Genes to Products

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The reorganisation of SCRI's science strategy and management structure has brought together, under the 'Genes to Products' Theme, the key disciplines and approaches required to deliver added value products into the food chain. The primary research thrust of the Theme is the development and application of tools and resources required to address, in a novel way, biological questions which limit the development of next generation crops and plant-derived products. The Genes to Products Theme incorporates two research programmes, 'Quality, Health and Nutrition' and 'Genome Dynamics'.

A primary goal of the Theme is to develop added value products by combining the power of contemporary gene discovery and germplasm enhancement tools with targets that can be delivered through a comprehensive understanding of plant biochemistry and phytochemistry. Genetic, molecular, phytochemical and biochemical diversity will be explored to identify the important regulatory mechanisms which govern the traits targeted. These include enhancement of the nutritional value of foods, the introduction of novel texture and flavour and improved quality for specific market outlets e.g. the malting industry. This will be achieved through a combination of basic and strategic research with contemporary plant breeding as the primary vehicle to deliver products to the market place. Links and collaborations with the other scientific themes will be imperative to deliver scientific novelty and products which fulfil the important requirements of sustainable production practices Clear goals of the Genes to Products Theme include:

The exploitation of genomics to provide critical information on the importance of genome organisation and architecture, gene function, allelic variation and gene dosage in trait establishment using species of distinct relevance, but not unique to, the Scottish economy.

The identification of plant products, processes and underlying regulatory elements relevant to the development of produce that will enhance consumer health and well-being.

The exploration of genetic, biochemical and phenotypic diversity to nurture and develop new niches for plants and plant products (new habitats, new functionalities, novel compounds). Germplasm enhancement using all available and relevant technologies which provide a competitive advantage to SCRI in terms of both research and development remains a very high priority.

Consumers will be important end users and beneficiaries of the products developed (enhanced nutritional content/health promoting properties of foods, improved/novel organoleptic properties, advanced food safety testing procedures). However, added value should be gained throughout the production and processing chains (e.g. seed producers [new culti-

Genes to Products

vars], niche markets for growers, reduced processing costs, new products for food manufacturers, processors and retailers e.g. branded products and improved choice). The basic science components will make a significant contribution to our current knowledge of processes and mechanisms.

Quality, Health & Nutrition Programme In an international retail world that is becoming even more competitive and consumers much more demanding of products, both in its design and value for money, the marketability and success of a product is becoming more complex. Two areas being given much more attention are: (1) nutritional profile and value and

(2) quality and functional properties (for food, drink and industrial market sectors). These parameters need to be explored via collaborative research between scientific bodies and private industry. Traditionally crops have been bred for high yield, and disease resistance and certain components of quality e.g. waxy maize and low sugar potatoes for processing. Far less attention has focused on the enhancement of crops for nutritional value in its broad-

est sense, although consumers are now becoming very discerning with respect to the food they buy and eat from both plant and animal origins.

Opportunities exist to improve the quality, uniqueness and nutritional value of raw materials entering the food chain. This includes commodities important to the Scottish economy and particularly where the commodity e.g. potato, contributes significantly to the daily diet. Further opportunities exist to develop germplasm which is differentiated through improved flavour and texture or which produces clear efficiency gains in downstream processing e.g. malting. Genetic diversity in the attributes under investigation will play a crucial role in formulating our understanding of the fundamental processes and the genes or allelic variants involved. This will be achieved through key interactions between scientists with expertise in phytochemistry, biochemistry, genomics and applied genetics. Interactions will be driven by common goals and targets and by integrated delivery platforms, which translate knowledge gained at the level of gene and cell into germplasm enhancement and performance evaluation in a commercially relevant environment. The programme supports four primary research topics: antioxidants and bioactive pigments, mechanisms and processes regulating organoleptic properties, cereal quality and metabolomics (as an underpinning platform technology).

Genome Dynamics Programme The programme aims to exploit genomics and informatics technologies and resources to explore the inherent dynamics of the plant genome through an analysis of diversity and evolution under natural selection, and through domestication, plant breeding and historically imposed selection. Investigating the dynamics of the genome is central to understanding developmental and evolutionary mechanisms and to provide a rationale for crop improvement or diversification via tradi-

> tional or biotechnological means. A key challenge is to relate variation at the level of the gene and of the genome to variation in biochemical and other important phenotypes such as adaptation to environmental stress. Detailed knowledge of, and accessibilappropriate ity to, germplasm is essential, and bio-diverse germplasm collec-(such tions as the Commonwealth Potato Collection)

coupled with genomics and profiling technologies provide the basic platform for our research.

The Programme supports three primary research areas; Contemporary Genetics, Environmental Genomics & Biodiversity and Crop Evolution which are underpinned by a significant commitment to Genomics Resource and Enabling Technology development. The entire Pogramme focuses on the exploitation of modern genetic enabling technologies such as Simple Sequence Repeats (SSRs) and Single Nucleotide Polymorphisms (SNPs) to address a range of end-user relevant biological/genetical questions. In addition, resources such as comprehensive EST collections, large insert Bacterial Artificial Chromosome (BAC) libraries and experimentally developed populations including Doubled Haploid (DHs), Recombinant Chromosome Substitution Line (RCSLs) and mutant populations for barley and multi-trait selection pedigrees for potato are key components of our strategy to link genes to phenotypes. Technology exploitation through a focused germplasm improvement programme is a key mechanism for delivering the products of our research to the commercial sector and ultimately the marketplace.