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# Determination of heritability and genetic parameters of yield and yield components related to salinity tension in barley cultivars through crossing Diallel

**S. Solhi[1], V. Rashidi [1*], H. Shahbazy[2], F. Farahvash[1], A.R. Ahmadzadeh[1]**

*1. Department of Agronmy and Plant Breeding, Tabriz Branch, Azad University, Tabriz, Iran*
*2. Department of Agronmy and Plant Breeding, Ardebil Branch, Azad University, Ardebil, Iran*

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***Abstract***

In order to determine the heritability and genetic parameters of yield and yield components under salinity stress in barley, a crossing 7×7 one-way diallel was conducted during 2016 – 2017 in Islamic Azad University, Ardabil, Iran. The F1 seeds alongwith their parents were grown in a greenhouse experiment under non-stress (control) and salinity stresses of 8 and 12 ds/m. In this research, yield and some morphological and agronomic traits were measured. The results of the goodness of fit indicate the adequacy of additive-dominant model for all of the traits. Results showed that all traits had high broad sense heritability, suggesting the usefulness of the traits under study in selection of salinity stress of barley. The results of the experiment showed that the average degree of dominance in all salinity levels was greater than one, so the above traits were controlled by the over-dominance. Results showed that for plant height, dominant alleles and for grain yield and 100 kernels weight, recessive alleles are favorable. Non-significant GCA source of variation in Grifting's method in most of the traits, confirmed the contribution of dominance effects. The narrow sense heritability of traits was low, suggesting that selection for these traits should be delayed until after some homozygosity was achieved. Based on the narrow sense heritability, it was concluded that, under moderate salinity (8ds/m) spike weight, number of seeds/spike and plant yield and under sever salinity (12ds/m) spike weight, number of fertile tillers and plant yield can be regarded as favorable criteria for selection of salinity tolerance in barley.

***Keywords*****:** Barley, Genetics, Heritability, Salinity, Yield Components

**Table 1. List of barley cultivars used in diallel crosses**

| Parent | Cultivar | Tolerance | Pedigree,Origin |
|---|---|---|---|
| **1** | **Afzal** | tolerant | Chahafzal |
| **2** | **Nosrat** | tolerant | Karoon/Kavir, Iran |
| **3** | **Walfajr** | susceptible | CI-108985, Egypt |
| **4** | **Kavir** | susceptible | Arivat, USA |
| **5** | **Rihane03** | tolerant | As46//Avt/Aths |
| **6** | **Sahra** | susceptible | L. B. LRAN/ Una8271// Giorias "s" Com |
| **7** | **Yusef** | susceptible | Lignee527/chn-01//Gustoe/4/Rhn-08/3/DeirAlla 106//DI71/strain 205 |

[*]Correspondent author.Varahram Rashidi; E-Mail: rashidi.varahram@gmail.com.

**Table 2. Analysis of variance Wr-Vr for model-enhancement-dominance model for evaluated traits in the barley under the stress of 12 dc Siemens salinity**

| S.O.V | df | Bush height | Bush number | Fertile tiller number | Number of seeds per spike | yield of seed | Weight 100 seeds | Weight of spike |
|---|---|---|---|---|---|---|---|---|
| **Repeat** | 2 | 608.238$^{ns}$ | 134.137$^{ns}$ | 21.247$^{ns}$ | 28.715$^{ns}$ | 5.163$^{ns}$ | 6.103$^{ns}$ | 13.589$^{ns}$ |
| **Row** | 6 | 745.118$^{ns}$ | 71.617$^{ns}$ | 15.056$^{ns}$ | 46.115$^{ns}$ | 3.127$^{ns}$ | 2.365$^{ns}$ | 5.448$^{ns}$ |
| **Error** | 12 | 1248.841 | 36.371 | 30.206 | 40.977 | 2.182 | 2.853 | 6.083 |

$^{ns}$,*, ** indicate non-significant and significant at 0.05 and 0.01 probability level, respectively.

**Table 3. Analysis of variance Wr-Vr for model-enhancement-dominance model for evaluated traits in the barley under the stress of 8 dc Siemens salinity**

| S.O.V | df | Bush height | Bush number | Fertile tiller number | Number of seeds per spike | yield of seed | Weight 100 seeds | Weight of spike |
|---|---|---|---|---|---|---|---|---|
| **Repeat** | 2 | 554.288$^{ns}$ | 23.919$^{ns}$ | 28.727$^{ns}$ | 26.107$^{ns}$ | 9.168$^{ns}$ | 8.085$^{ns}$ | 9.587$^{ns}$ |
| **Row** | 6 | 685.428$^{ns}$ | 20.617$^{ns}$ | 18.273$^{ns}$ | 62.584$^{ns}$ | 2.688$^{ns}$ | 6.757$^{ns}$ | 5.063$^{ns}$ |
| **Error** | 12 | 1324.642 | 12.933 | 43.967 | 56.322 | 3.286 | 3.415 | 4.065 |

$^{ns}$,*, ** indicate non-significant and significant at 0.05 and 0.01 probability level, respectively

**Table 4. Analysis of variance Wr-Vr for model-enhancement-dominance model for evaluated traits in the barley under tension and not-tension salinity**

| S.O.V | df | Bush height | Bush number | Fertile tiller number | Number of seeds per spike | yield of seed | Weight 100 seeds | Weight of spike |
|---|---|---|---|---|---|---|---|---|
| **Repeat** | 2 | 351.05$^{ns}$ | 104.807$^{ns}$ | 20.445$^{ns}$ | 38.417$^{ns}$ | 7.223$^{ns}$ | 7.887$^{ns}$ | 20.599$^{ns}$ |
| **Row** | 6 | 1152.8$^{ns}$ | 133.318$^{ns}$ | 15.417$^{ns}$ | 56.266$^{ns}$ | 3.761$^{ns}$ | 3.496$^{ns}$ | 5.142$^{ns}$ |
| **Error** | 12 | 733.425 | 31.936 | 26.595 | 37.514 | 2. 853 | 2.865 | 5.021 |

$^{ns}$,*, ** indicate non-significant and significant at 0.05 and 0.01 probability level, respectively

**Table 5. Analysis of the variance of diallel for barley evaluated traits by using the Walters and Morton method under 12 dc Siemens salinity tension**

| منبع تغییر S.O.V | df | Bush height | Bush number | Fertile tiller number | Number of seeds per spike | yield of seed | Weight 100 seeds | Weight of spike |
|---|---|---|---|---|---|---|---|---|
| **repeat** | | 947.887$^{**}$ | 8.822$^{ns}$ | 73.798$^{**}$ | 27.515$^{ns}$ | 27.98$^{ns}$ | 5.965$^{ns}$ | 47.624$^{**}$ |
| **A** | | 73.524$^{**}$ | 16.270$^{**}$ | 24.048$^{*}$ | 21.578$^{ns}$ | 6.602$^{**}$ | 44.598$^{**}$ | 9.019$^{**}$ |
| **B** | | 67.317$^{**}$ | 12.560$^{**}$ | 14.528* | 20.502$^{ns}$ | 4.588$^{**}$ | 9.523$^{ns}$ | 8.265$^{**}$ |
| | **$b_1$** | 232.397$^{**}$ | 24.766$^{*}$ | 24.766$^{ns}$ | 10.635$^{ns}$ | 3.058$^{ns}$ | 15.718$^{ns}$ | 5.943$^{ns}$ |
| | **$b_2$** | 64.621$^{*}$ | 19.305$^{**}$ | 13.241$^{ns}$ | 18.229$^{ns}$ | 2.279$^{ns}$ | 25.440$^{**}$ | 7.483$^{*}$ |
| | **$b_3$** | 56.681$^{**}$ | 8.79$^{ns}$ | 14.348$^{ns}$ | 22.181$^{ns}$ | 1.686$^{**}$ | 2.259$^{ns}$ | 8.765$^{**}$ |
| **error** | | 21.103 | 5.093 | 7.847 | 14.094 | 1.949 | 7.358 | 2.498 |

ns,* and ** means non-significant and significant at the 5% and 1% levels, respectively. A: Additive effect. B: non-additive effect. b1: the direction of dominance. b2: Gene abundance balance. b3: Specific dominance.

**Table 6. Analysis of the variance of diallel for barley evaluated traits by using the Walters and Morton method under 8 dc Siemens salinity tension**

| S.O.V | df | Bush height | Bush number | Fertile tiller number | Number of seeds per spike | yield of seed | Weight 100 seeds | Weight of spike |
|---|---|---|---|---|---|---|---|---|
| repeat | | 943.441$^{**}$ | 4.185$^{ns}$ | 59.737$^{**}$ | 6.859$^{ns}$ | 26.92$^{**}$ | 7.203$^{ns}$ | 37.175$^{**}$ |
| A | | 78.333$^{**}$ | 37.192$^{**}$ | 14.172$^{ns}$ | 23.002$^{ns}$ | 4.672$^{ns}$ | 71.657$^{**}$ | 8.640$^{**}$ |
| B | | 67.305$^{**}$ | 17.882$^{**}$ | 15.183* | 28.182$^{*}$ | 2.761$^{ns}$ | 10.999$^{**}$ | 7.536$^{**}$ |
| | $b_1$ | 242.105$^{**}$ | 5.250$^{ns}$ | 12.024$^{ns}$ | 8.754$^{ns}$ | 2.041$^{ns}$ | 27.767$^{**}$ | 3.717$^{ns}$ |
| | $b_2$ | 65.292$^{*}$ | 38.194$^{**}$ | 17.211$^{ns}$ | 21.675$^{ns}$ | 1.381$^{ns}$ | 41.761$^{**}$ | 3.918$^{ns}$ |
| | $b_3$ | 47.256$^{**}$ | 9.474$^{**}$ | 15.182$^{ns}$ | 32.358$^{**}$ | 3.452$^{ns}$ | 3.431$^{ns}$ | 9.343$^{**}$ |
| error | | 24.454 | 1.451 | 8.647 | 10.391 | 2.219 | 5.832 | 2.147 |

ns,* and ** means non-significant and significant at the 5% and 1% levels, respectively. A: Additive effect. B: non-additive effect. b1: the direction of dominance. b2: Gene abundance balance. b3: Specific dominance.

**Table 7. Analysis of the variance of diallel for barley evaluated traits by using the Walters and Morton method under tension and not-tension salinity**

| S.O.V | df | Bush height | Bush number | Fertile tiller number | Number of seeds per spike | yield of seed | Weight 100 seeds | Weight of spike |
|---|---|---|---|---|---|---|---|---|
| repeat | | 975.327$^{**}$ | 3.062$^{ns}$ | 59.291$^{**}$ | 23.619$^{ns}$ | 8.160$^{ns}$ | 6.725$^{ns}$ | 8.536$^{ns}$ |
| A | | 35.117$^{ns}$ | 17.367$^{**}$ | 14.172$^{ns}$ | 19.939$^{ns}$ | 3.872$^{ns}$ | 42.254$^{**}$ | 7.729$^{ns}$ |
| B | | 59.197$^{*}$ | 9.196$^{*}$ | 15.182$^{*}$ | 23.578$^{**}$ | 3.628$^{ns}$ | 7.452$^{ns}$ | 4.765$^{ns}$ |
| | $b_1$ | 99.322$^{ns}$ | 1.105$^{ns}$ | 2.024$^{ns}$ | 23.569$^{ns}$ | 4.198$^{ns}$ | 14.914$^{ns}$ | 3.234$^{ns}$ |
| | $b_2$ | 27.089$^{ns}$ | 19.397$^{**}$ | 17.211$^{ns}$ | 30.751$^{*}$ | 1.479$^{ns}$ | 26.943$^{**}$ | 6.142$^{ns}$ |
| | $b_3$ | 69.233$^{*}$ | 6.124$^{ns}$ | 15.182$^{ns}$ | 20.504$^{*}$ | 4.496$^{**}$ | 3.751$^{ns}$ | 4.189$^{ns}$ |
| error | | 30.982 | 5.271 | 8.457 | 10.218 | 2.099 | 8.492 | 3.445 |

ns,* and ** means non-significant and significant at the 5% and 1% levels, respectively. A: Additive effect. B: non-additive effect. b1: the direction of dominance. b2: Gene abundance balance. b3: Specific dominance.

**Table 8. Genetic parameters of evaluated characteristics barley in Diallel Crossing, Under Salt Stress under 12 dc Siemens salinity tension**

| Parameter | Bush height | Bush number | Fertile tiller number | Number of seeds per spike |
|---|---|---|---|---|
| D | 34.58$^{**}$±3.57 | 9.36$^{**}$±1.99 | 9.48$^{**}$±1.34 | 4.94$^{**}$±1.78 |
| $H_1$ | 145.99$^{**}$±8.59 | 29.25$^{**}$±4.784 | 27.58$^{**}$±3.22 | 43.59$^{**}$±4.29 |
| $H_2$ | 118.18$^{**}$±7.57 | 4.22$^{**}$±20.70 | 21.46$^{**}$±2.84 | 38.89$^{**}$±3.77 |
| F | 56.71$^{**}$±8.56 | 4.77$^{**}$±15.52 | 8.58$^{**}$±3.21 | 1.32$^{ns}$±4.27 |
| $h^2$ | 39.37$^{**}$±5.08 | 2.82$^{**}$±5.91 | 5.74$^{**}$±1.91 | 6.78$^{ns}$ ±2.54 |
| Averagd | 2.05 | 1.77 | 1.71 | 2.97 |
| H2/4H1 | 0.20 | 0.18 | 0.19 | 0.22 |
| KD/KR | 2.33 | 2.76 | 1.72 | 1.09 |
| Hn | 0.07 | 0.15 | 0.31 | 0.22 |
| Hb | 0.81 | 0.79 | 0.77 | 0.75 |
| E | 7.37**±1.26 | 1.71**±0.70 | 2.62**±0.47 | 4.69**±0.63 |
| rYr(wr+vr) | -0.92$^{**}$ | -0.08$^{ns}$ | 0.07$^{**}$ | 0.09** |
| B | 0.56 | 0.25 | 0.26 | 0.22 |
| A | -17.29 | -0.84 | 0.43 | -0.69 |

**Table 8. Continued**

| Parameter | yield of seed | Weight 100 seeds | Weight of spike |
|---|---|---|---|
| **D** | 2.31$^{**}$±0.85 | 20.68$^{**}$±1.72 | 3.14$^{**}$±1.05 |
| **$H_1$** | 7.24$^{**}$±2.04 | 30.56$^{**}$±4.14 | 11.84$^{**}$±2.53 |
| **$H_2$** | 6.69$^{**}$±1.80 | 19.95$^{**}$±3.65 | 9.40$^{**}$±2.31 |
| **F** | 1.01$^{ns}$ ±2.03 | 26.24$^{**}$±4.13 | 1.93$^{ns}$±2.52 |
| **$h^2$** | 1.55$^{ns}$ ±1.21 | 1.36$^{ns}$ ±2.45 | 1.29$^{ns}$ ±1.50 |
| **Averagd** | 1.77 | 1.22 | 1.94 |
| **H2/4H1** | 0.23 | 0.16 | 0.20 |
| **KD/KR** | 1.28 | 3.18 | 1.38 |
| **Hn** | 0.28 | 0.25 | 0.36 |
| **Hb** | 0.65 | 0.75 | 0.83 |
| **E** | 0.65$^{**}$±0.30 | 2.45$^{**}$±0.61 | 0.83$^{**}$±0.37 |
| **rYr(wr+vr)** | 0.59$^{**}$ | 0.76$^{**}$ | 0.12$^{ns}$ |
| **B** | 0.53 | 0.72 | 0.35 |
| **A** | -0.48 | -2.17 | -0.22 |

$^{ns}$,*, ** indicate non-significant and significant at 0.05 and 0.01 probability level, respectively

**Table 9. Genetic parameters of evaluated characteristics barley in Diallel Crossing, Under Salt Stress under 8 dc Siemens salinity tension**

| Parameter | Bush height | Bush number | Fertile tiller number | Number of seeds per spike |
|---|---|---|---|---|
| **D** | 25.58$^{**}$±3.43 | 7.14$^{**}$±1.45 | 9.46$^{**}$±1.41 | 5.03$^{**}$±1.72 |
| **$H_1$** | 137.82$^{**}$±4.52 | 24.41$^{**}$±3.50 | 31.36$^{**}$±3.39 | 44.92$^{**}$±4.14 |
| **$H_2$** | 109.01$^{**}$±7.78 | 17.14$^{**}$±3.09 | 23.99$^{**}$±2.99 | 35.30$^{**}$±4.12 |
| **F** | 52.64$^{**}$±5.64 | 11.86$^{**}$±3.49 | 12.25$^{**}$±3.38 | 6.02$^{ns}$ ±4.12 |
| **$h^2$** | 29.71$^{**}$±4.36 | 3.96$^{**}$±2.07 | -0.43$^{ns}$ ±2.02 | 5.52$^{ns}$ ±2.45 |
| **Averagd** | 1.95 | 1.85 | 1.82 | 2.99 |
| **H2/4H1** | 0.21 | 0.17 | 0.19 | 0.20 |
| **KD/KR** | 2.19 | 2.63 | 2.10 | 1.50 |
| **Hn** | 0.09 | 0.18 | 0.21 | 0.26 |
| **Hb** | 0.79 | 0.78 | 0.75 | 0.79 |
| **E** | 6.96$^{**}$±1.84 | 1.57$^{**}$±0.51 | 2.68$^{**}$±0.49 | 3.41$^{**}$±0.61 |
| **rYr(wr+vr)** | -0.64$^{ns}$ | -0.38$^{ns}$ | 0.09$^{ns}$ | - 0.44$^{ns}$ |
| **B** | 0.56 | 0.42 | 0.31 | 0.27 |
| **A** | -13.11 | -1.91 | -0.95 | -2.30 |

**Table 9. Continued**

| Parameter | yield of seed | Weight 100 seeds | Weight of spike |
|---|---|---|---|
| **D** | 1.63$^{**}$±0.87 | 22.06$^{**}$±1.81 | 3.10$^{**}$±1.07 |
| **$H_1$** | 6.83$^{**}$±2.11 | 34.97$^{**}$±4.36 | 8.73$^{**}$±2.58 |
| **$H_2$** | 6.81$^{**}$±1.85 | 23.24$^{**}$±3.84 | 7.23$^{**}$±2.27 |
| **F** | -0.09$^{ns}$ ±2.09 | 28.18$^{**}$±4.34 | 1.65$^{ns}$±2.57 |
| **$h^2$** | 1.965$^{ns}$ ±1.24 | -0.38$^{ns}$ ±2.58 | 0.14$^{ns}$ ±1.52 |
| **Averagd** | 2.04 | 1.26 | 1.67 |
| **H2/4H1** | 0.25 | 0.17 | 0.21 |
| **KD/KR** | 1.01 | 3.06 | 1.37 |
| **Hn** | 0.24 | 0.24 | 0.33 |
| **Hb** | 0.71 | 0.73 | 0.74 |
| **E** | 1.03$^{**}$±0.31 | 3.11$^{**}$±0.64 | 1.14$^{**}$±0.37 |
| **rYr(wr+vr)** | 0.52$^{**}$ | 0.55$^{**}$ | 0.01$^{ns}$ |
| **B** | 0.53 | 0.71 | 0.42 |
| **A** | -0.70 | -2.94 | -0.26 |

$^{ns}$,*, ** indicate non-significant and significant at 0.05 and 0.01 probability level, respectively

**Table 10. Genetic parameters of evaluated characteristics barley in Diallel Crossing, Under Salt Stress under tension and not-tension salinity**

| parameter | Bush height | Bush number | Fertile tiller number | Number of seeds per spike |
|---|---|---|---|---|
| **D** | 46.88$^{**}$±3.97 | 13.13$^{**}$±2.32 | 11.79$^{**}$±1.95 | 6.83$^{**}$±1.86 |
| **$H_1$** | 169.15$^{**}$±9.58 | 40.24$^{**}$±5.58 | 33.56$^{**}$±4.69 | 49.08$^{**}$±4.50 |
| **$H_2$** | 130.88$^{**}$±8.44 | 27.68$^{**}$±4.92 | 25.04$^{**}$±4.13 | 42.59$^{**}$±3.97 |
| **F** | 78.76$^{**}$±9.54 | 23.20$^{**}$±5.57 | 18.03$^{**}$±4.67 | 4.81$^{ns}$ ±4.48 |
| **$h^2$** | 63.54$^{**}$±5.66 | 0.74$^{**}$±3.31 | 3.52$^{**}$±2.77 | 2.60$^{ns}$ ±2.66 |
| **Averagd** | 1.89 | 1.75 | 1.68 | 2.68 |
| **H2/4H1** | 0.19 | 0.17 | 0.19 | 0.22 |
| **KD/KR** | 2.58 | 3.04 | 2.66 | 1.30 |
| **Hn** | 0.08 | 0.14 | 0.11 | 0.23 |
| **Hb** | 0.87 | 0.92 | 0.73 | 0.81 |
| **E** | 5.19$^{**}$±1.40 | 0.65$^{ns}$ ±0.82 | 2.74$^{**}$±0.68 | 3.46$^{**}$±0.66 |
| **rYr(wr+vr)** | -0.88$^{ns}$ | -0.08$^{ns}$ | - 0.53$^{ns}$ | -0.07$^{ns}$ |
| **B** | 0.63 | 0.25 | 0.25 | 0.28 |
| **A** | -20.41 | -0.84 | -0.57 | -1.90 |

**Table 10. Continued**

| parameter | yield of seed | Weight 100 seeds | Weight of spike |
|---|---|---|---|
| **D** | 1.37$^{ns}$ ±0.81 | 24.29$^{**}$±1.82 | 2.84$^{**}$±1.03 |
| **$H_1$** | 5.96$^{**}$±1.95 | 39.46$^{**}$±4.38 | 9.38$^{**}$±2.47 |
| **$H_2$** | 5.63$^{**}$±1.72 | 25.0$^{9**}$±3.86 | 8.24$^{**}$±2.18 |
| **F** | 0.37$^{ns}$ ±1.94 | 34.26$^{**}$±4.37 | 0.58$^{ns}$±2.46 |
| **$h^2$** | 0.95$^{ns}$ 5±1.16 | 5.06$^{ns}$ ±2.59 | 1.31$^{ns}$ ±1.47 |
| **Averagd** | 2.08 | 1.27 | 1.82 |
| **H2/4H1** | 0.24 | 0.16 | 0.22 |
| **KD/KR** | 1.14 | 3.47 | 1.12 |
| **Hn** | 0.24 | 0.20 | 0.38 |
| **Hb** | 0.73 | 0.87 | 0.84 |
| **E** | 0.73$^{**}$±0.29 | 1.27$^{**}$±0.64 | 0.71$^{ns}$ ±0.36 |
| **rYr(wr+vr)** | 0.67$^{**}$ | 0.83$^{**}$ | 0.44$^{ns}$ |
| **B** | 0.39 | 0.62 | 0.27 |
| **A** | -0.26 | -1.63 | 0.39 |

$^{ns}$,*, ** indicate non-significant and significant at 0.05 and 0.01 probability level, respectively

**Table 11. Analysis of variance Wr + Vr for testing the increase-dominance model for evaluated traits under stress of 12 dc siemense**

| S.O.V | df | Bush height | Bush number | Fertile tiller number | Number of seeds per spike |
|---|---|---|---|---|---|
| **Public Combination ability** | 6 | 23.1781$^{ns}$ | 4.4004$^{ns}$ | 15.5414$^{**}$ | 4.6088$^{ns}$ |
| **Private Combination ability** | 21 | 126.7178$^{**}$ | 5.3210$^{ns}$ | 23.4343$^{**}$ | 29.0784$^{**}$ |
| **Error** | 54 | 40.0823 | 9.5913 | 6.9012 | 13.2265 |

**Table 11. Continued**

| S.O.V | df | yield of seed | Weight 100 seeds | Weight of spike |
|---|---|---|---|---|
| **Public Combination ability** | 6 | 1.3790$^{ns}$ | 5.1344$^{ns}$ | 0.9684$^{ns}$ |
| **Private Combination ability** | 21 | 6.3063$^{**}$ | 16.8392$^{**}$ | 11.5524$^{**}$ |
| **Error** | 54 | 2.6069 | 8.9746 | 3.7524 |

$^{ns}$,*, ** indicate non-significant and significant at 0.05 and 0.01 probability level, respectively

**Table 12. Analysis of variance Wr + Vr for testing the increase-dominance model for evaluated traits under stress of 8 dc siemense**

| S.O.V | df | Bush height | Bush number | Fertile tiller number | Number of seeds per spike |
|---|---|---|---|---|---|
| **Public Combination ability** | 6 | 1311.9612 ns | 11.4039 ns | 26.1905** | 11.2486 ns |
| **Private Combination ability** | 21 | 879.9413 ns | 5.0428 ns | 15.3810** | 27.4927** |
| **Error** | 54 | 1784.0957 | 7.1230 | 7.9259 | 10.0277 |

**Table 12. Continued**

| S.O.V | df | yield of seed | Weight 100 seeds | Weight of spike |
|---|---|---|---|---|
| **Public Combination ability** | 6 | 1.5970 ns | 16.4612 ns | 1.7408 ns |
| **Private Combination ability** | 21 | 4.1347 ns | 16.9051 ns | 5.9706 ns |
| **Error** | 54 | 3.3042 | 11.2120 | 3.8423 |

ns,*, ** indicate non-significant and significant at 0.05 and 0.01 probability level, respectively

**Table 13. Analysis of variance Wr + Vr for testing the increase-dominance model for evaluated traits under not-tension salinity**

| S.O.V | df | Bush height | Bush number | Fertile tiller number | Number of seeds per spike |
|---|---|---|---|---|---|
| **Public Combination ability** | 6 | 65.6226 ns | 4.0122 ns | 106.9224 ns | 13.2065 ns |
| **Private Combination ability** | 21 | 101.6702** | 6.7465 ns | 165.9740 ns | 21.0659 ns |
| **Error** | 54 | 24.4717 | 9.6561 | 119.7932 | 15.9217 |

**Table 13. Continued**

| S.O.V | df | yield of seed | Weight 100 seeds | Weight of spike |
|---|---|---|---|---|
| **Public Combination ability** | 6 | 0.7197 ns | 9.7740 ns | 1.4770 ns |
| **Private Combination ability** | 21 | 6.6484** | 12.5878 ns | 9.6839** |
| **Error** | 54 | 1.9571 | 10.3521 | 3.2968 |

ns,*, ** indicate non-significant and significant at 0.05 and 0.01 probability level, respectively