BioNano genome map of wheat chromosome arm 7DS supports accurate sequence assembly

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Specific features of the bread wheat genome, such as its size (17 Gbp), polyploid nature and prevalence of repetitive sequences make whole-genome-sequencing a challenge. BAC-by-BAC sequencing based on chromosomal physical maps, which has been adopted by the International Wheat Genome Sequencing Consortium as the key strategy, reduces problems due to the complexity and polyploidy. However, high content of repeats (over 80%) still prevents unambiguous sequence assembly, both on a small (BAC clones) as well as large (whole chromosomes) scale. Availability of a high-resolution genomic map that would reveal discrepancies in sequence assemblies and provide a clue for sequence scaffolding would be highly beneficial for obtaining an accurate and complete genome sequence in wheat.

Aiming to produce a quality reference genome sequence of the short arm of chromosome 7D (7DS), we constructed de novo genome map of the 7DS arm using BioNano IRYS platform. The mapping was based on direct visualization of sequence motifs (7-bp recognition sites of Nt.BspQI nickase) on single DNA molecules hundreds to thousands of kilobases in length that were prepared from flow-sorted 7DS arm. High frequency of Nt.BspQI recognition sites (~13 nicks per 100 kb wheat DNA) together with high integrity of the chromosomal DNA enabled construction of a high-resolution map covering 92% of the estimated arm length. The map consists of 371 fragments with average length of 0.9 Mb and N50 of 1.3 Mb. The genome map has been anchored to available sequence assemblies of 7DS BAC clones obtained from Illumina pair-end sequencing. Anchoring the 7DS map to a contiguous sequence of ~700 kb indicated several discrepancies between the BAC assemblies and the BioNano map which provided suggestions for assembly improvement. Analysis of 67 assembled BAC clones across the 7DS arm is underway to verify both the clone assemblies and the genome map. Hitherto obtained results suggest that the BioNano maps derived from individual wheat chromosomes/arms will become an affordable tool to support sequence assembly and scaffolding and lead to the production of improved pseudomolecules.

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