# ECONOMICS OF CO-EXISTENCE MEASURES OF GM AND CONVENTIONAL MAIZE IN SPAIN AND GERMANY

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## Summary

In this paper the costs of the two basic co-existence measures buffer strips and discard widths were investigated for the Spanish region Aragon. Furthermore for two Bavarian regions the expenses for buffer strips were analysed. We calculated the costs for each measure considering distances of 20 m, 50 m and 100 m, GM maize adoption rates of 30% and 50% as well as several economic assumptions. The results show an independency of costs from the GM adoption rate. There are however differences in costs with regard to various distances and price differences between GM and non-GM maize.

## Introduction

Co-existence refers to the ability of farmers to make a practical choice between conventional or GM-based crop production in compliance with the relevant EU legislation on labelling and purity standards. EU regulations have introduced a 0.9% labelling threshold for the adventitious presence of GM-material in non-GM food or feed products, which allows farmers and consumers a free choice between products and avoids further market and trade disruptions. However, since agriculture does not take place in a closed environment and since farmers growing non-GM crops should be enabled to keep the adventitious presence of GM-material in their harvest below the required labelling thresholds, appropriate technical and organisational measures along the production chain are necessary to ensure co-existence. Therefore, the European Commission has elaborated several general recommendations and measures. One of the most important and effective co-existence measures is the isolation of GM and non-GM-fields of the same crop by implementing buffer zones of a certain distance between the respective fields (Messéan et al., 2006: 9, 24 f.; Reitmeier and Menrad, 2006: 1; Reitmeier et al., 2006: 10; European Commission, 2003).

However, these measures also generate costs which strongly depend on varieties, countries and regions, whereof all available assessments of co-existence costs should be based on case studies on specific plants and regions. However, so far the regional dimension of co-existence measures in maize only has been analysed in a few regions, like e. g. in the "Poitou-Charentes" region in Western France (Menrad and Reitmeier, 2006: 53 ff.) and the region of Bavaria (Reitmeier and Menrad, 2006). Thus the following paper concentrates on analysing the economic effects of co-existence measures for maize in the Spanish region Aragon and in two regions of the German federal state Bavaria in order to create additional knowledge on regional effects of co-existence measures in maize.

## Methods

Spain is the third largest maize producer in the EU-15 after France and Italy and moreover the only European country which cultivates GM maize at a significant rate (13% of the national maize area in 2005). The region Aragon (municipality Gurrea de Gallego) was chosen as it represents the second largest maize producing region in Spain (Gauffreteau, 2006: 1; Gómez and Rodriguez, 2007: 7). The municipality of Gurrea de Gallego has a total agricultural area of 964 ha, allotted to 489 fields, which results in an average field size of 1.97 ha. In 2005 maize was planted on 47 fields, corresponding to 105.5 ha or 2.2 ha average field size. These low field sizes characterize a quite small-scaled landscape which can be regarded as a particular challenge to ensure co-existence between different production systems. Also the model regions in Bavaria are characterized by small-scaled fields with average field sizes between 1.89 ha and 2.17 ha. For Bavaria two different model regions were analyzed, one with a high proportion of maize on agricultural crop land (44% maize on ACL, intensive maize cultivation, higher yields) and the other with a low proportion of maize (19% maize on ACL, extensive maize cultivation, lower yields). The total agricultural area of model region I is 20,900 ha, therefrom 9,101 ha maize, allotted to 4,224 fields. Model region II has a total agricultural area of 31,511 ha, therefrom 6,105 ha maize, allotted to 3,083 fields of maize.

Costs were calculated for the two basic co-existence measures buffer strips (strips on the GM-field but planted with conventional maize, for Spain and for Germany) and discard widths (strips on the non-GM-field planted with conventional maize, only for Spain). The distances 20 m, 50 m, 100 m as well as GM maize adoption rates of 30% or 50% were considered for both co-existence measures and regions. All GM maize fields were randomly selected among the already cultivated maize fields by a statistical algorithm, illustrations and calculations were done using the GIS software ArcView.

Furthermore, some economic assumptions are necessary to calculate the regional co-existence costs. Regarding the gross margin of GM maize and conventional maize in Spain, research by Gómez and Rodriguez (2007: 13 ff.) has shown that farmers growing GM maize obtain higher yields (+4.7%) and can save pesticides (12.5 €/ha) but also face higher seed costs (29.2 €/ha). The price for GM maize and conventional maize is the same (0.128 €/kg) since most GM and non-GM maize is sold for feed purposes. Taken all together, there is a gross margin difference between GM and conventional maize of 85 €/ha, which represents a 13% increase over the average gross margin obtained by a non-GM-farmer. By taking the analyses of Degenhardt et al. (2003) and LfL (2006) into consideration, gross margins for GM maize in Germany can be calculated with a profit of 38 €/ha (in case of low infestations with Corn Borer) to 66 €/ha (in case of high infestations with Corn Borer) under the following assumptions: GM maize provides between 3% and 4% higher yields, saves insecticides (40 €/ha) and causes higher seed costs (35 €/ha). Furthermore as in Spain GM and non-GM maize achieve the same price (0.118 €/kg). In case of buffer strips the GM-farmer has to plant conventional maize on these strips. For the harvest of these acreages he gets the non-GM gross margin and therefore loses 85 €/ha in Spain and between 38 €/ha and 66 €/ha in Germany respectively.

For the co-existence measure discard width the following three scenarios were taken into account:

- Scenario 1: No difference between the prices of GM and non-GM maize. Therefore, the non-GM farmer can sell his entire harvest as GM maize, no costs would occur.
- Scenario 2: No difference between the prices for GM and non-GM maize. But the non-GM farmer sells only the harvest of the discard width as GM maize and the separate harvest of the remaining field as non-GM maize. Therefore, there is need of separate harvesting and transport. The additional costs due to these separate working steps were calculated with 35.5 €/ha.
- Scenario 3: Further to additional costs due to separate harvesting, we assumed a higher price of non-GM maize compared to GM maize (5%, 10% or 15% price difference respectively).

**Results - Germany**

*Buffer strips:*

In Germany in case of a 30% GM adoption rate the costs of buffer strips range from 19.7 €/ha to 42.9 € (model region I). Analogue costs for the 50% adoption rate occur with increasing buffer strip distances (19.4 €/ha to 39.8 €/ha). In model region II costs for buffer strips are clearly lower than in model region I, ranging between 6.3 €/ha and 18.4 €/ha and 6.4 €/ha and 19.1 €/ha respectively. This results from lower potential conflicts due to a lower share of maize cultivation in the whole region.

Table 1: Co-existence costs of buffer strips for different GM adoption rates and distances in Germany

| GM adoption rate (%) | | 30 | | | 50 | | |
|---|---|---|---|---|---|---|---|
| Buffer strip (m) | | 20 | 50 | 100 | 20 | 50 | 100 |
| Loss due to gross m differences (€) | Region I | 47,680 | 74,085 | 103,930 | 76,134 | 109,409 | 156,053 |
| | Region II | 9,741 | 19,888 | 28,695 | 15,625 | 32,898 | 46,306 |
| Costs per ha GM maize (€/ha) | Region I | 19.7 | 30.6 | 42.9 | 19.4 | 27.9 | 39.8 |
| | Region II | 6.3 | 12.8 | 18.4 | 6.4 | 13.6 | 19.1 |

Source: Own calculations.

**Results - Spain**

*Buffer Strips:*

In Spain in case of a 30% GM adoption rate the loss due to co-existence measures averages between 39.3 €/ha and 84.5 €/ha. Assuming a GM adoption rate of 50% the GM farmers, who have to bear these costs, face expenditures between 40.5 € and 84.7 € per hectare respectively. With increasing distance the opportunity costs due to this co-existence measure therefore tends towards the economic advantage of GM maize (see Table 2). This result corresponds with the findings of Menrad and Reitmeier (2006: 53 ff.) for the French region Poitou-Charentes.

Table 2: Co-existence costs of buffer strips for different GM adoption rates and distances in Spain

| GM adoption rate (%) | 30 | | | 50 | | |
|---|---|---|---|---|---|---|
| Buffer strip (m) | 20 | 50 | 100 | 20 | 50 | 100 |
| Loss due to gross margin differences | 1,326 | 2,303.5 | 2,847.5 | 2,150.5 | 3,748.5 | 4,496.5 |
| Costs per ha GM maize area (€/ha) | 39.3 | 68.3 | 84.5 | 40.5 | 70.6 | 84.7 |

Source: Own calculations.

*Discard widths:*

In general no huge differences in costs between a GM maize share of 30% and 50% can be observed. Therefore, taking into account additional harvesting costs of 35.5 €/ha (Scenario 2) the costs amount between about 5 €/ha and 29 €/ha GM maize area. For Scenario 3 we obtain the following results: In case of a 5% price difference between GM and non-GM maize the costs per ha range between about 10 € and 58 €, for a 10% price difference we have costs between 19 €/ha and 115 €/ha. And a price difference of 15% leads to costs ranging from 29 €/ha to 173 €/ha.

Table 3: Co-existence costs of discard widths for different GM adoption rates and distances in Spain

| | GM adoption rate (%) | 30 | | | 50 | | |
|---|---|---|---|---|---|---|---|
| | Discard width (m) | 20 | 50 | 100 | 20 | 50 | 100 |
| Scenario 2 | Loss due to separate harvesting costs (€) | 181.4 | 450.8 | 972.7 | 252.1 | 710.0 | 1,547.8 |
| | Costs per ha GM maize area (€/ha) | 5.4 | 13.4 | 28.9 | 4.7 | 13.4 | 29.1 |
| Scenario 3: 5% price difference | Loss due to gross margin differences (€) | 392.6 | 923.1 | 1,950.5 | 531.7 | 1,433.3 | 3,082.7 |
| | Costs per ha GM maize area (€/ha) | 11.6 | 27.4 | 57.9 | 10.0 | 26.9 | 58.1 |
| Scenario 3: 10% price difference | Loss due to gross margin differences (€) | 749.8 | 1,810.7 | 3,865.5 | 1,027.9 | 2,831.1 | 6,129.9 |
| | Costs per ha GM maize area (€/ha) | 22.2 | 53.7 | 114.7 | 19.3 | 53.3 | 115.4 |
| Scenario 3: 15% price difference | Loss due to gross margin differences (€) | 1,106.9 | 2,698.2 | 5,780.2 | 1,524.1 | 4,228.7 | 9,176.7 |
| | Costs per ha GM maize area (€/ha) | 32.8 | 80.1 | 171.5 | 28.7 | 79.6 | 172.8 |

Source: Own calculations.

## Conclusions

In generally results of this study show that the average costs for the two considered co-existence measures buffer strips and discard widths are relatively independent from the GM maize adoption rate as there are no big cost differences identifiable between a GM maize share of 30% and 50%. Comparing the results for Spain and Germany costs of buffer strips are higher in Aragon than in Bavaria, which is mainly caused by higher GM profits in Spain. Regarding the different co-existence measures discard widths are the more cost saving solution than buffer strips for all considered distances in Spain assumed that there are no price differences between GM and non-GM maize. Results for the Poitou-Charentes region however show that buffer strips are more cost-effective which is probably due to the fact that Poitou-Charentes is a larger-scaled region than Aragon (Menrad and Reitmeier, 2006: 53). However with increasing price differences and distances the costs of discard widths increase disproportionately.

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