

**Table S1.** Statistical analysis including analysis of variance (degrees of freedom (df), F-values, and significance level) of the effect of year, irrigation level, potassium level, and their interaction on seed yield (SY), chlorophyll meter (Chlm), water use efficiency (WUE), and potassium use efficiency (KUE) of squash.

| S.O.V               | df | SY          | Chlm               | WUE      | KUE         |
|---------------------|----|-------------|--------------------|----------|-------------|
| Years (Y)           | 1  | 48113.42**  | 90.30**            | 0.0083** | 1.015604**  |
| Y x I               | 2  | 6105.46**   | 2.38**             | 0.0015** | 0.150039**  |
| Irrigation (I)      | 2  | 691059.89** | 502.08**           | 0.0087** | 18.577474** |
| Error a             | 12 | 353.47      | 0.33               | 0.00002  | 0.004479    |
| Potassium (P)       | 2  | 463405.39** | 197.51**           | 0.0659** | 0.823033**  |
| P x Y               | 2  | 12248.89**  | 53.62**            | 0.0011** | 0.285437**  |
| P x I               | 4  | 46303.68**  | 246.82**           | 0.0062** | 1.396281**  |
| P x Y x I           | 4  | 15485.07**  | 6.26 <sup>ns</sup> | 0.0031** | 0.339156**  |
| Error b             | 24 | 639.84      | 2.76               | 0.0001   | 0.020172    |
| Irrigation LSD 0.05 |    | 13.222      | 0.406              | 0.003    | 0.047       |
| Potassium LSD 0.05  |    | 15.829      | 1.143              | 0.007    | 0.098       |
| Irrg. x K LSD 0.05  |    | 27.417      | 1.980              | 0.012    | 0.169       |

**Table S2** Statistical analysis including analysis of variance (degrees of freedom (df), F-values, and significance level) of the effect of year, irrigation level, potassium level, and their interaction on spectral indices of squash.

| S.O.V               | df | NDI780, 550 | NCI        | NDI 970, 670 | NWI-1970,900           | NWI-3970,880           | NWI-3970,920           |
|---------------------|----|-------------|------------|--------------|------------------------|------------------------|------------------------|
| Years (Y)           | 1  | 0.026424**  | 0.015413** | 0.023222**   | 0.007824**             | 0.009480**             | 0.003279**             |
| Y x I               | 2  | 0.021600**  | 0.003096** | 0.004470**   | 0.000121**             | 0.000135**             | 0.000110**             |
| Irrigation (I)      | 2  | 0.330337**  | 0.053295** | 0.070716**   | 0.000176**             | 0.000199**             | 0.000134**             |
| Error a             | 17 | 0.000178    | 0.000257   | 0.000293     | 0.000003               | 0.000003               | 0.000002               |
| Potassium (P)       | 2  | 0.031284**  | 0.011606** | 0.013757**   | 0.000087**             | 0.000074**             | 0.000088**             |
| P x Y               | 2  | 0.014465**  | 0.004501*  | 0.006312*    | 0.000000 <sup>ns</sup> | 0.000000 <sup>ns</sup> | 0.000002 <sup>ns</sup> |
| P x I               | 4  | 0.088057**  | 0.036793** | 0.046715**   | 0.000060**             | 0.000070**             | 0.000047**             |
| P x Y x I           | 4  | 0.011555**  | 0.007669** | 0.009892**   | 0.000084**             | 0.000102**             | 0.000072**             |
| Error b             | 24 | 0.000714    | 0.001148   | 0.001272     | 0.000006               | 0.000006               | 0.000006               |
| Irrigation LSD 0.05 |    | 0.009       | 0.011      | 0.012        | 0.001                  | 0.001                  | 0.001                  |
| Potassium LSD 0.05  |    | 0.018       | 0.023      | 0.025        | 0.002                  | 0.002                  | 0.002                  |
| Irrg. x K LSD 0.05  |    | 0.032       | 0.040      | 0.043        | 0.003                  | 0.003                  | 0.003                  |

Cont. Table S2.

| S.O.V          | df | NDI558,646,708 | NDI538,708,648 | NDI558,644,708         | NDI744,746,738 | NDI704,580,712 | NDI704,712,582 |
|----------------|----|----------------|----------------|------------------------|----------------|----------------|----------------|
| Years (Y)      | 1  | 0.000304*      | 0.000347**     | 0.000138 <sup>ns</sup> | 0.000004**     | 0.000229**     | 0.000102**     |
| Y x I          | 2  | 0.000440**     | 0.000590**     | 0.000379**             | 0.000003**     | 0.000444**     | 0.000412**     |
| Irrigation (I) | 2  | 0.009278**     | 0.009629**     | 0.008211**             | 0.000085**     | 0.007729**     | 0.007670**     |
| Error a        | 17 | 0.000019       | 0.000020       | 0.000020               | 0.00000004     | 0.000005       | 0.000005       |
| Potassium (P)  | 2  | 0.000451**     | 0.000663**     | 0.000426**             | 0.000008**     | 0.000438**     | 0.000426**     |
| P x Y          | 2  | 0.001001**     | 0.001674**     | 0.000993**             | 0.000002**     | 0.000541**     | 0.000521**     |

|                     |    |                        |                        |                        |            |            |            |
|---------------------|----|------------------------|------------------------|------------------------|------------|------------|------------|
| P x I               | 4  | 0.000104 <sup>ns</sup> | 0.000020 <sup>ns</sup> | 0.000062 <sup>ns</sup> | 0.000016** | 0.001703** | 0.001640** |
| P x Y x I           | 4  | 0.000096 <sup>ns</sup> | 0.000073 <sup>ns</sup> | 0.000082 <sup>ns</sup> | 0.000001** | 0.000080** | 0.000077** |
| Error b             | 24 | 0.000041               | 0.000039               | 0.000041               | 0.0000001  | 0.000014   | 0.000014   |
| Irrigation LSD 0.05 |    | 0.003                  | 0.003                  | 0.003                  | 0.000      | 0.002      | 0.002      |
| Potassium LSD 0.05  |    | 0.004                  | 0.004                  | 0.004                  | 0.000      | 0.003      | 0.003      |
| Irrg. x K LSD 0.05  |    | 0.008                  | 0.007                  | 0.008                  | 0.000      | 0.004      | 0.004      |

Cont. Table S2.

| S.O.V               | df | NDI602,598,600         | NDI644,630,652         | NDI648,662,624         | NDI670,628,392         | NDI572,558,602         | NDI670,630,392         |
|---------------------|----|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| Years (Y)           | 1  | 0.000041**             | 0.000100**             | 0.002727**             | 0.007039**             | 0.000045**             | 0.012568**             |
| Y x I               | 2  | 0.000003**             | 0.000050**             | 0.000065**             | 0.001926**             | 0.000011 **            | 0.002137**             |
| Irrigation (I)      | 2  | 0.000004 **            | 0.000022**             | 0.000216**             | 0.017008**             | 0.000155**             | 0.017634**             |
| Error a             | 17 | 0.0000003              | 0.000001               | 0.000003               | 0.000155               | 0.000001               | 0.000159               |
| Potassium (P)       | 2  | 0.000014**             | 0.000120**             | 0.000642**             | 0.002794*              | 0.000020**             | 0.002955**             |
| P x Y               | 2  | 0.000004 <sup>ns</sup> | 0.000003 <sup>ns</sup> | 0.000016 <sup>ns</sup> | 0.000665 <sup>ns</sup> | 0.000007 <sup>ns</sup> | 0.000658 <sup>ns</sup> |
| P x I               | 4  | 0.000014**             | 0.000035**             | 0.000137**             | 0.000793 <sup>ns</sup> | 0.000013**             | 0.000792 <sup>ns</sup> |
| P x Y x I           | 4  | 0.000005*              | 0.000025*              | 0.000238**             | 0.000511 <sup>ns</sup> | 0.000006 <sup>ns</sup> | 0.000474 <sup>ns</sup> |
| Error b             | 24 | 0.000002               | 0.000006               | 0.000016               | 0.000504               | 0.000003               | 0.000499               |
| Irrigation LSD 0.05 |    | 0.0004                 | 0.001                  | 0.001                  | 0.009                  | 0.001                  | 0.009                  |
| Potassium LSD 0.05  |    | 0.001                  | 0.002                  | 0.003                  | 0.015                  | 0.001                  | 0.015                  |
| Irrg. x K LSD 0.05  |    | 0.001                  | 0.003                  | 0.005                  | 0.027                  | 0.002                  | 0.027                  |

Table S3. Ranking of the most significant spectral characteristics

| Variable | Spectral features | Top-level spectral features  |
|----------|-------------------|--|
| KUE      | a                 | R1066, R554, R1038, R562, R1006, R684, R938, R986, R538, R514, R902, R1026, R766, R890, R530, R1046, R934, R624, R988, R630, R936, R656, R704, R390, R648, R340, R364, R552, R338, R616  |
|          | b                 | NDI 538-708-648  |
|          | c                 | NDI538-708-648, R648, NDI558-646-708, R1026, R1046, R530, R934, R988, R656, R902, R936, R890, R704, R562, R630, R1038, R986, R554, R684, R538, R1066, R1006, NDI538-648-708, R616, R390, R514, R340, R364, R338, NDI558-708-646, R624  |
| SPAD     | a                 | R604, R974, R676, R504, R710, R712, R564, R996, R360, R1038, R456, R386, R696, R502, R358, R376, R330, R384, R388, R688  |
|          | b                 | NDI704-712-580, NDI704-712-582, NDI704-580-712   |
|          | c                 | NDI704-580-712, R376, NDI704-712-582, R604, R974, R676, R710, R712, R996, R502, R1038, R456, R358, R504, R386, R696, R564, R688, R360, R330, NDI744-738-746, R388, NDI704-712-580  |
| WUE      | a                 | R622, R1010, R970, R938, R1062, R960, R966, R728, R776, R758, R772, R1046, R586, R1074, R900, R742, R744, R902, R992, R462, R464, R600, R986, R974, R712, R784, R762, R476, R1044, R538, R950, R714, R616, R548, R948, R720, R888, R994, R946, R988, R936, R480, R366, R566, R1050, R358, R384, R696, R602, R976, R562, R964, R610, R546, R498, R1006, R926, R972, R930, R716, |

|       |   |   |
|-------|---|---|
|       |   | R754, R544, R896, R706, R962, R998, R778, R922, R1060, R1040, R1026, R710, R752, R990, R906, R1038, R624, R524, R444, R630, R620, R844, R644, R700, R608, R568, R910, R584, R846, R638, R558, R564, R494, R540, R658, R698, R574, R422, R952, R636, R996, R694, R556, R958, R1048, R646, R748, R594, R940, R496, R592, R656, R1066, R654, R522, R532, R686, R460, R1036, R516, R944, R1042, R626, R668, R760, R670, R932, R454, R500, R530, R580, R552, R676, R1032, R612, R550, R724, R652, R396, R492, R684, R510, R1072, R614, R650, R598, R542, R458, R690, R362, R344, R368, R440, R334, R394, R514  |
|       | b | NDI <sub>602-598-600</sub> , NDI <sub>602-600-598</sub> , NDI <sub>644-630-652</sub>  |
|       | c | R1038, R422, R952, R636, R996, R694, R556, R958, R574, R1048, R748, R594, R940, R496, R592, R656, R1066, R646, R654, R698, R540, R524, R444, R630, R620, R844, R644, R700, R658, R608, R910, R584, R846, R638, R558, R564, R494, R568, R522, R532, R686, R396, R492, R684, R510, R1072, R614, R650, R652, R598, R458, R690, R362, R344, R368, R440, R334, R542, R724, R550, R612, R460, R1036, R516, R944, R1042, R626, R668, R760, R670, R932, R454, R500, R530, R580, R552, R676, R1032, R624, R394, R514, R990, R902, R992, R462, R464, R600, R986, R974, R744, R712, R762, R476, R1044, R538, R950, R714, R616, R784, R548, R742, R1074, NDI <sub>602-600-598</sub> , NDI <sub>644-652-630</sub> , NDI <sub>648-662-624</sub> , R622, R1010, R970, R938, R900, R1062, R966, R728, R776, R758, R772, R1046, R586, R960, R906, R948, R888, R972, R930, R716, R754, R544, R896, R706, R926, R962, R778, R922, R1060, R1040, R1026, R710, R752, R998, R720, R1006, R546, R994, R946, R988, R936, R480, R366, R566, R498, R1050, R384, R696, R602, R976, R562, R964, R610, R358, NDI <sub>602-598-600</sub> , NDI <sub>644-630-652</sub> |
|       | a | R676, R368, R342, R332, R326  |
| Yield | b | NDI <sub>670-630-392</sub>  |
|       | c | R676, R368, R342, R326, R332, NDI <sub>670-630-392</sub> , NDI <sub>670-392-628</sub>   |

The symbols a, b, and c indicate DT-based bands, 3D-RSIs, the aggregation of all spectral features, respectively.