

# **CO-EXISTENCE IN THE PRIMARY SECTOR**

Main text and selected appendices

Report by the Temporary Committee chaired by J. van Dijk  
Committee members: Biologica, LTO Nederland, Plantum NL, Platform Aarde Boer  
Consument

**The Hague, 1 November 2004**

## 1. Introduction

Co-existence refers to the simultaneous existence of genetically modified crops next to conventional and organic crops. The new Commission Recommendation (EC) 556/2003 encourages Member States to work out national strategies and methods to deal with co-existence.

A few years ago, the Dutch Ministry of Agriculture, Nature and Food Quality and the Ministry of Housing, Spatial Planning and the Environment launched a broad public debate on outcrossing and co-existence. Various scenarios for co-existence were discussed with stakeholding organisations during this debate. The Ministry of Agriculture used the outcome of the debate to draw up a Dutch policy on co-existence, which was published in October 2003. Co-existence is primarily a practical problem and in view of the Government's policy of deregulation, the Dutch Government would prefer a system of self-regulation for co-existence issues. The policy document proposed that a self-regulation agreement could be in place by 1 July 2004. During parliamentary discussions on this issue at the end of 2003, the Minister of Agriculture and the State Secretary for the Environment agreed to appoint an independent person to chair the consultations between the primary stakeholders.

The aim of this so-called co-existence consultation was to realise a sector approach to co-existence; an approach drawn up and supported by all stakeholder representatives, which would make it possible for conventional, organic and genetically modified crops to exist side by side in the Netherlands. The chair of this temporary committee was appointed early in March 2004 and representative organisations from the sector, Biologica, LTO Nederland and Plantum NL were invited to participate in the consultation. Shortly afterwards, *Platform Aarde Boer Consument* (Earth-Farmer-Consumer Forum) also joined the committee at the request of public interest groups.

The committee's scope was limited to co-existence in the stage of commercial crop growth: from the propagation of seed stock to sowing, harvest and sale. The preceding stages (import, seed stock trade) and subsequent stages (collective trade, transport, industry, export) did not fall under the scope of this assignment, but the committee did stress that co-existence plays a crucial role in these stages. The stages preceding commercial production determine to a large extent how co-existence will be realised in the primary sector. In the post-production stage, the results of co-existence during production find their way to the end of the chain.

The outcome of the committee's explorations must of course be in accordance with all relevant laws: European legislation governing the authorisation of GM crops and prescribing conditions of use<sup>1</sup>, the Commission's recommendations on co-existence (556/2003) and the Dutch Civil Code. Under European Directive 2001/18/EC, GM crops are allowed if they are proven safe for humans, animals and the environment. The co-existence debate is about freedom of choice, about keeping chains distinct and about the potential economic and legal consequences of cross-contamination, or varietal mixing.

The committee members held their own views and basic principles and conditions which reflected the broad social debate on freedom of choice. The parties agreed to

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<sup>1</sup> The most relevant acts being Directive 2001/18/EC (replacing 90/220/EC) and Regulations 1829/2003/EC and 1830/2003/EC.

discuss the issues with the intention of realising an agreement that would minimise the risk of economic losses and of stakeholders having to take their case to court.

## **2. Approach and method**

The parties invited to join the committee agreed to take part in a constructive discussion exploring the possibilities for an agreement on co-existence. The committee members used the first few meetings to describe which principles and issues were important to them. A method was then drawn up to tackle the various issues. During discussion of the issues, points of contention and agreement were recorded. These are reflected in this report.

The committee called on external experts when necessary. Staff members from various ministries supplied information which gave the committee a clearer delineation of the current legislative framework. The committee also looked at the development of national strategies in other European Member States. In addition, requests for information were made to COGEM (Commission on Genetic Modification), IRMA (Institute for Risk Management in Agriculture), Interpolis insurers and the AVEBE sounding board group. The Ministry of Agriculture, Nature and Food Quality commissioned research to gather the latest knowledge on outcrossing and separation distances (see summary of that report).

The committee also organised public sounding board meetings, which gave parties other than those represented in the committee the chance to voice their opinions. At the first public meeting, those present were asked what results they expected and what they felt the committee should keep in mind. At the second meeting, participants could give their reactions to the lines of thought drawn up by the committee. At this time, no decision had been made as regards separation distances and the creation of a fund.

By late June, it was apparent that the committee would not be able to conclude its assignment by 1 July. However, good progress had been made in the four months since the start of the project and committee members felt there were good perspectives for an agreement on co-existence at the end of the line. The committee therefore requested an extension of the deadline to 1 November 2004. The Minister approved this request.

## **3. Results**

### **3.1 Freedom of choice**

In the matter of co-existence, it is vital that producers and consumers have the greatest possible freedom of choice. Ideally, everyone would prefer complete freedom of choice, within the constraints of the law, safety and ethics. The co-existence committee acknowledged this but also observed that this principle actually contradicted itself. In any community, there can never be absolute freedom of choice. One person's freedom of choice could restrict or even take away another's freedom of choice.

The co-existence of different crops implies that one crop might hinder another. Pollen might be blown from one field to another. Crops grown in the field are never absolutely pure. The admixture of GM crops with conventional or organic crops could result in the presence of GMOs in non-GMO crops and vice versa.

The committee concluded that it might be difficult to give a 100% GMO-free guarantee in an open system of agricultural production. Intermingling is always a risk. Within the scope of its assignment, the committee decided to accept the facts and to let go of the aim of absolute zero-tolerance in conventional and organic crops. Instead, it drew up a new aim: to minimise varietal mixing between GM crops and non-GM crops.

The greatest possible freedom of choice for all parties can only be realised when everyone fulfils their obligations. These should be reasonable and should preferably fall within the action domain of individual farmers.

### **3.2 Possible consequences, costs and economic losses**

When admixture occurs between GM crops and non-GM crops, there are likely to be costs and economic losses on top of the normal costs and losses of primary production. The committee identified the possible consequences, costs and losses of co-existence for primary production, thus excluding the possible costs and losses in the rest of the chain (processing, retail) or losses resulting from imported GM products. The costs and economic losses listed below may be a consequence of legislation or of market standards. In general, costs and losses can be divided into one of five categories:

- a. consequences for farm management;
- b. loss of income due to restrictions in crop choice and management;
- c. costs of additional measures during growth, harvest and storage;
- d. loss of income due to cross-contamination;
- e. loss of income without evidence of cross-contamination (market attitude).

Table 3.2.1 gives a comprehensive overview of all possible consequences, costs and economic losses per category. These are explained in detail below.

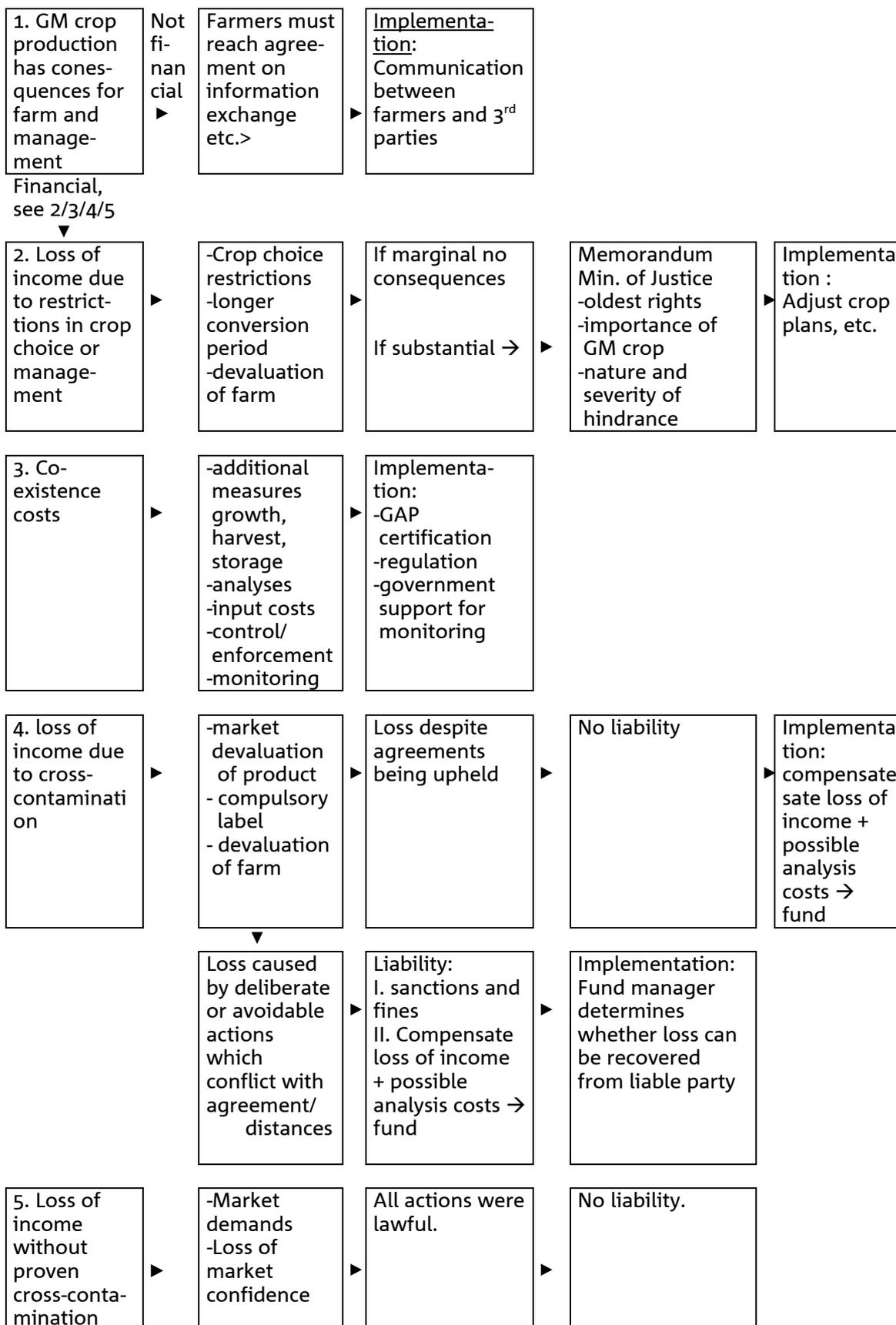
#### *3.2.1 Consequences for business operations*

The production of different crops can have consequences for how a farm is managed (communication). Growers must negotiate with each other and seek mutual agreement on their respective crop plans.

#### *3.2.2 Loss of income due to restrictions in crop choice and management*

- a. *Restrictions in crop choice and management:* when one farmer decides to grow a GM crop near a non-GM farm, the latter farmer is restricted in the crops he can grow under a GM-free guarantee. For example: a non-GM farmer could not grow maize next to his neighbour's GM-maize field. He will have to keep this in mind in his crop plan. Next to crop choice, the style of farm management could also be restricted. For example: it will be difficult for a conventional farmer situated next to a GM-farmer to convert to organic production.
- b. *Longer conversion time:* When a GM crop has been grown at a particular site, the area may not be suitable for organic production for quite some time.

*Table 3.2.1 Consequences, losses and costs of GM crop production and co-existence agreements*



### 3.2.3 Cost of co-existence measures

- a. *Cost of co-existence measures*: In order to guarantee a GM-free production chain, GM and non-GM production flows should remain distinct. This might be realised by taking special measures during crop growth, harvest and storage to avoid cross-contamination. These additional costs would be made by both GM and non-GM producers.
- b. *Cost of analyses*: Laboratory analyses of genetic material are necessary to determine whether a product is GM-free. These costs would be made by producers, inspection bodies or buyers of primary products. These costs may have to be born by the grower. For example: producers who refuse to label their products would have to give evidence that their product contains less than 0.9% GMOs. Effectively, this would force producers to test their crops for GMOs.
- c. *The result of a and b: rising prices for GM-free materials*: The price of GM-free materials (e.g. seed stock) might rise if the costs of maintaining distinct chains are born solely by the non-GM sector. Non-GM primary producers would get higher input costs.
- d. *Cost of control and enforcement*
- e. *Cost of monitoring*

### 3.2.4 Loss of income due to cross-contamination

Admixture could reduce the value of the crop (loss of turnover) and might even devaluate the farm property. For example:

- a GM-free consignment must be labelled; the cost of labelling reduces its net value;
- an organically grown product cannot be sold as organic; its net value is reduced to that of conventional products;
- a party contains less than 0.9% GMO but the buyer demands a GM-free crop;
- an organic farm loses its organic certification.<sup>2</sup>

### 3.2.5 Loss of income without proven cross-contamination: market attitudes

Wholesalers or retailers might reject a product simply because it was grown in the immediate vicinity of a GM crop. They might switch to another supplier, even though GM traits were not found in the product. This type of attitude in market parties might also lead to a devaluation of the farm property, even though there is no proof of cross-contamination.

In the Netherlands, the chance of market exclusion resulting from GM cultivation is determined by the following factors:

- realistic possibility that GM-free products contain GMOs;
- market parties' degree of confidence in the GM-free status of GM-free products;
- how informed people are about genetic engineering: realistic estimation of risks, knowledge of potential pros and cons;
- co-existence measures in other countries, including establishing GM-free zones;
- degree of public support for GM cultivation and products; consumer demands.

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<sup>2</sup> This could be possible in theory, but legal criteria have yet to be drawn up.

### 3.3 Legal framework for liability

The issue of liability for nuisance and economic loss resulting from co-existence is an important point of discussion<sup>3</sup>. The Ministry of Justice has examined the current legal framework covering liability issues as laid down in the Civil Code. When GM crops are first introduced, the GM farmer will be regarded as the 'newcomer'. This is the situation on which this report is based<sup>4</sup>. The question of who is responsible for compensating nuisance or loss will depend on whether 'unlawful action' was taken by the farmer which led to the loss or damage.

When the introduction of a new crop leads to a conflict of interest between GM farmers and non-GM farmers, the court will consider the matter of liability on the basis of:

- oldest rights;
- nature, severity and duration of the nuisance and resulting loss;
- the public importance and interests served by the activities which caused the nuisance;
- the possibilities for measures which can be taken to prevent losses;
- local circumstances.

The Ministry of Justice noted that it would be impossible to determine liability in cases of loss resulting solely from market attitudes (3.2.5). The committee has tried to work out both parties' respective obligations as regards the measures to be taken to prevent co-existence and any resulting losses or nuisance. The committee feels that a party that has fulfilled its obligations cannot be held liable for losses resulting directly from co-existence<sup>5</sup>. The committee feels that those who do not fulfil their obligations to avoid co-existence can be held liable for the ensuing losses. Legal jurisprudence has shown that the courts always take account of private agreements between stakeholders in deciding whether actions were unlawful. The co-existence agreements made by the direct stakeholders will therefore play a crucial role in determining who is responsible for the losses incurred.

### 3.4 Crop-specific measures

#### 3.4.1 Farm measures

The types of measures which are appropriate to prevent outcrossing in any given situation will depend largely on the type of crop (vegetative, generative) and the sensitivity to outcrossing. GM varieties for commercial may become available soon for potato, sugar beet and maize. We have identified measures for these three crops, but they might also be used for other, comparable crops. European admission will probably raise coexistence questions for the cultivation of GM rape, but this crop is not expected to be grown commercially in the Netherlands in the near future. The crop's characteristics make good co-existence agreements difficult and the committee did not have the time to work out sound measures for this crop.

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<sup>3</sup> Environmental liability is not discussed here, as it is particularly addressed in Directive 2004/35/EC. Similarly, product liability also falls outside the scope of this report.

<sup>4</sup> At this time, we cannot make any statements regarding liability after GM crops have become well-established.

<sup>5</sup> The indemnification here concerns liability for losses resulting from co-existence and not for environmental damage or product liability.

The committee evaluated various measures for potato, sugar beet and maize on their effectiveness and role in realising a mutually agreeable co-existence. The measures are plotted in a matrix and described in a co-existence manual for farmers. Some measures are compulsory, others are optional. All farmers should be informed about this comprehensive package of measures. Briefly, the measures can be summarised as follows:

1. All parties in the primary sector should have knowledge about GM cultivation.
2. It is crucial that farmers communicate and adapt their crop plans before sowing:
  - a. Farmers planning to grow a GM crop should inform and consult with farmers of adjacent fields in writing before 1 February. They should also consult with all farmers within the 'crop-specific separation radius' of a GM farm or field.
  - b. Farmers planning to grow a GM crop should notify the public registrar of their intentions before 1 February. The Ministry of Housing, Spatial Planning and Environment records all commercial GM cultivation for environmental monitoring purposes. This registration currently takes place in May, however. The committee feels that prior notification is necessary for co-existence purposes and proposes 1 February as the deadline for notifications. It is important that individual farmers' privacy is assured where possible. Therefore, data will be available to stakeholders only. The details of parties requesting information will be recorded.
  - c. It is important that GM farmers know by 1 February at the latest which farmers in their area produce for GM-free markets, so that crop plans can be adapted accordingly.
3. After local crop plans have been adapted and the competent authorities have been notified of GM cultivation, farmers will be required to take all measures which fall under the code of Good Agricultural Practice. E.g. measures to keep GM and non-GM parties separate, measures to prevent contamination during harvest, transport and storage and to prevent cross-contamination from an external source. Particular attention should be paid to the control of bolters in sugar beet and volunteers in sugar beets and potatoes.
4. Separation distances are one of the most effective measures to prevent outcrossing and admixture. In view of the most recent scientific knowledge, the committee decided to specify separation distances depending on the crop and local situation. A distinction should be made between conventional farmers and GM-free farmers – organic or otherwise – who have integrated GM-free principles in their farm management and who produce for a market which makes specific demands regarding products' GM-free status. The following separation distances are prescribed for the various situations:
  - a. Separation distances between a GM crop and a non-GM crop (same species) must be 3 m for potatoes, 1.5 m for sugar beet and 25 m for maize.
  - b. The separation distance between a GM crop and a registered GM-free crop (same species) must be 10 m for potato, 3 m for sugar beet and 250 m for maize.
  - c. Both GM-free farmers and non-GM farmers will have to cluster parcels as much as possible.

Farm certification is an appropriate method to ensure that these measures are complied with. The committee feels that the measures concerning cultivation and farm management could be incorporated in cultivation certificates (such as Arable Production and Food Safety; GMP 11 cultivation guideline on feed cultivation). The

compulsory elements, such as notification, separation distances and GAP measures can be laid down in a co-existence regulation. The regulation would also ensure compliance by third parties. Such a regulation sanction could be imposed when these requirements are not fulfilled. Naturally, all legislation would have to be in agreement with EU policy.

#### *3.4.2 Regional agreements*

The committee also considered the possibility of regional measures, such as the establishment of GMO-free zone or GM zones or clusters for a single crop. Growers can always make mutual agreements about this, subject to the Civil Code.

The Ministry for the Environment has suggested that municipalities might use their spatial planning instruments if they want to declare certain areas GM-free or plot a GM zone. Assigning a single type of production to a whole area will also have to be in harmony with EU law. The European Commission's recommendations on co-existence (2003/556/EC) will serve as the standard. European policy offers little scope for banning certain types of crop production at the regional level.

#### *3.4.3 Third parties*

The committee believes that allotment gardeners should also be educated about the cultivation of GM crops and that co-existence agreements are also made to include allotment gardeners. An active part could be played in this by the boards of allotment associations.

While it is important to increase farmers' and allotment gardeners' knowledge about the cultivation of GM crops and co-existence agreements, we must not forget the importance of educating the community at large (market parties, consumers).

### **3.5 Remaining losses, liability and the creation of a fund**

The committee is confident that compliance with the measures above will minimise the risk of cross-contamination. At the same time, there is no such thing as a zero-risk. Should losses resulting from cross-contamination occur despite the fact that all compulsory measures were complied with, parties should be released from liability for the losses. Some other adequate arrangement will have to be made.

The committee explored the pros and cons of insurance and compensation funds and concluded that an insurance policy would be almost impossible to realise at this stage. The obvious solution for the introductory stage would be a compensation fund, that might in future be combined with insurance. Under strict conditions, parties could apply to such a fund for compensation of the economic losses resulting directly from cross-contamination (e.g. loss of income, cost of laboratory tests). In order to qualify for compensation, a farmer would have to give evidence of the damage and not be responsible for causing the damage himself.

The Ministry of Justice proposes that the injured party first tries to settle the matter if the liable party can be identified. The committee suggests that liability can be decided on the basis of compliance with the co-existence agreement. If no one is liable – all parties have fulfilled their obligations or it is impossible to trace who caused the damage (multiple violators and/or the source or degree of cross-contamination cannot be established) – or if attempts to reach a settlement failed, the committee members agreed that the injured party should be able to apply to the compensation fund. In this case, the fund manager could determine, in addition to the consequential losses,

whether the damage can be traced to an infringement by one of the parties to the co-existence agreement who could then be held liable for the losses (loss of income). The committee advises authorising the fund manager to submit a claim on behalf of the injured party in these cases

The committee recommends establishing the fund on a crop basis. For each crop, all the parties concerned in the chain would contribute to the fund (i.e. growers of the crop, biotechnology companies marketing the GM variety, buyers of the GM crop). It will be essential that the government contributes to the fund in the introductory phase –covering the instrumental costs and acting as guarantor. The structure of such a fund would have to be in accordance with EU policy.

### 3.6 Co-existence monitoring

The aim of co-existence monitoring is to evaluate how effective the chosen measures are, so that adjustments can be made if necessary.<sup>6</sup>

#### 3.6.1 Principles of monitoring

In order to monitor the implementation of co-existence measures, it is necessary to establish:

- the purity of plant and seed stock (the start situation);
- which co-existence measures have been taken (monitoring compliance);
- the net effect of the measures; measuring possible cross-contamination in the harvested product (end situation).

If the desired effect – no cross-contamination – was achieved, the measures can be maintained or even relaxed in the course of time. If unintentional admixture did occur, it will be necessary to establish the cause. Possible causes might be:

- Use of contaminated plant or seed stock;
- Outcrossing due to inadequate separation distances and/or buffer zones;
- Adventitious presence during cultivation, harvest, transport or storage of the product or because of volunteer plants.

Once the cause of cross contamination has been established, it will be possible to adjust coexistence measures adequately.

#### 3.6.2 Monitoring protocol

Below, the committee has made a number of recommendations for a monitoring protocol. The interested reader could also consult the Ministry of Environment's memorandum on sampling and detection.

- a) *Sampling schedule*: samples should be collected before, during and after cultivation. The sampling schedule provides assurance that monitoring is carried out correctly. The sampling schedule will also make it easier to trace the cause of cross-contamination, should this occur.
- b) *Detection/analysis*: analysis costs should be kept as low as possible. We therefore recommend analysing a sample of the harvested product first. If evidence of cross-contamination is found, the other samples can be analysed in order to trace the cause of the cross-contamination.

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<sup>6</sup> This is not the same as the control and enforcement of measures.

- c) *Frequency*: monitoring and control should be carried out frequently in the first three years of GM cultivation (based on representative random samples). The frequency may be reduced if the measures are found to have the desired effect.
- d) *Reporting*: the results of monitoring should be reported to all stakeholders once a year.
- e) *Consequences of monitoring outcome*: if necessary, co-existence measures will be adapted.

#### 4. Conclusions: agreements and recommendations

The committee concludes its assignment with the following recommendations.

##### General

1. The links in the chain preceding and following primary production are important for the realisation of co-existence in the primary sector and for the success of co-existence in the chain.
2. The agreements and arrangements in this report, which may be regarded as a covenant, are part of an integral package. It is vital that all components of this package are implemented.

##### Specific

3. In the interests of freedom of choice, every effort should be made to prevent cross-contamination. Crops should be cultivated in a way that minimises the chance of losses resulting from admixture. The crop and farm management obligations formulated in this covenant are appropriate instruments for achieving this aim, provided they are proportionate and reasonable.
4. The committee has reached agreement between the stakeholders concerning: the acquisition of knowledge, the exchange of information and crop adaptations between farmers, the registration requirement for GM growers, measures that tie in with the code of Good Agricultural Practice and separation distances. Compliance with these measures could be assured with a system of certification of GM growers. The measures concerning crop production and farm management could be incorporated in the system of certificates (arable crops, feed manufacturing). The implementation of compulsory notification, separation distance and GAP measures should be incorporated in a co-existence regulation.
5. The committee laid down separation distances for three crops on the basis of the latest scientific information. At this time, however, little information is geared specifically to the Dutch context of crop farming, in particular as regards fodder maize. Further research geared to the Dutch situation is necessary.
6. Farm-level measures must go hand in hand with monitoring. The aim of monitoring is to evaluate the measures' effectiveness, so that they may be adapted if necessary.
7. The stakeholders have agreed that every effort should be made to prevent cross-contamination disputes being taken to court. The agreements in the covenant aim to prevent this from becoming common practice. The committee feels that those who fail to comply with the agreements, resulting in proven damage, should be held to account for the losses resulting from admixture on the basis of current liability legislation. The covenant sets out each party's obligation in avoiding admixture and hindrance. Those who have carried out their part of the agreement in good faith should be indemnified from liability for losses resulting from cross-contamination (income loss and costs of analyses).

8. A compensation fund should be created per cultivar to cover losses. Under certain conditions, injured parties may qualify for compensation of income losses resulting from cross-contamination.
9. The government and all relevant parties in the chain (per cultivar) should contribute to the fund.
10. Market exclusion can have serious consequences for GM-free growers, but at the same time it might be impossible to identify a liable party. Every effort should be made to minimise the threat of market exclusion. The committee is certain that this can be achieved by: strict co-existence measures combined with control and enforcement, monitoring and if necessary adjustment of measures, research, educating market parties and consumers. The committee believes that these conditions will be realised adequately with this covenant. It will also be important to harmonise co-existence strategies.
11. An agreement on rapeseed was not drawn up due to time constraints, the low degree of urgency for this crop and the complexity of this crop. Co-existence agreements would therefore have to be made before GM rape could be introduced commercially.
12. The coexistence agreements will be evaluated after three years of implementation, starting from the 2005 growing season. The agreements will not expire after three years, but may be adapted with the agreement of all the parties involved following the results of the evaluation. Interim adjustments may also be possible on the basis of new scientific evidence. All adjustments should be made by consensus only.
13. A satisfactory solution for 'resulting damage', for example to the status of a farm after GM contamination, is yet to be developed. As yet, there is no policy to deal with a farm losing GM free certification, including organic certification.

The committee makes the following recommendations:

1. in the short term, cultivation and farm management measures should be incorporated in cultivation certificates (food safety for the arable sector, GMP 11 for feed production) and their implementation should be supported by a regulation, to be drawn up in the near future;
2. The Ministry of Agriculture and the Ministry of Environment should arrange for the technical facilities for GM crop registration before 1 February of the year of cultivation;
3. The structure and functioning of a compensation fund and the conditions under which a farmer may qualify for compensation need to be worked out;
4. The IRMA will make an estimate of the required scope of the fund;
5. In the short term, a monitoring protocol must be drawn up, including all the elements identified by the committee;
6. All stakeholders must make a serious effort to generate support for the implementation of co-existence agreements and measures, at the very least among their own grassroots;
7. Third parties should also be informed of co-existence and the coexistence agreements now made concerning GM cultivation. If necessary, active extension by for example allotment associations should ensure that the agreements are complied with;
8. All field trials allowed by the Ministry of Environment should take account of the separation distances agreed by the committee members;
9. In view of the Dutch Government's wish to enable coexistence and to facilitate self-regulation, it should

- seek to close the knowledge gap by commissioning research in the short term, to provide more field data on separation distances especially for fodder maize. In particular, research is needed on the effectiveness of separation distances for fodder maize in combination with separate harvesting of non-GM plating rows. Research should also be carried out into the possibilities for minimizing separation distances and for a uniform approach to this matter;
  - contribute financially to the cost of managing the compensation fund and act as guarantor;
  - contribute financially to the monitoring programme;
  - support the co-existence agreements made in the Netherlands and give its approval to the European Commission regulation and fund;
  - contribute to the dissemination of knowledge on GM cultivation and associated regulations;
  - contribute to campaigns informing consumers and market parties about coexistence.
10. The Dutch Government should closely follow developments in neighbouring countries regarding their coexistence strategies and maintain open lines of communication in order to prevent problems arising in border zones.
11. The Dutch Government should lobby for harmonisation of European coexistence strategies.

## Annex 6b Coexistence measures per crop

		Maize	who	Potato	who	Sugar beet	Who
<b>2.1 General</b>							
2.1.1	Voluntary agreements between growers on zones with a single production type	Between private parties	optional	Between private parties	optional	Between private parties	optional
2.1.2	Training	compulsory for every grower, custom worker etc Control through certification	Parties in the chain	compulsory for every grower, custom worker etc Control through certification	Parties in the chain	compulsory for every grower, custom worker etc Control through certification	Parties in the chain
2.1.4.1	Information / harmonisation with neighbouring growers	At early stage (before Feb. 1) so crop plans can be harmonised	Initially GM grower plus suggestions from grower of produce labelled 'GM-free'	At early stage (before Feb. 1) so crop plans can be harmonised	Initially GM grower plus suggestions from grower of produce labelled 'GM-free'	At early stage (before Feb. 1) so crop plans can be harmonised	Initially GM grower plus suggestions from grower of produce labelled 'GM-free'
2.4.1.2	Registration	before Feb. 1 so crop plans can be harmonised	GM grower	before Feb. 1 so crop plans can be harmonised	GM grower	before Feb. 1 so crop plans can be harmonised	GM grower
<b>2.2 Preparing fields for cultivation of GM crops</b>							
2.2.1	Separation distances to be observed	250 m from grower of produce labelled 'GM-free'; 25m from other growers; both GM and 'GM-free' growers should try clustering fields where possible	GM-grower  GM grower and grower of produce labelled 'GM-free'	10 m from grower of produce labelled 'GM-free';  3 m from other growers; both GM and 'GM-free' growers should try clustering fields where possible	GM-grower  GM grower and grower of produce labelled 'GM-free'	3 m from grower of produce labelled 'GM-free';  1.5 m from other growers; both GM and 'GM-free' growers should try clustering fields where possible	GM-grower  GM grower and grower of produce labelled 'GM-free'
2.2.2	Buffer zones pollen traps or barriers	Buffer zones, pollen traps or barriers may reduce distances to be observed	optional	Not applicable		Not applicable	
2.2.3	Harmonising crop plans	may prevent outcrossing, different flowe-ring times a.o.	optional	may prevent outcrossing	optional	may prevent outcrossing	optional
2.2.4	Field margin management	wild relatives do not occur		Wild relatives do not occur		wild relatives do not occur	
2.2.5	Tubers etc/ volunteers	Not applicable		Volunteers must be destroyed	grower	Bolting must be prevented	grower
2.2.6	Reduce pollen production	De-tassel maize in outer rows	optional	Not applicable		Not applicable	
2.2.7	Clean drilling machinery must be cleaned before and after use	Important demand concerning sowing	Requirement applies to all workers incl. contract workers	Important demand concerning planting	Requirement applies to all workers incl. contract workers	Important demand concerning sowing	Requirement applies to all workers incl. contract workers
2.2.8	Share drilling machinery with other growers planting the same crop	Cleaning task can be shared	optional	Cleaning task can be shared	optional	Cleaning task can be shared	optional
2.2.9	Prevent spilling	Good	Requirement	Good	Requirement	Good	Requirement

	during transport	Agricultural Practice	applies to all workers incl. contract workers	Agricultural Practice	applies to all workers incl. contract workers	Agricultural Practice	applies to all workers incl. contract workers
2.2.10	Grower's own propagating material	Use only certified propagating material	grower	Use only certified propagating material	grower	Use only certified propagating material	grower
<b>2.3 Harvesting measures</b>							
2.3.1	Keep losses to absolute minimum	Good Agricultural Practice	All workers	Good Agricultural Practice	All workers	Good Agricultural Practice	All workers
2.3.2	Clean all machinery that may retain reproductive plant parts	Harvesting machines must be cleaned before and after use	Requirement applies to all workers incl. contract workers	Harvesting machines must be cleaned before and after use	Requirement applies to all workers incl. contract workers	Harvesting machines must be cleaned before and after use	Requirement applies to all workers incl. contract workers
2.3.3	Share harvesting machinery with other growers harvesting the same crop	Advantage when cleaning	optional	Advantage when cleaning	optional	Advantage when cleaning	optional
2.3.4	Harvest field margins separately	Separate from rest of field	optional	Not applicable	optional	Not applicable	optional
2.3.5	Reduce seed bank, control volunteers	Not applicable		Prevent/control volunteers no turning of soil before winter	grower	Control bolting / resistance	grower
<b>2.4 Transport and storage</b>							
2.4.1	physically segregate between GM and non-GM crops	Visible segregation of crops in transport and storage (certification requirement)	Grower and carrier	Visible segregation of crops in transport and storage (certification requirement)	Grower and carrier	Visible segregation of crops in transport and storage (certification requirement)	Grower and carrier
2.4.2	Prevent spilling of harvested crop	Good Agricultural Practice	Requirement applies to all workers incl. custom workers	Good Agricultural Practice	Requirement applies to all workers incl. custom workers	Good Agricultural Practice	Requirement applies to all workers incl. custom workers
2.4.3	Report calamities	Report to certification body and take appropriate measures	grower	Report to certification body and take appropriate measures	grower	Report to certification body and take appropriate measures	grower

**Appendix 9 . Summary PRI-report**

*Inventory of current knowledge on outcrossing in maize, oilseed rape, potato and sugar beet crops for the co-existence consultations in 2004*

**PLANT RESEARCH INTERNATIONAL  
WAGENINGEN UR**

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## SUMMARY

This report aims to update current knowledge on outcrossing in maize, oilseed rape, potato and sugar beet crops. The Ministry of Agriculture, Nature and Food Quality asked for an inventory to be made, for the co-existence consultations between the primary stakeholders. The consultations took place in a temporary committee chaired by Mr J van Dijk and aimed to achieve a sector approach to co-existence, drawn up jointly by all stakeholder representatives, which would make it possible for conventional, organic and genetically modified crops to exist side by side in the Netherlands.

The significance of outcrossing for co-existence is as an important source of GM admixture when the pollen of a GM plant fertilises a non-GM plant. In maize, which is a wind-pollinated species, and oilseed rape, which is pollinated by both insects and wind, the great part of outcrossing occurs in the immediate vicinity of the source crop, but as the distance between GM crops and non-GM crops increases, outcrossing rates go down fast. Pollination over longer distances may still occur at a low level.

Oilseed rape is a more complicated case. Here, seeds left behind from the harvested GM crop may germinate the following season and outcrossing may occur with other volunteers and feral populations or even with wild relatives close to the GM field. For potato and sugar beet outcrossing is less relevant as seeds are not part of the harvest. This report does not deal with admixture through the seeds used for sowing the fields or that may occur during transport or processing further down the chain.

The EU maintains a 0.9% percent threshold above which GM labelling is required. Discussions are still taking place about whether to use this same threshold for organic products or whether a lower threshold should be used. In the strictest scenario, a practical detection limit of 0.1 per cent would apply. Admixture in the harvested product will be assessed by measuring the quantity of transgenic DNA (number of copies) against the total DNA of the crop (number of haploid genomes). The ratio depends on the type of GM crop and the part of the crop being assessed. The quantification method is calibrated on the basis of a crop and transformation event-specific standard sample. However, the precise conversion method is still being evaluated. So far, outcrossing field trials have worked with the percentage of seeds produced by cross fertilisation. Without calibration such percentages cannot be easily converted into the values found through real time PCR DNA quantification. In most cases, the values arrived at through DNA quantification will be lower than those arrived at by other methods (colour markers or herbicide tolerance). In seeds produced on a non-GM mother plant through pollination by a GM father plant, the number of haploid genomes containing the transgene is significantly less than half of the total number of haploid genomes, as is the normal situation in the embryo. This is because the other parts of the seeds either exclusively derive from the non-GM mother plant (the seed coat) or contain maternal and paternal genomes in a ratio of 2 : 1 (the storage tissue called endosperm). Final results will depend on the extent to which directives provide for the conversion from the results arrived at through DNA quantification to, for instance, the percentage of seeds produced by cross fertilisation.

In the British Farm Scale Evaluations (FSE) and recent Spanish field trials with maize, the real time PCR DNA quantification method was used; this is the method that will be used in practice for harvested products. The latest results of the British FSE show that incrossing below the 0.9% percent threshold occurs at an average 25 m distance from the adjacent field. This happens to individual plants in situations where source and receiving crop are in fields next to each other. When separation distances are observed, an open space will separate the fields. As in this open space the pollen is not caught by other maize plants, older data would suggest that pollen will travel further. Most pollen will not go beyond 25-50 m however. A limited part of recent trials in Spain and France show that an open space of 25 m between fields will also produce incrossing below the 0.9% percent threshold in the outer rows (5 m) of a neighbouring field. However, these results have not yet been subjected to peer-reviewed scientific publication.

Also, climatic circumstances in the Netherlands are different. Thus, the rest of the trials in Spain and France in adjacent fields show that incrossing below the 0.9% percent threshold occurs at smaller distances (10-20 m) than those suggested by the British trials, which have been under climatic conditions more similar to those in The Netherlands. The field trials in France did not use the PCR DNA quantification method, but after conversion of the percentage of seeds produced by cross fertilisation they arrived at roughly the same results as did the Spanish trials. Given the possibility of flukes under exceptional conditions in the field, it would be wise to use a separation distance of more than 25 m. No specific data are available for this. A safety margin is also necessary for relatively smaller receiving fields whose smaller pollen clouds offer less protection to the incoming pollen from larger fields. To achieve threshold levels of less than 0.3% the British FSE indicates that separation distances of 80 m should be observed, and distances over 250 m to achieve levels below 0.1%. The Netherlands mainly produces silage maize whose grains (the potentially admixed part) make up at most half of the weight of the end product. This does not necessarily mean that the admixture found with the PCR DNA quantification method will also be half as much. Admixture levels found will depend on the relative levels of DNA in the various parts of the plant and the efficiency with which the DNA can be extracted from them. Here, too, the calibration standard and conversion method used will be the deciding factors. If admixture in silage maize is reduced by half, the 25 m distances between fields might, on account of the non-linear curve of pollen dispersion, be brought down to distances of 15 to 20 m in FSE situations. The deciding factor in formulating directives is the criterion on which they are based: incrossing in seeds or the relative admixture of the total product.

In the oilseed rape studies to date, outcrossing is worked out in transgenic seed percentages instead of PCR DNA quantification. On the basis of meta-analysis and large field trials the conclusions are, that for oilseed rape an average separation distance of 50 m suffices to achieve incrossing rates below 0.9% in seeds. The study is based on open spaces between fields. It should be noted that this 50 m separation distance applies to the first time a GM crop is planted in a field next to conventional crops. As time goes by other factors will contribute to admixture, such as volunteer crops from seed left in the soil and outcrossing between volunteers and other oilseed rape crops, or feral populations and wild relatives. Tentative quantifications of these factors can be extracted from the literature, but studies based on the French computer model GENESYS represent the most comprehensive approach up till now. The latest GENESYS based publication (Colbach *et al.*, 2004) indicates a 200 m separation distance for intensive production to achieve threshold levels below 0.9%. But the absolute values provided by the models must be considered with care, since the models are not yet fully validated. Moreover, little is known about the variables in the Dutch situation. To be on the safe side therefore, a separation distance of at least 200 m appears to be called for. Compensation is possible by means of longer rotation intervals (periods longer than 6 years). Even in situations where the GM crop is planted for the first time among conventional crops, separation distances for threshold levels considerably below 0.9% are large and depend, as in maize, on field size. Compliance with 0.3% threshold levels in a field 50 m in depth, would mean observing a separation distance of 200 m. Compliance with 0.1% threshold levels in fields 200 m in depth, would mean observing a separation distance of 100 m. Depending on crop and cultivation technique, threshold levels of 0.1% would require separation distances of over 200m.

The situation for potatoes differs from that of maize and oilseed rape. First, because the seed is not part of the harvested product, and second, the combination of a low cross-pollination percentage and the negligible role of wind pollination means that even at 10 m distances incrossing of seeds easily complies with the 0.1% threshold. Although definite figures cannot be given, with normal farming practices, volunteers arising from seeds will be poor competitors with other plants, and so, these volunteers would be unlikely to form GM tubers that might lead to admixture with a subsequent non-GM potato crop. Admixture from incrossed seeds does not pose as much a risk as does admixture from overwintering GM tubers left in the soil. Strict rotation of crops is required under Dutch phytosanitary rules to prevent contamination of subsequent crops. Therefore, admixture from tubers is not likely to be

problematical or lead to admixture exceeding threshold levels. Because of physiological aging, tubers will not survive in the soil for long unless annual regeneration takes place. A separation distance can be proposed for potatoes that is the same as that required to prevent harvested tubers from being mixed.

For sugar beet the situation is different again. In sugar beet the seed is not part of the harvested product and neither does the plant flower in the cropping season, except for the incidental bolters and annual weed beets. Under normal circumstances, these are few, and outcrossing is therefore rather low. However, if the incidental bolters and weed beets are not controlled, a strong increase in weed beets is possible. Thus separation distances are not the prime method for preventing outcrossing in sugar beet but a strictly observed control of bolters before flowering and seed set has occurred. Very strict control measures would also safeguard small-scale seed production of vegetable forms of beet. GM beets must not be introduced in fields infested with volunteer plants.

For crops with high outcrossing rates such as silage maize and oilseed rape, preventive measures might be taken such as temporal separation or physical separation (fencing, wind breaks, border rows). Temporal separation (so that GM and non-GM crops flower at different times) would not be very effective in the Netherlands. Oilseed rape has a very long flowering season, maize has a short growing season that leaves small margins for moving the sowing date without considerable loss of yield. Border rows such as hemp will only significantly dampen incrossing when fields are in close proximity and will only work for plants right behind these barriers. Further down the field outcrossing levels may even go up on account of changes in wind speed and direction or surface turbulence (but usually at rates < 0.9%). It would be more effective to remove the crop's outer rows for the amount of space that a border or barrier would take up.