

Mapping genes and QTLs associated with flavour and texture in potatoes



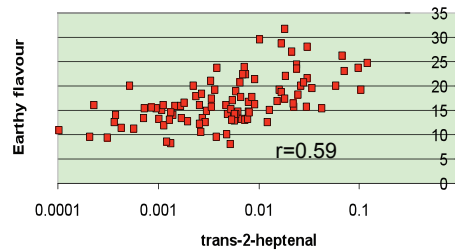
Lloyd D, Ramsay G, Hackett C, Taylor M and Bryan G

Introduction

Potato flavour and texture are traits of increasing importance as drivers of consumer choice. Previous efforts to identify genetic factors influencing such traits have suffered from a lack of variation among commercial varieties. We have expanded the phenotypic variability by use of our unique population of long-day adapted diploid *Solanum phureja* clones, known to possess strong flavours as well as unusual textural properties.

Correlation of volatile compounds with sensory attributes

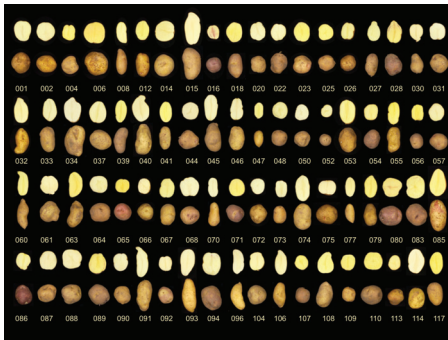
The FT4 population was profiled for headspace volatiles in cooked tuber tissue. Volatiles were entrained on Tenax-TA polymer and analysed by ATD GC-MS. A number of correlations were found with organoleptic attributes, most notably between lipid oxidation products such as aldehydes and flavour and aroma characteristics.



Correlation of earthy flavour and trans-2-heptenal content in headspace

Population development

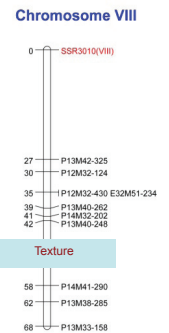
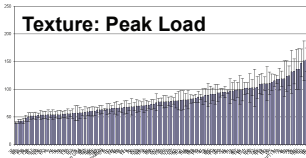
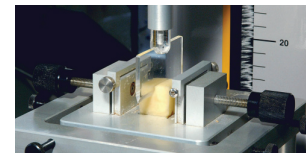
Hybrid clones resulting from an initial cross between diploid *S. tuberosum* clone 2DH40 and *S. phureja* clone DB337(37) (the variety Mayan Gold) were used in backcrosses to both parents. One of the four hybrid populations (FT.4) was taken forward for genetical studies of sensory and volatile characteristics of potato. A sample of tubers from different clones of the FT.4 population is shown in the figure below.



Texture analysis of cooked tuber tissue

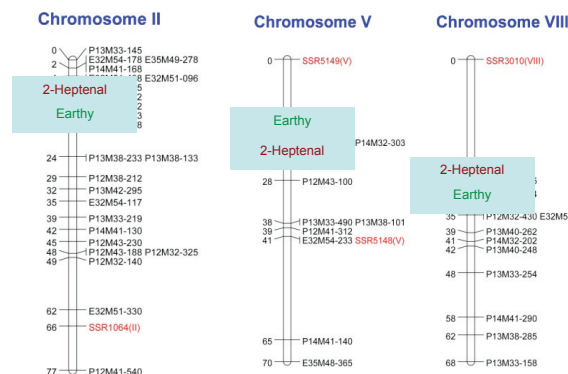
Texture was quantitatively analysed, measuring the amount of force required to pass an acrylic probe through cooked tuber tissue, replicating a "biting" action. Some season to season variability has been observed, indicating a gene by environment effect, a significant QTL has been found on chromosome 8.

While no direct correlations have been found between these texture measurements and sensory attributes, a preliminary study has indicated a correlation with Pectin Methyltransferase expression, known from microarray analysis to be differentially expressed between tuberosum and phureja varieties.



QTL analysis of volatile and sensory data

The FT4 population had previously been subjected to linkage analysis, in which a genetic map was constructed using around 250 molecular markers (AFLPs and SSRs). Volatile and sensory data were then subjected to Kruskal-Wallis Quantitative Trait Loci (QTL) analysis, revealing more than 100 significant QTLs, a number of them co-segregating, suggesting possible causative linkages.



Co-segregation of QTLs for earthy flavour and trans-2-heptenal on chromosomes II, V and VIII

Summary

QTLs for volatiles, texture and sensory traits have been identified for the first time in potatoes. Some QTLs for volatiles co-segregate with sensory traits, indicating possible causative linkages. This, along with further, on-going biochemical analyses will pave the way for the identification of candidate genes and other functional studies.