



# Production of platform chemicals in plants: lysine and itaconic acid

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## Introduction

In many industrialized countries there is a growing consciousness about the diminishing fossil resources, and that it is preferable for economical, environmental and social reasons to make use of bio fuel and chemical building blocks from more durable resources, such as plants. This research project is focusing on the development of the production of high value base chemicals by plants.

## Results

Plants present a good production platform for compounds that contain in combination with C and H (such as the typical petrochemical compounds) also N and O, because functionalizing of petrochemical carbon hydrates is chemically very difficult and energetically very costly. Several plant compounds can form a link between agriculture and chemistry, such as organic acids and amino acids. When these chemicals can be produced in crops to a relatively high extent, without hindering the production of the main product (e.g. sugar or starch), and without interfering with the extraction process of the main product, these chemicals can be produced much cheaper compared to production by fermentation.

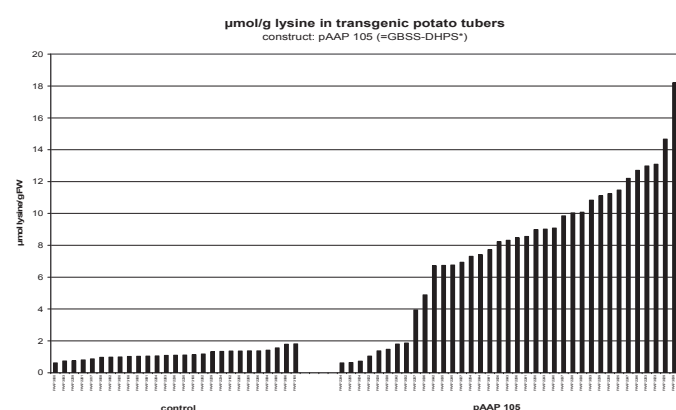


Figure 1. Lysine levels in tubers of wild type plants (left series) and transgenic plants (right series) containing mutated DHPS gene.

We focused on crops such as starch potato and sugar beet because of their high water content, which remains after the extraction of the main product (starch, sugar).

We produced by genetic modification potato plants that accumulate a high level of lysine and itaconic acid in their tubers. Lysine is a precursor of Nylon-6 and itaconic acid is a 'green replacement' of acrylic and metacrylic acid in petrochemistry.

- Itaconic acid gene (CAD) was cloned from *Aspergillus terreus*
- Optimized gene was expressed in plants resulting in 2% IA of the dry weight
- Key gene of lysine synthesis was mutated in order to render it feedback insensitive
- Expression of this mutated gene in potato tubers resulted in an increase of lysine synthesis (1.2% of DW)
- Starch potatoes produce a high level of lysine and itaconic acid

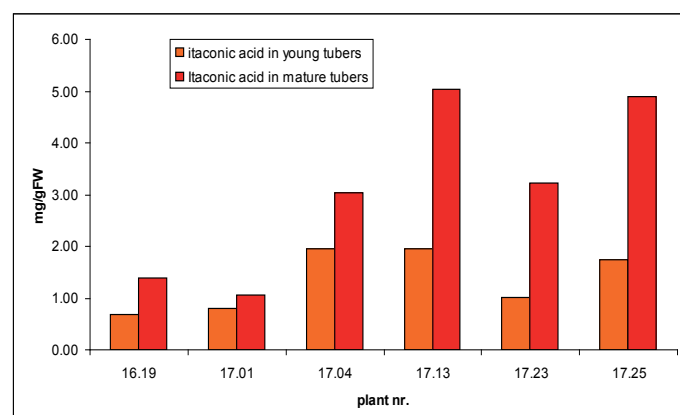


Figure 2. Itaconic acid levels in young and old transgenic potato tubers.

## Conclusions

We produced by GM potato plants that accumulate lysine and itaconic acid in their tubers. Lysine is a precursor of Nylon-6 and itaconic acid is a 'green replacement' of acrylic and metacrylic acid in petrochemistry.

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