

## Executive Summary

Consumers, food/feed industry and retailers demand a reasonable degree of choice between GMO- and non-GMO-derived products. But different modes of agricultural production are not naturally compartmentalised. If GM crops increase their share in EU agriculture (which is now minimal) questions arise concerning their possible co-existence with non-GM crops (conventional and organic) at farm level or regional level. Some of these questions are of agronomic and economic nature, and these are addressed in this report:

- *What will be the levels of adventitious presence of GM crops in organic or conventional crops, with current farming practices if the share of GM crops increases to 10% or 50%?*

The study was done for three crops for which GM varieties are available (oilseed rape for seed production, maize for feed production and potatoes for consumption), and for several farm types (both organic and conventional) that were defined to cover the variability present in EU farming infrastructure. For all crop-farm combinations, a hypothetical share of GM crops of 10% or 50% in the region was considered. A share of 50% mimics the situation in countries that adopted GM crops readily (for example the share of GM oilseed rape in Canada is currently 54%), while the 10% figure represents a scenario of slow adoption of GM crops in the EU.

In these scenarios, an estimation of the expected levels of adventitious presence of GM crops in non-GM crops was done with a combination of computer modelling and expert opinion. The estimations have a strong relative value (i.e. they are useful in predicting the effect of a change in farming practices) but the absolute figures obtained have to be taken with care since the models are not yet fully adjusted with field data.

The estimated levels of adventitious presence of GM crops do not change dramatically between the two scenarios of GM crop share (10% or 50%). A practical consequence is that measures to prevent adventitious presence of GM crops (see below) may have to be implemented in the early stages of adoption.

On the other hand, the estimated levels of adventitious presence of GM crops in non-GM crops - assuming the current farming practices specified in the study- vary significantly depending on the crop and farm type (for example, as much as 2.2% for a conventional intensive maize farm or as low as 0.1% for an organic potato farm). In general there is a trend to expect lower levels of adventitious presence of GM crops on organic farms, because of segregation systems already in place, but there are notable exceptions. For example in seed production of rape, organic farms will face higher probability of adventitious presence of GM crops due to problems in controlling volunteers with organic practices.

Sources of adventitious presence of GM crops are well known, and can be divided into four main origins (seed impurities, cross-pollination, volunteers and harvesting-storage practices). The relative importance of each source for the final level depends on the crop and farm type: volunteers are a key source of adventitious presence of GM crops for rape seed farms (especially organic) but are of low importance in maize farms, where seed impurities and cross-pollination account for most of the adventitious presence of GM maize.

- *Can this adventitious presence of GM crops in organic or conventional crops be reduced below certain policy-relevant thresholds with changed farming practices?*

Once again the answer depends on the farm-crop combination. The thresholds used in the analysis are similar to those being discussed in various regulations. These are 0.3% for seed

production of allogamous species (rape) and 1% for maize and potato crops (for food-feed uses). All farm types producing oilseed rape seed or conventional maize will be able to meet their thresholds provided they change the set of current farming practices defined in the study. It should be noted that these current farming practices are a compromise, given the diversity of European farms in this regard. Therefore, some of the changes proposed (and the estimated costs associated) could be already in use in number of farms. In some cases (dependent on farm type) changing farming practices at the individual farm level will be insufficient. In these cases changes may involve co-operation between neighbouring farms. Examples are the introduction of flowering time differences between GM and non-GM varieties, or region-wide border management. In contrast, all potato farm types and some maize farm types (organic) could meet these thresholds with the set of current farming practices defined in the study (with all the reservations already mentioned for the value of absolute figures).

- *Can adventitious presence of GM crops in organic or conventional crops be avoided?*

The possibility of changing practices to meet very low thresholds for all crops, near the analytical limit of quantification (~ 0.1%) is also considered in the report. This reflects the situation in organic farming where the use of GM varieties is not permitted (Council Regulation (EC) 1804/1999), setting a *de facto* threshold. The report concludes that a 0.1% limit will be extremely difficult to meet for any farm-crop combination in the scenarios considered (10% and 50% GMOs in the region), even with significant changes in farming practices. Perhaps some farm types producing seed of oilseed rape could approach such thresholds, but only with significant changes of farming practices.

- *What is the cost of these changes?*

In the analysis all costs are allocated to conventional or organic crop production, including those affecting primarily GMO production in case of co-operation. Compliance with the 1% and 0.3% thresholds through changes in farming practices and introduction of a monitoring system as well as likely insurance needs may result in additional costs of 1% - 10% of current product price for the farm-crop combinations studied (in the 50% scenario). Exceptions are found in the production of seed of oilseed rape, where costs can be much higher in particular farm types (up to 41%). In all cases, monitoring activities account for a large part of the additional costs. Cost reductions might be possible with segregation becoming an integrated part of agricultural practices and with decreasing costs of GMO tests. Generally, organic farms face higher costs (especially indicative insurance costs) per hectare and per tonne than conventional farms. However, when relating costs to product prices, the price premium for organic crops may reduce this difference considerably. Costs have been calculated without taking into account any changes in demand or market prices that would probably accompany an increased level of GM crops in agriculture.

- *Can the different types of production co-exist in a region?*

This question has to be examined case-by-case for each crop. However, it seems clear that co-existence with thresholds in the region of 0.1% is virtually impossible in any of the scenarios considered. When considering the 0.3% (production of seed) and 1% (food-feed production) thresholds, co-existence of GM and non-GM crops in a region (with 10% or 50% GMO share) might technically be possible but economically difficult because of the costs and complexities of changes associated. This is the case exemplified by seed production of rape. For potato the costs are much lower and no significant change of practices is needed, so co-existence could be a reality. The costs and types of adaptation of maize growers put this crop in an intermediate situation, but some types of conventional, intensive maize farms will have difficulties in a co-existence situation.

- *Can the different types of production co-exist on the same farm?*

Finally, cultivation of GM and conventional or organic crops on the same farm might be an unrealistic scenario, even for larger farms. Due to the importance of volunteers, oilseed rape seed producers will exclude growing GM crops on the same farm to avoid adventitious presence of GM seeds in their non-GM seeds. Also for maize and potatoes it would make the handling of the crops rather difficult.