10th GCIRC INTERNATIONAL RAPESEED CONGRESS

GMO RAPESEED/COLZA/CANOLA WORKSHOP- OCTOBER 1999

Chairmen: Melvyn Askew, Keith Downey Rapporteur: Phil Salisbury

(1a) Genetically modified rapeseed/colza/canola survey - Poster (Melvyn Askew)

Results of a world-wide survey by Melvyn Askew revealed that genetically modified (GM) rapeseed/colza/canola, to date, been grown commercially only in Canada and USA. GM rapeseed commercialisation is expected to commence in Australia and Germany in the next two years, with commercialisation in Argentina, PRC, France, Belgium, UK, Czech Republic, Denmark and Finland likely beyond 2002.

The GM rapeseed traits commercialised to date have been glufosinate tolerance (Liberty Link), glyphosate tolerance (Roundup Ready), the InVigour hybrid system and high lauric acid. Bromoxynil tolerance will be commercialised in Canada in 2000.

Other GM rapeseed traits being developed include modified fatty acid composition types, pest and disease resistance, bioplastics, pharmaceutical products and shatter tolerance.

(1b) Where are we with GM Canola? (Dale Adolphe)

Canada is seeking to maintain its competitive position and increase its edible oil canola production, both through expansion of the area planted and improved yields. Biotechnology provides the best option for improved yields. It should make canola more attractive and lead to an increased acreage. There are 40 million acres available for canola cropping in Canada. With a 1 in 4 year rotation, this would equate to 10 million acres planted. With advances in weed, disease and insect control through biotechnology, there is the potential to tighten the rotation to 1 in 3 (13 million acres) or 1 in 2 (20 million acres).

GM canola was introduced in Canada in 1995, with closed loop production for sale in Canada and USA in 1995 and 1996. Since 1995, the Roundup Ready, Liberty Link and InVigour hybridisation system products have been grown. In 1997, full commercial production on a non-segregated basis commenced, with market approvals in Canada, USA, Japan and Mexico. These countries were 94% of the Canadian market in 1995-96.

Consumers have both a "need to know as well as a "want to know attitude. Consumers need to know about food safety, nutrition and allergenicity, but they also want to know more about the science of GMOs. This information is available, but how should it be disseminated?

Europe and Japan require mandatory food labelling of GMO products, but such labelling is discriminatory, because it labels the process and not the product. Therefore, why not label cheese, beer, bread, and pharmaceuticals?

We need to be organised with regard to education of consumers. A pro-GMO lobby group is urgently required. Every stakeholder needs to be part of the process of getting information to consumers.

Discussion points:

P. Dale: GMO presentations must be clearly balanced and not just seen as propaganda. The anti-GMO lobby is well organised and well-resourced e.g. Greenpeace is spending 20 million pounds in UK and $9 million in North America. The debate has become political, it is not about science. However, we will lose the science if we don't get organised. It is easier to sell bad news than good news .

K. Downey: The organic food industry has much to gain from advances in plant biotechnology. An alliance would be quite profitable for both industries. Studies of food deaths by the US Centre for Disease Control show that organic food is more than eight times more likely to cause deaths by *E. coli* than conventional food.1,2

(2) Risks and consequences of gene flow (Antoine Messean)

Gene flow is mainly a political issue. Genetic contamination occurs through seed and pollen dispersal. It is not a new phenomenon, but new quality requirements and consumer demands have enhanced its importance in the global community. Concerns which need to be addressed include the transfer of genetic material to adjacent fields (raising issues of volunteer plants, certification of non-GMO crops and new 'weeds' – with both crop management and legal implications), the effects of borders (reservoirs for transgenes), outcrossing to wild relatives and possible gene flow to micro-organisms.

The general pattern of pollen dispersal is well known. However, there can be significant variability in results depending on the size of the donor and recipient fields, varieties and climatic conditions. There is a need to consider the effects of crop breaks, the effects of honey bees and to estimate individual plant dispersion curves.

The likelihood of outcrossing to weeds is species dependent and is considered most likely in *Raphanus raphanistrum*. More information is needed on the fitness of hybrids, the effects of genomic structure and the behaviour of low-probability events (stochastic models).

To ensure consequences of gene flow can be managed, there is a need for an acceptable threshold defined with scientific data. Individual guidelines need to be defined for isolation distances and borders, while collective guidelines are required for HT farming systems. A monitoring system is required, which would detect unexpected events. To reduce pollen dispersal and outcrossing, the use of chloroplast DNA and cleistogamy is being considered. Longer term, positioning of the transgenes on the genome could play an important role. Research should be focussed on preventing outcrossing and reducing pollen dispersal.

Modelling is required for long term decision making at the political level (i.e. thresholds), the collective level and the individual farm level. Monitoring is useful for management, but it is difficult to design appropriate strategies.

Discussion points:

J. MacLeod: International seed purity standards of 99.5% for commercial seed and 99.9% for certified seed are accepted world-wide. With 400m isolation, no crops failed to meet these standards.

G. Röbbelen: These are safe distances for agricultural production. We must demonstrate what we know to the politicians, rather than focus on what we don't know.

A. Messean: We have sufficient information to provide guidelines for GM rapeseed. We must share data to build these guidelines.

(3) Risks and consequences of volunteers (Jeremy Sweet)

Results of the Melbourne UK study showed that, following a trial containing both GMO and non-GMO plots, the proportion of GM volunteers decreased over time. Similarly, a field margin study using isogenic lines (+/- bar gene) revealed superior establishment of the non-GMO lines relative to the GMO lines. Results from several NIAB National list trials and other trials have shown that where different herbicide tolerant (HT) types were sown close together, some multiple HT plants occur. However, these were well controlled by selective broad-leaf herbicides in subsequent cereal crops.

In the Bright project, a mixture of glufosinate, glyphosate and imidazolinone tolerant plants were allowed to hybridise, and the control of volunteers was evaluated. The overall conclusion from these studies was that the incidence and persistence of HT rape was not greater than that of non-HT varieties.

Rapeseed is well adapted to the agro-environment and seed will persist in the soil. Volunteers may significantly contaminate subsequent broad-leaf crops. Care is needed in the management of specific HT volunteers and in different quality oil and pharmaceutical types.

Rapeseed is not well adapted to non-agricultural environments, nor is GM rapeseed. Feral population colonise disturbed ground and are transient. They generally do not spread or colonise permanently. New fitness genes may increase competitiveness of *B. napus* and *B. rapa* volunteers, but normal agricultural practices should control them.

Key discussion points:

K. Downey: Two HT *B. rapa* varieties have been approved in Canada with closed loop production in 1998 and 1999. They are unlikely to proceed to full commercialisation at this stage, as the market is not large. *B. rapa* tends to be weedy in the UK, but not in western Canada.

J. Sweet: In terms of risk management, we need to assume gene flow will occur and focus on the consequences.

H. Svensk: Breeding for improved fitness in new conventional cultivars has not enhanced weediness in natural environments. The same principle applies for HT cultivars.

(4) The risks of gene stacking (Phil Dale)

Gene stacking can occur both unintentionally and intentionally. Unintentional gene stacking arises from pollen movement between crops e.g. multiple HT in variety trials. This raises issues in regard to farmer kept seed. Appropriate management protocols are required. Unintentional gene stacking is of particular concern when growing specialty crop products such as for plastics, detergents, pharmaceuticals etc.

Intentional gene stacking (gene pyramiding) occurs in breeding programs, either though multiple transformations for different traits or through hybridisation. Longer term, larger fragments of DNA, combining several genes, are likely to be inserted. Regulations regarding gene stacking differ between countries. In USA, deregulated GMO lines can be freely combined. In Canada, transgenes can be combined, but must receive 'Novel Crop' approval. In the EU, all stacked genes require regulatory approval. Are these regulations sustainable?

We need to consider the risk assessment of genetic interactions if combining the same promoters or using the same coding regions, because of the potential for silencing or instability. There is a need to test for a number of generations for longer-term instability effects.

Also, we need to consider pathogen induced transgene instability associated with homologous interactions. For example, natural CaMV infection of GM canola with the CAMV35S promoter can produce an homologous interaction which switches off the promoter and the transgene.

Relevant data to counteract emotional arguments against GMOs is available at the website www.gmissues.org.

Discussion points:

K. Downey: A large monitoring program to detect unintentional gene stacking has started in Canada.

G. Röbbelen: The need for monitoring of seed crops is being used by the anti-GMO movement as a delay tactic. This monitoring has occurred for 50 years as part of seed certification/production.

(5) Codes of practice for GM crop production (Melvyn Askew)

SCIMAC (Supply Chain Initiative on Modified Agricultural Crops) is an industry driven initiative, established in 1998 to support the responsible and effective introduction of GM crops in the UK. It represents the entire farm supply chain, from initial seed stock to harvested crop, and involves compliance with an industry-wide code of practice.

Members of SCIMAC are British Society for Plant Breeders, British Agrochemicals Association, National Farmers Union, UK Agricultural Supply Trade Association and British Sugar Beet Seed Producers Association.

The code of practice sets out basic requirements, including provision of information, record keeping and good management practices. It aims to maintain the integrity of GM and non-GM crops and optimise effectiveness of GM technology.

Guidelines for managing newly developed HT crops include operator training, seed storage and planting cleanliness, machinery operation, crop separation distances (utilising existing seed industry standards), crop management and herbicide use, harvest and post-harvest management guidelines, on-farm monitoring and record keeping, plus independent audit. The system has 'teeth', as companies will lose their licence for seed sales if guidelines are not followed.

Discussion points:

M. Askew (in response to several questions regarding cost): As the system is really an amalgamation of existing regulations, there is limited additional cost.

(6) Identity Preservation (Keith Downey)

Identity preservation for quality is different to identity preservation for threshold limits. For example, consider the difference in impact of a 98% threshold on identity preservation for quality and identity preservation for GMO purity. A mixture of 97% low erucic acid content canola and 3% high erucic acid content rapeseed produces a weighted average of 1.98% erucic acid, which is still within the legal definition of canola, but would fail to meet a 98% GMO threshold. Identity preservation for GMO purity is important.

GMO pollen in honey is an important issue. Canadian honey is made from GMO canola. It is impossible to filter pollen from the honey. Since DNA is carried in the pollen, Canadian honey is refused entry into EU. The issue of viability of pollen after long distance travel needs further resolution.

It is virtually impossible to achieve zero tolerance levels, because of the likelihood of contamination from external sources. A likely position is to declare that a product is derived from a non-GMO source, in contrast to a product containing no GMOs.

(7) How much GM determines a GMO? (Bill Scowcroft)

There is a need for GMO testing for varietal identification, cargo certification and future supply chain quality issues. A 'free from GM' specification theoretically means any detectable level is unacceptable. However, 'freedom from' really means a tolerance limit (usually 1-2%). GMO% can be estimated either using many single grain analyses or by using a ground sample (1000 or more seeds). Ground sample analyses are faster and cheaper than single kernel tests. Many test situations need a fast turn-around time.

There is a soybean four-hour antibody test, specific to RR protein. The test uses an Eliza plate or a dip-stick (presence or absence only) for detection. A test of 14 transgenic varieties produced variable results. However, while the test did not accurately detect GMO% in 13/14 varieties, it was useful to detect the presence/absence of GMOs. The test was not reliable below 2% GMO.

Industry should move towards the best available test strip assay to detect presence/absence of GMOs. It should be fast, taking only 5-15minutes, using a single ground sample. The industry needs to move towards tolerance limits, not freedom from GMOs. Nobody can guarantee complete freedom from GMOs.

Industry needs to provide specific DNA sequences or probes to identify individual cultivars. This could be part of the cultivar registration scheme. It is important that industry has access to appropriate methods for identification and testing of GM grains to provide quality assurance and appropriate certification and to support the development of identity preservation systems. Such a system needs to be timely, rapid and affordable.

Discussion points:

H. Svensk: Such identity could be based on transformation events, rather than varieties.

T. Schuller: How do you economically test for 'all genes' if you are claiming 'GMO free'. You would need to test for the full range of transgenes.

M. Askew: Grower choice (availability of both GMOs and non-GMOs) is a key issue in the UK.

W. Scowcroft: We must ensure that this technology is not lost.

D. Adolphe: We need international harmonisation of GMO food issues. There should be a science-based review of food and feed.

J. MacLeod: With a 2% threshold, physical contamination is more of an issue than pollen drift.

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(8) Summary

Key Issues

- Current GMO labelling is discriminatory, focussing on the process not the product, with not all GM products being labelled.
- A pro-GMO lobby is urgently needed.
- To ensure that the consequences of gene flow can be managed, acceptable thresholds need to be defined. Such thresholds will allow GM and non-GM crops (including organic crops) to co-exist.
- Multiple HT plants occur where different HT crops are grown close together, but they can be readily controlled with selective herbicides.
- Codes of practice for the management of HT crops (e.g. SCIMAC from the UK) are being developed in many countries.
- There is a need for international harmonisation on GMO food issues.

Key Research Issues

- It is important that research should focus on methods to reduce/prevent outcrossing and reduce pollen dispersal. Shorter term, issues of crop breaks and honeybee movements will be addressed. Longer term, the use of chloroplast DNA, cleistogamy and positioning of transgenes on the genome will be evaluated.
- Further understanding of GMO pollen/proteins in honey is required.
- Rapid, reliable tests for the detection of low levels of GMOs are required as part of the establishment of industry thresholds.

References

1 European Science and Environment Forum Press Release, 18 August 1999.
2 Avery, D (1999). 'The Fallacy of the Organic Utopia'. *In* Fearing Food: Risk, Health and Environment. J. Morris and R. Bate (Eds), Butterworth-Heinemann.