Plant Science into Practice

GENETICS OF WHEAT FLAG LEAF SIZE

Helping to breed better performing wheat

As flag leaf photosynthesis is a major driver of wheat yield, understanding the genetic control of flag leaf size could allow further optimisation of yield potential.

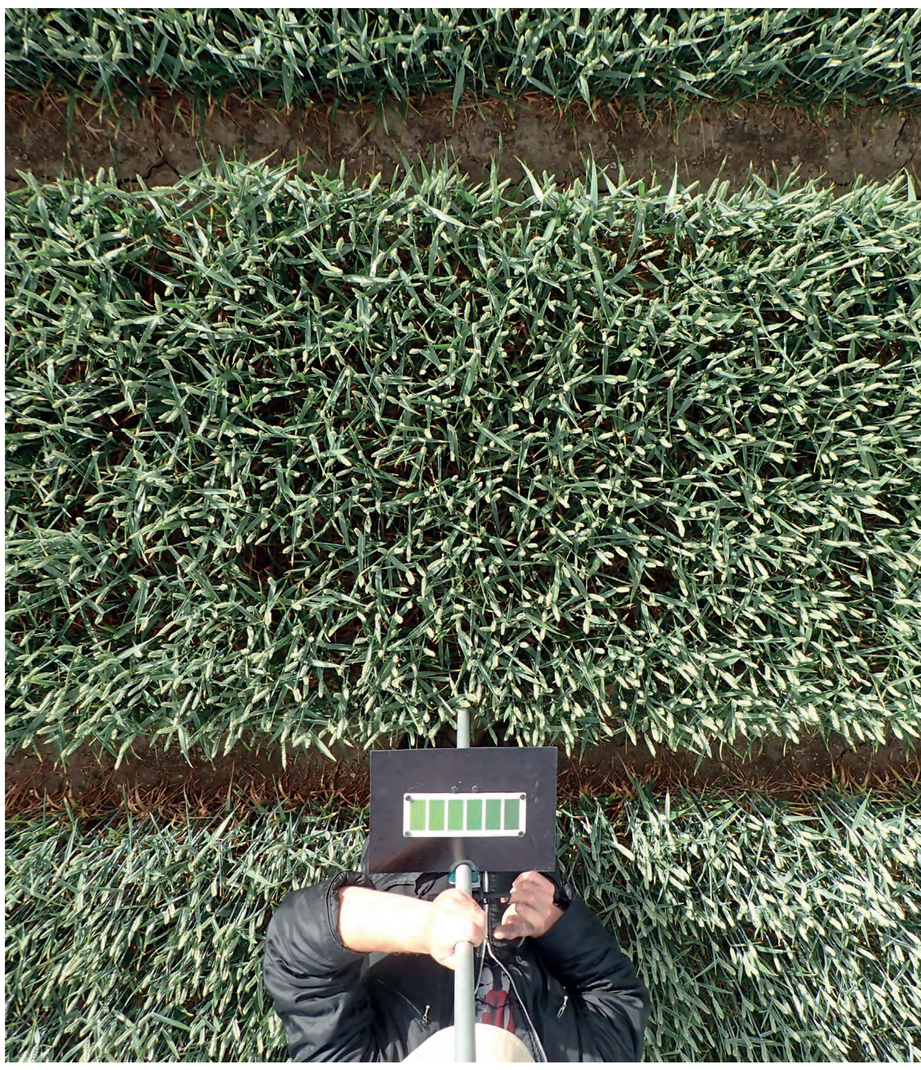
As part of a collaboration between NIAB, the University of Essex, and BASF, funded by the BBSRC, the flag leaf size was investigated in the NIAB 8-founder MAGIC Elite winter wheat population. The study identified a chromosomal region *QMfll.niab-5A.1* that controlled a 5-10% difference in flag leaf length.

A pair of wheat lines were developed (termed near isogenic lines or NILs) that were 95% genetically identical, but differed at *QMfll.niab-5A.1*. These are demonstrated in these plots at 2024 Cereals Event.

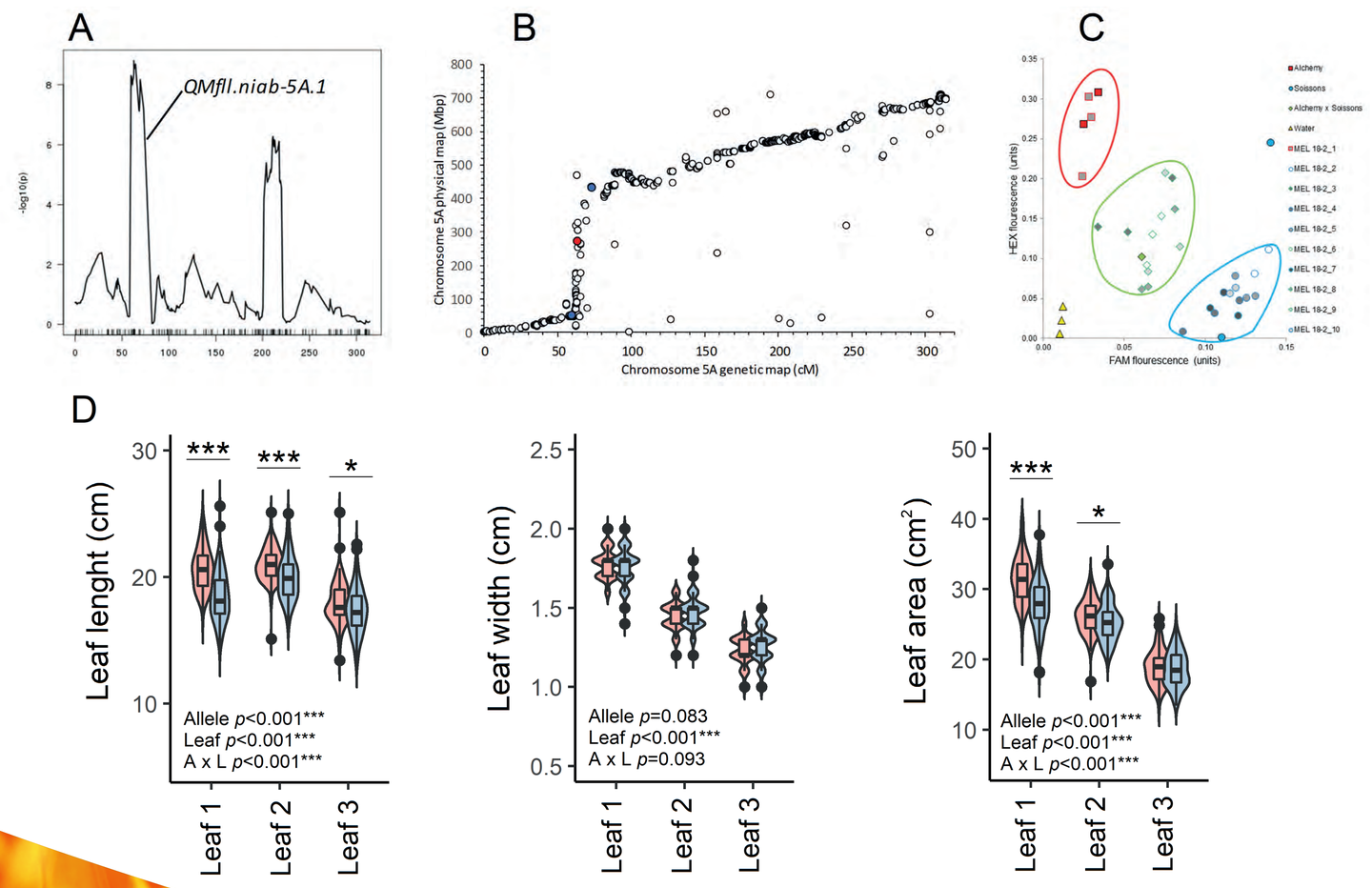
When these lines FLL5A+ (longer) and FLL5A- (shorter) were grown across multiple years and sites, it was found that leaves of FLL5A- had more numerous, but smaller, stomata than FLL5A+. Across a panel of modern varieties, the smaller FLL5A- variant is the more common, indicating possible trade-offs between leaf size and other associated traits such as stomata size.

This information can be used in combination with knowledge of the genetics underlying other grain yield traits to help design better performing wheat varieties in the future.

Assessing NILs in field trials



Investigating the genetic control of flag leaf size.
(A) Localisation of *QMfll.niab-5A.1* to chromosome 5A.
(B) This is located in a region showing low recombination.
(C) Genetic markers were developed to distinguish between the long (FLL5A+) and short (FLL5A-) flag leaf length variants.
(D) Assessment of NILs FLL5A+ (red) and FLL5A- (blue) over multiple years and sites confirm that *QMfll.niab-5A.1* controls the length of the flag leaf (Leaf 1) and subsequent leaves in the canopy (Leaf 2, Leaf 3), resulting in changes in total leaf area



It's MAGIC

The NIAB Multi-parent Advanced Generation Inter-Cross, known as MAGIC, wheat populations brought together eight different parents in a complex crossing scheme that took three generations to assemble. It mixed up the genes from different parents much more than normal crossing. In comparison with conventional two parent plant breeding, MAGIC encompasses more genetic diversity from eight varieties. Over 1,000 new wheat lines were developed and, over 10 years later, are still being used to study the traits that make wheat such a high yielding crop.

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