UNDERSTANDING AND IMPROVING SENSORY CHARACTERISTICS IN POTATO

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BACKGROUND

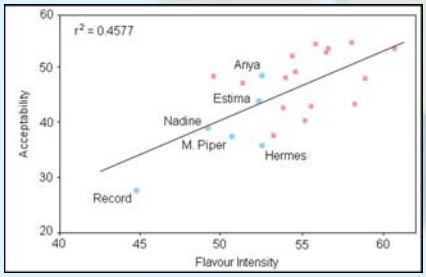
In potato, selection for organoleptic traits (flavour, odour and mouth-feel), has been limited due to the small amount of variation for these characteristics between *Solanum tuberosum* varieties. In South America, varieties of the cultivated, diploid species *S. phureja* are prized because of the range of interesting sensory characteristics that they exhibit. To identify the differences in organoleptic attributes between these two species and to determine the extent of variation that exists, boiled potatoes of sixteen *S. phureja* clones and Record) were submitted to sensory and volatile and analyses. In order to obtain an understanding of the genetic control of organoleptic quality, crosses have been set-up between diploid *S. tuberosum* and *S. phureja*, and the F1s used to obtain backcross populations that will used for mapping. In addition to sensory and volatile analyses, these populations will be studied genetically using AFLPs and SSRs.

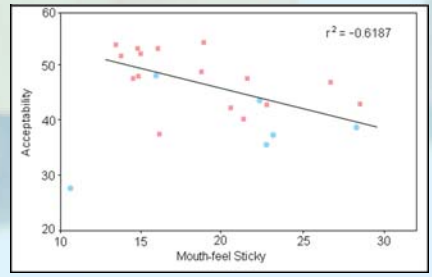
1. SENSORY ANALYSIS

A sensory panel of 15 tasters assessed the boiled potatoes of 16 *S. phureja* clones and six *S. tuberosum* varieties for twenty-two sensory attributes falling into five main categories: appearance, aroma, flavour, after-taste and mouth-feel. They were also scored for overall acceptability. Significant differences were observed between the two species for colour attributes (yellowness and whiteness) with Phureja potatoes possessing a more yellow flesh that Tuberosum potatoes. There was also a significant difference for acceptability and flavour intensity with *S. phureja* scoring more highly for these attributes.

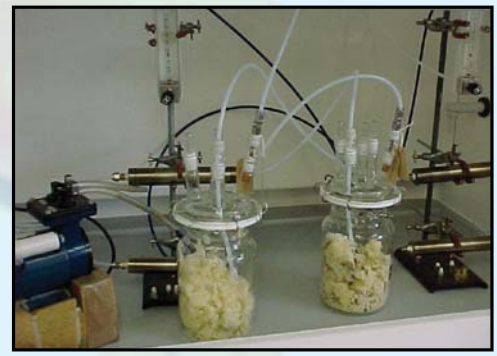
Ranking to acceptability, four of the six *S. tuberosum* varieties were in the bottom five. Anya, the *S. tuberosum* variety that received the highest score for acceptability, only ranked ninth. Record scored the poorest of all the potatoes studied.

Acceptability was strongly correlated with flavour intensity and creamy flavour, and was negatively correlated with metallic taste and after-taste and sticky mouth-feel.



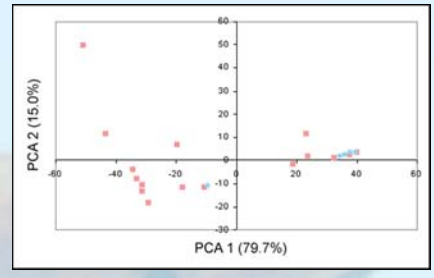


2. VOLATILE ANALYSIS



Analysis of headspace volatiles was performed by gas chromatography-Mass Spectrometry (GC-MS). To date, 68 compounds have been unambigiuosly identified in boiled potatoes.

Several compounds were significantly different between Phureja and Tuberosum. Given that, in sensory analysis, Phureja performed better than Tuberosum potatoes, we looked for compounds that distinguished the two types and also related to acceptabiity. No correlations were found. There were correlations between several compounds and earthiness (2,3-pentanedione, 2-pentanal, 2,4-octadienal, 2,4-heptadienal) and metallic (2-methylbutanol, pentanal, dimethyl disulphide, dimethyl trisulphide) flavour and after-taste.

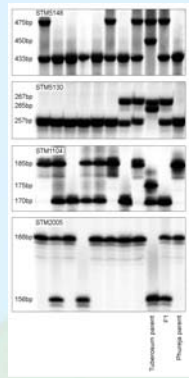


In principal component analysis, hexanal and α-copaene accounted for much of the variability of the first two axes. These two compounds separated out the two groups of potatoes with the mean for hexanal being higher in Phurejas and the mean for α-copaene being higher in Tuberosum cultivars. The compound α-copaene, although not correlating with acceptability, was positively correlated with intensity of aroma and flavour.

3. MOLECULAR ANALYSIS

Hierarchical cluster analysis of AFLP data derived from 30 clones of *S. phureja* (including the 16 clones used in the sensory and volatile studies), and on a small number of *S. tubersosum varieties,* showed the former to be distinct from the latter. The overall degree of variability in *S. phureja* may be less than that seen in *S. tuberosum*.

Molecular analysis, using 42 SSR markers, of the parents, F1 and a small subset of the backcross population, has confirmed parentage and allowed the selection of informative, polymorphic markers. Twenty-eight were polymorphic and six were monomorphic. Eight primer pairs amplified poorly or gave no amplification at all. The two parents and the F1 were included in the trial. No bands were inconsistent with the stated parentage.
Segregation of the target characters in these crosses should enable us to gain an understanding of the genetic and biochemical control of flavour and mouth-feel characteristics in potato.



AIMS OF PROJECT

The scientific objective of the project is to gain a fundamental understanding of the genetic and biochemical control of flavour characteristics in potato using the variation found in *S. phureja* potatoes. The commercial objectives are the generation of Phureja potato products with consumer appeal, improved Tuberosum breeding material carrying desirable Phureja flavour and mouth-feel characteristics, and the development of molecular and biochemical markers that can be used for marker-assisted breeding (MAB). Backcross populations from *S. tuberosum-S. phureja* hybrids have been established to provide mapping resources for sensory, volatile and metabolite attributes. Genetic analysis of the target characters in these crosses should enable us to gain an understanding of the genetic and biochemical control of flavour and mouthfeel characteristics in potato.

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