**Table S3** Correlation coefficients for kernel traits in different environments

kernel length

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 　 | 2017CZ | 2017YA | 2018CZ | 2018YA | 2019CZ | 2019WJ | BLUP |
| 2017CZ | 1 | 　 | 　 | 　 | 　 | 　 | 　 |
| 2017YA | 0.61\*\* | 1 | 　 | 　 | 　 | 　 | 　 |
| 2018CZ | 0.67\*\* | 0.45\*\* | 1 | 　 | 　 | 　 | 　 |
| 2018YA | 0.63\*\* | 0.38\*\* | 0.60\*\* | 1 | 　 | 　 | 　 |
| 2019CZ | 0.61\*\* | 0.37\*\* | 0.65\*\* | 0.54\*\* | 1 | 　 | 　 |
| 2019WJ | 0.66\*\* | 0.39\*\* | 0.74\*\* | 0.63\*\* | 0.69\*\* | 1 | 　 |
| BLUP | 0.85\*\* | 0.62\*\* | 0.86\*\* | 0.82\*\* | 0.80\*\* | 0.86\*\* | 1 |

kernel width

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 　 | 2017CZ | 2017YA | 2018CZ | 2018YA | 2019CZ | 2019WJ | BLUP |
| 2017CZ | 1 | 　 | 　 | 　 | 　 | 　 | 　 |
| 2017YA | 0.31\*\* | 1 | 　 | 　 | 　 | 　 | 　 |
| 2018CZ | 0.26\*\* | 0.31\*\* | 1 | 　 | 　 | 　 | 　 |
| 2018YA | 0.17 | 0.25\* | 0.45\*\* | 1 | 　 | 　 | 　 |
| 2019CZ | 0.46\*\* | 0.32\*\* | 0.43\*\* | 0.41\*\* | 1 | 　 | 　 |
| 2019WJ | 0.24\* | 0.30\*\* | 0.14 | 0.12 | 0.35\*\* | 1 | 　 |
| BLUP | 0.61\*\* | 0.60\*\* | 0.62\*\* | 0.69\*\* | 0.77\*\* | 0.56\*\* | 1 |

kernel thickness

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 　 | 2017CZ | 2017YA | 2018CZ | 2018YA | 2019CZ | 2019WJ | BLUP |
| 2017CZ | 1 | 　 | 　 | 　 | 　 | 　 | 　 |
| 2017YA | 0.11 | 1 | 　 | 　 | 　 | 　 | 　 |
| 2018CZ | 0.43\*\* | 0.20\* | 1 | 　 | 　 | 　 | 　 |
| 2018YA | 0.32\*\* | 0.19\* | 0.52\*\* | 1 | 　 | 　 | 　 |
| 2019CZ | 0.41\*\* | 0.08 | 0.35\*\* | 0.37\*\* | 1 | 　 | 　 |
| 2019WJ | 0.35\*\* | 0.08 | 0.39\*\* | 0.30\*\* | 0.33\*\* | 1 | 　 |
| BLUP | 0.64\*\* | 0.39\*\* | 0.77\*\* | 0.77\*\* | 0.60\*\* | 0.64\*\* | 1 |

thousand kernel weight

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 　 | 2017CZ | 2017YA | 2018CZ | 2018YA | 2019CZ | 2019WJ | BLUP |
| 2017CZ | 1 | 　 | 　 | 　 | 　 | 　 | 　 |
| 2017YA | 0.41\*\* | 1 | 　 | 　 | 　 | 　 | 　 |
| 2018CZ | 0.44\*\* | 0.41\*\* | 1 | 　 | 　 | 　 | 　 |
| 2018YA | 0.33\*\* | 0.31\*\* | 0.39\*\* | 1 | 　 | 　 | 　 |
| 2019CZ | 0.35\*\* | 0.25\*\* | 0.48\*\* | 0.25\* | 1 | 　 | 　 |
| 2019WJ | 0.38\*\* | 0.43\*\* | 0.51\*\* | 0.25\* | 0.42\*\* | 1 | 　 |
| BLUP | 0.69\*\* | 0.61\*\* | 0.77\*\* | 0.68\*\* | 0.67\*\* | 0.72\*\* | 1 |

kernel length/kernel width

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 　 | 2017CZ | 2017YA | 2018CZ | 2018YA | 2019CZ | 2019WJ | BLUP |
| 2017CZ | 1 | 　 | 　 | 　 | 　 | 　 | 　 |
| 2017YA | 0.23\* | 1 | 　 | 　 | 　 | 　 | 　 |
| 2018CZ | 0.03 | 0.55\*\* | 1 | 　 | 　 | 　 | 　 |
| 2018YA | 0.42\*\* | 0.10 | 0.03 | 1 | 　 | 　 | 　 |
| 2019CZ | 0.28\*\* | 0.05 | 0.36\*\* | 0.31\*\* | 1 | 　 | 　 |
| 2019WJ | 0.03 | 0.45\*\* | 0.67\*\* | 0.01 | 0.19\* | 1 | 　 |
| BLUP | 0.14 | 0.25\*\* | 0.50\*\* | 0.34\*\* | 0.28\* | 0.33\*\* | 1 |

kernel size

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 　 | 2017CZ | 2017YA | 2018CZ | 2018YA | 2019CZ | 2019WJ | BLUP |
| 2017CZ | 1 | 　 | 　 | 　 | 　 | 　 | 　 |
| 2017YA | 0.08 | 1 | 　 | 　 | 　 | 　 | 　 |
| 2018CZ | -0.01 | 0.32\* | 1 | 　 | 　 | 　 | 　 |
| 2018YA | 0.19\* | 0.07 | 0.05 | 1 | 　 | 　 | 　 |
| 2019CZ | 0.17 | 0.12 | 0.32\*\* | 0.28\*\* | 1 | 　 | 　 |
| 2019WJ | 0.02 | 0.24\*\* | 0.31\*\* | 0.04 | 0.26\*\* | 1 | 　 |
| BLUP | 0.23 | 0.22\* | 0.41\*\* | 0.28\*\* | 0.50\*\* | 0.15 | 1 |

factor form density

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 　 | 2017CZ | 2017YA | 2018CZ | 2018YA | 2019CZ | 2019WJ | BLUP |
| 2017CZ | 1 | 　 | 　 | 　 | 　 | 　 | 　 |
| 2017YA | 0.31\*\* | 1 | 　 | 　 | 　 | 　 | 　 |
| 2018CZ | 0.22\* | 0.35\*\* | 1 | 　 | 　 | 　 | 　 |
| 2018YA | 0.29\*\* | 0.01 | 0.25\* | 1 | 　 | 　 | 　 |
| 2019CZ | 0.14 | 0.12 | 0.19\* | 0.13 | 1 | 　 | 　 |
| 2019WJ | 0.26\* | 0.39\*\* | 0.49\*\* | 0.21 | 0.18 | 1 | 　 |
| BLUP | 0.56\*\* | 0.50\*\* | 0.65\*\* | 0.59\*\* | 0.64\*\* | 0.66\*\* | 1 |

\* Correlation is significant at the 0.05 level, \*\* Correlation is significant at the 0.01 level.