

CENTRE FOR BIOSYSTEMS GENOMICS

▶ The Netherlands Plant Genomics Network

▶ www.biosystemsgenomics.nl

PARTNERSHIP

Academia

- | Wageningen University
- | Utrecht University
- | University of Amsterdam
- | University of Nijmegen

Research Institutes

- | Plant Research International
- | ATO

Industry

- | Agrico Research, Averis Seeds, HZPC Holland, C. Meijer, Van Rijn
- | Enza Zaden, De Rooter Zaden, Rijk Zwaan, Nickerson Zwaan, Syngenta, SVS
- | AVEBE
- | Keygene
- | HPA, VAVI



MISSION

- ▶ Exploit genomics as basis for the development of sustainable agroproduction systems
- ▶ Contribute to high quality, safe and healthy food crops and derived products for consumers and the environment
- ▶ Contribute to the advancement of science and technology while creating economic and societal value

AMBITION

- ▶ Centre of Excellence in plant genomics
- ▶ Partner in international networks
- ▶ Maintain state-of-the-art infrastructure
- ▶ Educate and train scientists
- ▶ Provide an interdisciplinary setting
- ▶ Stimulate knowledge transfer and exploitation by publications, IP and bio-entrepreneurship
- ▶ Transparent to society



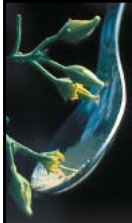
A MATTER OF CHOICES

- ▶ Society asks for
 - | high quality food crops
 - | safe for the environment
 - | healthy for the consumer
- ▶ Added value to the innovation process
- ▶ Synergy with international plant genomics initiatives
- ▶ International strength of the Netherlands
 - | plant and crop scientists of world class
 - | track record in plant genomics and excellent infrastructure available
 - | Dutch potato and tomato breeders, growers and processors are global market players



STRONG INDUSTRIAL BASE TO BUILD UPON Dutch potato industry

- ▶ Largest exporter of:
 - | seed (80%) and consumption potatoes in the world
 - | french fries: market share 45.8% or 1 million ton in 2001
- ▶ Dutch seed potatoes: € 300 million/year
- ▶ Export starch potatoes and processed products (food and non-food): € 1.5 billion/year
- ▶ Increase in consumption production areas because increased processing to crisps and fast food
- ▶ Value of quality improvement: 1% decrease of tuber water content, 5% energy saving during processing



STRONG INDUSTRIAL BASE TO BUILD UPON

Value improved tomato seed

- ▶ 4th most cultivated vegetable
 - | potato 295 MT
 - | cassava 158 MT
 - | sweet potato 129 MT
 - | tomato 90 MT
- ▶ Healthiness and Mediterranean cuisine
 - | carotenoids (lycopene, β -carotene)
 - | flavonoids, vitamin C, antioxidants, anti-tumorals
- ▶ Value seed (excl. industrial): € 200 million
- ▶ Retail value tomato: € 4 billion



STRONG KNOWLEDGE BASE

- | | General | Quality traits |
|----------------------|---|---|
| Potato ▶ | <ul style="list-style-type: none"> High-density integrated genetic and trait map 90.000 ESTs, BAC libraries, physical map, micro-arrays Biodiversity, synteny | <ul style="list-style-type: none"> ▶ Germplasm, populations, R and Q loci, R-genes Phytophthora: collections races, AFLP maps, BACs, ESTs Trait knowledge |
| Tomato ▶ | <ul style="list-style-type: none"> Saturated genetic maps 160,000 EST's, BAC, YAC libraries, micro-arrays Mutants, biodiversity, synteny Tomato Genome Initiative | <ul style="list-style-type: none"> ▶ Chromosome 6 physical map R-genes Metabolomics, pathway engineering (lycopene, linalol, quercetine) QTL fruit size |
| Arabidopsis ▶ | <ul style="list-style-type: none"> Full genome sequence insertion mutants, activation-tagged mutants Micro-arrays, X-omics Ecotypes | <ul style="list-style-type: none"> ▶ Segregating populations QTLs plant performance (flowering time) Oomycete interaction QTLs for vitamins, metals, |

OUR RESEARCH FOCUS

unveiling mechanisms contributing to crop quality

Environmental Quality

- ▶ Reduction agrochemicals
 - | resistance to diseases
- ▶ Availability of soils and water
 - | cold/drought/salt/metal tolerance

Food and Non-food Quality

- ▶ Changing consumer demands
 - | appeal, health
- ▶ Improving the chain
 - | freshness, storability, transport
 - | reduction post-harvest chemicals, waste, processing energy
 - | 'green' chemicals

ENVIRONMENTAL QUALITY

Potato and *Phytophthora infestans*



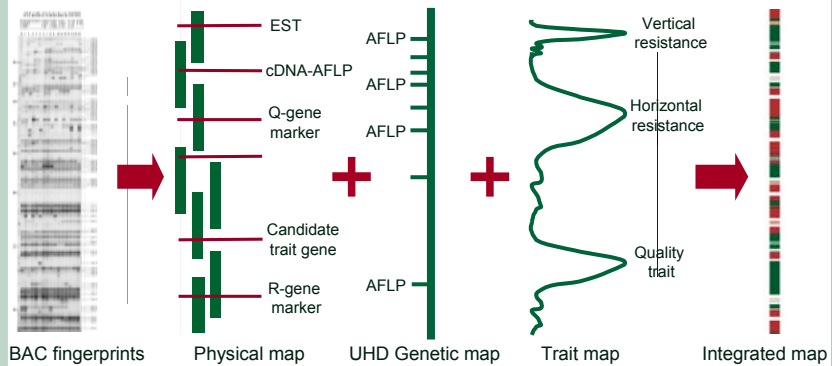
1845-1846



1997

RESEARCH APPROACH 1

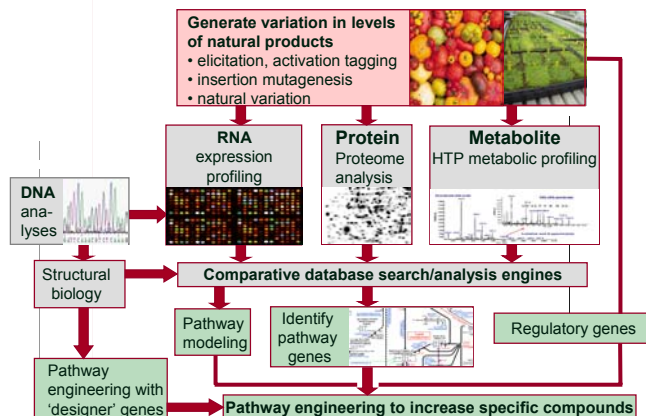
- ▶ | Scanning the full genome for trait markers
- ▶ | Comparative genomics: wild species, varieties



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RESEARCH APPROACH 2

- ▶ | Scanning the full genome for trait markers



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DELIVERABLES OF OUR RESEARCH

Scientific

- ▶ In depth knowledge of plant-pathogen interaction
 - | potato/Phytophthora
 - | resistance gene evolution
- ▶ In depth knowledge of plant performance QTLs and metabolic networks
 - | vitamins, minerals, health-promoting and antinutritional compounds
 - | (a)biotic stress adaptation
- ▶ Synteny Arabidopsis/tomato/potato
- ▶ Translation to general phenomena

Applied

- ▶ Genes/markers for resistance
 - | phytophthora resistance
 - | *in silico* designed durable resistance
- ▶ Genes/markers for quality
 - | potato: tuberisation, sprouting, chipping, cooking, starch, yield
 - | tomato: flavour, nutrition, health, soluble solids, yield
- ▶ Knowledge to modify metabolic pathways
 - | health promotion
- ▶ Knowledge flow from model to crop



SOCIETAL ASPECTS OF GENOMICS

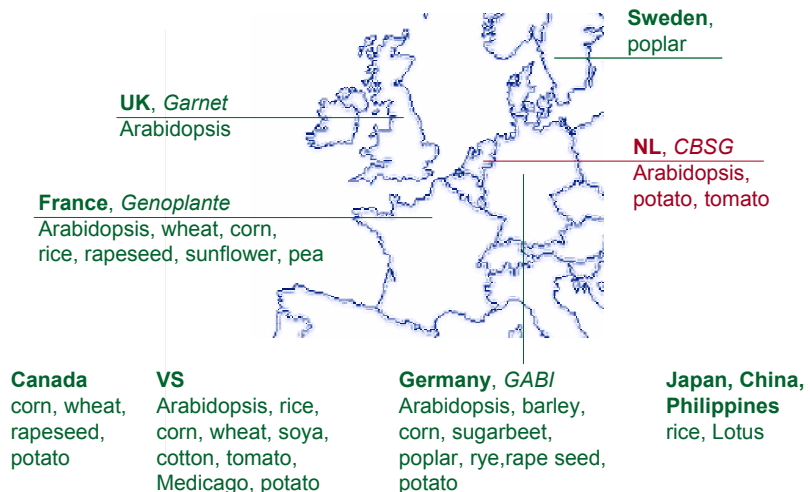
License to research, produce and sell

- ▶ Understand how societal values, sustainability, translate into products and consumer preferences
 - | co-creation of deliverables with all stakeholders
 - | deliberation on meaning and implication of genomics
 - | interactive communication via internet, panels etc.
- ▶ Link research in natural and social sciences:
 - | Improve the interaction between natural and social scientists
 - | genomics and bioinformatics with social psychology, agricultural economy, applied philosophy, ethics, communication and consumer studies

FINANCES 2003 - 2007

Budget research programme	49.4 M€
Universities, Research Institutes	27.0 M€
▶ Industry	6.1 M€
▶ Netherlands Genomics Initiative	16.3 M€
▶ Investment	
personnel	
infrastructure	

INTERNATIONAL PLANT GENOMICS INITIATIVES



Added value ERA-NET Plant Genomics

- ▶ **Competitive advantage**
 - | Synergy
 - | Focus
- ▶ **Cost effective by sharing**
 - | Expertise (bioinformatics)
 - | Infrastructure
 - | Resources
- ▶ **Multidisciplinarity**

Challenges ERA-NET Plant Genomics

- ▶ **National research programmes**
 - | Open
 - | Choices and focus
- ▶ **Differences**
 - | 'state-of-the-art', happy few
 - | research culture
- ▶ **Coordination of large programmes**
- ▶ **Role of industry and IPR**