Konstantin Skryabin

EU-Russia cooperation within Plant biotechnology platform: prospects of Russian scientists

Russian plant biotechnology platform

Plant genomics and bioinformatics

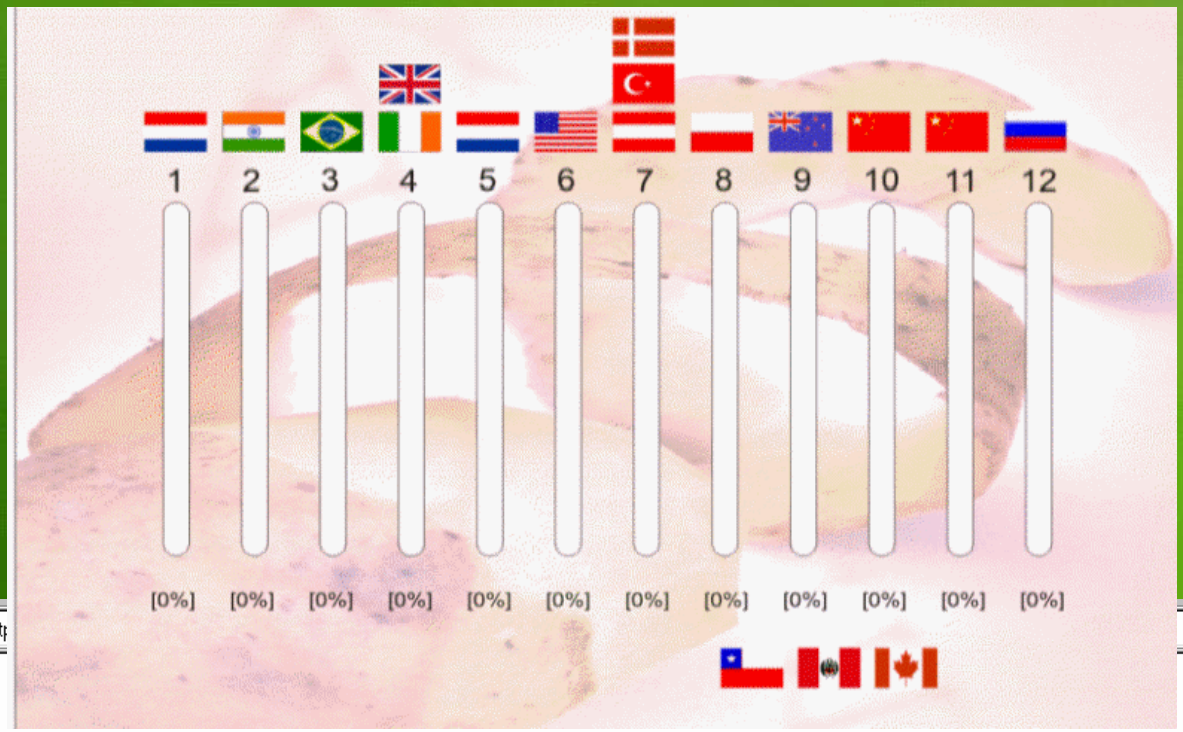
Exploration of biodiversity

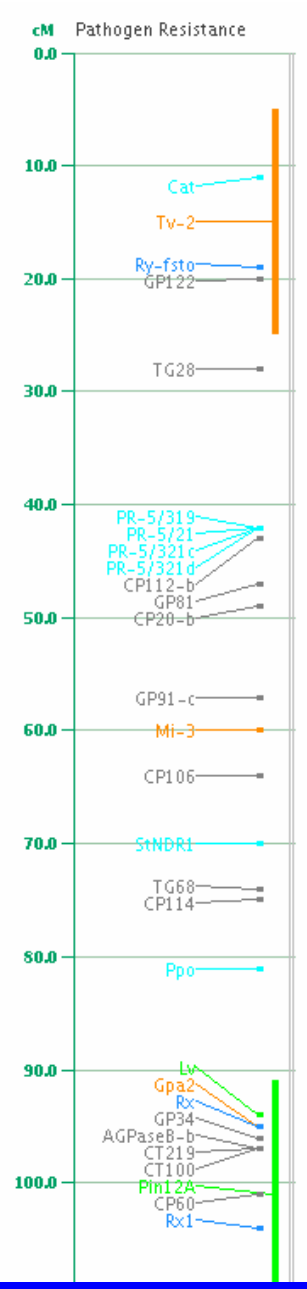
Plants as biofactories, edible vaccines

Biotechnology and sustainable agriculture

Interactions between plants and microorganisms

Potato Genome Sequencing Consortium





Адрес: http

THE POTATO GENOME SEQUENCING Consortium

Home | Research | Events | News* | Publications* | Links | Contacts | Forum

The Centre for Bioengineering (RAS) in Moscow has been formally invited to participate in the PGSC. The Centre has set aside a budget for this work and is aiming to start the practical work early in 2006.

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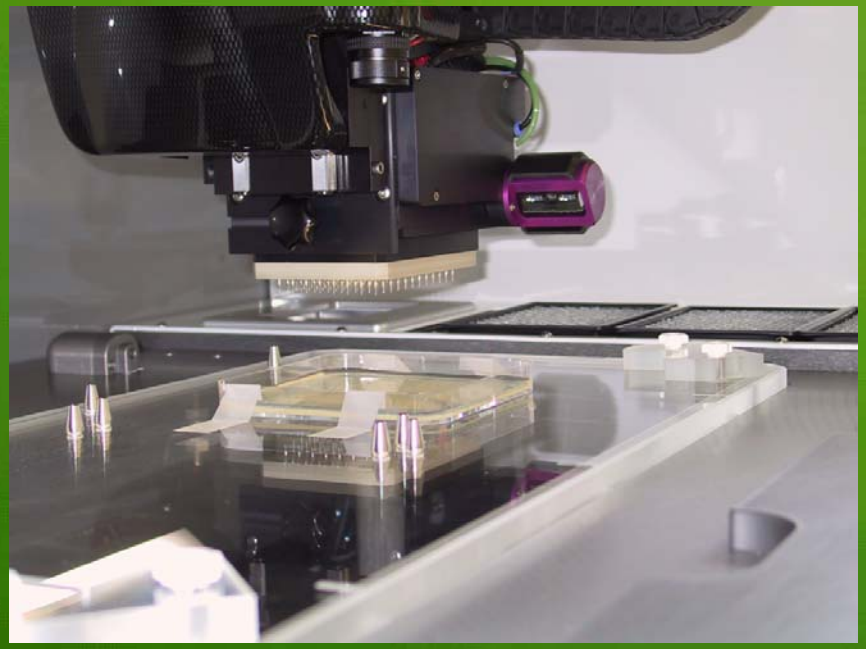
XII Potato Chromosome



Genetix – GB, QP Display C
work capacity 4000 colonies / h

Two 96 channel and one 48 channel sequenators (ABI)

Computer cluster

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Biodiversity and its sustainable exploration for the production of biological resources

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Research example

Analysis of Biodiversity in *Solanaceae* and *Poaceae*

potato	tomato	pepper	*Aegilops* (wild wheat)
503 accessions	*62 accessions*	*250 accessions*	*270 accessions*

Nuclear genome:

- total genome sequences analysis
  - AFLP - RAPD - ISSR
- gene families sequences analysis
  - RGA- marking - MADS- marking - PK- marking
- ribosomal operon sequences analysis
  - ITS1 - 5.8S - ITS2
- point mutation analysis of individual genes
  - SNP
- microsatellite locus of nuclear DNA analysis
  - SSR

Chloroplast genome:

- microsatellite locus of cp DNA analysis
  - cpSSR
- cp DNA sequences restriction analysis
  - RFLP

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Biotechnology and sustainable agriculture

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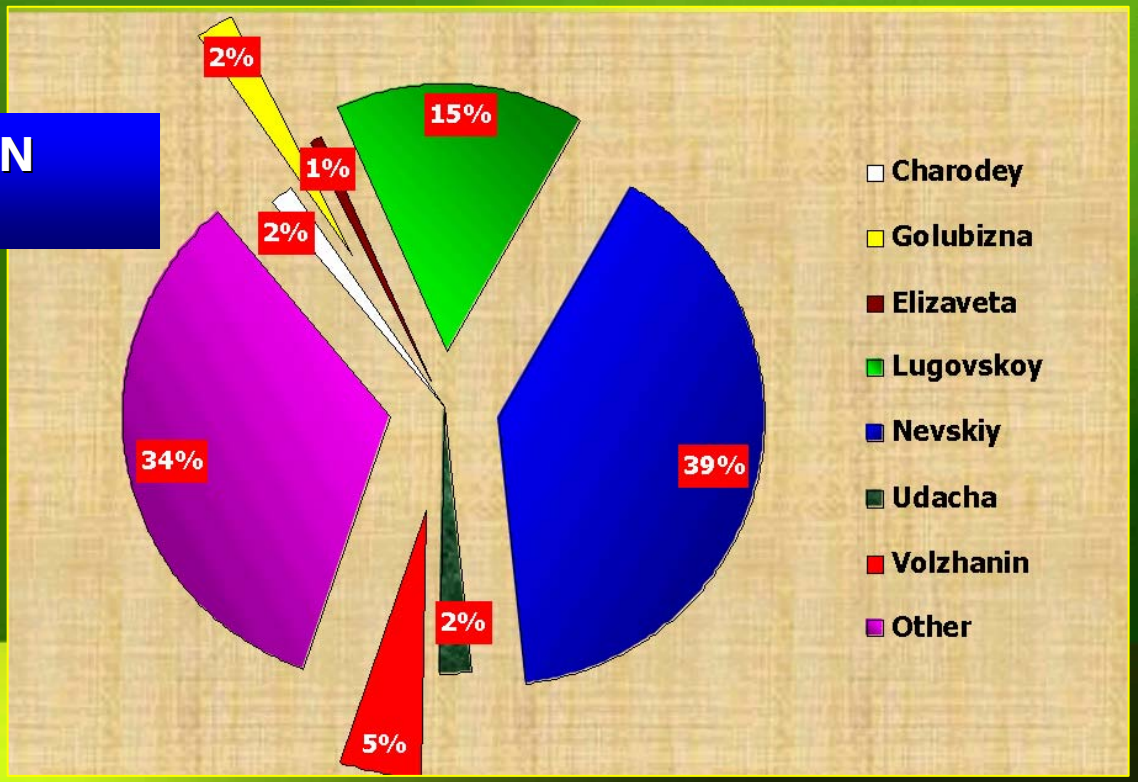
Crop losses in Russian Federation, 2000

crops	weeds		pests		disease		Total
	losses, tons	%	losses, tons	%	losses, tons	%	%
Cereals	11700	13	9000	10	11700	13	36
Sunflower	60	2	780	26	1020	34	62
Sugar beet	5400	25	5184	24	648	3	52
Potatoes	**600**	**2**	**5400**	**>18**	**4800**	**16**	**>36**
Vegetables	700	7	2000	20	1200	12	39
Fruits	50	2	800	32	900	32	66

Potato commercial Projects

- ✓ Pests resistance
- ✓ Decease resistance

POTATO VARIETIES IN RUSSIA, %



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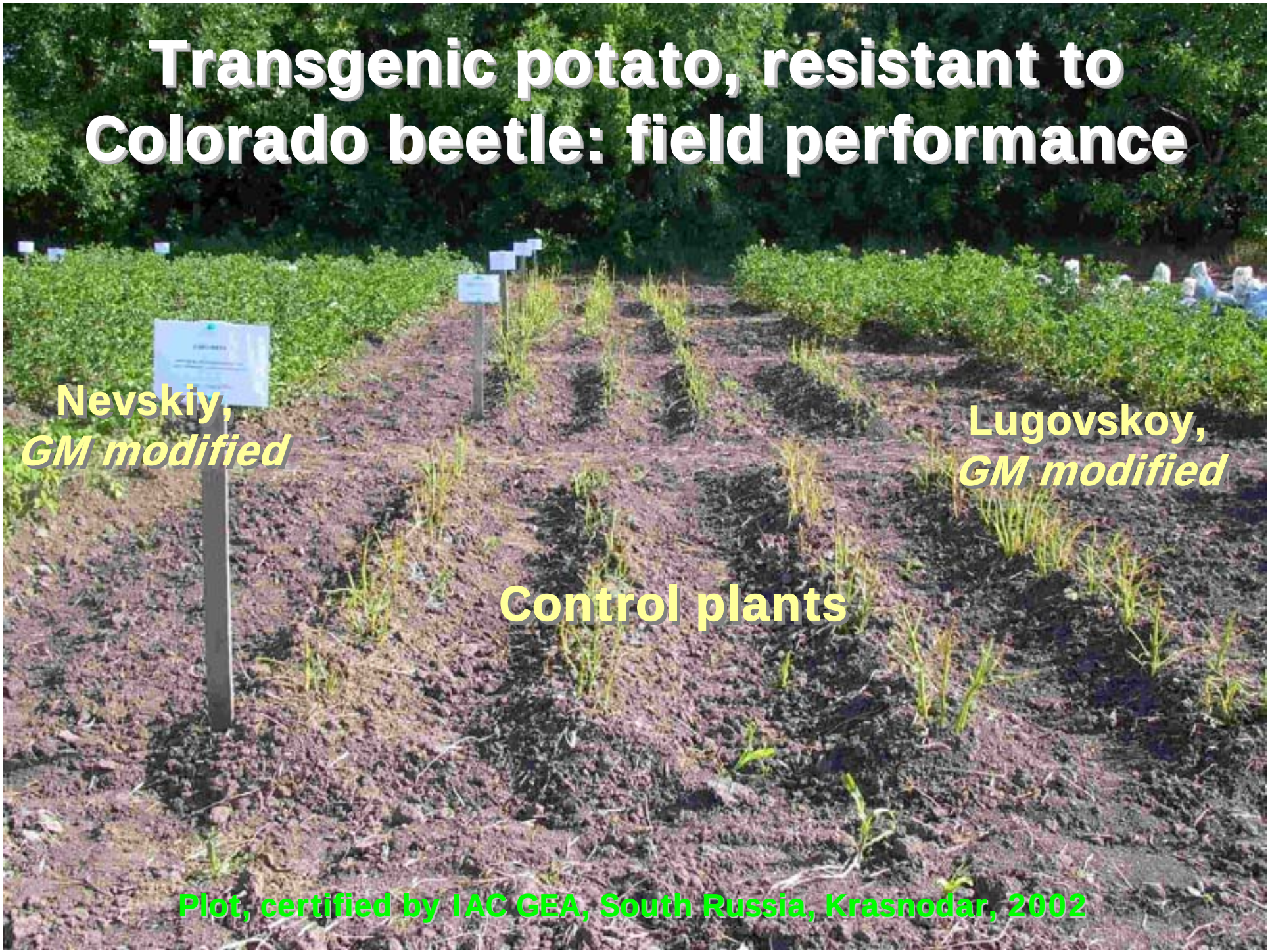
Transgenic potato, resistant to Colorado beetle: field performance
Nevskiy, GM modified
Lugovskoy, GM modified
Control plants
Plot, certified by IAC GEA, South Russia, Krasnodar, 2002

Research example

Virus resistance of GM potato variety Centre1

CONTROL Transgenic Potato

Phytophtora resistance of GM potato with *MP3* gene

CONTROL **H55 *GM* LINE**

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Research example

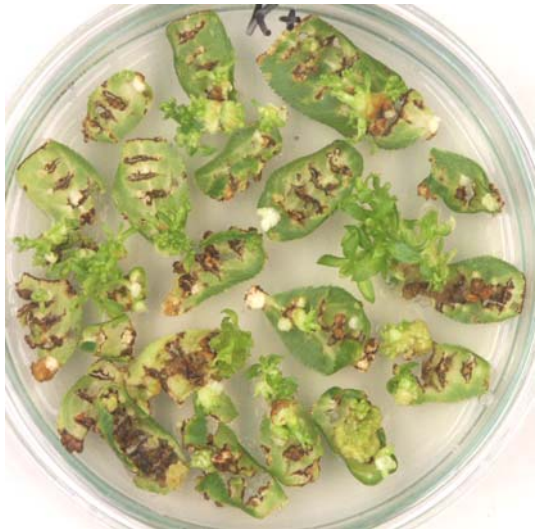
The Problem: *Plum Pox Virus*

- affects fruit quality
- reduces yields
- loss of inventory of infected plants
- cost to destroy infected plants
- cost and time loss for replacing trees
- loss of export market
- loss of sales due to incomplete product line
- disease subject to quarantine

http://www.apsnet.org/online/feature/PlumPox/

Research example

The Solution: creation of transgenic plants



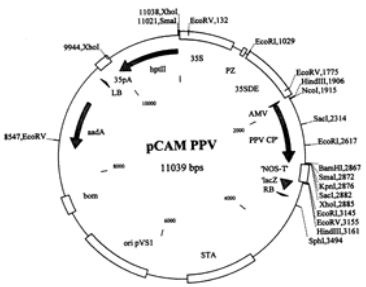
1. Efficient system of regeneration from somatic tissues

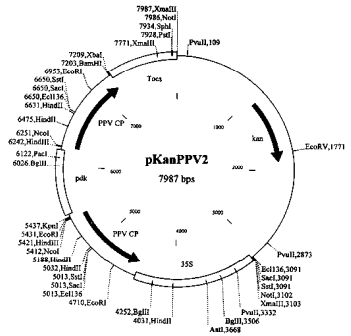
The efficient protocols for adventitious shoot regeneration have been developed.
(shoot regeneration more 80%)

2. High frequency of transformation

Efficient selection systems

The different selective systems based on ***negative*** *(antibiotics) and* ***positive*** *(mannose) selection have been developed.*
(transformation frequencies more 2.2%)





3. Resistance genes

Transcriptional gene silencing (**TGS**)

Post-transcriptional gene silencing (**PTGS**)

Improving plant productivity and quality: abiotic stresses

Development of drought and salt tolerant plants

Salt tolerance of transgenic tobacco expressing H^+ pyrophosphatase gene from *R. rubrum*

Control Plants, 150 mM NaCl

Transgenic Plants, 150 mM NaCl

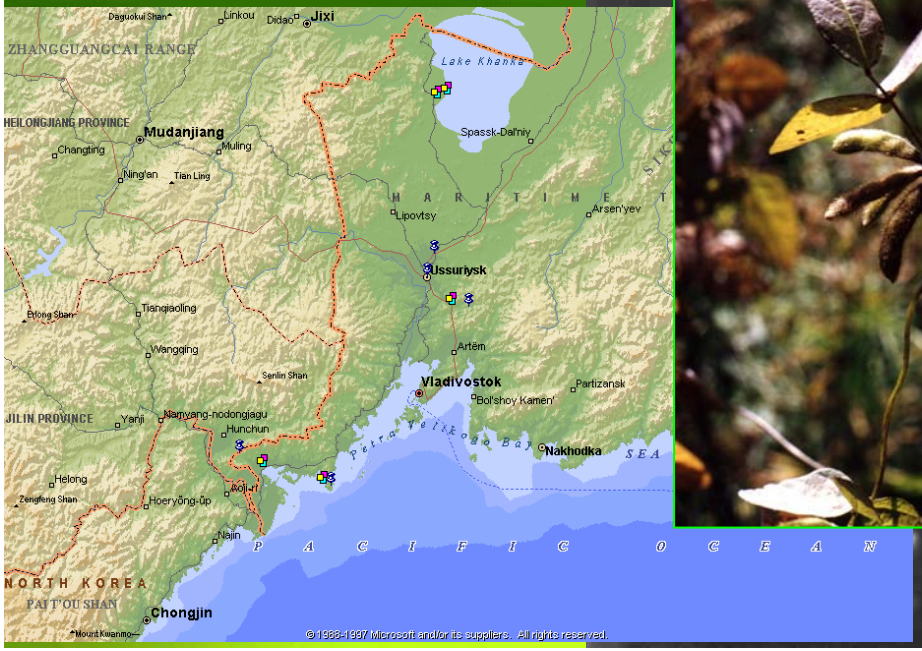
Research example

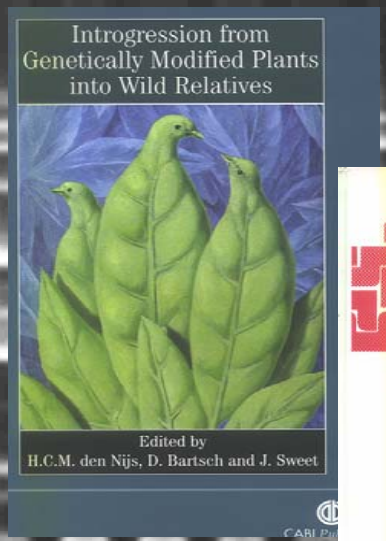
Biological, ecological, genetic and food safety are spheres of priority in Russian Federation

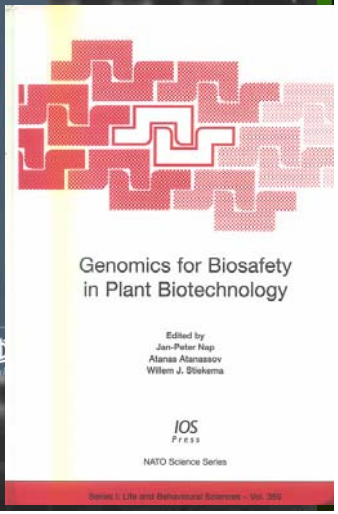
Coexistence of biotechnological crops with different agriculture systems and wild relatives in the centers of origin and diversity

Herbicide tolerant soybean in the center of origin and diversity in Far East region of the Russian Federation

Biotechnological wheat in Caucasian centre of diversity of wild-growing relatives.







Co-Extra

is a 4-years Integrated Project
(Contract nr 007158)
funded by the European Commission
through the Sixth Framework Programme
under the Food Quality and Safety Priority

WP1 – Biological approaches for gene flow mitigation

WP2 - Supply chain analysis, description and modelling

WP3 – Economic costs and benefits of traceability and co-existence

WP4 – Development of testing and sampling approaches

WP5 – Development and integration of analytical traceability tools

WP6 - Technical challenges of GMO detection

WP8 – Dialogue and communication

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KBBE-2007-1-1-01: Development of new tools and processes to support R&D in crop plants: molecular breeding

KBBE-2007-1-1-03: Development of genetic systems for crop improvement through a systems biology approach

KBBE-2007-1-2-02: Genomics for cereal improvement for food, feed and non-food uses

KBBE-2007-1-4-10: Containment of Sharka virus in view of EU-expansion

KBBE-2007-1-4-18: External costs of pesticides

KBBE-2007-1-2-03: Development of more efficient risk analysis techniques for pests and pathogens of phytosanitary concern

possible partners from the Russia:

- Vavilov Institute of Plant Breeding
- Russian Research Institute of Phytopathology
- Russian State Agricultural University
- Institute of General Genetics RAS
- Institute of Cytology and Genetics SB RAS
- Institute of Bioorganic Chemistry RAS
- Centre “Bioengineering” RAS
- Research Institute of Agricultural Biotechnology

and other research institutions

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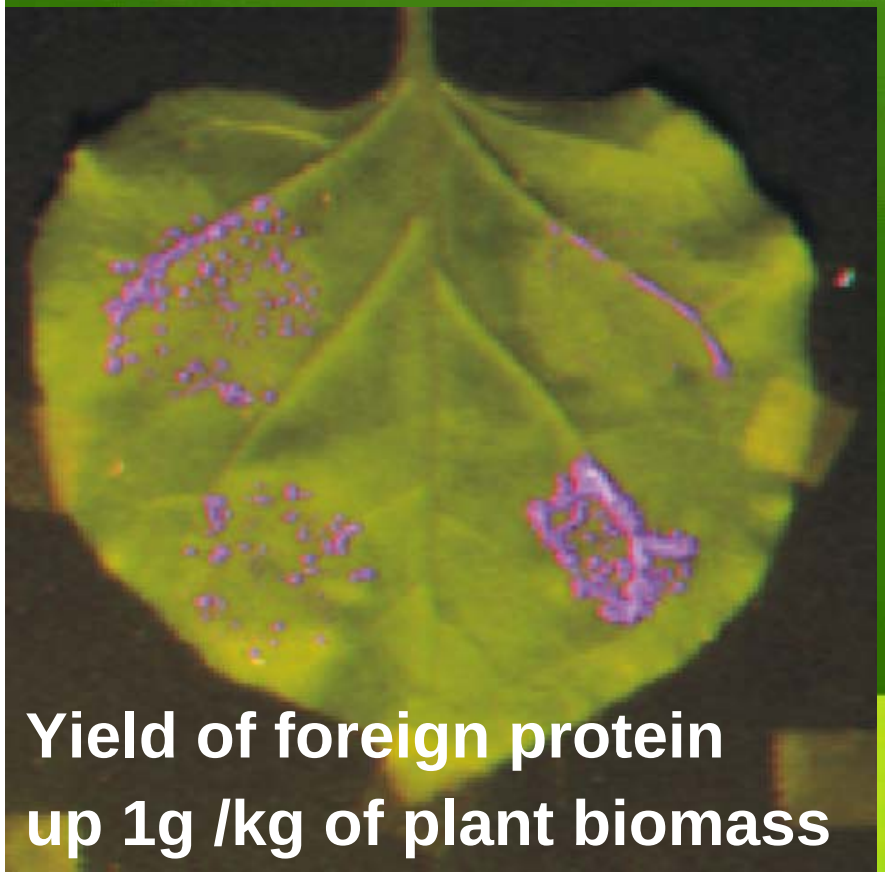
Plants as green factories

- New objects and new technologies
- Biopharmaceuticals
- Enzymes and polymers
- Bioenergy

Advantages of plant viral vectors for gene expression in plants



Yield of foreign protein
up 1g /kg of plant biomass

- Plant viruses multiply rapidly and accumulate in high quantities - very hidh levels of target protein accumulation
- Target protein expression takes only several weeks
- Plant viral systems are safe

Plants as green factories

Production of vaccine proteins

-Tuberculosis

- Influenza

- Rubella

- Enteric diseases

Production of antibodies

Industrial proteins: enzymes, polymers, artificial fibers…

KBBE-2007-3-1-05: BIO-VET-PHARMING - Plant made recombinant pharmaceuticals for animals

KBBE-2007-3-1-09: GREEN FACTORY – The expression and accumulation of valuable industrial compounds in plants

<u>Indicative topic of the work programme 2008:</u>

PLANTS as EDIBLE VACCINES - SICA

Possible partners from the Russia:

- **Biological Faculty, Moscow State University**
- **Centre “Bioengineering” RAS**
- **Research institutions in medicine and veterinary**
- **Private companies including SMEs**

and other research institutions

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