**Supplementary Table 1.** Comparison of mean values of moisture content and water phase proportions in maize kernels between cultivars and nitrogen treatments under different soaking time. MC represents for moisture content, BWP for bound water proportion, SBWP for semi-bound water proportion, FWP for free water proportion.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| ST | N | MC (%) | BWP (%) | SBWP (%) | FWP (%) |
| DK517 | LY99 | ZD958 | DK517 | LY99 | ZD958 | DK517 | LY99 | ZD958 | DK517 | LY99 | ZD958 |
| T1 | N30 | 6.84Ab | 10.62Aa | 7.53Aab | 71.94 Aa | 71.30 Aa | 71.30 Aa | 15.49Ab | 19.90Aa | 14.52Ab | 12.57Aa | 8.79Cb | 11.84Aa |
|  | N60 | 7.70Aa | 8.44Aa | 7.84Aa | 72.36 Aa | 70.71 Aa | 70.71 Aa | 14.60Aa | 15.17ABa | 15.33Aa | 13.04Aa | 14.12Aa | 11.27Aa |
|  | N180 | 8.00Aa | 7.51Aa | 6.44Aa | 70.92 Aa | 75.47 Aa | 75.47 Aa | 16.37Aa | 14.17ABa | 12.76Aa | 12.71Aa | 10.37BCa | 12.82Aa |
|  | N300 | 8.54Aa | 8.56Aa | 5.32Aa | 70.82 Aa | 74.42 Aa | 74.42 Aa | 17.28Aa | 13.75ABa | 14.98Aa | 11.90Aa | 11.83ABa | 11.70Aa |
| T2 | N30 | 14.16Bb | 19.91Aa | 14.60Ab | 73.61Aa | 71.67Aa | 75.89Aa | 14.21Bb | 22.43Aa | 13.48Ab | 12.18Aa | 5.90Ba | 10.63Aa |
|  | N60 | 14.22Aa | 16.42Aa | 14.81Aa | 74.57Ab | 75.40Aab | 82.02Aa | 12.53Ba | 16.07Aa | 11.41Aa | 12.90Aa | 8.53ABa | 6.57ABb |
|  | N180 | 15.16Aa | 15.49Aa | 11.64Aa | 70.41Ab | 74.42Aab | 78.23Aa | 18.76ABa | 17.61Aa | 12.05Aa | 10.82Aab | 7.98Ba | 9.71ABa |
|  | N300 | 20.92Aa | 16.26Aab | 11.51Ab | 69.63Ab | 73.88Aab | 77.11Aa | 21.22Aa | 18.63Aab | 12.71Ab | 9.15Ab | 7.75Aa | 10.18Aa |
| T3 | N30 | 19.66Bb | 26.06Aa | 19.17Ab | 75.00Aa | 67.49Ab | 75.50ABa | 17.59Bb | 27.61Aa | 18.44ABb | 7.41ABa | 4.89Bb | 6.06Aab |
|  | N60 | 19.00Ba | 23.59Aa | 19.68Aa | 74.53Aab | 70.71Ab | 78.23Aa | 17.28Aa | 21.52Aa | 14.55Ba | 8.20Aa | 7.76Aa | 7.21Aa |
|  | N180 | 22.30ABa | 21.75Aa | 17.34Aa | 71.03Aa | 71.75Aa | 74.54ABa | 21.31Aa | 21.41Aa | 18.54ABa | 7.66ABa | 6.83Aa | 6.92Aa |
|  | N300 | 27.20Aa | 22.14Aab | 19.58Ab | 61.67Bb | 71.36Aa | 69.77Ba | 31.90Aa | 21.60Ab | 22.70Ab | 6.43Ba | 7.04Aa | 7.53Aa |
| T4 | N30 | 23.14Bb | 28.79Aa | 23.17Ab | 74.17Aa | 65.86Ab | 71.93Aab | 19.61Bb | 29.44Aa | 21.98Aab | 6.22Aa | 4.70Ba | 6.09Aa |
|  | N60 | 22.09Ba | 26.64Aa | 23.82Aa | 73.33Aa | 66.95Aa | 72.84Aa | 19.75Ba | 26.67Aa | 21.00Aa | 6.92Aa | 6.38Aa | 6.16Aa |
|  | N180 | 25.38ABa | 25.72Aa | 21.96Aa | 67. 84Aa | 70.10Aa | 71.75Aa | 25.71Ba | 23.83Aa | 21.27Aa | 6.45Aa | 6.06ABa | 6.98Aa |
|  | N300 | 29.85Aa | 25.63Aab | 23.19Ab | 58.83Bb | 70.44Aa | 68.29Aa | 35.04Aa | 23.73Ab | 24.57Ab | 6.13Aa | 5.83ABa | 7.14Aa |
| T5 | N30 | 27.61ABa | 32.12Aa | 27.94Aa | 67.55Aa | 61.93Aa | 68.43Aa | 26.65ABa | 33.75Aa | 26.15Aa | 5.80Aa | 4.32Bb | 5.42Aab |
|  | N60 | 26.86Ba | 30.75Aa | 29.50Aa | 69.28Aa | 63.09Aa | 64.71Aa | 24.95Ba | 31.18Aa | 29.94Aa | 5.77Aa | 5.73Aa | 5.35Aa |
|  | N180 | 29.71ABa | 30.54Aa | 28.02Aa | 64.23ABa | 66.33Aa | 64.58Aa | 29.60ABa | 28.05Aa | 28.97Aa | 6.16Aa | 5.61ABa | 6.45Aa |
|  | N300 | 31.99Aa | 30.72Aa | 28.25Aa | 57.22Ba | 65.42Aa | 65.85Aa | 36.31Aa | 29.42Aa | 28.19Aa | 6.47Aa | 5.16ABb | 5.96Aab |

At each water absorption time point, uppercase letters indicate significant differences (*P* < 0.05) between different nitrogen treatments within the same Cultivars, while lowercase letters indicate significant differences (*P* < 0.05) between cultivars under different nitrogen application levels, based on Duncan's Significant Studentized Range (SSR) test.