



An ICRISAT Success Story



Transgenic Groundnut – *the World's First*

The world's first genetically modified groundnut – developed by ICRISAT – has reached the field trial stage. The new transgenic groundnut contains genes for resistance to the peanut clump virus (PCV), which is widespread in India and West Africa.

The problem

PCV is transmitted by *Polymyxa graminis*, a soil-borne fungus that is difficult to control because it persists in the soil for several years. Suitable biocides are lacking, as are resistant groundnut genotypes. ICRISAT scientists screened over 10,000 germplasm accessions but found no sources of resistance.

The answer was biotechnology. ICRISAT scientists developed protocols for genetically transforming groundnut with resistance genes introduced from the virus itself. Such genes, when stably expressed and inherited, can form an important germplasm source. Plant breeders can transfer resistance from this new germplasm into other adapted germplasm by using conventional plant breeding methods.



Bare patches, stunted plants – peanut clump virus can cause large-scale losses on farmers' fields.

New science

The biotech work involved four stages.

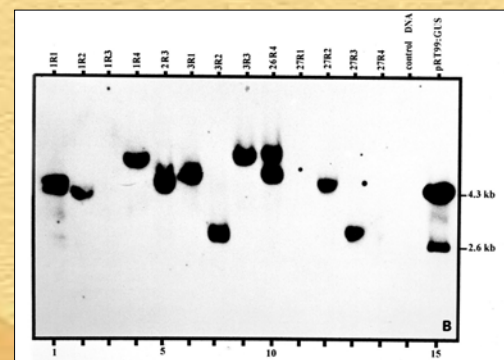
- Gene sequencing and cloning was done by ICRISAT in collaboration with SCRI.
- The coat protein (cp) and replicase genes of Indian peanut clump virus (PCV) were transferred into economically important groundnut cultivars. This was done through *Agrobacterium tumefaciens*-mediated genetic transformation.
- Extensive molecular characterization of the transgenics for gene integration, function, and inheritance was undertaken.
- Field trials are in progress under controlled conditions to test the response of transgenic groundnut to the peanut clump disease, with permission from the Government of India.



Introduction of genes by using cotyledon explants.



Transgenic groundnut plant containing IPCV coat protein gene.



Molecular analysis of genomic DNA from transgenic groundnut plants.

Contained field testing of transgenic peanuts

Several T3 transgenic lines carrying either the cp or replicase gene were first tested at ICRISAT, Patancheru under contained conditions during the rainy season of 2002 with very encouraging results. Some of the selected lines showed normal growth and total virus elimination. New trials to further validate the results have been initiated in 2003. Subject to permission from host country governments, the selected transgenic lines will also be tested in open field trials in India against various Indian isolates, and in West African locations against the African isolate of PCV.

The benefits

ICRISAT aims to harness the power of modern biotechnology to improve crop productivity and alleviate rural poverty. The new transgenic groundnut varieties will do both. Yield losses of up to US\$38 million globally due to the peanut clump disease can be eliminated or largely reduced. And smallholder farmers in PCV-endemic areas will see their incomes rise dramatically. Moreover, the transgenic groundnuts resistant to the viruses will also ensure health safety by providing virus-free produce.

Partner

- Scottish Crop Research Institute (SCRI), Dundee, UK

Donor

- Department for International Development (DFID), UK



Uninfected and infected (arrow) plants of groundnut.



Field trial for IPCV resistance at ICRISAT Patancheru.



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