100 and 200), and this indicates that The number of spikes (m2) increases significantly with the increase in the number of total spikes and for all spray levels, and the spike length increases with the increase in the number of spikes, m2 at the spray level (100). While the number of grains per spike decreases significantly with the increase in the number of spikes.m-2 at the spray level (0 and 200), while the weight of 1000 grains increases with the increase in the number of spikes.m2 for all spray levels. This result agrees with Daoud et al. (2004), Ali et al. (2008) and Abdel- mohsen et al. (2012), who found a positive phenotypic correlation of spike length and the number of grains per spike, and negatively for 1000-grain weight with the number of spikes.The trait of weight of 1000 grains (g) was associated with a positive and significant correlation with the number of total tillers (tillers. m-2) at the 5% probability level for the (100) level and with a positive and highly significant correlation at the 5% probability level for the levels (0 and 200) and it was correlated with leaf area The knowledge of a positive and significant correlation at the 5% probability level for the (0) level and it was associated with the length of the spike with a positive and highly significant correlation at the 5% probability level for the (0) level and it was correlated with the number of grains. spikes -1 with negative and highly significant correlation at 1% probability level and for all levels.This means that the weight of 1000 grains increases with the increase in the number of total tillers at all levels and with the increase in the area of the flag leaf and the length of the spike for the non-spray level, but the weight of 1000 grains decreases significantly with the increase in the number of grains in the spike and at all levels of spraying, and these results agree with Abdel-mohsen et al. (2012) who found a negative and significant correlation between the trait of the number of grains in the spike and the weight of 1000 grains.Associated with the adjective number of grains. Spike-1 was negatively and highly significant with the number of total tillers(tillers .m-2) at the 1% probability level for the non-spray level (0), as well as with the area of the flag leaf, it was significantly negatively related at the 5% probability level and at the non-spray level (0) as well. , This average that the number of grains in the spike decreases with the increase in the number of total tillers m-2 in a highly significant manner and with the increase in the area of the flag leaf is significant and the level of non-spraying for both traits. grains. spike-1.The trait of spike length was associated with a negative and significant relationship with the trait of heading spikes at the 5% probability level for the spray level (200), and it was associated with the plant height trait with a positive and significant correlation at the 5% probability level for the non-spray level (0) and it was correlated with the area of the flag leaf with a positive and highly significant correlation at 1% probability level for level (0 and 100),This indicates that the length of the spike increases with the short period of time to the heading of the spikes and significantly to the level of spraying (200), while the length of the spike increases significantly with the increase in the height of the plant to the level of non-spraying, while it increases in a highly significant manner with the increase in the area of the flag leaf for the level of spraying (0,100).), and this result agrees with Hassan and Bektas (2014), who found a negative and Significantly phenotypic relationship between the heading of spikes and the length of the spike.The characteristic of the total number of tillers (tillers .m-2) was positively and significantly with the plant height trait at a probability level of 5% for the spray level (100 and 200), which means that the number of total tillers.m-2 increases significantly with the increase in plant height and for the level of spraying. spraying (100 and 200), and this result agrees with Al-tabbal and Al-fraihat (2012).

Table 4. Genetic correlation between the studied traits of the interaction between genotypes and levels of ascorbic acid spray

Duration to heading the spikes (day)	Duration to physiological maturity (day)	height (cm)	Total number of tillers (tillers. m^{-2})	flag leaf area (cm^2)	spike length (cm)	number of grains. spike-1	1000grain weight (gm)	number of grains. spike-1	Grain yield (kg.ha-1)	Biological yield (kg.ha-1)	harvest index(%)	A	Studied traits
	-0.187	-0.195	-0.507*	-0.232	-0.039	0.101	0.208	-0.360	-0.117	-0.124	-0.037	0	Duration to heading the spikes (day)
	-0.356	-0.487*	-0.261	-0.113	-0.153	-0.114	0.112	-0.085	-0.100	-0.273	0.214	100	
	0.169	0.017	-0.341	-0.392	-0.506*	0.034	-0.260	-0.194	-0.302	-0.334	-0.103	200	
		-0.293	-0.036	0.355	0.065	-0.039	-0.169	-0.193	-0.325	-0.197	-0.365	0	Duration to physiological maturity (day)
		-0.077	0.032	-0.150	0.047	-0.237	-0.095	-0.103	-0.409	-0.314	-0.254	100	
		0.145	-0.056	0.302	0.221	0.034	-0.324	-0.143	-0.280	-0.248	-0.208	200	
			0.415	0.452	0.581*	-0.279	0.332	0.380	0.330	0.292	0.212	0	plant height (cm)
			0.557*	0.212	0.368	-0.116	0.240	0.347	0.287	0.080	0.353	100	
			0.544*	-0.015	0.250	-0.247	0.162	0.505*	0.295	0.163	0.401	200	
				0.417	0.510*	-0.752**	0.629**	0.933**	0.659**	0.593*	0.392	0	Total number of tillers(m-2 pt.)
				0.065	0.350	-0.288	0.542*	0.883**	0.757**	0.560*	0.458	100	
				0.063	0.433	-0.467	0.615**	0.944**	0.766**	0.701**	0.518*	200	
					0.759**	-0.559*	0.548*	0.133	-0.003	0.180	-0.335	0	flag leaf area (cm2)
					0.796**	-0.359	0.446	0.424	0.275	0.460	-0.177	100	
					0.483*	-0.346	0.233	-0.022	-0.191	0.007	-0.456	200	
						-0.443	0.627**	0.439	0.436	0.474	0.122	0	number of spikes (m^2)
						-0.189	0.392	0.516*	0.454	0.459	0.105	100	
						-0.119	0.332	0.389	0.420	0.422	0.216	200	
							-0.794**	-0.591*	-0.209	-0.222	-0.061	0	spike length (cm)
							-0.819**	-0.393	0.108	-0.074	0.284	100	
							-0.725**	-0.536*	-0.027	0.002	-0.076	200	
								0.580*	0.534*	0.578*	0.132	0	number of grains. spike-1
								0.645**	0.374	0.427	0.0278	100	
								0.682**	0.565*	0.529*	0.364	200	
									0.834**	0.713**	0.562*	0	1000grain weight (gm)
									0.827**	0.707**	0.375	100	
									0.793**	0.670**	0.639*	200	
										0.904**	0.583*	0	Grain yield (kg.ha-1)
										0.794**	0.547*	100	
										0.913**	0.678**	200	
											0.179	0	Biological yield (kg.ha-1)
											-0.075	100	
											0.319	200	
												0	harvest index (%)
												100	
												200	

*Significant at the 5% probability level
** Significant at 1% probability level

Table 5. The environmental correlation between the studied traits of the interaction between genotypes and levels of ascorbic acid spray

Duration to heading the spikes (day)	Duration to physiological maturity (day)	plant height (cm)	Total number of tillers(tillers. m^{-2} .)	flag leaf area (cm^2)	spike length (cm(	number of grains. spike-1	1000grain weight (gm(	number of grains. spike-1	Grain yield (kg.ha-1)	Biological yield (kg.ha-1)	harvest index (%)	A	Studied traits
	-0.024	0.261	-0.093	0.033	0.252	-0.109	0.162	0.101	-0.067	0.092	-0.116	0	Duration to heading the spikes (day)
	-0.027	0.024	-0.140	-0.201	0.215	0.164	0.223	-0.199	-0.065	0.375*	-0.341	100	
	0.362	0.020	-0.075	-0.019	0.001	0.086	-0.010	-0.232	0.060	0.150	-0.056	200	
		-0.129	-0.061	0.309	-0.011	0.051	-0.235	0.078	0.390*	-0.143	0.407*	0	Duration to physiological maturity (day)
		0.242	0.055	-0.331	0.081	-0.016	0.158	-0.103	-0.128	-0.112	-0.040	100	
		-0.062	0.027	-0.035	-0.136	.1510	-0.370	-0.108	-0.035	0.047	0.013	200	
			-0.441	0.061	0.231	-0.122	0.235	0.224	-0.042	0.011	-0.058	0	plant height (cm)
			-0.120	-0.295	0.306	0.249	-0.030	-0.499**	-0.366*	-0.066	-0.314	100	
			-0.133	-0.470	-0.233	-0.010	0.045	-0.038	-0.051	0.074	-0.066	200	
				.0380	-0.176	0.106	-0.197	-0.176	-0.215	0.010	-0.165	0	Total number of tillers(m-2 pt.)
				-0.155	0.335	0.018	-0.276	-0.079	-0.062	-0.622**	0.525**	100	
				.1750	0.212	-0.446	.0240	0.533**	0.154	0.009	0.191	200	
					0.027	-0.150	-0.137	0.213	-0.003	-0.165	0.140	0	flag leaf area (cm2)
					-0.066	0.154	-0.164	0.083	0.096	0.147	-0.001	100	
					0.010	-0.133	0.167	0.103	0.094	-0.105	0.089	200	
						-0.012	0.186	0.129	-0.008	0.319	-0.220	0	number of spikes (m2)
						0.025	-0.165	-0.096	0.115	-0.028	0.239	100	
						0.038	0.156	-0.078	0.220	-0.167	0.284	200	
							0.031	-0.779**	0.097	-0.109	0.093	0	spike length (cm)
							-0.116	-0.838**	0.047	-0.002	-0.047	100	
							-0.448*	-0.767**	0.371*	0.148	0.157	200	
								-0.432**	-0.006	0.041	-0.091	0	number of grains. spike-1
								-0.178	0.063	0.049	-0.037	100	
								-0.069	-0.154	-0.180	-0.021	200	
									0.013	0.025	0.065	0	1000grain weight (gm(
									0.148	0.186	0.095	100	
									-0.166	-0.055	-0.065	200	
										-0.068	0.748**	0	Grain yield (kg.ha-1)
										0.333	0.642	100	
										-0.197	0.739**	200	
											-0.693**	0	Biological yield (kg.ha-1)
											-0.461**	100	
											-0.742**	200	
												0	harvest index (%)
												100	
												200	

*Significant at the 5% probability level
** Significant at 1% probability level

Table 6. phenotypic correlation between the studied traits of the interaction between genotypes and levels of ascorbic acid spray

Duration to heading the spikes (day)	Duration to physiological maturity (day)	plant height (cm)	Total number of tillers(tillers. m^{-2} .)	flag leaf area (cm^2)	spike length (cm(	number of grains. spike-1	1000grain weight (gm(	number of grains. spike-1	Grain yield (kg.ha-1)	Biological yield (kg.ha-1)	harvest index (%)	A	Studied traits
	-0.184	-0.176	-0.493	-0.214	-0.029	0.096	0.035	-0.351	-0.116	-0.121	-0.038	0	Duration to heading the spikes (day)
	-0.354	-0.475	-0.260	-0.113	-0.146	-0.111	0.112	-0.086	-0.099	-0.271	0.212	100	
	0.171	0.017	-0.339	-0.378	-0.501*	0.035	-0.257	-0.194	-0.301	-0.332	-0.103	200	
		-0.287	-0.036	0.344	0.063	-0.038	-0.169	-0.191	-0.322	-0.196	-0.358	0	Duration to physiological maturity (day)
		-0.073	0.032	-0.147	0.047	-0.235	-0.094	-0.103	-0.409	-0.313	-0.254	100	
		0.136	-0.055	0.290	0.216	.0350	0.324-	-0.143	-0.278	-0.246	-0.203	200	
			0.376	0.420	0.564*	-0.272	0.326	0.373	0.320	0.284	0.204	0	plant height (cm)
			*0.542	0.180	0.366	-0.106	0.234	0.322	0.280	0.078	0.344	100	
			*0.517	-0.045	0.231	-0.236	0.156	0.483	0.283	0.157	0.382	200	
				0.389	0.485	-0.729**	0.614*	0.907**	0.646**	0.582*	0.380	0	Total number of tillers(m-2 pt.)
				0.058	0.348	-0.284	0.538*	0.868**	0.753**	0.556*	0.458	100	
				0.058	0.430	-0.467	0.610*	0.941**	0.762**	0.698**	0.515*	200	
					0.705**	-0.531*	0.515*	0.132	-0.003	0.168	-0.311	0	flag leaf area (cm2)
					0.741**	-0.333	0.421	0.403	0.262	0.438	-0.169	100	
					0.466	-0.337	0.229	-0.019	-0.184	0.006	-0.439	200	
						-0.431	0.616*	0.431	0.427	0.467	0.115	0	number of spikes (m2)
						-0.184	0.383	0.499 *	0.447	0.450	0.105	100	
						-0.117	0.330	0.383	0.418	0.418	0.217	200	
							-0.786**	-0.593*	-0.207	-0.220	-0.059	0	spike length (cm)
							-0.812**	-0.401	0.107	-0.073	0.282	100	
							-0.722**	-0.538*	-0.025	0.003	-0.073	200	
								0.573*	0.533*	0.578*	0.131	0	number of grains. spike-1
								0.635**	0.374	0.426	0.027	100	
								0.676**	0.562*	0.527*	0.361	200	
									0.829**	0.709**	0.557*	0	1000grain weight (gm)
									0.819**	0.700**	0.371	100	
									0.789**	0.667**	0.634**	200	
										0.903**	0.582*	0	Grain yield (kg.ha-1)
										0.794**	0.547*	100	
										0.9112**	0.677**	200	
											0.176	0	Biological yield (kg.ha-1)
											-0.075	100	
											0.315	200	
												0	harvest index(%)
												100	
												200	

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