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GM rapeseed could reduce fertiliser usage

Nitrogen fertiliser used in crop production is a substantial source of environmental pollution, contributing to around one third of the total greenhouse gas emissions from the world's agricultural sector. Recent research on a genetically modified (GM) variety of rapeseed, which has been made more nitrogen-efficient, suggests that yields comparable with conventional varieties can be obtained using significantly less fertiliser.

Global emissions of greenhouse gases (GHGs) from the agricultural sector have a significant effect on climate change, for example, the manufacture and use of nitrogen fertilisers. The manufacture of nitrogen fertilisers is a very energy intensive process, emitting considerable amounts of GHGs. Furthermore, the application of nitrogen fertilisers can also contribute significantly to climate change as the global warming potential of nitrous oxide (N_2O), emitted by such fertilisers, is approximately 300 times greater than carbon dioxide (CO_2). According to the researchers, growing genetically modified nitrogen use efficient (GMNUE) canola, a type of GM rapeseed, can therefore lead to a reduction in the application of nitrogen fertilisers while maintaining crop yield leading to consequent environmental benefits.

The researchers undertook a partial life-cycle assessment, adapted for crop production, comparing the environmental impact of growing one tonne of conventionally bred rapeseed with one tonne of GMNUE canola from crop growth trials in North America. The assessment estimated how much energy and materials were used in the entire production system, as well as how much waste was produced. The extraction of raw materials, processing and transportation through to waste disposal and decomposition were taken into consideration.

Although the use of GM crops is still debated, this research suggests that widespread use of GMNUE canola has the potential to reduce the environmental impact associated with extensive fertiliser application. Given that about 50 million tonnes of rapeseed are produced annually, the researchers suggest that replacing conventional rapeseed with GMNUE canola could reduce greenhouse gas emissions by the equivalent of 1 million tonnes of CO_2.

If GMNUE canola was grown in China and India, for example, which together account for about 40 per cent of the world's total rapeseed production, considerable reductions in greenhouse gas emissions and energy savings could be made. Cultivating GMNUE canola in North America and Canada, where large areas of rapeseed are already grown and where GM crops are more widely accepted, has the potential to decrease agricultural pollution, especially greenhouse gas emissions and diffuse water pollution. In addition, the researchers suggest that if GMNUE canola were grown in Europe, Europe could reduce its fertiliser use, with a consequent decrease in nitrogen-related water pollution. This would have the potential to help meet targets contained in the Water Framework Directive[1].

Key research findings were:

- growing GMNUE canola reduced energy consumption by 22 per cent compared with the conventional variety
- GMNUE canola emitted 16.3 per cent less greenhouse gases per unit of crop produced than the conventional variety
- GMNUE canola had a reduced acidification potential of 16.2 per cent
- GMNUE canola emitted 17.3 per cent and 15.4 per cent less terrestrial and aquatic toxic emissions than the conventional variety

GM technology is closely regulated in Europe, and any products must be thoroughly assessed in accordance with the relevant legislation in order to ensure their safety to humans, animals and the environment.

1. See: Water Framework Directive http://ec.europa.eu/environment/water/water-framework/index_en.html

Source: Strange, A. Park, J., Bennett, R., and Phipps, R. (2008). The use of life-cycle assessment to evaluate the environmental impacts of growing genetically modified, nitrogen use-efficient canola. *Plant Biotechnology Journal*. 6(4): 337-345.
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