

## Axiom<sup>®</sup> Rose Genotyping Array

### Axiom Rose Genotyping Array accelerates quantitative trait loci (QTL) discovery and haplotype-assisted selection in tetraploid cut rose and garden rose cultivars

Axiom<sup>®</sup> Rose Genotyping Array (WagRhSNP Axiom Array) was designed through Affymetrix<sup>®</sup> Expert Design Program in collaboration with Wageningen UR Plant Breeding, Wageningen, The Netherlands, and Institute for Plant Genetics, Leibnitz University, Hannover, Germany.

The array offers a total of 68,893 SNPs selected from tetraploid cut rose and garden rose cultivars.<sup>1</sup>

#### Applications

##### Complex trait research:

- Polyploid linkage maps
- Identification of multi-SNP haplotypes in progenies and breeding material
- QTL analysis for discovery of marker haplotypes associated with important phenotypic traits such as disease resistance

##### Molecular breeding:

- Haplotype-assisted selection and haplotype-informed choice of crossing parents
- Accelerate and increase efficiency of cultivar development

##### SNP discovery

SNP discovery<sup>2</sup> was facilitated by transcriptome sequencing of flowers and leaves of the parents of two segregating F1 populations and several garden rose cultivars. SNP discovery and selection included the following steps:

- *De novo* assembly of each parent
- Assembly of a consensus transcriptome
- Reads of each parent mapped against the consensus transcriptome
- Identification of reliable SNPs, i.e., with sufficient read depth for the minor allele and 35 bp flanking sequence without SNPs
- Transcripts blasted against the Genome Database for Rosaceae for annotation to avoid splicing sites
- SNP identification was performed using QualitySNP (<http://www.bioinformatics.nl/tools/snpweb/>).

A total of 68,983 SNPs were selected for inclusion on Axiom Rose Genotyping Array.

#### Experimental results

A total of 672 samples were genotyped with Axiom Rose Genotyping Array.<sup>3</sup> These included:

- 96 samples representing the two tetraploid mapping populations
- 96 samples representing the tetraploid cut rose population K5
- 96 samples representing tetraploid garden roses
- 384 samples across 13 species varying in ploidy level from diploid (2x) to pentaploid (5x)

Axiom Rose Genotyping Array requires advanced analysis using fitTetra, an R package for assigning auto-tetraploid genotype scores.<sup>4</sup> The genotyping software fitTetra enables automated genotype calling in tetraploid species, which results in the scoring of the five alternative genotypes (aaaa, baaa, bbaa, bbba, and bbbb; nulliplex to quadruplex).

**Figure 1:** The typical graphical output of fitTetra is a histogram of the measured ratios of the two signals: (allele a)/(allele a + allele b), with the model that is fitted to the observed ratios superimposed as a green line.

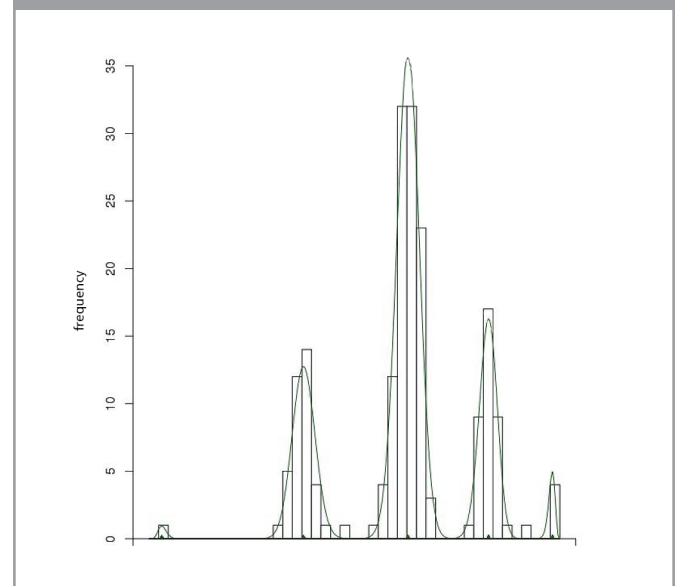
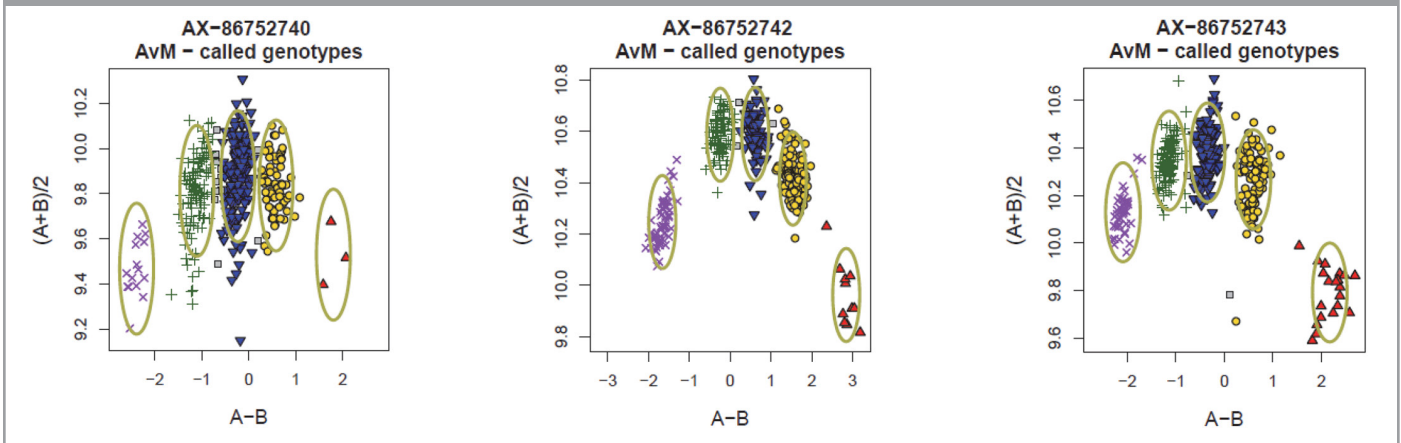


Figure 2: The cluster plots below show patterns that were observed in the data generated on Axiom® Rose Genotyping Array. Rose is an auto-tetraploid plant and typically exhibits five genotype clusters.



## References

1. Koning-Boucoiran, *et al.* The mode of inheritance in tetraploid cut roses. *Theoretical and Applied Genetics* **125**(3):591–607 (2012).
2. Smulders M., *et al.* Towards a large Axiom® Genotyping Array for tetraploid rose, *2012 Conference Next- Generation Plant Breeding, 2012-11-11/ 2012-11-14, Poster* (2012).
3. Smulders M. Genetic analysis of tetraploid F1 rose populations based on the Rose Axiom® SNP Array. *The VI International Symposium on Rose Research and Cultivation, oral presentation* (2013).
4. Voorrips R. E., Gort G., Vosman B. Genotype calling in tetraploid species from bi-allelic marker data using mixture models. *BMC Bioinformatics* **12**:172 (2011).

## Ordering information

Part number	Product name	Description
550450	Axiom® Rose Genotyping Array (WagRhSNP array)	Contains one plate with 96 arrays. Reagents and GeneTitan® MC consumables must be quoted separately.
901606	Axiom® GeneTitan® Consumables Kit	Contains all GeneTitan® Instrument consumables required to process one array plate
901758	Axiom® 2.0 Reagent Kit	Includes all reagents (except isopropanol) for processing 96 DNA samples

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