‘Clean-gene’ transformation technology for rice

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Half the world's population depends on rice as its major source of nutritional calories. Rice transformation technologies hold great promise for increasing rice productivity, especially in areas where rice farmers have little means to counter damage caused by pests and disease. The absence of classic plant breeding solutions (limited genetic sources of resistance available) and the limitations of chemical treatments (not economically feasible under low-input sustainable systems and extreme damage to the environment) present an excellent opportunity for biotechnological solutions.

PSP-funded research at the JIC has been successful in finding a way of producing transgenic crops that are free of undesirable selectable marker genes (such as antibiotic resistance genes) and containing simple transgenic loci. This overcomes a constraint to the employment of genetic engineering: the perceived risks from introducing antibiotic resistance genes, which are only included because they are part of the transformation process[1], into the genetically modified crop.

These new technologies involve the use of a natural vector for plant transformation (*Agrobacterium tumefaciens)* and a new dual binary vector system (pGreen/pSoup). pGreen is a small Ti-binary vector unable to replicate in *Agrobacterium* without the presence of another binary plasmid, pSoup, in the same strain. Both pGreen and pSoup can carry a T-DNA containing different transgenes. When co-transferred into the rice genome, the transgenes carried by pGreen (Fig. 6, in blue) and pSoup (Fig. 1, in red) can integrate at unlinked loci. This allows the recovery, by simple reassortment of genes, of rice plant progeny in later generations that contain only the gene of interest (on pGreen T-DNA) but without the selectable marker gene (on pSoup T-DNA).

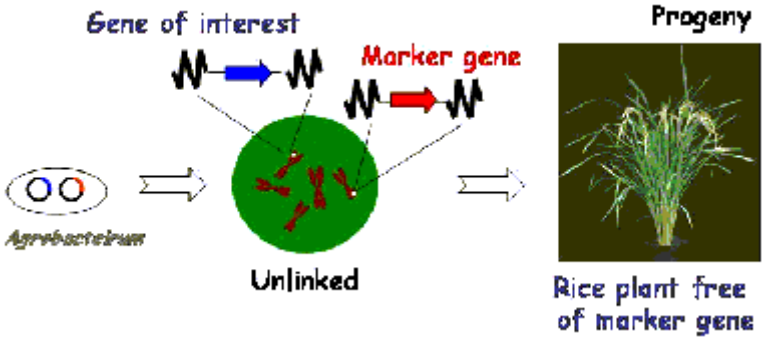

Figure 6. **Using the vector *Agrobacterium*, the transgenes carried by pGreen (blue) and pSoup (red) can integrate at unlinked loci, producing rice plant progeny containing the gene of interest but no selectable marker genes.**

[1] Antibiotic resistance genes are selectable markers that neutralise, for example, an antibiotic or a herbicide. They hence provide resistance in the plant cells that have been transformed. They are used to select the transformed cells on media containing the antibiotic or herbicide by killing non-transformed, susceptible ones.