**Suplementary material**

**Table S1**: Values of LOD score for the detected QTL and their respective positions for the first nine environments in Harrington x TR306 Barley Mapping Population, for the original data, predicted values by the standard AMMI model, and predicted values by the W-AMMI columns model.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|   |   | Data | AMMI | W-AMMI |
| Environments | Chromosomes | Location | LOD | Location | LOD | Location | LOD |
| AB92b | 1 | 146.6 | 3.32 | 186.2 | 0.99 | 186.2 | 1.92 |
| 2 | 0 | 1.46 | 195.4 | 3.94 | 195.4 | 3.72 |
| 3 | 59.656 | 1.57 | 147.9 | 4.93 | 147.9 | 9.32 |
| AB92c | 1 | 151.25 | 1.11 | 109.75 | 3.46 | 97.7 | 3.28 |
|  | 2 | 195.4 | 2.94 | 195.4 | 2.01 | 195.4 | 4.22 |
|   | 3 | 141.9 | 2.64 | 151.5 | 4.51 | 147.9 | 8.7 |
| AB93a | 2 | 205.4 | 3.12 | 201.7 | 3.98 | 195.4 | 3.27 |
|  | 3 | 147.9 | 4.87 | 443 | 8.48 | 147.9 | 9.34 |
|  | 4 | 124.8 | 6.57 | 124.8 | 3.02 | 124.8 | 3.02 |
|   | 7 | 151.25 | 3.05 | 38.6 | 5.18 | 38.6 | 4.34 |
| AB93b | 1 | 109.75 | 2.23 | 97.7 | 3.58 | 97.7 | 3.08 |
|  | 2 | 177.3 | 0.35 | 177.3 | 1.39 | 195.4 | 4.11 |
|   | 3 | 5.7 | 0.40 | 147.9 | 1.15 | 147.9 | 7.99 |
| AK93 | 2 | 195.4 | 0.78 | 195.4 | 1.26 | 195.4 | 4.34 |
|   | 3 | 151.5 | 2.92 | 151.5 | 3.74 | 147.9 | 9.46 |
| MB92 | 1 | 109.75 | 3.11 | 146.6 | 1.46 | 130.6 | 1.14 |
|  | 3 | 154.3 | 0.28 | 443 | 4.35 | 443 | 5.15 |
|  | 4 | 124.8 | 2.21 | 124.8 | 3.72 | 124.8 | 5.31 |
|  | 6 | 36.4 | 3.45 | 108.7 | 3.88 | 119.5 | 2.81 |
|   | 7 | 228.2 | 1.75 | 38.6 | 3.54 | 7 | 4.29 |
| MB93 | 3 | 443 | 5.06 | 154.3 | 2.58 | 443 | 4.17 |
|  | 4 | 124.8 | 3.40 | 124.8 | 5.97 | 124.8 | 6.71 |
|  | 6 | 108.7 | 1.25 | 119.5 | 4.15 | 119.5 | 2.10 |
|   | 7 | 21.4 | 3.50 | 7 | 5.27 | 3.8 | 5 |
| MO93  | 12347 | 82.374.3124.887.20 | 3.990.401.011.662.64 | 146.6201.7147.9124.838.6 | 1.522.694.193.123.81 | 130.6201.7443124.838.6 | 1.053.948.152.945.10 |
| ND92  | 23467 | 205.4124.8124.815947.7 | 1.230.432.971.811.66 | 201.7443124.8119.538.6 | 2.965.295.503.025.36 | 201.7443124.8119.542.8 | 4.279.254.301.515.58 |

**Table S2**: Values of LOD score for the detected QTL and their respective positions between the tenth and the sixteenth environments in Harrington x TR306 Barley Mapping Population, for the original data, predicted values by the standard AMMI model, and predicted values by the W-AMMI columns model.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|   |  | Original Data | AMMI | W-AMMI |
| Environments | Chromosomes | Location | LOD | Location | LOD | Location | LOD |
| ON92a | 2 | 121.05 | 1.75 | 201.7 | 2.01 | 201.7 | 3.01 |
|  | 3 | 17.2 | 0.92 | 443 | 4.90 | 443 | 4.81 |
|  | 4 | 124.8 | 3.40 | 124.8 | 3.90 | 124.8 | 3.77 |
|  | 6 | 119.5 | 3.08 | 96.6 | 2.58 | 119.5 | 3.20 |
|   | 7 | 135 | 3.58 | 38.6 | 5.69 | 38.6 | 4.48 |
| ON92b | 2 | 74.3 | 0.58 | 201.7 | 2.05 | 201.7 | 3.50 |
|  | 3 | 141.9 | 1.21 | 443 | 5.02 | 443 | 7.23 |
|  | 4 | 124.8 | 1.36 | 124.8 | 4.02 | 124.8 | 3.54 |
|  | 6 | 108.7 | 2.20 | 96.6 | 2.58 | 119.5 | 3.04 |
|   | 7 | 228.2 | 4.29 | 38.6 | 5.84 | 38.6 | 5.34 |
| ON93a | 1 | 3.4 | 6.30 | 146.6 | 1.41 | 3.4 | 1.82 |
|  | 3 | 133.4 | 1.29 | 443 | 4.77 | 443 | 4.12 |
|  | 4 | 124.8 | 4.27 | 124.8 | 5.6 | 124.8 | 3.56 |
|  | 6 | 159 | 0.97 | 96.6 | 2.56 | 119.5 | 3.32 |
|   | 7 | 159 | 4.12 | 38.6 | 5.42 | 38.6 | 4.30 |
| ON93b | 1 | 7.6 | 4.64 | 146.6 | 1.46 | 3.4 | 1.72 |
|  | 3 | 59.656 | 2.02 | 443 | 6.25 | 443 | 4.68 |
|  | 4 | 93.5 | 5.97 | 124.8 | 3.69 | 124.8 | 3.74 |
|  | 6 | 108.7 | 3.56 | 96.6 | 2.64 | 119.5 | 3.26 |
|   | 7 | 7 | 6.98 | 38.6 | 5.84 | 38.6 | 4.44 |
| PE92  | 3467 | 59.656124.8119.5131.1 | 1.093.135.465.91 | 443124.8119.57 | 4.595.653.014.90 | 443124.8119.57 | 5.446.142.29 |
| 5.36 |
| PE93  | 3467 | 0140.1108.77 | 0.696.144.928.84 | 443124.8119.57 | 3.136.174.055.33 | 443124.8119.57 | 4.826.581.936.39 |
| QC92 | 2 | 0 | 0.74 | 201.7 | 2.67 | 201.7 | 4.02 |
|  | 3 | 147.9 | 0.20 | 147.9 | 4.18 | 147.9 | 6.53 |
|  | 4 | 159 | 1.25 | 124.8 | 2.59 | 124.8 | 3.29 |
|   | 7 | 21.4 | 1.86 | 38.6 | 3.34 | 38.6 | 4.01 |

**Table S3**: Values of LOD score for the detected QTL and their respective positions for the last nine environments in Harrington x TR306 Barley Mapping Population, for the original data, predicted values by the standard AMMI model, and predicted values by the W-AMMI columns model.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|   |   | Original Data | AMMI | W-AMMI |
| Environments | Chromosomes | Location | LOD | Location | LOD | Location | LOD |
| QC93 | 3 | 138.2 | 3.29 | 138.2 | 4.33 | 138.2 | 4.91 |
|  | 4 | 124.8 | 2.38 | 124.8 | 5.31 | 124.8 | 6.31 |
|  | 6 | 119.5 | 1.56 | 108.7 | 3.86 | 119.5 | 2.15 |
|  | 7 | 3.8 | 5.24 | 7 | 6.15 | 7 | 5.95 |
| SK92a | 2 | 108 | 0.71 | 201.7 | 3.85 | 195.4 | 3.35 |
|  | 3 | 151.5 | 2.31 | 147.9 | 6.41 | 147.9 | 9.41 |
|  | 4 | 159.8 | 0.67 | 124.8 | 3.41 | 124.8 | 2.79 |
|  | 7 | 47.7 | 2.09 | 42.8 | 4.18 | 38.6 | 4.15 |
| SK92b | 2 | 90.1 | 0.38 | 195.4 | 3.69 | 195.4 | 4.37 |
|   | 3 | 147.9 | 3.41 | 147.9 | 4.47 | 147.9 | 8.57 |
| SK92c | 1 | 160.4 | 1.34 | 97.7 | 2.45 | 97.7 | 4.46 |
|  | 2 | 177.3 | 0.71 | 195.4 | 0.55 | 195.4 | 3.69 |
|  | 3 | 151.5 | 0.31 | 17.2 | 0.42 | 147.9 | 7.01 |
|   | 6 | 77.5 | 3.18 | 15.2 | 1.99 | 77.5 | 2.25 |
| SK92d | 1 | 66.3 | 4.16 | 97.7 | 1.98 | 97.7 | 2.41 |
|  | 2 | 177.3 | 0.22 | 195.4 | 2.42 | 195.4 | 4.04 |
|   | 3 | 133.4 | 2.05 | 147.9 | 2.75 | 147.9 | 7.09 |
| SK93a | 3 | 92.9 | 0.46 | 138.2 | 3.96 | 138.2 | 5.61 |
|  | 4 | 17.8 | 4.87 | 124.8 | 5.76 | 124.8 | 5.98 |
|  | 5 | 143.7 | 5.48 | 143.7 | 1.62 | 143.7 | 0.93 |
|  | 6 | 36.4 | 0.70 | 119.5 | 3.26 | 119.5 | 2.32 |
|   | 7 | 3.8 | 2.76 | 7 | 6.16 | 7 | 5.11 |
| SK93b | 3 | 120.1 | 1.11 | 138.2 | 5.01 | 138.2 | 5.37 |
|  | 4 | 17.8 | 0.36 | 124.8 | 5.77 | 124.8 | 6.04 |
|  | 6 | 119.5 | 2.27 | 119.5 | 3.09 | 119.5 | 2.42 |
|   | 7 | 38.6 | 2.22 | 38.6 | 5.19 | 7 | 5.22 |
| SK93c | 1 | 160.4 | 2.94 | 97.7 | 4.11 | 97.7 | 4.75 |
|  | 2 | 130.9 | 1.78 | 195.4 | 1.86 | 195.4 | 3.73 |
|  | 3 | 147.9 | 2.42 | 147.9 | 1.59 | 147.9 | 7.68 |
| WA93 | 2 | 195.4 | 2.45 | 195.4 | 3.44 | 195.4 | 4.12 |
|  | 3 | 120.1 | 1.27 | 147.9 | 4.34 | 147.9 | 5.45 |
|  | 5 | 78.2 | 3.49 | 159.9 | 1.65 | 114.7 | 2.05 |
|  | 6 | 96.6 | 4.33 | 77.5 | 1.70 | 77.5 | 1.92 |