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Bioanalysis adds taste to tomatoes

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Syngenta is a global agribusiness and a world leader in crop protection and seeds. The company was formed in 2000 by the merger of Zeneca Agrochemicals and Novartis' agribusiness. Sales in 2006 were approximately $8.1 billion and Syngenta currently employs around 21,000 people in over 90 countries.

Syngenta has three main market areas; crop protection, seeds and professional products. The company is a leader in research and development and spent 10% of 2006 sales on R&D. Increased market share is partly achieved by improving sales and selling 'whole solutions' and packages to farmers. This focus on the agrochemical supply chain ensures that Syngenta retains a significant market share and recognises customer needs.

The company has three main analytical science functions; Analytical Development, Environmental Sciences and Research Analysis. Analytical scientists are integrated into other departments and provide support to research, product and environmental science as well as quality control and bioanalysis. Bioanalysis is used primarily to understand the flavour of foods.

BIOANALYSIS: THE QUALITY TOMATO PROJECT

An example of how bioanalysis adds value to Syngenta's business is demonstrated by the Quality Tomato project. This is part of an international initiative within the Seeds and Crop Protection Research area to understand the links between genetics of plants and their consumer appeal.

Tomatoes are one of the most widely consumed food crops in the world. Consumers prefer certain characteristics in foods, and with tomatoes the challenge is to develop an innovative method to breed these characteristics into plants.

Using technology platforms developed in-house, scientists can determine the levels of endogenous metabolites which produce the desired characteristics, and relate these back to the genetic constitution of the plant.

Fixing tomato vines

By correlating the abundance of endogenous metabolites with desired fruit attributes and relating these metabolite profiles to particular genetic markers it is possible to locate parts of the genome that control quality characteristics.

Ultimately, researchers can use these Quantitative Trait Loci (QTL) to determine the parts of the tomato genome which control the quality characteristics of interest; these can be exploited by breeders for product enhancement.

This project presented a significant logistical challenge. Large numbers of plants had to be grown that exhibited the various desirable qualities.

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LC-MS-MS Ultra analysis equipment

Thousands of tomato plants were grown in Agadir (Morocco), processed and frozen on-site within days. The crop was then transported by air to Syngenta's research centre in Jealott's Hill, Berkshire. These then had to be prepared for the laboratory and analysed in detail.

Analytical protocols were required for 35 biochemical components; metabolites ranged from the very polar e.g. sugars, small organic acids and amino acids, to very lipophillic e.g. pigments such as lycopene. To meet this analytical challenge Syngenta developed various high throughput technology platforms using an array of state-of-the-art modern analytical instruments. These included liquid chromatography equipped with tandem mass spectrometry (LC-MS-MS), diode array and fluorescence detection (LC-DAD and LC-FLD) and electrochemical detection (LC-ECD). Even the volatile components released from tomatoes were identified using dynamic headspace technology with thermal desorption linked to gas chromatography mass spectrometry (GC-MS).

Making quantitative measurements of a large number of target metabolites is challenging and producing high quality and reproducible data was essential.

The production of consistent and high quality data was achieved by using stable isotope internal standardisation with mainly deuterated surrogate compounds.

In May 2007, the data set was complete. Nearly 2000 samples were analysed, and over 70,000 results were generated and stored.

The database is a unique resource which can be mined to investigate the biochemistry and genetic make-up of tomatoes in unprecedented detail.

This will give Syngenta a competitive edge when using the marker assisted technologies in future breeding programs.

This vast potential to improve consumer products was achieved by investing in analytical R&D; a key success factor for adding value to Syngenta's business and products.

This case study forms part of the **Measurement Science and Technology (MST)** priority established by Chemistry Innovation to demonstrate how MST adds value to business. The MST priority is a critical aspect of the innovative chemistry and processes that industry relies on for its solutions. Chemistry Innovation has set an immediate challenge to identify key stakeholders in this sector and to develop strong leadership within the MST community.

For further information please visit our website at: **www.chemistryinnovation.co.uk**

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