

Joint Research Centre

the European Commission's in-house science service



## European Coexistence Bureau Technical Working Group for Cotton

### Best Practice Document "Coexistence of genetically modified cotton with conventional and organic farming"

Advisory group on the food chain and  
animal and plant health,  
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# Coexistence concepts

Coexistence strategies in EU are developed at national level

following general guidelines from the EC.

EC  development of technical advice through the ECoB

The mission of the ECoB (2008) is:

- to organise the exchange of technical and scientific information on the best agricultural management practices for coexistence; and
- to develop consensually agreed crop-specific guidelines for technical coexistence measures.

# European Coexistence Bureau

[TWG Maize](#), [TWG Soybean](#), [TWG Cotton](#) and [TWG Potato](#).

The TWG Maize:

TWG Soybean:





## **European Coexistence Bureau**

Technical Working Group of Cotton consist of nominee experts from 11 MS and Liechtenstein began work on June 2014

**Belgium**

**Bulgaria**

**Czech Republic**

**Greece**

**Spain**

**Croatia**

**Cyprus**

**Hungary**

**Romania**

**Finland**

**United Kingdom**

**Liechtenstein**

## Scope of the work TWG Cotton

- Coexistence of GM cotton cultivation in the EU with non-GM cotton and honey production;
- Crop production up to the first point of sale, including on farm storage;
- Thresholds for coexistence to be analysed: legal labelling threshold and private market thresholds;
- Review the methods for quantification of GM cotton presence in other crops and honey;
- GM cotton that contain a single transformation event.



## Work of the ECoB TWG Cotton

Two meetings : October 2014 and April 2015

Review of literature (in total 169 references) for:

- adventitious GM presence in cotton production;
- existing segregation systems in cotton production;
- management farm practices;
- the presence of cotton pollen in honey;
- detection and identification of GM cotton material in non-GM cotton harvests and honey.

# Structure of the report

- 1. Introduction**
- 2. Cotton biology**
- 3. Cotton cultivation in the EU: demand and crop production**
- 4. Existing segregation systems in cotton production**
- 5. Review of the available information on adventitious GM presence in cotton production**
- 6. Occurrence of cotton pollen in honey**
- 7. Detection of GM events in cotton crops and honey**
- 8. Best practices for coexistence of GM cotton and honey production**
- 9. Economic analyses of the best practice**
- 10. References**

## 2. Cotton biology

- The cotton flowers open in the morning shortly after dawn and last only a daylong, closing at night and never reopening.
- The cotton flowers have both floral and extra-floral nectaries, while secretion of extra-floral ones starts 5-6 days before flowering and initially peaks on the day of anthesis.
- So, despite the cotton flower being large and showy to attract insects, the majority of seed set is the result of self-pollination not cross-pollination.
- Cotton pollen is large, heavy, and sticky (coated with a viscous material that causes them to adhere to each other), with long spines and is not easily dispersed by wind.



## 2. Cotton biology

- Furthermore only 16% of foraging honeybees that landed on cotton flowers collected pollen.
- Wild bees such as bumble and black bees, are known as real pollinators and honeybees are secondary pollinators because they generally do not collect pollens or do not carry them far away.
- Cotton seeds are large, covered with thick fibres and enclosed in a tough boll that retains most of the seeds on the plant. Therefore the gene flow mediated by incidental seeds dispersal is likely to be minimal.
- However, as cotton does not generally reproduce vegetative, spread within the environment occurs by seed dispersal.
- Cotton seeds in general do not possess seed dormancy.

### 3. Cotton cultivation in the EU

- Cotton is produced currently only in three EU MS on around 300,000 ha :
  - Greece is the main cotton grower, with 80% of European cotton area;
  - Spain (mainly the region of Andalucía) with a share of 20%;
  - Bulgaria produces cotton on less than 1000 ha.
- Although cotton represents less than 0.2% of the value of European agricultural production, it has strong regional importance in the two main producing MS.
- In the EU, most farms growing cotton are characterised by their small size (Greece: 2-10 ha and Spain: 10-20 ha) and large number (approx. 65,000 in Greece and 4,500 in Spain).

## 4. Existing segregation systems in cotton production

1. Cotton seed production.
2. Schemes for Identity-preserved (IP) cotton production.
3. Organic cotton.
4. Modelling scenarios for coexistence between GM and non-GM Cotton in Andalusia, Spain

## 4.1. Cotton seed production

The isolation distances to meet the standards for varietal purity (Council Directive 2002/57/EC) of cotton seeds are as follows:

- 400 meters for production of basic seeds;
- 200 meter - certified seeds.

## 4.2. Schemes for Identity-preserved (IP) cotton production

- Over the last decade a number of projects have been launched to improve agricultural practices for cotton production in developing countries, with aim to satisfy all three components of sustainability: economic, social and environmental.
- Tree of them: Organic cotton, Fairtrade cotton (FT) and Cotton made in Africa (CmiA) exclude the possibility for GM cotton cultivation;
- Another two: Better Cotton Initiative (BCI) and Bayer's e3 are open for both production systems.
- The last two for 2012/2013 comprised about 75% of total world production of identity-preserved cotton

## 4.3. Organic cotton.

India\* produced 81% of world organic cotton, with 80-85% of the cotton cultivated area in the country under GM cotton.

Organic cotton means certified organic cotton:

1. A minimum 3m buffer zone from farm boundary to organic cotton and the planted buffer crop to be different of cotton;
2. Additional measures, recommended to avoid adventitious admixture arising from:
  - mixing of seed;
  - planting of GM seed;
  - mixing during harvest;
  - mixing in storage;
  - mixing during transport;
  - mixing in storage of gin.

\*for 2009/2010, Textile Exchange, 2010

## 4.4. Modelling scenarios for coexistence between GM and non-GM Cotton in Andalusia, Spain

To evaluate ex ante scenarios for coexistence between conventional and GM cotton in European cultivation conditions.

The analysis identified eight possible points as potential sources of admixture: seeds/crop from the previous year's harvest; seeds for sowing; seed storage; sowing; cross-pollination; harvesting; transport; and intermediate storage.

The identification of coexistence practices to achieve GM cotton under the threshold of 0.9% or 0.1% is feasible.

To achieve the threshold of 0.1% not permit the sharing of machinery.

The economic effect at farm level of these coexistence measures for both thresholds of 0.9% and 0.1% is predicted as negligible.

## 5. Review of the available information on adventitious GM presence in cotton production.

- Outcrossing to wild relatives: wild cotton species do not exist in Europe;
- Overview of cross-pollination studies captured a broad range of geographical regions and field conditions from 6 continents: Europa , Asia , North America, South America, Australia and Africa, indicated that cross-pollination:
  - beyond 5m of buffer zone is below 0.9%; and
  - 10m buffer zone are sufficient to achieve 0.1%.

High concentration of beehives in vicinity of cotton fields (>11 beehives/ha) will lead to double the above mentioned distance.



## 5. Review of the available information on adventitious GM presence in cotton production.

Bare land required to limit potential out-crossing:

- to 0.9% is 30m; and
- for below 0.1% at least 100m needed.

Seed-mediated gene flow has received less attention than pollen-mediated gene flow

Volunteers: is limited by soil moisture content and frost; and can be controlled mechanically or chemically.

Seed dispersal may also occur during: seeding, harvesting, handling, storage and transport.

## 6. Occurrence of cotton pollen in honey

- out of the 200 nectar-producing plants, cotton is in the lowest class, with 0-25 kg honey/ha/season;
- This quantitative palynological analysis places cotton pollen as “important minor pollen” between 3 - 15%;

## 7. Detection of GM events in cotton crops and honey

- PCR-based methods, both qualitative and quantitative
- Protein-based methods (strip tests)

The EU-RL GMFF has validated quantitative PCR methods for identification and quantification of several GM cotton events.

A practical and robust PCR protocol able to quantify GM pollen relative to total pollen in honey or honey as whole is not available.

## 8. Best practice for coexistence in cotton production

### Best practices for ensuring seed purity

The use of certified cotton seeds (EU legislation)

### Best practice for reducing pollen-mediated gene flow

#### Buffer zones :

- 5 m buffer zone is efficient to limit cross-pollination to 0.9%;
- 10 m buffer zone is required if 0.1% is targeted.

Significantly increased abundance of honeybees (>11 beehives/ha) doubled the size of buffer zones.

#### Isolation distances :

- 30 m for 0.9% threshold; and
- 100 m for 0,1%

Temporal isolation is not feasible in European conditions

## **Best practices during sowing, harvesting and storage in farm**

Harvesting is the most critical step in cotton production.  
The equipment used for processing of GM cotton should be cleaned thoroughly before it can be used for processing of non-GM crops.

## **Best practice for coexistence with honey production**

The current practices in honey production and marketing in Europe are sufficient to ensure that adventitious presence of GM cotton pollen in honey is far below the legal labelling thresholds and even below 0.1%.

## 9. Economic analyses of proposed best practices

- No empirical data are available
- Ceddia et al. (2008) analysed *ex-ante* the effects of introduction of Bt cotton in Andalusia, Spain and reported that the gross margin would increase by 6.7% per ha
- Quiao (2015) , based on the official static data, showed that the economic benefit of Bt cotton remained stable in last 15 years for conditions of China.
- Farmers will consider both monetary and non-monetary benefits of GM cotton adoption versus coexistence costs in their decision making process to select what kind of variety to adopt.

## 10. References



# Thank you for your attention

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