Fusarium head blight monitoring in wheat ears using machine learning and multimodal data during asymptomatic to symptomatic periods

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| --- | --- | --- | --- | --- |
|  | **Year** | **Cultivars** | **Number of pots** | **Data type** |
| Exp. 1 | 2019–2020 | Aikang-58 and Sumai-3 | 24 | Hyperspectral reflectance  Chlorophyll fluorescence imaging |
| Exp. 2 | 2020–2021 | Aikang-58 and Sumai-3 | 24 | Hyperspectral reflectance  Chlorophyll fluorescence imaging |
| Exp. 3 | 2020–2021 | Aikang-58, Bainong-418, Zhongyou-9507, Jimai-31, Wenmai-6, Chianmai-42, Huangpei-R4, and Sumai-3 | 56 | High throughput phenotyping |

**Table S1** Detail of the plant material

**Table S2** Spectral chlorophyll related indices selected for fusarium head blight detection and estimation in current study

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Chlorophyll indices** | **Abbreviations** | **Formulas** | **References** |
| **1** | Reciprocal Reflectance | RR |  | Gitelson et al. (1999) |
| **2** | Modified Red-edge Ratio | mSR | (R750-R445)/(R705-R445) | Sims and Gamon (2002) |
| **3** | Pigment Specific Simple Ratio | PSSRa | R800/R675 | Blackburn (1998b) |
| **4** |  | PSSRb | R800/R650 | Blackburn (1999) |
| **5** | Ratio Analysis of Reflectance Spectra | RARSa | R675/R700 | Chappelle et al. (1992) |
| **6** |  | RARSb | R675/(R675×R700) |
| **7** | Normalized Difference Vegetation Index | NDVI | (R800-R670)/(R800+R670) | Rouse et al. (1974) |
| **8** | Red-edge NDVI | mNDVI | (R750-R705)/  (R750+R705) | Gitelson and Merzlyak (1994) |
| **9** | Modified Red-edge Normalized Difference Vegetation Index | mNDI | (R750-R705)/(R750-R705-2R445) | Sims and Gamon (2002) |
| **10** | Pigment Specific Normalized Difference | PSNDa | (R800-R675)/  (R800+R675) | Blackburn (1998a) |
| **11** |  | PSNDb | (R800-R650)/  (R800+R650) |
| **12** |  | PSNDc | (R800-R470)/  (R800+R470) |
| **13** | Macc01 | Macc01 | (R780-R710)/(R780-R680) | Maccioni et al. (2001) |
| **14** | The MERIS terrestrial chlorophyll ind | MTCI | (R754-R709)/(R709-R681) | Dash and Curran (2004) |
| **15** | DATT | DATT | (R850-R710)/(R850-R680) | Datt (1998) |
| **16** | Modified DATT | MDATT | (R721-R744)/(R721-R714) | Datt (1999) |
| **17** | Vogelmann indices | VOG1 | R740/R720 | Vogelmann et al. (1993) |
| **18** |  | VOG2 | (R734-747)/(R715-726) |
| **19** |  | VOG3 | (R734-R747)/(R715+R720) |
| **20** | Gitelson & Merzlyak indices | GM1 | R750/R550 | Gitelson and Merzlyak (1996) |
| **21** |  | GM2 | R750/R700 |
| **22** | Transformed Chlorophyll Absorption in Reflectance Index | TCARI | 3×[(R700-R670)-0.2×(R700-R550)× (R700/R670)] | Haboudane et al. (2002) |
| **23** | Chlorophyll Index Red Edge | CI | R750/R710 |
| **24** | Simple Ratio Pigment Index | SRPI | R430/R680 | Penuelas et al. (1995) |
| **25** | Normalized Pigments Index | NPCI | (R680-R430)/(R680+R430) |
| **26** | Carter indices | CTRI1 | R695/R420 | Carter (1994) |
| **27** |  | CAR | R695/R760 |
| **28** | Reflectance band ratio indices | DCabCxc | R672/(R550×3R708) | Datt (1998) |
| **29** |  | NDIRCabCxc | R860/(R550×R708) |
| **30** | Structure-Intensive Pigment Index | SIPI | (R800-R445)/(R800+R680) | Penuelas et al. (1995) |
| **31** | ChlRE opt | ChlRE opt | (1/R680-730-1/R780-800)×R755-780 | Féret et al. (2011) |
| **32** | RI708,775 | RI708,775 | R708/R775 |
| **33** | ND780,712 | ND780,712 | (R780-R712)/(R780+R712) |
| **34** | Chlorophyll/carotenoid Index | CCI | (R531-R645)/(R531+R645) | Gamon et al. (2016) |

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