Comparison of tuber proteomes of potato (Solanum sp.) varieties, landraces and genetically modified lines

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Background

Crop improvement by genetic modification is still controversial. One of the major issues is the potential for unintended effects. Comparative safety assessment includes targeted analysis of key nutrients and anti-nutritional factors but broader scale profiling or "omics" methods could increase the chances of detecting unintended effects. Comparative assessment should consider the extent of natural variation and not simply compare genetically modified (GM) lines and parental controls.

The aim of this work was to provide an insight into the extent of variation in potato tuber proteome by analysing a large selection of potato genotypes. In addition, several previously characterised GM potato lines were studied for possible unintended effects.

Materials

A total of 32 non-GM potato genotypes:

• 21 cultivars of tetraploid potato (S. tuberosum)
• eight landraces
• three diploid genotypes of S. phureja

10 GM potato lines, including vector-only and wild type controls

Two-dimensional electrophoresis of potato genotypes

The expression of 1077 individual protein spots out of 1111 was significantly different among the non-GM genotypes. A total of 1932 spots were detected in all genotypes.

Results

Only nine proteins out of 730 showed significant differences between GM lines or their controls. There was no clear separation between any of the lines in principal component analysis.

Furthermore, cv. Maris Piper and S. phureja were clearly separated from each other and from all GM and non-GM Desirée samples, while no separation was observed between wild-type Desirée and transformed lines.

Conclusions

• Genotypic variation was extensive; most of the proteins detected showed differences between varieties and landraces
• The effects of transformation on the proteome were much less clear
• Proteomic screening can provide much more information on crop composition than targeted analysis alone

References


Figure 1. Two-dimensional gel electrophoresis images of tuber proteins of a range of potato genotypes. A: cv. Desirée; B: cv. Maris Piper; C: landrace accession TBR3369 (1); D: S. phureja accession PHU4637 (1).