

Antibiotic resistance genes in GM crops.

Will antibiotic resistance marker genes (ARG) used in the development of GM crops increase the occurrence of antibiotic resistant bacteria?

The use and mis-use of antibiotics in medicine and animal husbandry are the main causes of increased antibiotic resistance. Society must decide if the relative risks require existing GM varieties to be directly replaced, with substantial costs to industry and loss of benefits, or gradually replaced as new varieties are introduced.

The Regulatory Process

The scientific community has been mindful of potential risks (however minimal) associated with use of ARGs and has been addressing this since 1990. Currently,

- ACRE guidelines recommend the use of alternatives to ARG.
- The new EU Directive on the deliberate release of GMO's into the environment requires particular consideration to be given to those that contain ARG for therapeutic antibiotics.
- No consent to market will be granted by the Secretary of State for Environment for GM crops containing ARG after 2004 and for experimental field release after 2008.

Therefore, the replacement of ARG with alternative selectable markers and the development of 'clean gene' technology is the future of GM varieties.

Occurrence of Antibiotic Resistance in Nature

- Resistance to ampicillin and penicillin occurs naturally in soil bacteria.
- We consume more than one million kanamycin-resistant bacteria every day and resistant bacteria are already present in the digestive systems of 10-20% of humans.
- Effective degradation of DNA occurs in the digestive tract and any small fragments that do remain after digestion do not contain whole genes.
- No evidence has been found of active ingested genes, even those designed to work in human cells.

Potential for increased antibiotic resistance or horizontal gene transfer (HGT)

- The transfer of genetic material occurs naturally in the environment within bacterial populations and could potentially occur between microbial species or between plants and microbes.
- Modified ARG are optimised for expression in plants rather than bacteria and would function weakly, if at all, on transfer back to bacteria.
- There is no evidence to date of gene transfer from GMO's to naturally occurring soil bacteria under field conditions, but there are examples under optimal laboratory conditions.
- The use of prokaryotic sequences in plants may provide sufficient homology to allow gene transfer between plants and bacteria.

Horizontal gene transfer to gut bacteria could, in principle, make existing bacterial pathogens of humans or animals less treatable by antibiotics?

There is already widespread resistance to kanamycin and ampicillin, the antibiotics most commonly used in production of GM crops, and they are being used less often. Ampicillin, is however used as an important line of defence although there are many pathogens that have

become resistant to it. Its use in GM plants is very limited and use of kanamycin resistance genes is being phased out.

The BBC drama "Fields of Gold" implied the transfer of ARG from GM crops would create new pathogens?

Compared to other causes of antibiotic resistance, the risk is minimal.

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