BioMath

APPLIED STATISTICS AND INFORMATICS IN LIFE SCIENCES

Post Market Monitoring of insect protected Bt maize MON 810[1] in Europe

Biometrical annual Report on the 2017 growing season

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[1] The commercial name for MON 810 being YieldGard®corn borer maize. YieldGard®corn borer is a registered trademark of Monsanto Technology LLC.

Contents

Summary

Monitoring of a genetically modified organism (GMO) that has been placed on the market is regulated in Annex VII of Directive 2001/18/EC [OJEC, 2001]. Monitoring efforts were supposed to detect the allegedly occurrence and impact of adverse effects of the GMO or its use as related to human health, animal health or the environment not anticipated in the ERA. Monsanto has implemented monitoring of *Bt* maize containing event MON 810 through different tools, the main one being a farm questionnaire implemented since 2006.

This biometrical report presents the outcomes of the statistical analysis of the farm questionnaires collected in Europe's major MON 810 cultivating countries Spain and Portugal in 2017. The questionnaires have been completed between January and March 2018. In the 2017 growing season 250 farmers have been surveyed.

2017 data indicate that in comparison to conventional maize plants, MON 810 plants

- germinated more vigorously,
- had less incidence of stalk/root lodging caused by the inherent protection against certain lepidopteran pests,
- had a longer time to maturity caused by the absence of pest pressure of certain lepidopteran pests,
- gave a higher yield caused by the better fitness of the plant,
- were less susceptible to pests, other than corn borers, especially lepidopteran pests caused by the inherent protection against certain lepidopteran pests and the resulting better fitness of the plants,
- received less insecticides caused by their inherent protection against certain lepidopteran pests.

The identified deviations were expected due to the knowledge of the MON 810 characteristics. The observed significant effects are not adverse. They mostly relate to the increased fitness of MON 810 plants resulting from the inherent protection against certain lepidopteran pests. Overall, the monitoring results substantiate the results from scientific research.

In this year of data collection, no adverse effects have been identified by MON 810 cultivating farmers.

1 Introduction

According to Annex VII of Directive 2001/18/EC [OJEC, 2001] of the European Parliament and of the Council on the deliberate release into the environment of genetically modified plants (GMP), the objective of the monitoring is to:

- identify the occurrence of adverse effects of the GMO or its use on human or animal health, or the environment, which were not anticipated in the ERA.

Upon approval of MON 810 (Commission Decision 98/294/EC [OJEC, 1998]), Monsanto has established a management strategy in order to minimize the development of insect resistance and offered to inform the Commission and/or the Competent Authorities about the results. These results on insect resistance monitoring, however, are not part of the current report.

The risk assessment for MON 810 showed that the placing of MON 810 on the market poses negligible risk to human and animal health and the environment. Potential adverse effects of MON 810 on human and animal health and the environment, which were not anticipated in the ERA, can be addressed under General Surveillance (GS). An important element of the GS, applied by Monsanto on a voluntary basis, is a farm questionnaire.

The objective of this biometrical report is to present the rationale behind the farm questionnaire approach and the analysis of the farm questionnaire results from the 2017 planting season. The questionnaire approach was applied for the first time in 2006. The format of the questionnaire is reviewed on a yearly basis based on the outcome of the latest survey.

2 Methodology

2.1 Tool for General Surveillance: the farm questionnaire

2.1.1 Structure of the farm questionnaire

Based on commonly defined protection goals, such as soil function, plant health and sustainable agriculture together with derived areas of potential impact on these protection goals, a range of relevant monitoring characters for MON 810 GS has been identified (Table 1). These monitoring characters might be influenced by the cultivation of MON 810, but in an agricultural landscape other influencing factors (Table 3) exist which need to be taken into account and they are therefore monitored as well.

For that purpose, a farm questionnaire was designed to obtain data on monitoring characters and influencing factors (see Appendix B). Deviating observations in monitoring characters would lead to an assessment of the collected information in order to determine whether the unusal observation is attributable to changes in influencing factors or the genetic modification. Farmers record a range of agronomic information and are the most frequent and consistent observers of crops and fields (*e.g.* by collection of field-specific records of seeds, tilling methods, physical and chemical soil analysis, fertilizer application, crop protection measures, biotic and abiotic damage, yields and quality). Additionally, farmers hold in "farm files", which are historical records of their agricultural land and its management. These provide background knowledge and experience that can be used as a baseline for assessing deviations from what is normal for their cultivation areas.

The experimental questionnaire was developed by the German Federal Biological Research Centre for Agriculture and Forestry (BBA, now JKI), maize breeders and statisticians in Germany [Wilhelm, 2004]. Its questions were developed in order to be to be easily understood, not to be too burdensome and to be sufficiently pragmatic to take into account real commercial situations.

The questionnaire approach was tested in a pilot survey in 2005. Based on that survey an adapted version of the questionnaire was created and applied for the first time in 2006. The format of the questionnaire is reviewed on a yearly basis based on the outcome of the latest survey. As appropriate, adjustments are made to improve the statistical relevance of the collected data. In 2009, the questionnaire was adapted according to DG Environment feedback (13 March 2009) and discussions within EuropaBio (see Appendix B).

The questionnaire is organized around collecting data in four specific areas:

Part 1: Maize grown area

Part 2: Typical agronomic practices to grow maize on the farm

Part 3: Observations of MON 810

Part 4: Implementation of *Bt* maize specific measures

Part 1 records general, basic data on maize cultivation, cultivation area and local pest and disease pressure (independent from GM or non-GM cultivation background and possible influencing factors). The objectives of **Part 2** are to establish what the usual practices of conventional cultivation are. It therefore establishes a baseline to which information generated in *Bt* areas can be compared. **Part 3** collects data on MON 810 practices and observations.

The aim of the survey is to identify potential adverse effects that might be related to MON 810 plants and their cultivation. Therefore, most questions are formulated to identify deviation from the situation with conventional maize. Farmers are asked to assess the situation in comparison to conventional cultivation. If a farmer assesses the situation to be different, he is additionally asked to specify the direction of the difference; hence the category $Different$ is divided into two subcategories. To simplify this two-stage procedure in the questionnaire for most questions, three possible categories of answers are given: $As\ usual$, $Plus$ (*e.g.* later, higher, more) and $Minus$ (*e.g.* earlier, lower or less). Thus, a rather high frequency (> 10 %) of $Plus$- or $Minus$- answers would indicate possible effects (see Section 2.4).

Moreover, Monsanto uses this questionnaire to monitor if farmers are in compliance with the MON 810 cultivation recommendations. For that purpose, the answers and free remarks in **Part 4** were evaluated.

2.1.2 Coding of personal data

For both confidentiality and identification reasons, each questionnaire was assigned a unique code where personal data were coded according to the following format:

2	0	1	6	-	0	1	-	M	A	R	-	E	S	-	0	1	-	0	1	-	0	1
Year					Event Code			Partner Code				Country Code			Interviewer Code			Farmer Code			Area Code	

Codes:

Event:	01	MON 810
	02	...
Partner:	MON	Monsanto
	MAR	Markin
	AGR	Agro.Ges
	...	...
Country:	ES	Spain
	PT	Portugal
	...	...
Interviewer:	01	A
	02	B
	03	...
Farmer:	farmer's ID within the interviewer	
Area:	incremental counter within the farmer	

(*e.g.* 2017-01-MAR-ES-01-01-01).

The data were stored and handled in accordance with the Data Protection Directive 95/46/EC [OJEC, 1995]. This is in order to ensure an honest response and to avoid competitive intelligence.

Within the data base, each questionnaire got a consecutive number (starting in 2006):

Furthermore, within the database each farmer has his own ID to follow multiple participitation in the MON 810 monitoring.

2.1.3 Training of interviewers

To assist the interviewers in filling out the questionnaires with the farmers, a 'user's manual' was developed. While questions have been carefully phrased to obtain accurate observations from farmers, preceding experience with the questionnaire may increase awareness.

Additionally, like in previous years, all interviewers have been trained to understand the background of the questions. Here also experience gained during previous years surveys (uncertainties, misinterpretation of questions) could be shared.

2.2 Definition of monitoring characters

The main focus of the questionnaire was the survey of several monitoring characters that were derived from protection goals like soil function, plant health and sustainable agriculture. Table 1 provides an overview on the monitored characters and the protection goals that are addressed by them.

Table 1: Monitoring characters and corresponding protection goals

Monitoring characters	Protection goals
Crop rotation	Sustainable agriculture, plant health
Time of planting	Sustainable agriculture
Tillage and planting technique	Sustainable agriculture
Insect control practices	Sustainable agriculture
Weed control practices	Sustainable agriculture
Fungal control practices	Sustainable agriculture
Fertiliser application	Sustainable agriculture, soil function
Irrigation practices	Sustainable agriculture
Time of harvest	Sustainable agriculture, plant health
Germination vigour	Plant health
Time to emergence	Plant health
Time to male flowering	Plant health
Plant growth and development	Plant health, soil function
Incidence of stalk/ root lodging	Plant health
Time to maturity	Sustainable agriculture, plant health
Yield	Plant health, soil function
Occurrence of MON 810 volunteers	Sustainable agriculture
Disease susceptibility	Plant health, sustainable agriculture, biodiversity
Insect pest control (*Ostrinia nubilalis*)	Plant health, sustainable agriculture
Insect pest control (*Sesamia* spp.)	Plant health, sustainable agriculture
Pest susceptibility	Sustainable agriculture, plant health, biodiversity
Weed pressure	Sustainable agriculture, soil function, biodiversity
Occurrence of insects	Biodiversity
Occurrence of birds	Biodiversity
Occurrence of mammals	Biodiversity
Performance of fed animals	Animal health
Additional observations	All

Note: only the main corresponding protection goals are listed. However, each of the monitoring characters is addressing most of the protection goals, *e.g.*: all the characters that concur to demonstrate the agronomic equivalence of MON 810 to conventional maize are addressing impact on biodiversity.

The data for the monitoring characters were surveyed on a qualitative scale by asking farmers for their assessment of the situation compared to conventional cultivation. The farmer is asked to specify the conventional variety/ies he is cultivating on his farm to then use it/them as comparator(s). The farmers additionally use their general experience of cultivating conventional maize, thereby especially assessing the seasonal specifics. Farmers usually know whether observed differences are based on *e.g.* different varieties' maturity groups. For most questions, the possible categories of answers $As\ usual$ and $Different$, with the latter category subdivided into $Plus$ (*e.g.* later, higher, more) or $Minus$ (*e.g.* earlier, lower or less) were given (see Table 2).

Table 2: Monitoring characters and their categories

	Monitoring characters – observations of MON 810	*As usual*	*Different Minus*	*Different Plus*
Agronomic practices	Crop rotation	as usual	-	changed
	Time of planting	as usual	earlier	later
	Tillage and planting technique	as usual	-	changed
	Insect control practices	as usual	-	changed
	Weed control practices	as usual	-	changed
	Fungal control practices	as usual	-	changed
	Fertiliser application	as usual	-	changed
	Irrigation practices	as usual	-	changed
	Time of harvest	as usual	earlier	later
Characteristics in the field	Germination vigour	as usual	less	more
	Time to emergence	as usual	accelerated	delayed
	Time to male flowering	as usual	accelerated	delayed
	Plant growth and development	as usual	accelerated	delayed
	Incidence of stalk/root lodging	as usual	less	more
	Time to maturity	as usual	accelerated	delayed
	Yield	as usual	lower	higher
	Occurrence of MON 810 volunteers	as usual	less	more
Einvironment and wildlife	Disease susceptibility	as usual	less	more
	Insect pest control (*Ostrinia nubilalis*)	good	weak	very good
	Insect pest control (*Sesamia* spp.)	good	weak	very good
	Pest susceptibility	as usual	less	more
	Weed pressure	as usual	less	more
	Occurrence of insects	as usual	less	more
	Occurrence of birds	as usual	less	more
	Occurrence of mammals	as usual	less	more
	Performance of fed animals	as usual	-	changed

2.3 Definition of influencing factors

Besides named monitoring characters, several potentially influencing factors were surveyed to assess the local conditions and to determine the cause of potential effects in the monitoring characters (Table 3).

Table 3: Monitored influencing factors

Type	Factor
Site	Soil characteristics
	Soil quality
	Humus content
Cultivation	Crop rotation
	Soil tillage
	Planting technique
	Weed and pest control practices
	Application of fertilizer
	Irrigation
	Time of sowing
	Time of harvest
Environment	Local pest pressure
	Local disease pressure
	Local occurrence of weeds

2.4 Definition of baselines, effects and statistical test procedure

Normally - if there is no effect of MON 810 cultivation or other influencing factors, and the question is well formulated and unambiguous - one would expect a predominant part of the farmers assessing the situation to be *As usual*. Small frequencies of differing answers result for example from uncertainty or environmental impacts and are expected to be balanced in both *Plus* and *Minus* direction and to run up to approximately 5 % (Figure 1). Therefore, the ***baseline*** for the analysis of monitoring characters with categories *As usual* and *Different* is 90 % - 10 %, where *Plus*- and *Minus*- answers are balanced and both about 5 %.

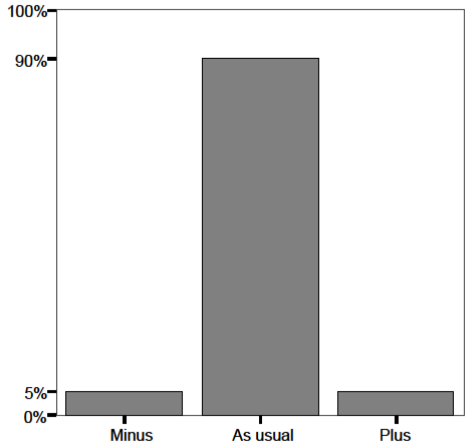

Figure 1: Balanced (expected) baseline distribution of the farmers' answers (no effect)

An effect of the cultivation of MON 810 or any other influencing factor would arise in a greater percentage of *Different* (*i.e. Plus*- or *Minus*-) answers, where "greater" or an ***effect***, was quantitatively defined by exceeding a threshold of 10 % (Figure 2(a) and (b)). Graphically, an effect would be expressed by an unbalanced distribution (Figure 3(a) and (b)).

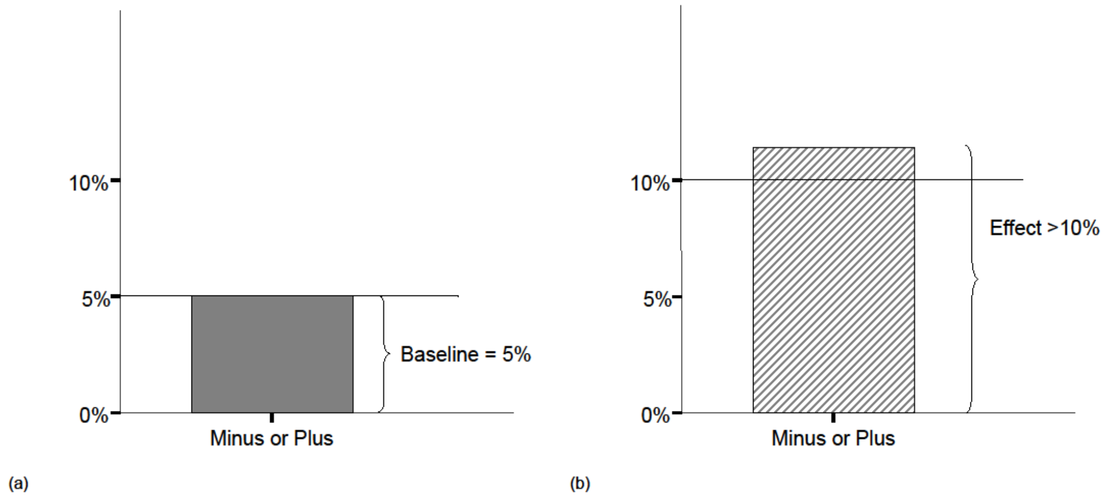

Figure 2: Definition of (a) baseline and (b) effect

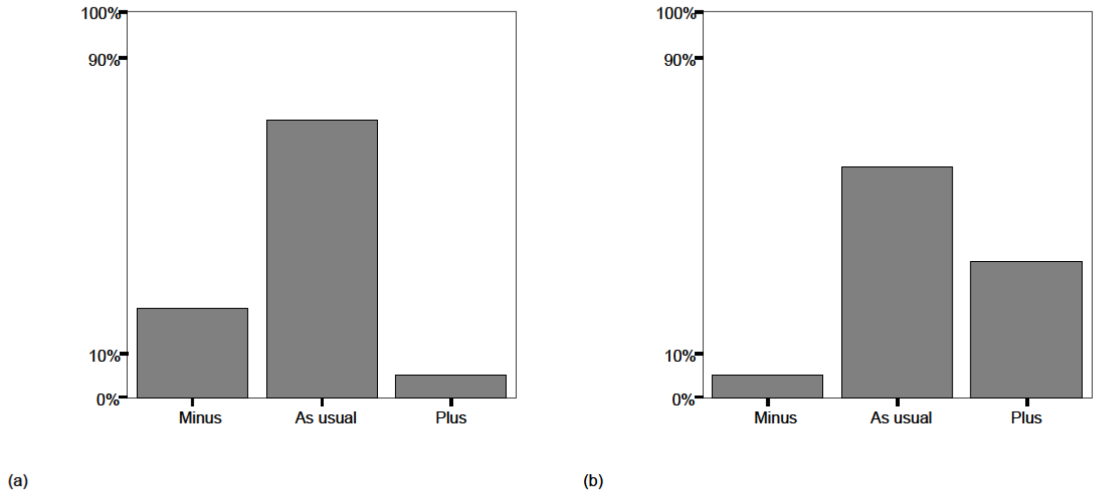

Figure 3: Examples for distributions of farmers' answers indicating an effect (a) > 10 % in category $Minus$ → effect, (b) > 10 % in category $Plus$ → effect

To detect an effect the proportions of *Different* (*i.e. Plus* - or *Minus* -) answers have to be compared with the threshold of 10 % by a statistical test (one-sided, comparison of a probability with a constant). Since the *As usual*-, and *Different*- (*i.e. Plus*- or *Minus*-) answers complement each other, a closed test procedure is applied: first the *As usual*- proportion is compared with the threshold of 90%. If the *As usual*-proportion exceeds this threshold, the *Different*- (*i.e. Plus*- or *Minus*-) proportions cannot exceed the 10% and no effect is indicated. Otherwise, the *Different*- (*i.e. Plus*- or *Minus*-) proportions are to be compared with the 10% threshold and an effect is indicated if the threshold is exceeded by a *Different*- (*i.e. Plus*- or *Minus*-) proportion.

The frequencies of *As usual-*, and *Different-* (*i.e. Plus-* or *Minus-*) answers are statistically tested according to the closed principle test procedure (in case of questions that allow for only two answers like *e.g. Crop Rotation's* "as usual"/"changed", only *as usual-* and *plus-*answer frequencies are tested accordingly).

The categories *As usual*, *Plus* and *Minus* form a vector with a multinomial distribution

$$(Minus, As\ usual, Plus) \sim Mult(n; p_{Minus}, p_{As\ usual}, p_{Plus})$$

Therefore, each component of this vector is binomially distributed

$$Minus \sim B(n, p_{Minus}, k),\ As\ usual \sim B(n, p_{As\ usual}, k),\ Plus \sim B(n, p_{Plus}, k)$$

To detect an effect of MON810 cultivation, the following statistical hypothesis are formulated:

$$H_0^1 : p_{As\ usual} \leq 0.9 \quad \text{vs. } H_A^1 : p_{As\ usual} > 0.9$$

$$H_0^2 : p_{Minus} \geq 0.1 \quad \text{vs. } H_A^2 : p_{Minus} < 0.1$$

$$H_0^3 : p_{Plus} \geq 0.1 \quad \text{vs. } H_A^3 : p_{Plus} < 0.1$$

The set of null hypothesis $\{H_0^1, H_0^2, H_0^3\}$ is <u>closed under intersection</u> because

$$H_0^1 \cap H_0^2 = [0,0.9] \cap [0.1,1] = [0.1,0.9] \in [0,1] = \{H_0^1, H_0^2, H_0^3\} \text{ and}$$

$$H_0^1 \cap H_0^3 = [0,0.9] \cap [0.1,1] = [0.1,0.9] \in [0,1] = \{H_0^1, H_0^2, H_0^3\} \text{ and}$$

$$H_0^2 \cap H_0^3 = [0.1,1] \cap [0.1,1] = [0.1,1] \in [0,1] = \{H_0^1, H_0^2, H_0^3\}.$$

The detection of an effect is made in two steps. First, the global null hypothesis $H_0^1 : p_{As\ usual} \leq 0.9$ is tested. If this hypothesis is rejected, testing of the hypotheses H_0^2 and H_0^3 is not needed anymore since they will be rejected then, too. Secondly, if $H_0^1 : p_{As\ usual} \leq 0.9$ is not rejected, the hypotheses H_0^2 and H_0^3 are to be tested. The test procedure is displayed in Figure 4.

This test procedure is <u>coherent</u> because a rejection of the null hypothesis in step 1 implies a rejection of the hypotheses in step 2. The test procedure is called a closed test procedure.

Within the closed test principle, hypotheses are tested by applying the exact binomial test.

- Step (1): Test of the probability $p_{As\ usual}$ (usually the largest probability)

  Null hypothesis: GMP cultivation has an effect, the probability of getting $As\ usual$ -answers is smaller than 90 % ($H_0 : p_{As\ usual} \leq 0.9$)
- Step (2): Test of the p_{Minus} probabilities and p_{Plus} probabilities

Null hypothesis: GMP cultivation has an effect, the probability of getting $Minus$- or $Plus$-answers is larger than 10 % ($H_0 \colon p_{Minus} \geq 0.1$, $H_0 \colon p_{Plus} \geq 0.1$)

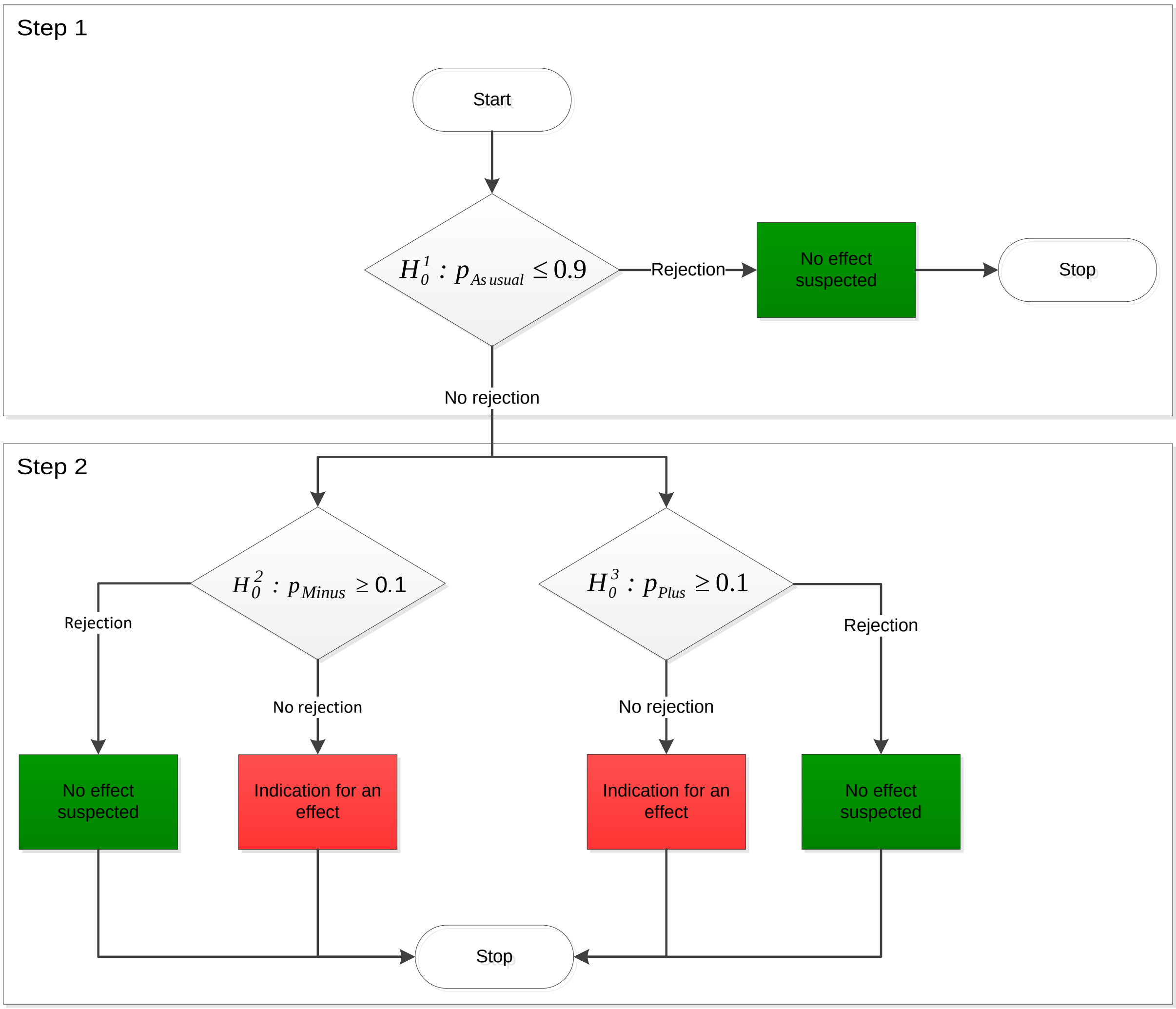

Figure 4: Closed test procedure for the three probabilities of $As\ usual$, $Plus$- and $Minus$-answers

This closed test procedure controls for the experiment-wise error rate because an erroneous decision, *i.e.* an error of the first kind (rejection of the null hypothesis although it is true) during the whole procedure can only be done once: an erroneous rejection of the null hypothesis (1) (*i.e.* in reality $p_{As\ usual} \leq 0.9$) corresponds to an erroneous rejection of the null hypotheses (2) (*i.e.* in reality $p_{Plus} \geq 0.1$ or $p_{Minus} \geq 0.1$) [Marcus, 1976], [Maurer, 1995].

Consequently the analysis of each monitoring character is to be performed according to the following scheme:

1. The frequencies of the farmer responses for the three categories are calculated. The calculation of frequencies and their percentages is done both on the basis of all and on the basis of valid answers. When farmers gave no statement, answers are accounted as missing values and therefore not considered valid. As a consequence, the "valid percentages" state the proportions of actually known answers, whereas the "percentages" only specify the proportions of the categories within

the whole answer spectrum, including no answers. Additionally, the accumulated valid percentages are calculated to illustrate the distribution function and for quality control reasons.

2. The frequencies of *As usual*, *Plus*- and *Minus*- answers are statistically tested according to the closed principle test procedure as described above (in case of questions that allow for only two answers like *e.g. Crop Rotation's* "as usual"/"changed", only *As usual*- and *Plus*- answer frequencies are tested accordingly).

   The resulting P-values are compared to a level of significance $\alpha = 0.01$. If the P-value is smaller than $\alpha = 0.01$, the corresponding null hypothesis is rejected. If the P-value is larger than $\alpha = 0.01$, respective hypothesis cannot be rejected.

   - In case Hypothesis (1) with $p_{As\ usual} \leq 0.9$ is rejected, no effect is indicated.
   - In case Hypothesis (1) with $p_{As\ usual} \leq 0.9$ cannot be rejected, but both hypotheses (2) with $p_{Minus} \geq 0.1$ and $p_{Plus} \geq 0.1$ can be rejected, no effect is indicated.
   - In case Hypothesis (1) with $p_{As\ usual} \leq 0.9$ cannot be rejected and at least one of the hypotheses (2) cannot be rejected either, an effect is indicated.

   (See Figure 4 for a flow chart of the above named decision making processes.)

3. Where an effect is indicated, the effect must be interpreted (adverse/beneficial).
4. Where an adverse effect is identified, the cause of the effect must be ascertained (MON 810 cultivation or other influencing factors).
5. Identification of adverse effects potentially caused by MON 810 cultivation would require further examinations. Such cases, however, have neither been found in this years', nor in previous years' data.

Subsequently, 99 % confidence intervals are calculated for the $p_{As\ usual}$, p_{Minus} and p_{Plus} . The probabilities of, *As usual*, *Plus*- and *Minus*- answers with corresponding confidence intervals are illustrated graphically.

2.5 Sample size determination and selection

The sample size determination of the survey was done for a period of 10 years (authorization period). It was based on the exact binomial test. It depends on the threshold for the test, the error of the first kind α, the error of the second kind β and the effect size d [Rasch, 2007a].

The error of the first kind is the probability to reject the null hypothesis although it is true, *i.e.* not to identify an existing effect. This probability should be as small as possible since it is the aim of GS to identify any existing effects. The error of the first kind is also called consumer's risk.

The error of the second kind is the probability to accept the null hypothesis although it is false, *i.e.* to identify an effect although none exists. This probability should also be as small as possible as it would raise false alarm (Table 4). The error of the second kind is also called producer's risk.

The magnitude of the effect size d was chosen from experience in analyzing farm questionnaires in a pilot study in Germany 2001 - 2005 [Schmidt, 2008].

Table 4: Error of the first kind α and error of the second kind β for the test decision in testing frequencies of $Plus$- or $Minus$-answers from farm questionnaires against the threshold of 10 %

		Real situation	
		$p \leq 0.9$ **Indication for an effect**	$p > 0.9$ **No effect**
Test decision	**Acceptance** $H_0 : p \leq 0.9$	Correct decision with Probability $1 - \alpha = 99\ \%$	Wrong decision with Probability $\beta = 1\ \%$
	Rejection $H_0 : p \leq 0.9$	Wrong decision with Probability $\alpha = 1\ \%$	Correct decision with Probability $1 - \beta = 99\ \% = POWER$

CADEMO light [Cademo, 2006] was used as proposed by [Rasch, 2007a] to determine the sample size for a binomial test (Method 3/62/1005). Within this survey the accuracy demands $p = 0.9$ (threshold for adverse effects to be tested: 90 % of $As\ usual$ -answers, $\alpha = 0.01$ (error of the first kind), $\beta = 0.01$ (error of the second kind), and $d = 3\ \%$ (minimum difference of practical interest) should be met. Under these demands for a one sample problem, testing a probability against a threshold with a one-sided test, a sample size of 2 436 questionnaires was calculated. To get this sample size even in the case of questionnaires having to be excluded from the survey *e.g.* because of low quality, this number was rounded to 2 500 questionnaires.

Since the monitoring objects are fields where genetically modified crops are cultivated, the total population consists of all fields within the EU being cultivated within the 10-years authorization period. From this population a maximum of 2 500 fields has to be selected for the GS survey. Sampling of these 2 500 fields should ensure to reflect the range and distribution of plant production systems and environments exposed to GMP cultivation. This range is on one hand characterized by the growing season (year and its climatic, environmental conditions), while on the other hand, it is characterized by the geographic regions where GM cultivation takes place. Regions may vary in terms of their production systems, regulatory requirements, agro-political and socio-economic conditions and therefore are best described by European countries. Consequently, sampling takes place within strata (defined by years and countries of cultivation).

The total number of 2 500 monitoring objects is firstly equally subdivided into 250 objects per year. It is then tried to consider the fluctuant adoption of the GMP (grade of market maturity) by assigning these 250 objects to the respective countries on a yearly basis. Consequently, the sample cultivation areas with a high uptake of the GMP may be over-represented by a large number of monitored fields, while as countries with proportionally very low cultivation may be excluded from the monitoring. If fewer than 250 fields per year are cultivated, the maximum possible number of monitoring objects is surveyed.

In a second step, a quota considering

- the countries of MON810 cultivation in the respective year,
- the magnitude of MON 810 cultivation (ha planted per country/ ha planted in the EU) and
- local situation (average field size in the country)

is applied.

In reality, the sampling procedure is afflicted by several challenges:

- the total population of interest, i.e. the total number of fields (and the field sizes) is not known,
- the development of areas of MON810 cultivation cannot be predicted,
- for the definition of the yearly sampling frame, not the total number of fields but only the total cultivated area (in ha, see Table 12) is known.

Therefore the sampling frame for this survey cannot be based on the total population of fields with MON 810 cultivation in Europe. Instead, each year the total MON 810 cultivated area (in ha) is known.

Table 12 shows the cultivation areas of 2017. For Protugal and Spain, the number of survey completions targeted from each country was set in proportion to the country's MON810-planted area:

Table 5: Sampling number proportional to cultivated MON810 area in Portugal and Spain 2017

Country	MON 810 area	No of questionnaires
Portugal	7,308	14
Spain	124,227	236
Total	131,553	250

This procedure was repeated within the countries:

Portugal:

Table 6: Sampling number proportional to cultivated MON810 area in Portugal 2017

Region	MON 810 area	% of country surface	Proportional No of questionnaires	Sampling
Norte	45.33	0.6	0	0
Centro	1,608.91	22.0	3	3
Lisboa e Vale do Tejo	2,466.10	33.7	5	5
Alentejo	3,187.21	43.7	6	6
Total	7,307.55	100.0	14	14

Norte because of very low cultivation was excluded from the monitoring.

Spain:

Table 7: Sampling number proportional to cultivated MON810 area in Spain 2017

Region	MON 810 area	% of country surface	Proportional No of questionnaires	Sampling
Andalucia	8,012.94	6.45	15	15
Aragon	49,608.47	39.93	95	169
Cataluna	39,091.53	31.47	74	
Castilla Leon	17.24	0.01	0	0
Castilla-La-Mancha	5,068.82	4.08	10	10
Comunidad de Madrid	270.76	0.22	0	
Comunidad Foral de Navarra	7,778.41	6.26	15	15
Comunidad Valenciana	292.35	0.24	0	0
Extremadura	13,976.06	11.25	27	27
Islas Baleares	106.47	0.09	0	0
La Rioja	3.53	0.00	0	0
De Murcia	0.29	0.00	0	0
Islas Canarias	0.59	0.00	0	0
Total	124,227.46	100.00	236	236

Revised sampling allocation in Spain

1. Aragón + Cataluña = one region

   Castilla-La-Mancha + Communidad de Madrid = one region

Justification: data available are an estimation of planted area based on company sales of MON 810 seeds (company to distributors), but distributors sell to point of sales and farmers that can be or cannot be in the same province/region as in the sales report

--> discrepancies to official report of planted area

2. no sampling in Comunidad Valenciana

Justification: marginal cultivation in Comunidad Valenciana, maize is very atypical and it may be the case that only 1 farmer is cultivating there or is a farmer in Albacete (neigbour province but part of Castilla-La Mancha) but buying the seeds in a distributor placed in Valencia

Within each region, the determined number of fields needed to be selected. Farmers were selected from customer lists of the interviewer companies, plus experience from previous surveys or search in the region. When buying the seeds, farmers are informed to possibly be contacted for a survey. All farmer refusals are recorded.

The whole sampling procedure ensured that the monitoring area was proportional to and representative of the total regional area under GM cultivation in 2017.

2.6 Power of the Test

The power of the test $p_{Minus} \geq 0.1$, $p_{Plus} \geq 0.1$, respectively is the probability to reject the null hypothesis of an effect where none exists (correct decision). It is defined as $1 - \beta$ (β = error of the second kind) and is calculated as followed:

$$Power = \sum_{F=0}^{F_u - 1} \left(\frac{n!}{F!\,(n-F)!} \right) p^F (1-p)^{n-F}$$

where:

$F_u = \min_F (P(F \leq F_E | H_0) > \alpha$

p = given probability of $Plus$- or $Minus$ -answers for which the power is calculated

F_E = absolute frequency of $Plus$- or $Minus$ -answers

Figure 5 illustrates the power for an alternative hypothesis value of 0.13 (effect size 0.03). The distribution of the null hypothesis value (0.10) is represented by the red curve; the distribution of the alternative hypothesis value (0.13) is represented by the blue curve. The green line shows the critical value for an error probability $\alpha = 0.01$. If the alternative hypothesis is actually true (GM cultivation has no effect) the rejection of the null hypothesis is a correct decision which will occur with 99 % probability (under the blue curve to the left of the green line), *i.e.* with a power of 99 %.

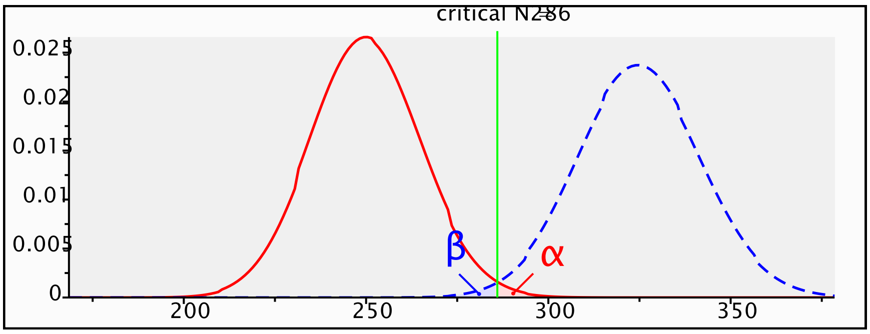

Figure 5: Null ($p = 0.1$) and alternative ($p = 0.13$) binomial distribution functions for a sample size of 2 500 type I and type II errors α and β both 0.01 (graph: G*Power Version 3.1.6)

2.7 Data management and quality control

A database was developed for data management and storage. For each question a variable was defined by a variable name (eight-digit in maximum) and a variable label (short description of the question). The variables were specified according to their type (qualitative or quantitative), format, *etc*. Missing values were defined (-1: no statement, -2: not readable). For not readable entries in the questionnaires, queries were formulated and the farmers were asked for clarification. Afterwards, these entries in the database were corrected. For quantitative variables (*e.g.* total maize area in ha) the real values from the questionnaire were taken for the database, for qualitative variables the possible parameter values (e.g. *As usual/ Plus/ Minus*) were defined and coded (and only the coded values taken).

High quality of the data is assured by preliminarily training the interviewers in a workshop via phone on a yearly basis. In face-to-face interviews, the interviewers are instructed to check whether the farmer`s answer corresponds to their documentation. When surveys are performed by phone, the farmers receive the questionnaire about two weeks in advance to pick up the information from their documentation. In 2017, all interviews were conducted face-to-face.

All data are entered and controlled for their quality and plausibility. A quality control check first verifies the completeness of the data. Some data fields (especially the monitoring characters or comments in case the farmer's assessments differ from *As usual*) are defined to be mandatory, therefore missing values or unreadable entries are not accepted. Furthermore, the values are verified for correctness (quantitative values within a plausible min-max range, qualitative values meeting only acceptable values). A plausibility control validates the variable values for their contents, both to identify incorrect answers and to prove the logical connections between different questions. It also looks for the consistency between *Plus-/ Minus-* answers and specifications, *i.e.* whether all these answers were provided with a specification and whether the specifications really substantiated the *Plus-/ Minus-*answers.

For any missing or implausible data the interviewers are asked to contact the farmers again to complete or correct the questionnaire (in these cases interviewers receive corresponding queries from BioMath).

3 Results

The questionnaires have been completed between January and March 2018. In the 2017 growing season 250 farm questionnaires have been collected. Quality and plausibility control confirmed that all 250 questionnaires could be considered for analysis. This good quality also resulted from the interviewer training.

The analysis shows that in most cases, the frequencies for the three categories of the monitoring characters show the expected balanced distribution. In some cases, deviations were identified.

An overview of numbers, percentages and levels of significance for the binomial tests of the data in 2017 is given in Table 8. The fields in the table highlighted in grey mark the cases for which the test against the 0.9/ 0.1 thresholds resulted in P-values greater than or equal to 0.01, so the null hypotheses (that these values are smaller than 0.9 or greater than 0.1, respectively) could not be rejected and therefore indicate the occurrence of an effect.

Table 9 lists the probabilities of *As usual- / Plus- / Minus*- answers for the monitoring characters together with corresponding 99 % confidence intervals. All probabilities with confidence intervals are shown on the same graph (for each of the *As usual- / Plus- / Minus* - answers) in Figure 6, thereby forming an overall pattern and allowing the assessment of MON 810 effects at one glance. The vertical dashed lines indicate the test thresholds of 0.9/ 0.1 (biological relevance).

No effect of MON 810 is indicated if

- for the *As usual*- probabilty the lower confidence bound is greater than the threshold of 0.9, *i.e.* the whole confidence interval lies on the right side of the dashed line or

An effect of MON 810 is indicated if

- for the *As usual*- probabilty the threshold lies between the lower and upper confidence bounds, *i.e.* the confidence interval crosses the dashed line.
- for the *As usual*- probabilty the upper confidence bound is smaller than the threshold, *i.e.* the whole confidence interval lies on the left side of the dashed line.

Table 8: Overview on the results of the closed test procedure for the monitoring characters in 2017 growing season

Monitoring character	N valid	*As usual*	P for $p_0 = 0.9$	*Minus*	P for $p_0 = 0.1$	*Plus*	P for $p_0 = 0.1$
Crop rotation	250	246 (98.4%)	< 0.01			4 (1.6%)	
Time of planting	250	246 (98.4%)	< 0.01	0 (0.0%)		4 (1.6%)	
Tillage and planting technique	249	248 (99.6%)	< 0.01			1 (0.4%)	
Insect control practices	250	235 (94.0%)	< 0.01			15 (6.0%)	0.18
Weed control practices	250	250 (100.0%)	< 0.01			0 (0.0%)	
Fungal control practices	249	249 (100.0%)	< 0.01			0 (0.0%)	
Maize Borer control practice	250	235 (94.0%)	< 0.01			15 (6.0%)	
Fertilizer Application	250	250 (100.0%)	< 0.01			0 (0.0%)	
Irrigation Practices	250	250 (100.0%)	< 0.01			0 (0.0%)	
Time of harvest	250	248 (99.2%)	< 0.01	0 (0.0%)		2 (0.8%)	
Germination vigor	250	231 (92.4%)	0.081	2 (0.8%)	< 0.01	17 (6.8%)	0.051
Time to emergence	250	249 (99.6%)	< 0.01	0 (0.0%)		1 (0.4%)	
Time to male flowering	250	249 (99.6%)	< 0.01	0 (0.0%)		1 (0.4%)	
Plant growth and development	250	245 (98.0%)	< 0.01	1 (0.4%)		4 (1.6%)	
Incidence of stalk / root lodging	250	198 (79.2%)	1.0	52 (20.8%)	1.0	0 (0.0%)	< 0.01
Time to maturity	250	223 (89.2%)	0.634	0 (0.0%)	< 0.01	27 (10.8%)	0.708
Yield	250	153 (61.2%)	1.0	1 (0.4%)	< 0.01	96 (38.4%)	1.0
Occurrence of volunteers	250	237 (94.8%)	< 0.01	13 (5.2%)		0 (0.0%)	
Disease susceptibility	250	244 (97.6%)	< 0.01	6 (2.4%)		0 (0.0%)	
Pest susceptibility	250	229 (91.6%)	0.172	21 (8.4%)	0.2342	0 (0.0%)	< 0.01
Weed pressure	250	249 (99.6%)	< 0.01	1 (0.4%)		0 (0.0%)	
Occurrence of insects	249	249 (100.0%)	< 0.01	0 (0.0%)		0 (0.0%)	
Occurrence of birds	249	249 (100.0%)	< 0.01	0 (0.0%)		0 (0.0%)	
Occurrence of mamals	249	249 (100.0%)	< 0.01	0 (0.0%)		0 (0.0%)	
Performance of animals	8	7 (87.5%)	0.430			1 (12.5%)	0.813

For grey highlighted probability values the binomial test against the threshold of 90 % for *As usual*-answers or 10 % for *Minus* - or *Plus*-answers, respectively, resulted in p-values greater than $\alpha = 0.01$, so the null hypotheses, that these values are smaller than 90 % for *As usual*-answers or greater than 10 % for *Minus* - or *Plus*-answers, respectively, could not be rejected, *i.e.* an effect is indicated.

Table 9: Overview on the $p_{As\ usual}$, p_{Minus} and p_{Plus} probabilities of the monitoring characters and corresponding 99 % confidence intervals

Monitoring character	$p_{As\ usual}$	lower 99 % confidence limit	upper 99 % confidence limit	p_{Minus}	lower 99 % confidence limit	upper 99 % confidence limit	p_{Plus}	lower 99 % confidence limit	upper 99 % confidence limit
Crop rotation	98.4%	96.4%	100.4%	-	-	-	1.6%	0.0%	3.6%
Time of planting	98.4%	96.4%	100.4%	0.0%	0.0%	0.0%	1.6%	0.0%	3.6%
Tillage and planting technique	99.6%	98.6%	100.6%	-	-	-	0.4%	0.0%	1.4%
Insect control practices	94.0%	90.1%	97.9%	-	-	-	6.0%	2.1%	9.9%
Weed control practices	100.0%	100.0%	100.0%	-	-	-	0.0%	0.0%	0.0%
Fungal control practices	100.0%	100.0%	100.0%	-	-	-	0.0%	0.0%	0.0%
Maize Borer control practice	94.0%	90.1%	97.9%	-	-	-	6.0%	2.1%	9.9%
Fertilizer Application	100.0%	100.0%	100.0%	-	-	-	0.0%	0.0%	0.0%
Irrigation Practices	100.0%	100.0%	100.0%	-	-	-	0.0%	0.0%	0.0%
Time of harvest	99.2%	97.7%	100.7%	0.0%	0.0%	0.0%	0.8%	0.0%	2.3%
Germination vigor	92.4%	88.1%	96.7%	0.8%	0.0%	2.3%	6.8%	2.7%	10.9%
Time to emergence	99.6%	98.6%	100.6%	0.0%	0.0%	0.0%	0.4%	0.0%	1.4%
Time to male flowering	99.6%	98.6%	100.6%	0.0%	0.0%	0.0%	0.4%	0.0%	1.4%
Plant growth and development	98.0%	95.7%	100.3%	0.4%	0.0%	1.4%	1.6%	0.0%	3.6%
Incidence of stalk / root lodging	79.2%	72.6%	85.8%	20.8%	14.2%	27.4%	0.0%	0.0%	0.0%
Time to maturity	89.2%	84.1%	94.3%	0.0%	0.0%	0.0%	10.8%	5.7%	15.9%
Yield	61.2%	53.3%	69.1%	0.4%	0.0%	1.4%	38.4%	30.5%	46.3%
Occurrence of volunteers	94.8%	91.2%	98.4%	5.2%	1.6%	8.8%	0.0%	0.0%	0.0%
Disease susceptibility	97.6%	95.1%	100.1%	2.4%	0.0%	4.9%	0.0%	0.0%	0.0%
Pest susceptibility	91.6%	87.1%	96.1%	8.4%	3.9%	12.9%	0.0%	0.0%	0.0%
Weed pressure	99.6%	98.6%	100.6%	0.4%	0.0%	1.4%	0.0%	0.0%	0.0%
Occurrence of insects	100.0%	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Occurrence of birds	100.0%	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Occurrence of mamals	100.0%	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Performance of animals	87.5%	57.4%	117.6%	-	-	-	12.5%	0.0%	42.6%

Grey highlighted confidence intervals cross the threshold of 90 % for $As\ usual$-answers or 10 % for $Minus$ - or $Plus$-answers, respectively, so the null hypotheses, that these values are smaller than 90 % for $As\ usual$-answers or greater than 10 % for $Minus$ - or $Plus$-answers, respectively, could not be rejected, *i.e.* an effect is indicated.

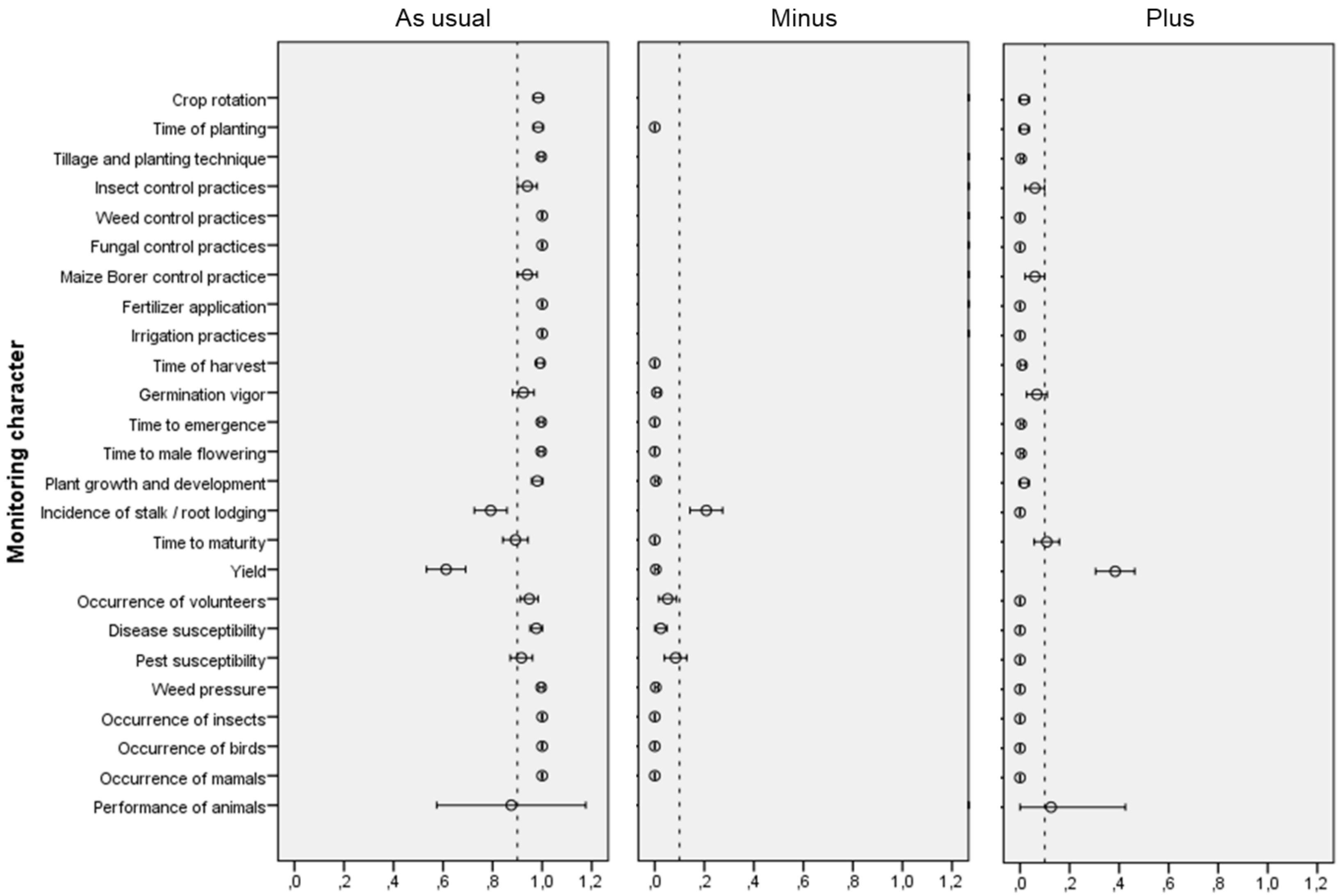

Figure 6: $As\ usual$- , $Plus$- and $Minus$ - answer probabilities of all monitoring characters, point estimates (circle) and 99 % confidence intervals (bars). Vertical dashed line indicates the test thresholds of 0.9 or 0.1, respectively (biological relevance)

Taken together, 2017 data indicate that in comparison to conventional maize, MON 810 plants

- germinated more vigourously,
- had less incidence of stalk/root lodging,
- had a longer time to maturity,
- gave a higher yield,
- showed less volunteers,
- were less susceptible to pests other than corn borers, especially lepidopteran pests,
- received less insecticides.

In the following sections the detailed analysis of all parameters surveyed using the questionnaire in 2017 is described and the results are assessed scientifically.

3.1 Sampling and quality and plausibility control

The questionnaires have been completed between January and March 2018. In the 2017 growing season 250 farm questionnaires have been collected.

In Spain, the largest market, the surveys (236) were performed by Instituto Markin, SL[2], in Portugal the surveys (14) were performed by Agro.Ges - Sociedade de Estudos e Projectos[3]. These companies have an established experience in agricultural surveys.

In Spain, 502 farmers were contacted, 266 did not respond for the following reasons: because they did not grow MON810 in 2017 (86), they did not grow maize in 2017 (61), they growed MON810 in 2017 but refused to sign the consent form (45), they grew MON810 in 2017 but refused to answer the interview (43), they were absent or could not be localized (18) they were retired (13). The response rate was 47%. 97 interviewed farmers for the first time took part in the survey. According to the sampling scheme, the farmers came from the following regions:

Table 10: Number of farmers interviewed in Spain 2017

REGION	No of farmers	
CATALUÑA - ARAGÓN		169
Lérida	74	
Huesca	75	
Zaragoza	20	
NAVARRA		15
Navarra	15	
EXTREMADURA		27
Badajoz	10	
Cáceres	17	
ANDALUCÍA		15
Sevilla	15	
CASTILLA- LA MANCHA		10
Albacete	10	
TOTAL INTERVIEWS		236

[2] Instituto Markin, SL; c/ Caleruega, 60 4º D -28033 Madrid -Spain
[3] Agro.Ges -Sociedade de Estudos e Projectos, Av. da República, 412, 2750-475 Cascais -Portugal

In Portugal, none of the contacted farmers refused to participate. The response rate was 100%. 6 interviewed farmers for the first time took part in the survey. According to the sampling scheme, the farmers came from the following regions:

Table 11: Number of farmers interviewed in Portugal 2017

Region	No of farmers
North	0
Center	3
Lisbon and Tagus Valley	5
Alentejo	6
Total	14

After the first quality and plausibility control, 6 inconsistencies occurred in the questionnaires: 4 cases of multiple choices, 1 incorrect pesticide/ variety names and 1 inconsistency to additional questions in the Annex 2017. After including the corrections, the quality and plausibility control confirmed that all 250 questionnaires could be considered for analysis.

The high quality of the questionnaires can also be ascribed to the interviewer training.

The database currently contains 3 127 cases (questionnaires) for 12 field seasons: 252 for 2006, 291 for 2007, 297 for 2008, 240 for 2009, 271 for 2010, 249 for 2011, 249 for 2012, 256 for 2013, 261 for 2014, 261 for 2015, 250 for 2016 and 250 for 2017.

3.2 Part 1: Maize grown area

3.2.1 Location

In 2017, 250 questionnaires were surveyed in the cultivation areas of MON 810 in Spain and Portugal. With an area of 124 227 ha in Spain and 7 036 ha in Portugal, these two countries represent Europes largest MON 810 cultivators. Of these areas, 6.4 % and 14.9 % were monitored in this study for Spain and Portugal, respectively (Table 12).

Figure 7 shows a geographical overview on the cultivation areas of MON 810 in Europe in 2017 (dark grey areas) and the location of the monitoring sites (numbers).

Table 12: MON 810 cultivation and monitored areas in 2017

Country	Total planted MON 810 area (ha)	Monitored MON 810 area (ha)	Monitored MON 810 area / total planted MON 810 area (%)
Spain	124227	7988	6.4
Portugal	7036	1050	14.9
Total	131553	9038	6.9

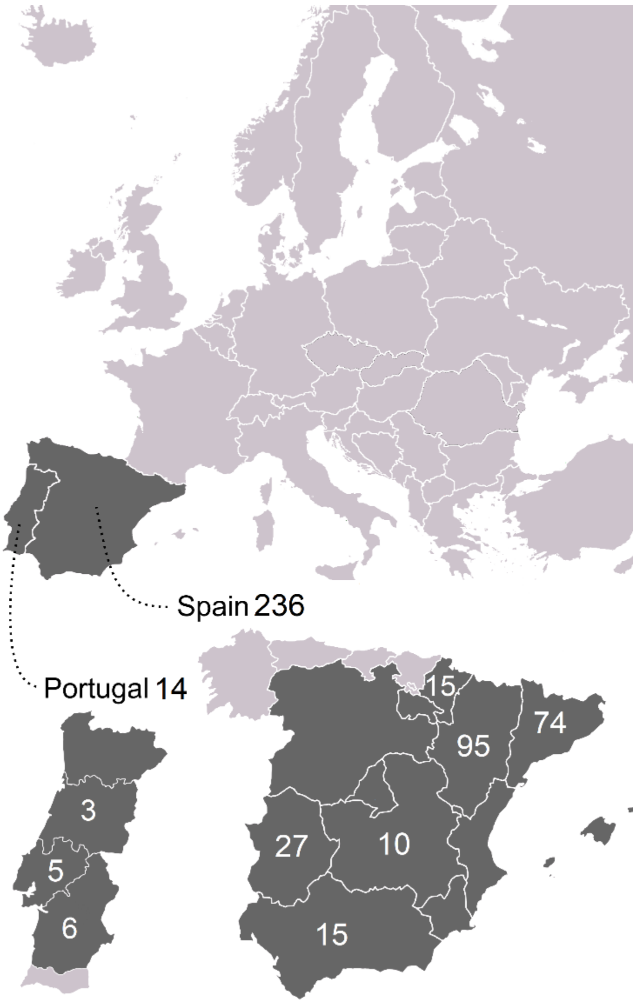

Figure 7: Number of sampling sites within the cultivation areas (dark grey) of MON 810 in Europe in 2017

3.2.2 Surrounding environment

The farmers were asked to describe the land usage in the surrounding of the areas planted with maize. 249/250 fields (99.6 %) were surrounded by farmland, 1 field was surrounded by forest or wild habitat (Table 13, Figure 8).

Table 13: Land usage in the surrounding of the areas planted with MON 810 in Europe in 2017

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	Farmland	249	99.6	99.6	99.6
	Forest or wild habitat	1	0.4	0.4	100.0
Total		250	100.0	100.0	

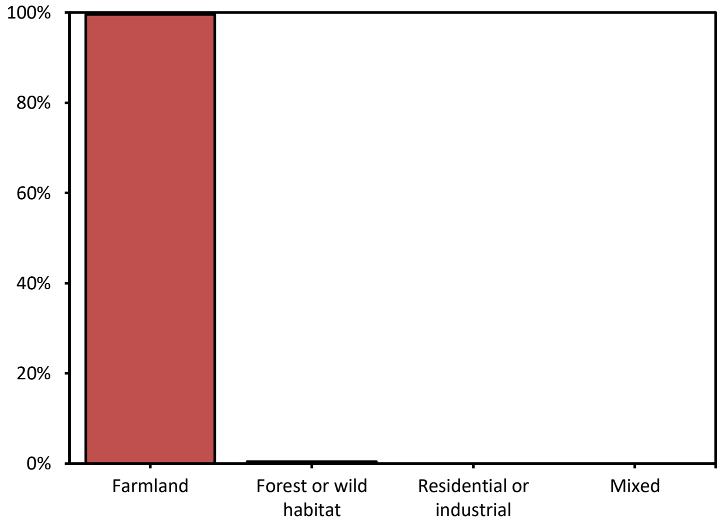

Figure 8: Land usage in the surrounding of the areas planted with MON 810 in Europe in 2017

3.2.3 Size and number of fields of the maize cultivated area

The size of the total maize area at the farms in 2017 ranged from 1 to 800 hectares. The average MON 810 areas per surveyed farmer in 2017 were 33.8 ha in Spain and 75.0 ha in Portugal. Details for cultivation of maize from 2006 to 2017 by country can be found in Table 14.

Table 14: Maize area (ha) per surveyed farmer in 2006, 2007, 2008 and 2009

		2006			2007			2008			2009		
Country	**Total Area (ha)**	**Mean**	**Min**	**Max**	**Mean**	**Min**	**Max**	**Mean**	**Min**	**Max**	**Mean**	**Min**	**Max**
Spain	all maize	26.9	1.0	204.0	31.6	1.0	210.0	31.6	1.5	294.0	28.3	3.0	260.0
	MON 810	21.0	1.0	170.0	25.2	1.0	200.0	24.9	0.5	266.0	21.1	2.0	200.0
France	all maize	80.4	9.6	500.0	54.6	6.0	500.0	-	-	-	-	-	-
	MON 810	18.3	0.4	104.0	35.8	2.0	150.0	-	-	-	-	-	-
Portugal	all maize	100.3	10.0	278.0	89.3	7.0	470.0	78.6	10.0	350.0	78.8	8.0	310.0
	MON 810	35.3	3.0	130.0	54.8	0.8	320.0	41.1	2.5	240.0	47.8	1.0	250.0
Czech Republic	all maize	424.6	52.0	2,500.0	433.8	89.3	1,400.0	431.9	57.4	3,000.0	338.9	8.4	789.1
	MON 810	28.2	1.5	125.0	86.3	19.5	466.0	107.6	10.0	561.1	90.4	6.5	500.0
Slovakia	all maize	491.7	65.0	1,300.0	277.2	20.0	659.4	340.2	124.0	637.3	546.7	270.0	895.0
	MON 810	10.0	10.0	10.0	50.6	10.0	174.6	130.1	10.0	400.0	132.3	50.0	285.0
Germany	all maize	274.8	39.0	1,110.0	239.5	20.0	1,130.0	256.1	4.8	1,470.0	-	-	-
	MON 810	17.3	1.0	50.0	43.0	0.5	166.0	51.6	0.2	200.0	-	-	-
Romania	all maize	-	-	-	1,969.8	253.0	5,616.0	591.4	5.4	6,789.0	417.5	2.5	6,869.0
	MON 810	-	-	-	61.4	0.5	216.0	149.0	2.0	2,705.0	62.1	1.0	1,114.0
Poland	all maize	-	-	-	79.0	20.0	130.0	222.7	4.2	940.0	58.0	39.0	95.0
	MON 810	-	-	-	13.0	11.0	15.0	17.0	4.2	50.0	12.8	5.5	25.0

Table 14 (cont): Maize area (ha) per surveyed farmer in 2010, 2011, 2012 and 2013

		2010			2011			2012			2013		
Country	**Total Area (ha)**	**Mean**	**Min**	**Max**	**Mean**	**Min**	**Mean**	**Min**	**Mean**	**Min**	**Mean**	**Min**	**Max**
Spain	all maize	34.2	2.0	34.2	2.0	34.2	2.0	33.0	1.0	320.0	41.6	1.5	1,000.0
	MON 810	23.9	1.0	23.9	1.0	23.9	1.0	21.8	1.0	278.0	27.7	1.0	700.0
France	all maize	-	-	-	-	-	-	-	-	-	-	-	-
	MON 810	-	-	-	-	-	-	-	-	-	-	-	-
Portugal	all maize	78.4	9.0	78.4	9.0	78.4	9.0	96.7	10.0	300.0	103.7	10.0	537.0
	MON 810	53.9	1.5	53.9	1.5	53.9	1.5	61.5	1.5	240.0	58.4	1.0	240.0
Czech Republic	all maize	355.7	2.2	355.7	2.2	355.7	2.2	492.2	8.4	2,000.0	454.0	9.3	1,300.0
	MON 810	112.7	2.0	112.7	2.0	112.7	2.0	108.6	6.6	230.0	95.8	7.3	250.0
Slovakia	all maize	594.9	150.0	594.9	150.0	594.9	150.0	862.9	862.9	862.9	-	-	-
	MON 810	184.2	60.0	184.2	60.0	184.2	60.0	169.0	169.0	169.0	-	-	-
Germany	all maize	-	-	-	-	-	-	-	-	-	-	-	-
	MON 810	-	-	-	-	-	-	-	-	-	-	-	-
Romania	all maize	196.9	20.0	196.9	20.0	196.9	20.0	124.0	20.0	500.0	749.0	548.0	950.0
	MON 810	32.9	0.1	32.9	0.1	32.9	0.1	21.6	0.0	59.3	227.8	55.6	400.0
Poland	all maize	61.1	19.0	61.1	19.0	61.1	19.0	-	-	-	-	-	-
	MON 810	23.8	1.5	23.8	1.5	23.8	1.5	-	-	-	-	-	-

Table 14 (cont): Maize area (ha) per surveyed farmer in 2014, 2015, 2016 and 2017

		2014			2015			2016			2017		
Country	**Total Area (ha)**	**Mean**	**Min**	**Max**	**Mean**	**Min**	**Max**	**Mean**	**Min**	**Max**	**Mean**	**Min**	**Max**
Spain	all maize	53.0	2.0	1,950.0	40.7	1.0	579	40.9	1.0	700	45.4	1.0	800
	MON 810	34.0	1.0	1,445.0	25.8	0.9	400	28.6	1.0	600	33.8	1.0	681
France	all maize	-	-	-	-	-	-	-	-	-			
	MON 810	-	-	-	-	-	-	-	-	-			
Portugal	all maize	111.7	10.0	800.0	109.6	10.0	728	120.8	37.0	180	128.8	19.0	374
	MON 810	64.3	1.0	640.0	66.3	1.0	582	79.0	10.0	136	75.0	5.0	147
Czech Republic	all maize	-	-	-	-	-	-	-	-	-			
	MON 810	-	-	-	-	-	-	-	-	-			
Slovakia	all maize	-	-	-	-	-	-	-	-	-			
	MON 810	-	-	-	-	-	-	-	-	-			
Germany	all maize	-	-	-	-	-	-	-	-	-			
	MON 810	-	-	-	-	-	-	-	-	-			
Romania	all maize	-	-	-	-	-	-	-	-	-			
	MON 810	-	-	-	-	-	-	-	-	-			
Poland	all maize	-	-	-	-	-	-	-	-	-			
	MON 810	-	-	-	-	-	-	-	-	-			

Figure 9 shows the mean percentage of MON 810 cultivation area within total maize area per farmer from 2006 to 2017.

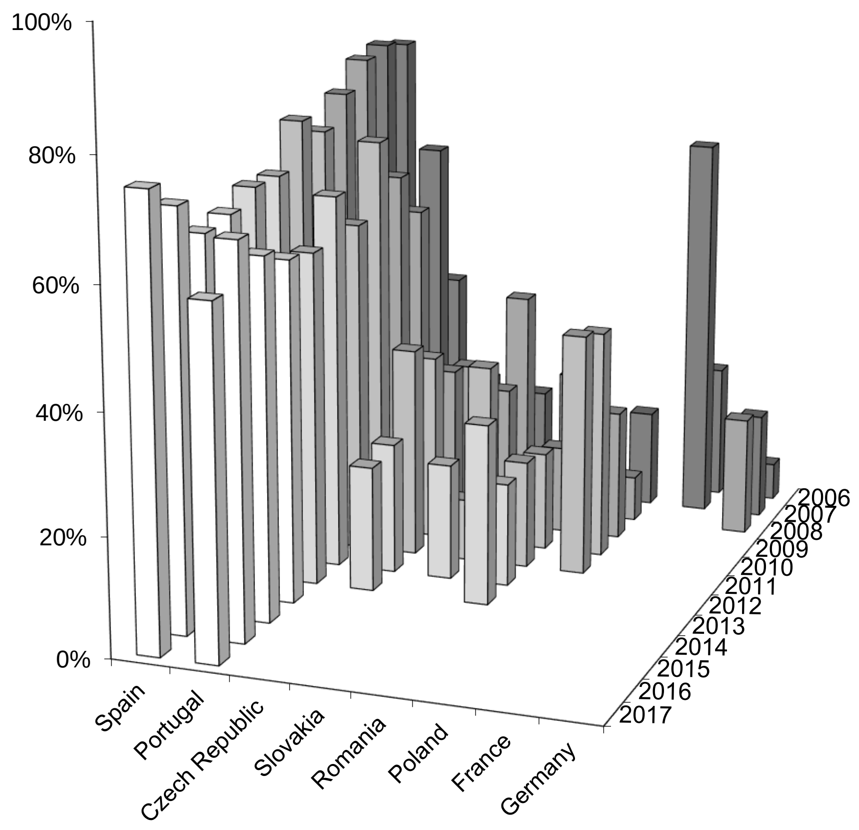

Figure 9: Mean percentage of MON 810 cultivation area of total maize area per farmer in 2006 - 2017 (surveyed countries only)

In 2017, MON 810 was cultivated on 1 - 55 fields per farm. On average every farmer cultivated MON 810 on 5 fields (Table 15).

Table 15: Number of fields with MON 810 in 2017

Valid N	Mean	Minimum	Maximum	Sum
250	5.09	1	55	1272

3.2.4 Maize varieties grown

The farmers were asked to list up to five MON 810 varieties and up to five conventional maize varieties they cultivated on their farm in 2017. 46 different MON 810 varieties and 50 different conventional maize varieties were listed. The most frequently listed varieties (at least 6 times) together with their respective frequencies are listed in Table 16.

Table 16: Names of most cultivated MON 810 and conventional maize varieties in 2017

MON 810 maize		Conventional maize	
Variety	Frequency	Variety	Frequency
DKC 6729 YG	65	DKC 6728	40
P 1570 Y	62	P 1921	26
P 1921 Y	50	P 0937	25
P 1758 Y	32	P 1570	23
P 0937 Y	28	P 1574	20
P 0933 Y	27	DKC 5031	15
DKC 5032 YG	26	DKC 6664	14
P 1574 Y	21	P 0933	13
DKC 5277 YG	19	P 1524	13
PR 33 Y 72	17	P 1758	11
DKC 6451 YG	10	DKC 6450	8
P 0725 Y	10	DKC 6630	8
DKC 6531 YG	8	DKC 5276	7
DKC 6631 YG	8	LG 3490	7
LG 30712 YG	6	RGT Ixabel	7
LG 30490 YG	6	PR 33 Y 74	6
		P 0725	6

3.2.5 Soil characteristics of the maize grown area

To assess the possible influence of the soil on monitoring characters, data on soil characteristics, quality and humus content were surveyed. Table 17 summarizes the reported soil types of the maize grown area.

Table 17: Predominant soil type of maize grown area in 2017

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	very fine	9	3.6	3.6	3.6
	fine	92	36.8	36.8	40.4
	medium	92	36.8	36.8	77.2
	medium-fine	19	7.6	7.6	84.8
	coarse	21	8.4	8.4	93.2
	no predominant soil type	17	6.8	6.8	100.0
Total		250	100.0	100.0	

Farmers' responses regarding the soil quality of the maize-grown areas are given in Table 18 and Figure 10. 99.2 % (248/250) of the maize was grown on *normal* or *good* soil according to the response of the farmers.

Table 18: Soil quality of the maize grown area as assessed by the farmers in 2017

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	below average - poor	2	0.8	0.8	0.8
	average - normal	187	74.8	74.8	75.6
	above average - good	61	24.4	24.4	100.0
Total		250	100.0	100.0	

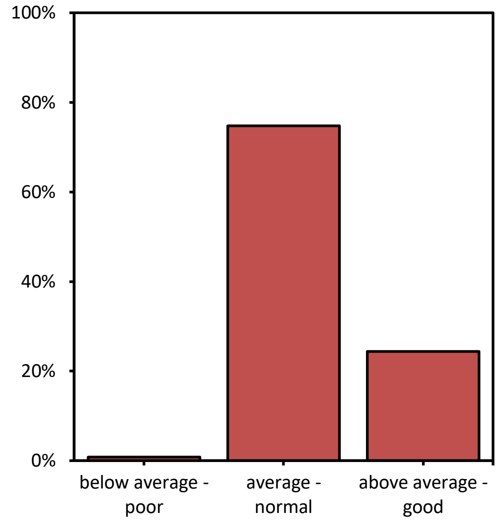

Figure 10: Soil quality of the maize grown area as assessed by the farmers in 2017

60 farmers were able to specify the humus content (not a commonly known measure all over Europe), which ranged from 1.0 % to 4.0 % with a mean of 33 % (Table 19). 190 farmers did not specify the humus content.

Table 19: Humus content (%) in 2017

Valid N	Mean	Minimum	Maximum	Missing N
60	3.3	1	4	190

3.2.6 Local disease, pest and weed pressure in maize

Data of local disease, pest and weed pressures in maize were collected to find out if these environmental data had any influence on the values of the monitoring characters. These data differ from year to year, depending on the cultivation area and reflect the assessment of the farmer.

3.2.6.1 Local disease pressure (fungal, viral) as assessed by the farmers

The local disease pressure (fungal, viral) in maize was assessed to be low or $as\ usual$ by 97.6 % (244/250) of the farmers (Table 20, Figure 11).

Table 20: Farmers assessment of the local disease pressure (fungal, viral) in 2017

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	low	143	57.2	57.2	57.2
	as usual	101	40.4	40.4	97.6
	high	6	2.4	2.4	100.0
Total		250	100.0	100.0	

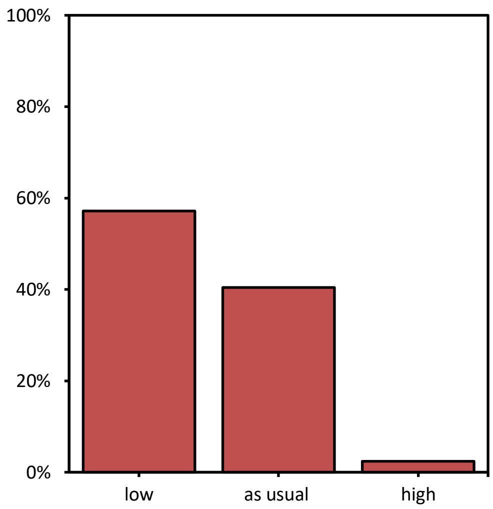

Figure 11: Farmers assessment of the local disease pressure (fungal, viral) in 2017

3.2.6.2 Local pest pressure (insects, mites, nematodes) as assessed by the farmers

Regarding the local pest pressure (insects, mites, nematodes), 72.8 % (182/250) of the farmers evaluated it to be low or $as\ usual$ and 27.2 % (68/250) evaluated it to be $high$ (Table 21, Figure 12).

Table 21: Farmers assessment of the local pest pressure (insects, mites, nematodes) in 2017

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	low	92	36.8	36.8	36.8
	as usual	90	36.0	36.0	72.8
	high	68	27.2	27.2	100.0
Total		250	100.0	100.0	

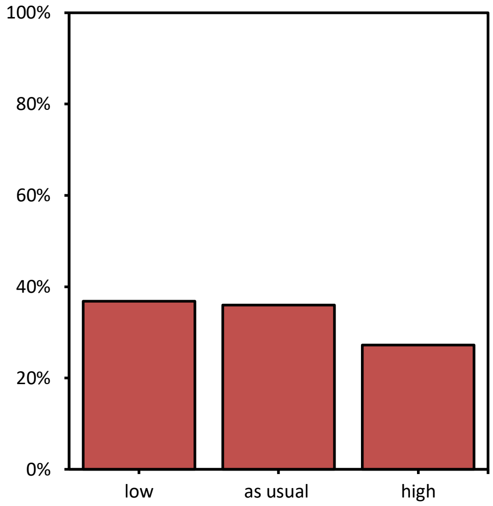

Figure 12: Farmers assessment of the local pest pressure (insects, mites, nematodes) in 2017

3.2.6.3 Local weed pressure as assessed by the farmers

97.2 % (243/250) assessed the local weed pressure to be *low* or *as usual* and 2.8 % (7/250) evaluated it to be *high* (Table 22, Figure 13).

Table 22: Farmers assessment of the local weed pressure in 2017

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	low	47	18.8	18.8	18.8
	as usual	196	78.4	78.4	97.2
	high	7	2.8	2.8	100.0
Total		250	100.0	100.0	

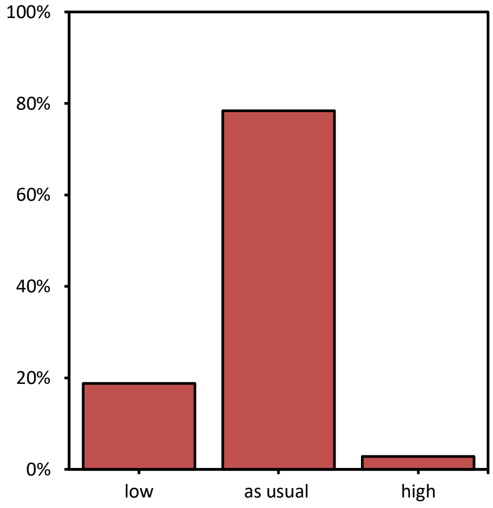

Figure 13: Farmers assessment of the local weed pressure in 2017

3.3 Part 2: Typical agronomic practices to grow maize

3.3.1 Irrigation of maize grown area

100,0 % (250/250) of the farmers irrigated their fields (Table 23). The irrigation of the maize grown area is a productivity factor. These data reflect the general practices on the Iberian Peninsula. The irrigation depends on the weather conditions, even though it could be relevant for the analysis of GM maize specific effects.

Table 23: Irrigation of maize grown area in 2017

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	yes	250	100.0	100.0	100.0
	no	0	0.0	0.0	100.0
Total		250	100.0	100.0	

Most of the irrigating farmers used Gravity (35.2 %) or by Sprinkler (49.2 %) followed by Pivot (9.6 %). Some of them used more than one of the named or other types of irrigation (Table 24).

Table 24: Irrigation of maize grown area in 2017

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	Sprinkler	123	49.2	49.2	49.2
	Gravity	88	35.2	35.2	84.4
	Pivot	24	9.6	9.6	94.0
	other	10	4.0	4.0	98.0
	Sprinkler and Pivot	3	1.2	1.2	99.2
	Gravity and other	1	0.4	0.4	99.6
	Pivot and other	1	0.4	0.4	100.0
Total		250	100.0	100.0	

3.3.2 Major rotation of maize grown area

The main crop rotation within three years is $maize - maize - maize$ followed by $maize - cotton - maize$. More crop rotations were mentioned, but all with low occurrence (Table 25).

Table 25: Major rotation of maize grown area before 2017 planting season (two years ago and previous year) sorted by frequency

	two years ago	previous year	Frequency	Percentage	Valid percentage	Accumulated percentage
Valid	maize	maize	103	92.0	92.0	92.0
	maize	cotton	6	5.4	5.4	97.3
	maize	cereals	1	0.9	0.9	98.2
	potato	cotton	1	0.9	0.9	99.1
	maize	potato	1	0.9	0.9	100.0
Total			112	100.0	100.0	

3.3.3 Soil tillage practices

The farmers were asked to answer whether they performed soil tillage. 94.0 % (235/250) said yes (Table 26) while 6.0 % (15/250) answered no.

Table 26: Soil tillage practices in 2017

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	yes	235	94.0	94.0	94.0
	no	15	6.0	6.0	100.0
Total		250	100.0	100.0	

All farmers who said yes specified the time of tillage. 71.1 % (167/250) performed it in $winter$, 28.9 % (68/250) in $spring$ and no one in $winter\ and\ spring$ (Table 27, Figure 14).

Table 27: Time of tillage in 2017

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	winter	167	71.1	71.1	71.1
	spring	68	28.9	28.9	100.0
	winter & spring	0	0.0	0.0	100.0
Total		235	100.0	100.0	

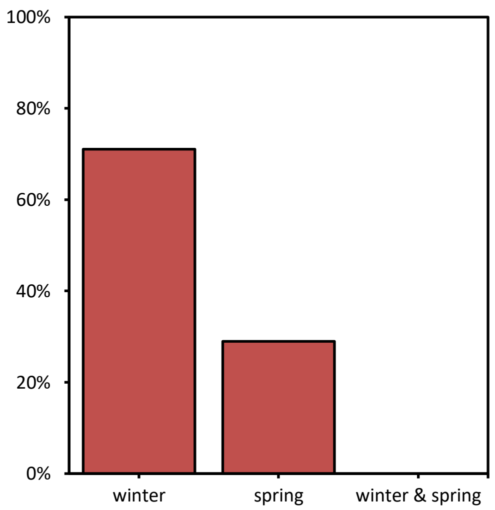

Figure 14: Time of tillage in 2017

3.3.4 Maize planting technique

82.4 % (206/250) of the farmers used *conventional* maize planting techniques, 11.6 % (29/250) *mulch* and 6.0 % (15/250) used *direct sowing* (Table 28, Figure 15).

Table 28: Maize planting technique in 2017

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	conventional planting	206	82.4	82.4	82.4
	mulch	29	11.6	11.6	94.0
	direct sowing	15	6.0	6.0	100.0
Total		250	100.0	100.0	

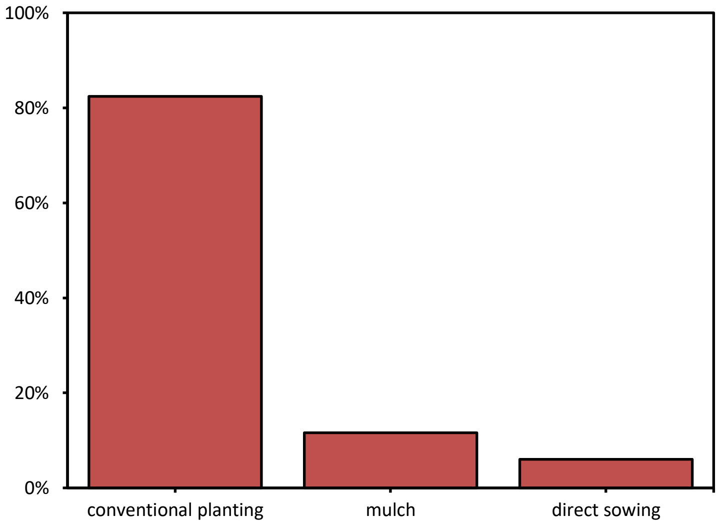

Figure 15: Maize planting technique in 2017

3.3.5 Typical weed and pest control practices in maize

Farmers were asked to specify the typical weed and pest control practices for maize at their farms. For conventional maize 99.2 % of all farmers (248/250) applied *insecticides* and 6.0 % (15/248) of them additionally applied *insecticides against corn borers*. 99.6% of the farmers (249/250) used *herbicides*, 1.6% (4/250) used *mechanical weed control*. None of the farmers used) *fungicides* or *biocontrol treatment* (Table 29

Table 29: Typical weed and pest control practices in maize in 2017

Insecticide(s)		Frequency	Percent
	yes	248	99.2
	no	2	0.8
Total		250	100.0
Insecticide(s) against Corn Borer		Frequency	Percent
	yes	15	6.0
	no	233	93.2
	Total	248	
Missing	no statement	2	0.8
Total		250	100.0
Use of biocontrol treatments		Frequency	Percent
	yes	0	0.0
	no	250	100.0
Total		250	100.0
Herbicide(s)		Frequency	Percent
	yes	249	99.6
	no	1	0.4
Total		250	100.0
Mechanical weed control		Frequency	Percent
	yes	4	1.6
	no	246	98.4
Total		250	100.0
Fungicide(s)		Frequency	Percent
	yes	0	0.0
	no	250	100.0
Total		250	100.0
Other		Frequency	Percent
	yes	0	0.0
	no	250	100.0
Total		250	100.0

3.3.6 Application of fertilizer to maize grown area

100.0% of the farmers (250/250) applied fertilizer to the maize grown area (Table 30).

Table 30: Application of fertilizer to maize grown area in 2017

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	yes	250	100.0	100.0	100.0
	no	0	0.0	0.0	100.0
Total		250	100.0	100.0	

3.3.7 Typical time of maize sowing

For quality control and to see if the collected data are plausible the farmers were asked about the typical time of maize sowing.

The time of sowing ranged from 20 March 2017 to 04 July 2017 (Table 31).

Table 31: Typical time of maize sowing in 2017

	Minimum	Maximum	Mean	Valid N
Sowing from	20.02.2017	20.06.2017	15.04.2017	250
Sowing till	10.03.2017	04.07.2017	08.05.2017	250

3.3.8 Typical time of maize harvest

In order to verify the plausibility of the data, farmers were also asked for their typical time of harvest. The time of harvest for maize grain ranged from 20 August 2017 to 30 December 2017 and for maize forage from 25 July 2017 to 30 December 2017 (Table 32).

Table 32: Typical time of maize harvest in 2017

	Minimum	Maximum	Mean	Valid N
Harvest grain maize from	20.08.2017	20.12.2017	15.10.2017	248
Harvest grain maize till	30.08.2017	30.12.2017	06.11.2017	248
Harvest forage maize from	25.07.2017	01.12.2017	26.09.2017	20
Harvest forage maize till	30.07.2017	30.12.2017	20.10.2017	20

3.4 Part 3: Observations of MON 810

3.4.1 Agricultural practice for MON 810 (compared to conventional maize)

3.4.1.1 Crop rotation

The crop rotation for MON 810 was specified to be $as\ usual$ in 98.4 % (246/250) of the cases (Appendix A Table A 1, Table 33, Figure 16). The individual specifications for $changed$ crop rotation before MON 810 are given in Appendix A, Table A 1.

Table 33: Crop rotation for MON 810 compared to conventional maize in 2017

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	as usual	246	98.4	98.4	98.4
	changed	4	1.6	1.6	100.0
Total		250	100.0	100.0	

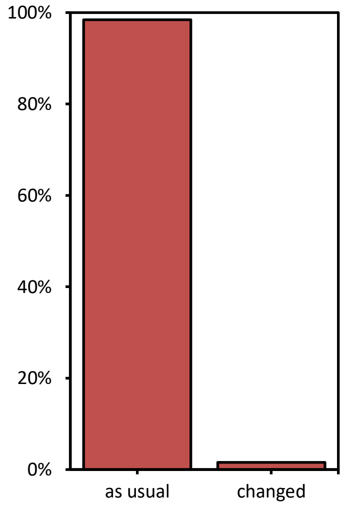

Figure 16: Crop rotation of MON 810 compared to conventional maize in 2017

(1) The valid percentage of $as\ usual$ crop rotation (98.4 %) is significantly greater than 90 %. The resulting P-value is less than the level of significance $\alpha = 0.01$ (Table 34) and therefore, the null hypothesis $p_{as\ usual} \leq 0.9$ is rejected with a power of 100.0 %.

No effect on crop rotation is indicated.

Table 34: Test results as well as 99% confidence intervals for $p_{As\ usual}$, p_{Minus} and p_{Plus} probabilities of crop rotation in MON 810 compared to conventional maize in 2017

N valid	*As usual*	*P* for $p_0 = 0.9$	*Minus*	*P* for $p_0 = 0.1$	*Plus*	*P* for $p_0 = 0.1$
250	246 (98.4 %)	< 0.01				

$p_{As\ usual}$	lower 99 % confidence limit	upper 99 % confidence limit	p_{Minus}	lower 99 % confidence limit	upper 99 % confidence limit	p_{Plus}	lower 99 % confidence limit	upper 99 % confidence limit
98.4%	96.4%	100.4%	-	-	-	1.6%	0.0%	3.6%

3.4.1.2 Time of planting

The time of planting of MON 810 was specified to be $as\ usual$ compared to conventional maize by 98.4 % (246/250) of the farmers (Table 35, Figure 17). The individual specifications for $later$ and $earlier$ planting of MON 810 are given in Appendix A, Table A 2.

Table 35: Time of planting for MON 810 compared to conventional maize in 2017

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	earlier	0	0.0	0.0	0.0
	as usual	246	98.4	98.4	98.4
	later	4	1.6	1.6	100.0
Total		250	100.0	100.0	

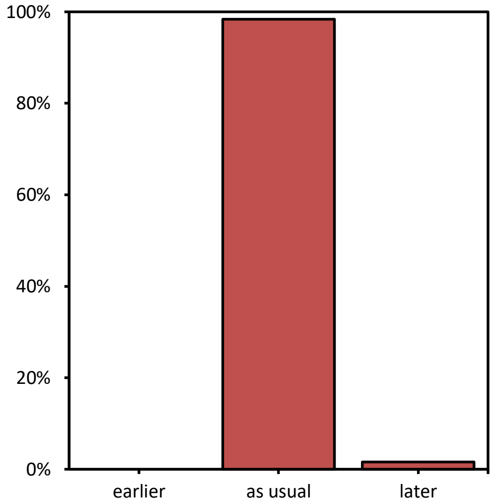

Figure 17: Time of planting of MON 810 compared to conventional maize in 2017

(1) The valid percentage of $as\ usual$ time of planting (984 %) is significantly greater than 90 % at the level of significance $\alpha = 0.01$ (Table 36) and therefore, the null hypothesis $p_{as\ usual} \leq 0.9$ is rejected with a power of 100% .

No effect on time of planting is indicated.

Table 36: Test results as well as 99% confidence intervals for $p_{As\ usual}$, p_{Minus} and p_{Plus} probabilities of time of planting in MON 810 compared to conventional maize in 2017

N valid	*As usual*	*P* for $p_0 = 0.9$	*Minus*	*P* for $p_0 = 0.1$	*Plus*	*P* for $p_0 = 0.1$
250	246 (98.4 %)	< 0.01				

$p_{As\ usual}$	lower 99 % confidence limit	upper 99 % confidence limit	p_{Minus}	lower 99 % confidence limit	upper 99 % confidence limit	p_{Plus}	lower 99 % confidence limit	upper 99 % confidence limit
98.4%	96.4%	100.4%	0.0%	0.0%	0.0%	1.6%	0.0%	3.6%

3.4.1.3 Tillage and planting techniques

The majority of the farmers did not change the tillage and planting techniques of MON 810 compared to those used for conventional maize, as reflected in Table 37 and Figure 18. Only 1 farmer (0.4 %) indicated a change. The individual specifications for $changed$ tillage and planting techniques of MON 810 are given in Appendix A,Table A 3.

Table 37: Tillage and planting techniques for MON 810 compared to conventional maize in 2017

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	as usual	248	99.2	99.6	99.6
	changed	1	0.4	0.4	100.0
	Total	249	99.6	100.0	
Missing	no statement	1	0.4		
Total		250	100.0		

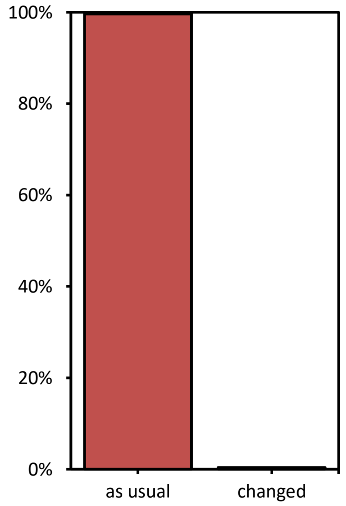

Figure 18: Tillage and planting techniques of MON 810 compared to conventional maize in 2017

(1) The valid percentage of $as\ usual$ tillage and planting techniques (99.2 %) is significantly greater than 90 %. The resulting P-value is less than the level of significance $\alpha = 0.01$ (Table 38) and therefore, the null hypothesis $p_{as\ usual} \leq 0.9$ is rejected with a power of 100 %.

No effect on tillage and planting techniques is indicated.

Table 38: Test results as well as 99% confidence intervals for $p_{As\ usual}$, p_{Minus} and p_{Plus} probabilities of tillage and planting techniques in MON 810 compared to conventional maize in 2017

N valid	*As usual*	*P* for $p_0 = 0.9$	*Minus*	*P* for $p_0 = 0.1$	*Plus*	*P* for $p_0 = 0.1$
249	248 (99.6 %)	< 0.01				

$p_{As\ usual}$	lower 99 % confidence limit	upper 99 % confidence limit	p_{Minus}	lower 99 % confidence limit	upper 99 % confidence limit	p_{Plus}	lower 99 % confidence limit	upper 99 % confidence limit
99.6%	98.6%	100.6%	-	-	-	0.4%	0.0%	1.4%

3.4.1.4 Insect and corn borer control practice

Insecticides applied in MON 810 fields sorted by their regulatory approval as seed treatment, spray application or microgranules are listed per country in Appendix A, Table A 4. MON 810 received insecticide treatments mainly through seed coatings, for which Thiacloprid was the major active ingredient in 2017. Abamectin and Chlorpyrifos were the most used active ingredients for spraying. Furthermore, Chlorpyrifos or Teflutrin were the active ingredients of all named granulate insecticides.

All farmers were asked to describe their insect control practice in MON 810 compared to conventional maize in 2015. 94.0 % (235/250) specified no change in practice, while 6.0 % (15/250) used a $different$ program Table 39, Figure 19).

Table 39: Use of insect control in MON 810 compared to conventional maize in 2017

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	as usual	235	94.0	94.0	94.0
	changed	15	6.0	6.0	100.0
Total		250	100.0	100.0	

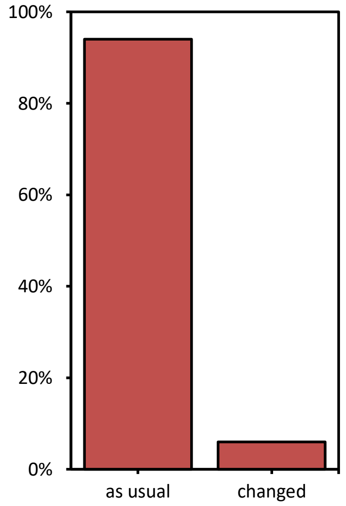

Figure 19: Insect control practice of MON 810 compared to conventional maize in 2017

(1) The valid percentage of $as\ usual$ insect control practice (94.0 %) is significantly greater than 90 % at the level of significance $\alpha = 0.01$ (Table 40) and therefore, the null hypothesis $p_{as\ usual} \leq 0.9$ is rejected.

(2) The valid percentage of $changed$ insect control practice (6.0 %) is smaller than 10 %. The resulting P-value is greater than the level of significance $\alpha = 0.01$ (Table 40) and therefore, the null hypothesis $p_{changed} \geq 0.1$ is not rejected.

An effect on insect control practice is indicated.

Table 40: Test results as well as 99% confidence intervals for $p_{As\ usual}$, p_{Minus} and p_{Plus} probabilities of insect control practice in MON 810 compared to conventional maize in 2017

N valid	*As usual*	*P* for $p_0 = 0.9$	*Minus*	*P* for $p_0 = 0.1$	*Plus*	*P* for $p_0 = 0.1$
250	235 (94.0 %)	<0.01				

$p_{As\ usual}$	lower 99 % confidence limit	upper 99 % confidence limit	p_{Minus}	lower 99 % confidence limit	upper 99 % confidence limit	p_{Plus}	lower 99 % confidence limit	upper 99 % confidence limit
94.0%	90.1%	97.9%	-	-	-	6.0%	2.1%	9.9%

All farmers that stated a difference in their insect control practices compared to conventional maize (Table 41) said that they specifically changed their corn borer control practice, as it is not necessary in MON 810 (Table 42, Figure 20). All individual explanations are given in Appendix A, Table A 5.

Table 41: Insect control practice compared to conventional maize in the context of the general use of insecticides in 2017

		Insect control practice in MON 810		
		as usual	changed	Total
Do you usually use insecticides? (section 3.3.5)	yes	233	15	248
	no	2	0	2
Total		235	15	250

Table 42: Corn Borer control practice compared to conventional maize in the context of the general use of insecticides against Corn Borer in 2017

		Corn borer control practice in MON 810		
		as usual	changed	Total
Do you usually use insecticides specifically against corn borer? (section 3.3.5)	yes	0	15	15
	no	233	0	233
	no statement	2	0	2
Total		233	15	250

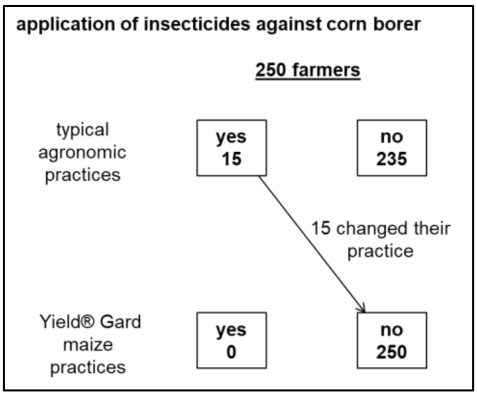

Figure 20: Change of insect control practice in MON 810 compared to conventional maize in 2017

The reduced use of conventional insecticides to control corn borers can be anticipated, since MON 810 is specifically designed to control corn borers as *Ostrinia nubilalis* and *Sesamia* spp. Therefore, planting of MON 810 makes insecticide applications for this purpose obsolete.

3.4.1.5 Weed control practice

The herbicides applied in MON 810 fields are listed in Appendix A, Table A 6. A wide number of herbicides and actives were used. The main actives of herbicides that were cited by the farmers are:

- (S)-Metolachlor
- Isoxaflutole
- Nicosulfuron
- Mesotrione
- Foramsulfuron
- Dicamba
- Tembotriona
- Isoxaflutole

all of which are well-known products used for weed control in maize.

The farmers were asked to describe their weed control practice in MON 810 in 2017 compared to conventional maize. All farmers (100 %) used the same weed control in MON 810 compared to conventional maize (Table 43).

Table 43: Use of weed control in MON 810 compared to conventional maize in 2017

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	as usual	250	100.0	100.0	100.0
	changed	0	0.0	0.0	100.0
Total		250	100.0	100.0	

No effect on weed control practice is indicated.

3.4.1.6 Fungal control practice

Since in 2017 no farmer declared to use a fungicide, no statement about the most common active ingredient in fungicides can be made.

No farmer did change the fungicide program of MON 810 compared to that of conventional maize (Table 44).

No effect on fungal control practice is indicated.

Table 44: Use of fungicides on MON 810 compared to conventional maize in 2017

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	as usual	249	99.6	100.0	100.0
	changed	0	0.0	0.0	100.0
	Total	249	99.6	100.0	
Missing	no statement	1	0.4		
Total		250	100.0		

3.4.1.7 Fertilizer application practice

All farmers answered the question regarding the fertilizer application in MON 810. No farmer used a *changed* program (Table 45).

Table 45: Use of fertilizer in MON 810 compared to conventional maize in 2017

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	as usual	250	100.0	100.0	100.0
	changed	0	0.0	0.0	100.0
Total		250	100.0	100.0	

No effect on fertilizer application practice is indicated.

3.4.1.8 Irrigation practice

All farmers answered the question regarding the irrigation practice in MON 810, no farmer *changed* the practice (Table 46, explanation: YieldGard - flood irrigation, conventional maize - sprinkler irrigation).

Table 46: Irrigation practice in MON 810 compared to conventional maize in 2017

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	as usual	250	100.0	100.0	100.0
	changed	0	0.0	0.0	100.0
Total		250	250	100.0	

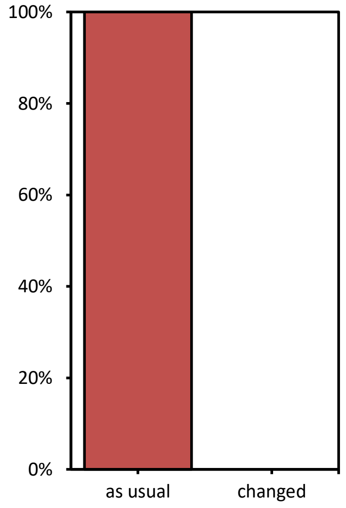

Figure 21: Irrigation practice of MON 810 compared to conventional maize in 2017

No effect on irrigation practice is indicated.

3.4.1.9 Harvest of MON 810

The farmers were asked whether they harvested MON 810 earlier or later than conventional maize or as usual. 248 of them (99.2 %) responded that no change in harvesting date was applied for MON 810. Only 0.8 % (2/250) stated that they harvested MON 810 *later* and no farmer (0.0 %) harvested *earlier* (Table 47, Figure 22). When asked for the reason for a *later* harvest of MON 810, most farmer said that it maturates later. The complete individual feedback of the farmers for a changed harvesting time is given in Appendix A, Table A 7.

Table 47: Harvest of MON 810 compared to conventional maize in 2017

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	earlier	0	0.0	0.0	0.0
	as usual	248	99.2	99.2	99.2
	later	2	0.8	0.8	100.0
Total		250	100.0	100.0	

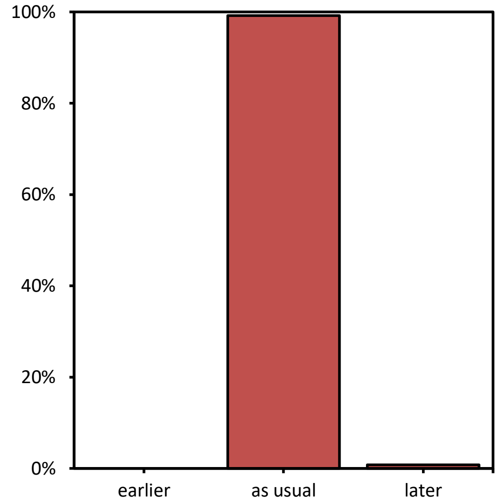

Figure 22: Harvest of MON 810 compared to conventional maize in 2017

(1) The valid percentage of $as\ usual$ harvest (99.2 %) is significantly greater than 90 %. The resulting P-value is less than the level of significance $\alpha = 0.01$ (Table 48) and therefore, the corresponding null hypothesis $p_{as\ usual} \leq 0.9$ could be rejected with a power of 100 %.

No effect on the harvest time is indicated.

Table 48: Test results as well as 99% confidence intervals for $p_{As\ usual}$, p_{Minus} and p_{Plus} probabilities of harvesting time in MON 810 compared to conventional maize in 2017

N valid	*As usual*	*P* for $p_0 = 0.9$	*Minus*	*P* for $p_0 = 0.1$	*Plus*	*P* for $p_0 = 0.1$
250	248 (99.2 %)	< 0.01				

$p_{As\ usual}$	lower 99 % confidence limit	upper 99 % confidence limit	p_{Minus}	lower 99 % confidence limit	upper 99 % confidence limit	p_{Plus}	lower 99 % confidence limit	upper 99 % confidence limit
99.2%	97.7%	100.7%	0.0%	0.0%	0.0%	0.8%	0.0%	2.3%

<u>Assessment of differences in agricultural practice in MON 810 (compared to conventional maize)</u>

Agricultural practices in MON 810 (compared to conventional maize) were not changed in terms of time of crop rotation, time of planting or harvest, tillage and planting techniques, weed control practice, fungal control practice, fertilizer application practice and irrigation practice. The one difference found refers to the insect and corn borer control practice of MON 810.

This difference in insect and corn borer control practice arises from farmers not controlling corn borers with conventional insecticide applications, because MON 810 is specifically designed to control corn borers as *Ostrinia nubilalis* and *Sesamia* spp. Furthermore, fewer insecticides were used in general since MON 810 is also less susceptible to several Lepidopteran pests other than *Ostrinia nubilalis* and *Sesamia* spp.

3.4.2 Characteristics of MON 810 in the field (compared to conventional maize)

3.4.2.1 Germination vigour

While 6.8 % (17/250) of all farmers assessed the germination of MON 810 to be $more\ vigorous$, 92.4 % (231/250) found it to be $as\ usual$ and 2 farmers (0.8 %) found MON 810 to be $less\ vigorous$ (Table 49, Figure 23). Most of these farmers made high field sanitation of Yieldgard maize accountable for the increased vigour. Individual explanations for the observations of the farmers are given in Appendix A, Table A 8.

Table 49: Germination of MON 810 compared to conventional maize in 2017

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	less vigorous	2	0.8	0.8	0.8
	as usual	231	92.4	92.4	93.2
	more vigorous	17	6.8	6.8	100.0
Total		250	100.0	100.0	

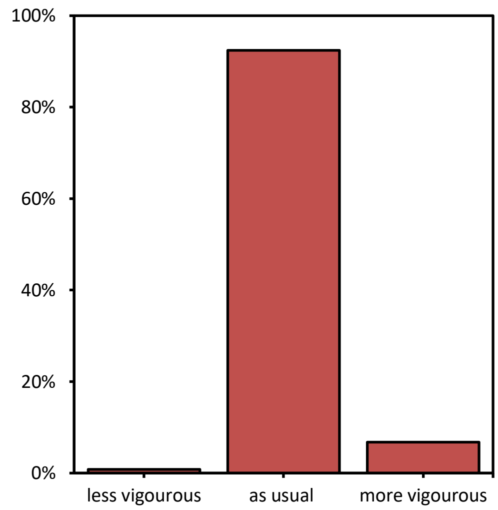

Figure 23: Harvest of MON 810 compared to conventional maize in 2017

(1) The valid percentage for $as\ usual$ germination (92.4 %) is not significantly greater than 90 % at the level of significance $\alpha = 0.01$ (Table 50), *i.e.* the null hypothesis $p_{as\ usual} \leq 0.9$ could not be rejected. The lower 99 % confidence interval limit is 88.1 %, the upper limit is 96.7 %.

(2) The valid percentage of $less\ vigorous$ germination (0.8 %) does not exceed the 10 % threshold. The P-value does not exceed the level of significance $\alpha = 0.01$ (Table 50), *i.e.* the null hypothesis for $p_{less\ vigorous} \geq 0.1$ could be rejected with a power of 100 %.

The valid percentage for $more\ vigorous$ germination (6.8 %) does not exceed the 10 % threshold, but the P-value exceeds the level of significance $\alpha = 0.01$ (Table 50), *i.e.* the null hypothesis for $p_{more\ vigorous} \geq 0.1$ is not rejected. The lower 99 % confidence interval limit is 2.7 %, the upper limit is 10.9 %.

An effect on the germination vigor is indicated.

Table 50: Test results as well as 99% confidence intervals for $p_{As\ usual}$, p_{Minus} and p_{Plus} probabilities of germination vigour in MON 810 compared to conventional maize in 2017

N valid	*As usual*	*P* for $p_0 = 0.9$	*Minus*	*P* for $p_0 = 0.1$	*Plus*	*P* for $p_0 = 0.1$
250	231 (92.4 %)	0.081	2 (0.8 %)	< 0.01	17 (6.8 %)	0.051

$p_{As\ usual}$	lower 99 % confidence limit	upper 99 % confidence limit	p_{Minus}	lower 99 % confidence limit	upper 99 % confidence limit	p_{Plus}	lower 99 % confidence limit	upper 99 % confidence limit
92.4%	88.1%	96.7%	0.8%	0.0%	2.3%	6.8%	2.7%	10.9%

3.4.2.2 Time to emergence

99.6 % (249/250) of the farmers found the time to emergence to be $as\ usual$, 0.4 % (1/250) assessed the time to emergence to be $delayed$ (Table 51, Figure 24). The individual explanation for this observation is given in Appendix A, Table A 8.

Table 51: Time to emergence of MON 810 compared to conventional maize in 2017

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	accelerated	0	0.0	0.0	0.0
	as usual	249	99.6	99.6	99.6
	delayed	1	0.4	0.4	100.0
Total		250	100.0	100.0	

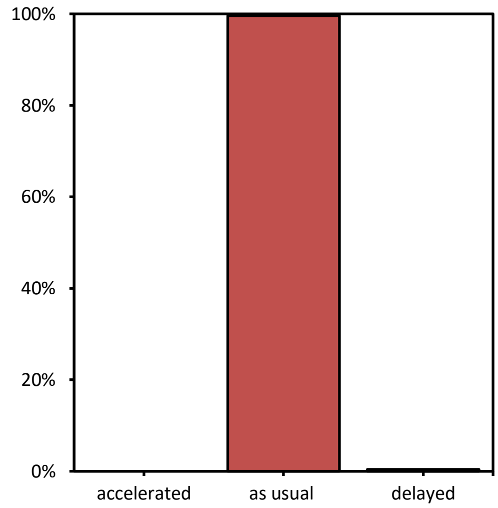

Figure 24: Time to emergence of MON 810 compared to conventional maize in 2017

(1) The valid percentage of $as\ usual$ time to emergence (99.6 %) is significantly greater than 90 %. The resulting P-value is less than the level of significance $\alpha = 0.01$ (Table 52) and therefore, the corresponding null hypothesis $p_{as\ usual} \leq 0.9$ could be rejected with a power of 100 %.

No effect on the time to emergence is indicated.

Table 52: Test results as well as 99% confidence intervals for $p_{As\ usual}$, p_{Minus} and p_{Plus} probabilities of time to emergence in MON 810 compared to conventional maize in 2017

N valid	*As usual*	*P* for $p_0 = 0.9$	*Minus*	*P* for $p_0 = 0.1$	*Plus*	*P* for $p_0 = 0.1$
250	249 (99.6 %)	< 0.01				

$p_{As\ usual}$	lower 99 % confidence limit	upper 99 % confidence limit	p_{Minus}	lower 99 % confidence limit	upper 99 % confidence limit	p_{Plus}	lower 99 % confidence limit	upper 99 % confidence limit
99.6%	98.6%	100.6%	0.0%	0.0%	0.0%	0.4%	0.0%	1.4%

3.4.2.3 Time to male flowering

99.6% (249/250) of the farmers assessed the time to male flowering to be *as usual*, only 1 farmer (0.4 %) assessed the time to male flowering to be *delayed* (Table 53, Figure 25). Individual explanations for these observations are given in Appendix A, Table A 8.

Table 53: Time to male flowering of MON 810 compared to conventional maize in 2017

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	accelerated	0	0.0	0.0	0.0
	as usual	249	99.6	99.6	99.6
	delayed	1	0.4	0.4	100.0
Total		250	100.0	100.0	

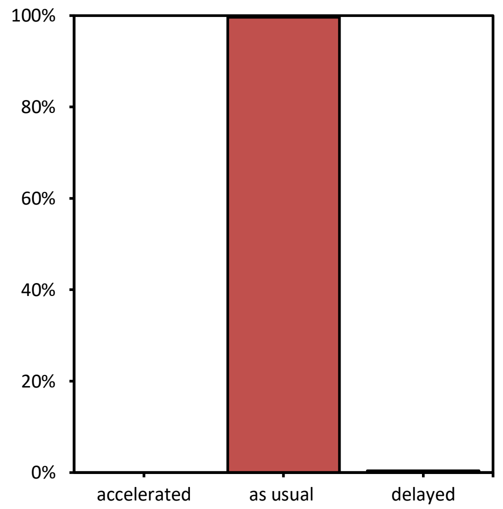

Figure 25: Time to male flowering of MON 810 compared to conventional maize in 2017

(1) The valid percentage of *as usual* time to male flowering (99.6 %) is significantly greater than 90 %. The resulting P-value is less than the level of significance $\alpha = 0.01$ (Table 54) and therefore, the null hypothesis $p_{as\ usual} \leq 0.9$ is rejected with a power of 100 %.

No effect on time to male flowering is indicated.

Table 54: Test results as well as 99% confidence intervals for $p_{As\ usual}$, p_{Minus} and p_{Plus} probabilities of time of male flowering in MON 810 compared to conventional maize in 2017

N valid	*As usual*	*P* for $p_0 = 0.9$	*Minus*	*P* for $p_0 = 0.1$	*Plus*	*P* for $p_0 = 0.1$
250	249 (99.6 %)	< 0.01				

$p_{As\ usual}$	lower 99 % confidence limit	upper 99 % confidence limit	p_{Minus}	lower 99 % confidence limit	upper 99 % confidence limit	p_{Plus}	lower 99 % confidence limit	upper 99 % confidence limit
99.6%	98.6%	100.6%	0.0%	0.0%	0.0%	0.4%	0.0%	1.4%

3.4.2.4 Plant growth and development

Plant growth and development was assessed to be *delayed* in 1.6 % (4/250), *accelerated* in 0.4 % (1/250), and to be *as usual* in 98.0 % (245/250) of all cases (Table 55, Figure 26). Individual explanations for these observations are given in Appendix A, Table A 8.

Table 55: Plant growth and development of MON 810 compared to conventional maize in 2017

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	accelerated	1	0.4	0.4	0.4
	as usual	245	98.0	98.0	98.4
	delayed	4	1.6	1.6	100.0
Total		250	100.0	100.0	

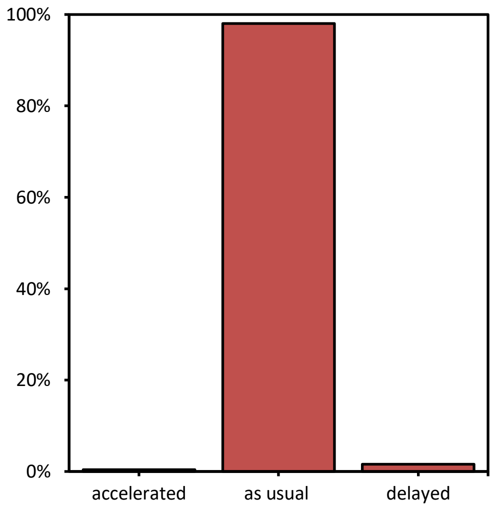

Figure 26: Plant growth and development of MON 810 compared to conventional maize in 2017

(1) The valid percentage of *as usual* plant growth and development (98.0 %) is significantly greater than 90 %. The resulting P-value is less than the level of significance $\alpha = 0.01$ (Table 56) and therefore, the corresponding null hypothesis $p_{as\ usual} \leq 0.9$ could be rejected with a power of 100 %.

No effect on plant growth and development is indicated.

Table 56: Test results as well as 99% confidence intervals for $p_{As\ usual}$, p_{Minus} and p_{Plus} probabilities of plant growth and development in MON 810 compared to conventional maize in 2017

N valid	*As usual*	*P* for $p_0 = 0.9$	*Minus*	*P* for $p_0 = 0.1$	*Plus*	*P* for $p_0 = 0.1$
250	245 (98.0 %)	< 0.01				

$p_{As\ usual}$	lower 99 % confidence limit	upper 99 % confidence limit	p_{Minus}	lower 99 % confidence limit	upper 99 % confidence limit	p_{Plus}	lower 99 % confidence limit	upper 99 % confidence limit
98.0%	95.7%	100.3%	0.4%	0.0%	1.4%	1.6%	0.0%	3.6%

3.4.2.5 Incidence of stalk/root lodging

Incidence of stalk/root lodging was assessed to be $less$ in MON 810 compared to conventional maize in 20.8 % (52/250) of all cases and $as\ usual$ in 79.2 % (198/25) (Table 57, Figure 27). Individual explanations for these observations are given in Appendix A, Table A 8.

Table 57: Incidence of stalk/root lodging of MON 810 compared to conventional maize in 2017

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	less often	52	20.8	20.8	20.8
	as usual	198	79.2	79.2	100.0
	more often	0	0.0	0.0	100.0
Total		250	100.0	100.0	

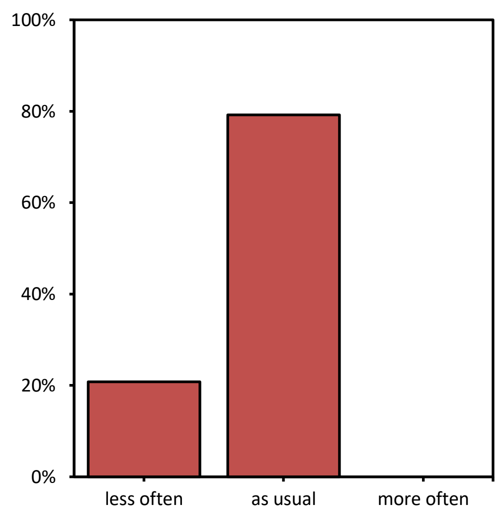

Figure 27: Incidence of stalk/root lodging of MON 810 compared to conventional maize in 2017

(1) The valid percentage of $as\ usual$ incidence of stalk/root lodging (79.2 %) is less than 90 %. The resulting P-value is larger than the level of significance $\alpha = 0.01$ (Table 58) and therefore, the corresponding null hypothesis $p_{as\ usual} \leq 0.9$ could not be rejected. The lower 99 % confidence interval limit is 72.6 %, the upper limit is 85.8 %.

(2) The valid percentage of $less$ incidence of stalk/root lodging (20.8 %) does exceed the 10 % threshold. The resulting P-value is greater than the level of significance $\alpha = 0.01$ (Table 58) and therefore, the corresponding null hypothesis $p_{less\ often} \geq 0.1$ could not be rejected. The lower 99 % confidence interval limit is 14.2 %, the upper limit is 27.4 %.

The valid percentage of $more$ incidence of stalk/ root lodging (0.0 %) is significantly smaller than 10 % (Table 58) *i.e.* the null hypothesis for $p_{more\ often} \geq 0.1$ could be rejected with a power of 100 %.

An effect on the incidence of stalk/root lodging of MON 810 is indicated.

Table 58: Test results as well as 99% confidence intervals for $p_{As\ usual}$, p_{Minus} and p_{Plus} probabilities of incidence of stalk/root lodging in MON 810 compared to conventional maize in 2017

N valid	*As usual*	P for $p_0 = 0.9$	*Minus*	P for $p_0 = 0.1$	*Plus*	P for $p_0 = 0.1$
250	198 (79.2 %)	1.0	52 (20.8 %)	1.0	0 (0.0 %)	< 0.01

$p_{As\ usual}$	lower 99 % confidence limit	upper 99 % confidence limit	p_{Minus}	lower 99 % confidence limit	upper 99 % confidence limit	p_{Plus}	lower 99 % confidence limit	upper 99 % confidence limit
79.2%	72.6%	85.8%	20.8%	14.2%	27.4%	0.0%	0.0%	0.0%

3.4.2.6 Time to maturity

10.8 % (27/259) of the farmers assessed the time to maturity to be $delayed$ for MON 810 (Table 59, Figure 28). Individual explanations for these observations are given in Appendix A, Table A 8.

Table 59: Time to maturity of MON 810 compared to conventional maize in 2017

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	accelerated	0	0.0	0.0	0.0
	as usual	223	89.2	89.2	89.2
	delayed	27	10.8	10.8	100.0
Total		250	100.0	100.0	

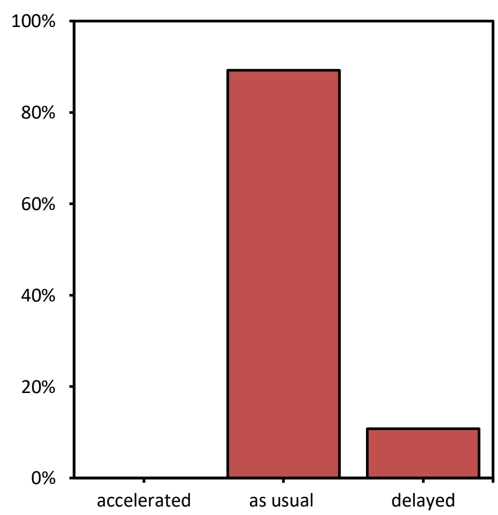

Figure 28: Time to maturity of MON 810 compared to conventional maize in 2017

(1) The valid percentage of $as\ usual$ time to maturity (89.2 %) is not significantly greater than 90 % at the level of significance $\alpha = 0.01$ (Table 60) and the null hypothesis $p_{as\ usual} \leq 0.9$ could not be rejected. The lower 99 % confidence interval limit is 84.2 %, the upper limit is 94.3 %.

(2) The valid percentage of $accelerated$ time to maturity (0.0 %) is significantly smaller than 10 % (Table 60) *i.e.* the null hypothesis for $p_{accelerated} \geq 0.1$ could be rejected with a power of 100 %.

The valid percentage of $delayed$ time to maturity (10.8 %) is greater than the 10 % threshold. The resulting P-value is greater than level of significance $\alpha = 0.01$ (Table 60) and therefore, the corresponding null hypothesis $p_{delayed} \geq 0.1$ could not be rejected. The lower 99 % confidence interval limit is 5.7 %, the upper limit is 15.9 %.

An effect on the time to maturity of MON 810 is indicated.

Table 60: Test results as well as 99% confidence intervals for $p_{As\ usual}$, p_{Minus} and p_{Plus} probabilities of time to maturity in MON 810 compared to conventional maize in 2017

N valid	*As usual*	P for $p_0 = 0.9$	*Minus*	P for $p_0 = 0.1$	*Plus*	P for $p_0 = 0.1$
250	223 (89.2 %)	0.634	0 (0.0 %)	< 0.01	27 (10.8 %)	0.708

$p_{As\ usual}$	lower 99 % confidence limit	upper 99 % confidence limit	p_{Minus}	lower 99 % confidence limit	upper 99 % confidence limit	p_{Plus}	lower 99 % confidence limit	upper 99 % confidence limit
89.2%	84.1%	94.3%	0.0%	0.0%	0.0%	10.8%	5.7%	15.9%

3.4.2.7 Yield

Yield was $higher$ in 38.4 % (96/250) of all cases (Table 61, Figure 29). Individual explanations for these observations are given in Appendix A, Table A 8.

Table 61: Yield of MON 810 compared to conventional maize in 2017

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	lower yield	1	0.4	0.4	0.4
	as usual	153	61.2	61.2	61.6
	higher yield	96	38.4	38.4	100.0
Total		250	100.0	100.0	

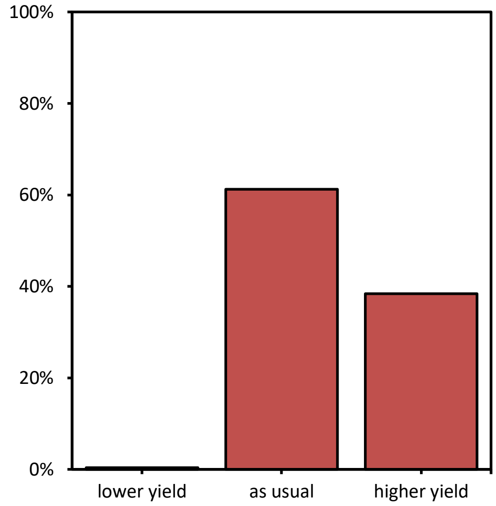

Figure 29: Yield of MON 810 compared to conventional maize in 2017

(1) The valid percentage of $as\ usual$ yield (61.2 %) is smaller than 90 %. The resulting P-value is greater than the level of significance $\alpha = 0.01$ (Table 62) and therefore, the corresponding null hypothesis $p_{as\ usual} \leq 0.9$ could not be rejected. The lower confidence interval limit is 53.3 %, the upper limit is 69.1 %.

(2) The valid percentage of $lower$ yield (0.4 %) is significantly smaller than the 10 % threshold. The resulting P-value is smaller than the level of significance $\alpha = 0.01$ (Table 62) and therefore, the corresponding null hypothesis $p_{lower\ yield} \geq 0.1$ could be rejected with a power of 100 %.

The valid percentage of $higher$ yield (38.4 %) exceeds the 10 % threshold. The resulting P-value is greater than the level of significance $\alpha = 0.01$ (Table 62) and therefore, the corresponding null hypothesis $p_{higher\ yield} \geq 0.1$ could not be rejected. The lower confidence interval limit is 30.5 %, the upper limit is 46.3 %.

An effect on yield of MON 810 is indicated.

Table 62: Test results as well as 99% confidence intervals for $p_{As\ usual}$, p_{Minus} and p_{Plus} probabilities of yield in MON 810 compared to conventional maize in 2017

N valid	*As usual*	*P* for $p_0 = 0.9$	*Minus*	*P* for $p_0 = 0.1$	*Plus*	*P* for $p_0 = 0.1$
250	153 (61.2 %)	1.0	1 (0.4 %)	< 0.01	96 (38.4 %)	1.0

$p_{As\ usual}$	lower 99 % confidence limit	upper 99 % confidence limit	p_{Minus}	lower 99 % confidence limit	upper 99 % confidence limit	p_{Plus}	lower 99 % confidence limit	upper 99 % confidence limit
61.2%	53.3%	69.1%	0.4%	0.0%	1.4%	38.4%	30.5%	46.3%

3.4.2.8 Occurrence of volunteers

The occurrence of volunteers was assessed to be *less* frequent for MON 810 than for conventional maize in 5.2 % (13/250) and *as usual* in 94.8 % (237/250) of all cases (Table 63, Figure 30). Individual explanations for these observations are given in Appendix A, Table A 8.

Table 63: Occurrence of MON 810 volunteers compared to conventional maize in 2017

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	less often	13	5.2	5.2	5.2
	as usual	237	94.8	94.8	100.0
	more often	0	0.0	0.0	100.0
Total		250	100.0	100.0	

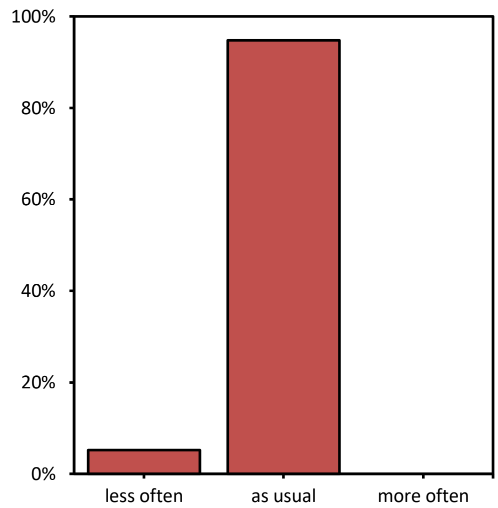

Figure 30: Occurrence of MON 810 volunteers compared to conventional maize in 2017

(1) The valid percentage of *as usual* occurrence of volunteers (94.8 %) is significantly greater than 90 %. The resulting P-value is smaller than the level of significance $\alpha = 0.01$ (Table 64) and therefore, the corresponding null hypothesis $p_{as\ usual} \leq 0.9$ is rejected.

No effect on occurrence of MON 810 volunteers is indicated.

Table 64: Test results as well as 99% confidence intervals for $p_{As\ usual}$, p_{Minus} and p_{Plus} probabilities of occurrence of volunteers in MON 810 compared to conventional maize in 2017

N valid	*As usual*	*P* for $p_0 = 0.9$	*Minus*	*P* for $p_0 = 0.1$	*Plus*	*P* for $p_0 = 0.1$
250	237 (94.8 %)	<0.01				

$p_{As\ usual}$	lower 99 % confidence limit	upper 99 % confidence limit	p_{Minus}	lower 99 % confidence limit	upper 99 % confidence limit	p_{Plus}	lower 99 % confidence limit	upper 99 % confidence limit
94.8%	91.2%	98.4%	5.2%	1.6%	8.8%	0.0%	0.0%	0.0%

<u>Assessment of differences in the characteristics of MON 810 in the field (compared to conventional maize)</u>

The results for the characteristics of MON 810 in the field compared to conventional maize can be summarized as follows

- more vigourous germination,
- an unchanged time to emergence,
- an unchanged time to male flowering,
- an unchanged plant growth and development,
- a less frequent incidence of stalk/root lodging,
- a delayed time to maturity,
- a higher yield and
- an unchanged occurrence rate of volunteers.

These results underline the substantial equivalence of MON 810 to comparable conventional lines, as evidenced by genomic and proteomic analyses [Coll, 2008]; [Coll, 2009]; [Coll, 2010]; [Coll, 2011].

The more vigourous germination is likely associated with the quality of the germplasm.

Corn borer damage affects maturation and especially yield negatively, therefore the differences in these monitoring characters can be explained by the absence of corn borer damage. The difference in the incidence of stalk/root lodging can be explained similarly. Therefore, differences in these parameters are anticipated and only underline the effectiveness of corn borer control.

The longer time to maturity can also be assigned as an effect of corn borer control: in the presence of pests, plants need to reach maturity faster. In the absence of pest pressure, plants can maximize the output of biomass and have a longer period of seed set and ripening. This could explain the longer time to maturity reported for MON 810 by 10.8 % of farmers. The low percentage indicates that this phenomenon is restricted to areas of pest pressure.

All additional observations during plant growth are listed in Appendix A, Table A 9.

3.4.3 Disease susceptibility in MON 810 fields (compared to conventional maize)

Farmers assessed MON 810 to be $less\ susceptible$ to diseases in 2.4 % (6/250) of the time (Table 65, Figure 31).

Table 65: Disease susceptibility in MON 810 compared to conventional maize in 2017

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	less susceptible	6	2.4	2.4	2.4
	as usual	244	97.6	97.6	100.0
	more susceptible	0	0.0	0.0	100.0
Total		250	100.0	100.0	

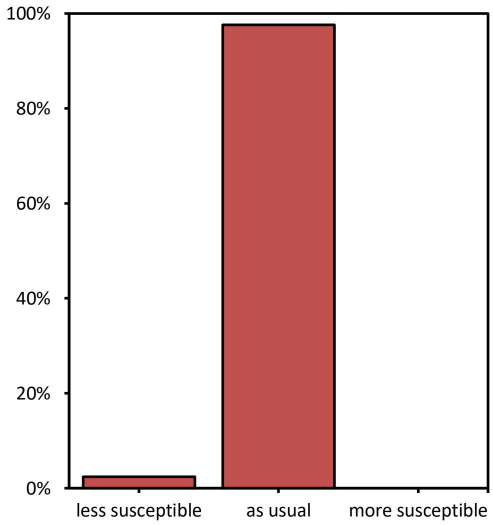

Figure 31: Disease susceptibility of MON 810 compared to conventional maize in 2017

(1) The valid percentage of $as\ usual$ disease susceptibility (97.6 %) is greater than 90 %. and the resulting P-value is greater than the level of significance $\alpha = 0.01$ (Table 66) and therefore, the corresponding null hypothesis $p_{as\ usual} \leq 0.9$ is rejected.

No effect on disease susceptibility is indicated.

Table 66: Test results as well as 99% confidence intervals for $p_{As\ usual}$, p_{Minus} and p_{Plus} probabilities of disease susceptibility in MON 810 compared to conventional maize in 2017

N valid	*As usual*	*P* for $p_0 = 0.9$	*Minus*	*P* for $p_0 = 0.1$	*Plus*	*P* for $p_0 = 0.1$
250	244 (97.6 %)	<0.01				

$p_{As\ usual}$	lower 99 % confidence limit	upper 99 % confidence limit	p_{Minus}	lower 99 % confidence limit	upper 99 % confidence limit	p_{Plus}	lower 99 % confidence limit	upper 99 % confidence limit
97.6%	95.1%	100.1%	2.4%	0.0%	4.9%	0.0%	0.0%	0.0%

The 6 farmers that answered different from *as usual* were asked to specify the difference in disease susceptibility by listing the diseases with an explanation. Table 67 lists the reported diseases with an assessment of the disease susceptibility of MON 810 compared to conventional maize. This list shows that the lower disease susceptibility was attributed to a lower susceptibility to *Fusariosis* (1.6 %, 4/250), *Hongos generos fusarium (1.2 %, 3/250), Ustilago maydis* (0.8 %, 2/250), *Sphacelotheca reiliana (0.8 %, 2/250),* and *Helmithosporium spp* (0.8 %, 2/250).

Table 67: Specification of differences in disease susceptibility in MON 810 compared to conventional maize in 2017

Group	Species	More	Less
Fungus	*Fusariosis*	0	4
	Hongos generos fusarium	0	3
	Ustilago maydis	0	2
	Sphacelotheca reiliana	0	2
	Helmithosporium spp.	0	2

Additional comments on disease susceptibility are given in (Appendix A, Table A 10).

<u>Assessment of differences in disease susceptibility in MON 810 fields (compared to conventional maize)</u>

The farmers reported less disease susceptibility to some fungal species, specified as *Fusariosis*, *Hongos generos fusarium, Ustilago maydis, Sphacelotheca reiliana,* and *Helmithosporium spp.*

The finding of supposedly less disease susceptible MON 810 varieties is not surprising, as it has been well established that feeding holes and tunnels of the corn borer serve as entry points for secondary fungal infections, especially for *Fusarium* spp. *Ustilago maydis* also has a high incidence especially with stressed plants (water stress, mechanical wounding, insect feeding damage), so that any reduction of a stress factor would immediately result in a lower incidence of disease. Therefore, the observed differences can be explained by corn borer control and confirm previous observations of lower fungal infections in MON 810 reported in the scientific literature [Munkvold, 1999]; [Dowd, 2000]; [Bakan, 2002]; [Hammond, 2003]; [Wu, 2006]. The farmers' testimonies (Appendix A, Table A 10) corroborate the findings from above.

3.4.4 Insect pest control in MON 810 fields (compared to conventional maize)

The insect pest control of *O. nubilalis* (European corn borer) was assessed to be *very good* or *good* in 100.0 % (250/250) of the cases (Table 68, Figure 32).

Table 68: Insect pest control of *O. nubilalis* in MON 810 in 2017

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	weak	0	0.0	0.0	0.0
	good	11	4.4	4.4	4.4
	very good	239	95.6	95.6	100.0
Total		250	100.0	100.0	

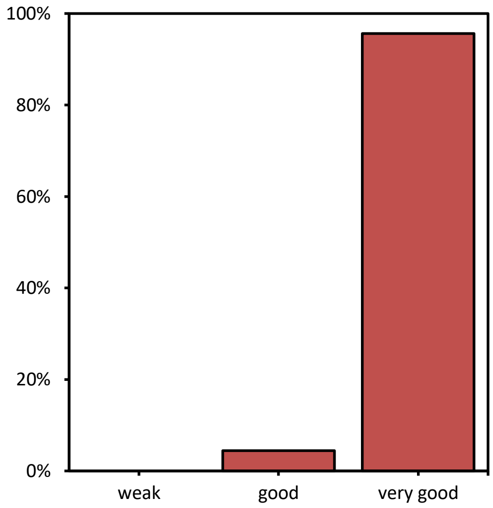

Figure 32: Insect pest control of *Ostrinia nubilalis* in MON 810 in 2017

100.0 % (250/250) of the farmers who gave a valid answer attested a *good* or *very good* control of *Sesamia* spp. (Pink Borer) (Table 69, Figure 33).

Table 69: Insect pest control of *Sesamia* spp. in MON 810 in 2017

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	weak	0	0.0	0.0	0.0
	good	11	4.4	4.4	4.4
	very good	239	95.6	95.6	100.0
Total		250	100.0	100.0	

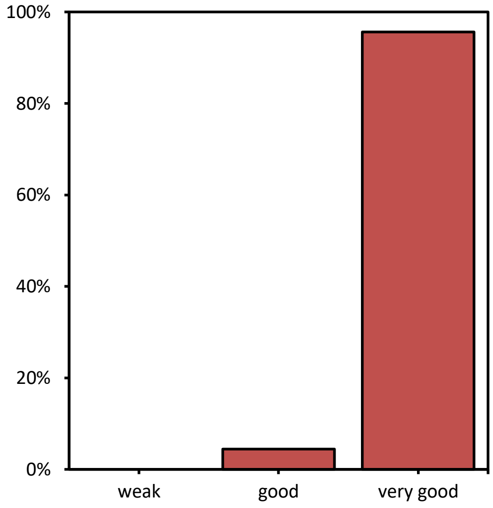

Figure 33: Insect pest control of *Sesa mia* spp. in MON 810 in 2017

Additional comments on insect pest control are listed in Appendix A, Table A 11.

Assessment of insect pest control in MON 810 fields (compared to conventional maize)

The results show that both pests (*Ostrinia nubilalis* and *Sesamia* spp.) are effectively controlled by MON 810.

3.4.5 Other pests (other than *Ostrinia nubilalis* and *Sesamia* spp.) in MON 810 fields (compared to conventional maize)

Farmers assessed MON 810 to be *less susceptible* to pests in 8.4 % (21/250) of all cases (Table 70, Figure 34).

Table 70: Pest susceptibility of MON 810 compared to conventional maize in 2017

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	less susceptible	21	8.4	8.4	8.4
	as usual	229	91.6	91.6	100.0
	more susceptible	0	0.0	0.0	100.0
Total		250	100.0	100.0	

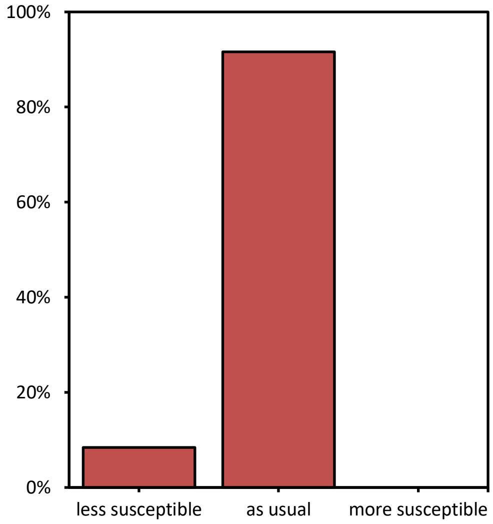

Figure 34: Pest susceptibility of MON 810 compared to conventional maize in 2017

(1) The valid percentage of $as\ usual$ pest susceptibility (91.6 %) is greater than 90 %.but the resulting P-value is greater than the level of significance $\alpha = 0.01$ (Table 71) and therefore, the corresponding null hypothesis $p_{as\ usual} \leq 0.9$ could not be rejected. The lower 99 % confidence interval limit is 87.1 %, the upper limit is 96.1 %.

(2) The valid percentage of lower pest susceptibility (8.4 %) does not exceed the 10 % threshold. The resulting P-value is greater than the level of significance $\alpha = 0.01$ (Table 71) and therefore, the corresponding null hypothesis $p_{less\ susceptible} \geq 0.1$ could not be rejected.

The valid percentage of higher pest susceptibility (0.0 %) does not exceed the 10 % threshold and the resulting P-value is smaller than the level of significance $\alpha = 0.01$ (Table 71), *i.e.* the null hypothesis $p_{more\ susceptible} \geq 0.1$ could be rejected with a power of 100 %.

An effect on pest susceptibility is indicated.

Table 71: Test results as well as 99% confidence intervals for $p_{As\ usual}$, p_{Minus} and p_{Plus} probabilities of pest susceptibility in MON 810 compared to conventional maize in 2017

N valid	*As usual*	*P* for $p_0 = 0.9$	*Minus*	*P* for $p_0 = 0.1$	*Plus*	*P* for $p_0 = 0.1$
250	229 (91.6 %)	0.172	21 (8.4 %)	0.234	0 (0.0 %)	< 0.01

$p_{As\ usual}$	lower 99 % confidence limit	upper 99 % confidence limit	p_{Minus}	lower 99 % confidence limit	upper 99 % confidence limit	p_{Plus}	lower 99 % confidence limit	upper 99 % confidence limit
91.6%	87.1%	96.1%	8.4%	3.9%	12.9%	0.0%	0.0%	0.0%

The 21 farmers that answered different from *as usual* were asked to specify the observed difference in pest susceptibility by listing respective pests with an explanation. Table 72 lists the reported pests with an assessment of the pest susceptibility of MON 810, compared to conventional maize. This list shows that the lower pest susceptibility was predominantly attributed to a lower susceptibility to pests of the order Lepidoptera.

Table 72: Specification of differences in pest susceptibility in MON 810 compared to conventional maize in 2017

Order	Name	N valid	*As usual*	*P* for $p_0 = 0.9$	*Minus*	*P* for $p_0 = 0.1$	*Plus*	*P* for $p_0 = 0.1$
Lepidoptera	Agrotis Ipsilon	250	238 (95.2 %)	< 0.01	12 (4.8 %)	< 0.01		
	Spodoptera Frugiperda	250	244 (97.6 %)	< 0.01	6 (2.4 %)	< 0.01		
	Heliothis	250	244 (97.6 %)	< 0.01	6 (2.4 %)	< 0.01		
	Mythimna spp. (Mitima)	250	247 (98.8 %)	< 0.01	3 (1.2 %)	< 0.01		
	Agrotis spp.	250	249 (99.6 %)	< 0.01	1 (0.4 %)	< 0.01		
	Helicoverpa spp.	250	249 (99.6 %)	< 0.01	1 (0.4 %)	< 0.01		
	Spodoptera spp.	250	249 (99.6 %)	< 0.01	1 (0.4 %)	< 0.01		
Arachnida	Red Spider	250	249 (99.6 %)	< 0.01	1 (0.4 %)	< 0.01		

What becomes clear in Table 72 is that for all listed pests

(1) the valid percentages of $as\ usual$ pest susceptibility in MON 810 compared to conventional maize in 2017 are greater than 90 % and the resulting P-value is smaller than the level of significance $\alpha = 0.01$.Therefore, the corresponding null hypotheses $p_{as\ usual} \leq 0.9$ could be rejected with a power of 77 %, 85 %, 99 %, 100 %, 100 %, 100 %, 100% and 100 % for *Agrotis ipsilon, Spodoptera frugiperda, Mythimna* spp.*, Spodoptera exigua*, *Heliothis,* Red Spider, *Agriotes* spp. and Aphids, respectively.

No effect of those pests is indicated.

Additional comments on other pest (other than *Ostrinia nubilalis* and *Sesamia* spp.) are given in Appendix A, Table A 12.

<u>Assessment of differences in susceptibility to other pests in MON 810 fields (compared to conventional maize)</u>

The data show that the susceptibility to other pests in MON 810 is slightly reduced.

The reduced susceptibility of MON 810 to Lepidoptera is not surprising, given the numerous scientific studies of laboratory and field experiments showing that the Cry protein expressed in MON 810 does not have a negative effect on any insects other than those belonging to the order for which it specifically has toxic properties [Marvier, 2007]; [Wolfenbarger, 2008]. The monitoring data thus corroborate the conclusions drawn during the environmental risk assessment and ongoing research.

3.4.6 Weed pressure in MON 810 fields (compared to conventional maize)

All except one farmer (249/250) found the weed pressure to be $as\ usual$ in MON 810 fields compared to conventional fields (Table 73, Figure 35). Explanation: " *In YieldGard there are less weeds because the maize is more vigorous, it gives more shade and weeds have less light* ".

Table 73: Weed pressure in MON 810 compared to conventional maize in 2017

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	less weeds	1	0.4	0.4	0.4
	as usual	249	99.6	99.6	100.0
	more weeds	0	0.0	0.0	100.0
Total		250	100.0	100.0	

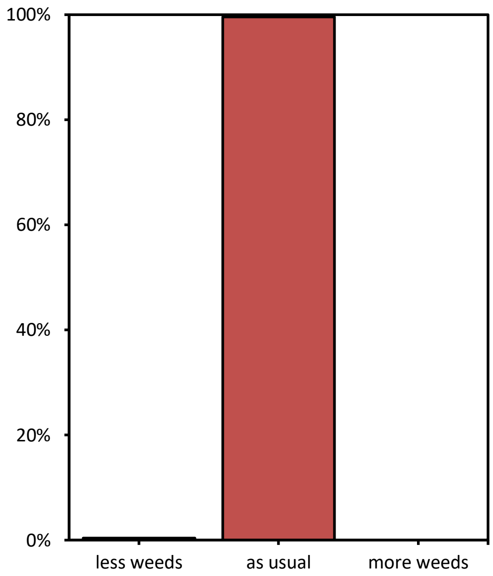

Figure 35: Weed pressure in MON 810 compared to conventional maize in 2017

(1) The valid percentage of $as\ usual$ weed pressure (99.6 %) is significantly greater than 90 %. The resulting P-value is less than the level of significance $\alpha = 0.01$ (Table 74) and therefore, the corresponding null hypothesis $p_{as\ usual} \leq 0.9$ could be rejected with a power of 100 %.

No effect on weed pressure is indicated.

Table 74: Test results as well as 99% confidence intervals for $p_{As\ usual}$, p_{Minus} and p_{Plus} probabilities of plant growth and development in MON 810 compared to conventional maize in 2017

N valid	*As usual*	*P* for $p_0 = 0.9$	*Minus*	*P* for $p_0 = 0.1$	*Plus*	*P* for $p_0 = 0.1$
250	249 (99.6 %)	< 0.01				

$p_{As\ usual}$	lower 99 % confidence limit	upper 99 % confidence limit	p_{Minus}	lower 99 % confidence limit	upper 99 % confidence limit	p_{Plus}	lower 99 % confidence limit	upper 99 % confidence limit
99.6%	98.6%	100.6%	0.4%	0.0%	1.4%	0.0%	0.0%	0.0%

The farmers were asked to name the three most abundant weeds in their MON 810 fields. Weeds that were listed more than 30 times are:

- *Sorghum halepense*
- *Abutilon theophrasti*
- *Chenopodium album*
- *Amaranthus retroflexus*
- *Datura stramonium*
- *Xanthium strumarium*

All named weeds and the corresponding frequencies of nomination are listed in Appendix A,Table A 13.

Assessment of differences in weed pressure in MON 810 fields (compared to conventional maize)

It is not surprising that the weed pressure in MON 810 fields has been described as similar to that in conventional maize. In accordance with the observations described in Section 3.4.1, no changes in weed control practices were reported in MON 810 fields compared to conventional maize fields.

3.4.7 Occurrence of wildlife in MON 810 fields (compared to conventional maize)

3.4.7.1 Occurrence of non target insects

Farmers assessed the occurrence of non target insects in MON 810 fields to be *as usual* in 99.6 % (249/250) of all cases (Table 75).

Table 75: Occurrence of non target insects in MON 810 compared to conventional maize in 2017

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	less	0	0.0	0.0	0.0
	as usual	249	99.6	100.0	100.0
	more	0	0.0	0.0	100.0
	Total	249	99.6	100.0	
Missing	no statement	1	0.4		
Total		250	100.0		

3.4.7.2 Occurrence of birds

99.6 % of the farmers (249/250) assessed the occurrence of birds in MON 810 fields to be *as usual* (Table 76).

Table 76: Occurrence of birds in MON 810 compared to conventional maize in 2017

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	less	0	0.0	0.0	0.0
	as usual	249	99.6	100.0	100.0
	more	0	0.0	0.0	100.0
	Total	249	99.6	100.0	
Missing	no statement	1	0.4		
Total		250	100.0		

3.4.7.3 Occurrence of mammals

99.6 % of the farmers (249/250) assessed the occurrence of mammals in MON 810 fields to be *as usual* (Table 77).

Table 77: Occurrence of mammals in MON 810 compared to conventional maize in 2017

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	less	0	0.0	0.0	0.0
	as usual	249	99.6	100.0	100.0
	more	0	0.0	0.0	100.0
	Total	249	99.6	100.0	
Missing	no statement	1	0.4		
Total		250	100.0		

Assessment of differences in occurrence of wildlife in MON 810 fields (compared to conventional maize)

The occurrence of wildlife in MON 810 is reported to be unchanged for non target insects, birds and mammals. No farmers stated that they found a changed number of wildlife animals.

These results again underline the specificity of the expressed Cry protein towards Lepidoptera, exhibiting no effect on other wildlife, especially non target insects. MON 810 thus is substantially equivalent to conventional maize and hosts the same wildlife. Birds are dependent on insects and wild plants in the agricultural landscape, and are a good indicator for larger scale level effects. The same holds true for mammals, although their occurrence in maize fields is limited. Studies have shown that no impact on mammals caused by the consumption of MON 810 is to be expected [Shimada, 2003]; [Shimada, 2006a]; [Shimada, 2006b]; [Stumpff, 2007]; [Bondzio, 2008].

3.4.8 Feed use of MON 810 (if previous year experience with MON 810)

3.2 % (8/250) of the farmers used the harvest of MON 810 to feed their animals (Table 78). These data reflect only the range of feeding; it is assumed that only farmers that cultivate silage maize feed them to their livestock. That could explain why only 3.2 % of the surveyed farmers fed MON 810, however, there are no strong data supporting this assumption.

Table 78: Use of MON 810 harvest for animal feed in 2017

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	yes	8	3.2	3.2	3.2
	no	242	96.8	96.8	100.0
Total		250	100.0	100.0	

Out of the 8 farmers who did feed the harvest of MON 810 to their animals, 87.5 % (7/8) found the performance of them to be *as usual* when compared to the animals fed with conventional maize (Table 79).

Table 79: Performance of the animals fed MON 810 compared to the animals fed conventional maize in 2017

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	as usual	7	87.5	87.5	87.5
	changed	1	12.5	12.5	100.0
Total		5	100.0	100.0	

No effect on the performance of animals fed with MON 810 is indicated.

Assessment of differences in feed use of MON 810 (if previous year experience with MON 810)

No farmer found a difference in performance of animals fed with MON 810.

3.4.9 Any additional remarks or observations

In the 2017 season no farmer made a comment on additional remarks or observations, *i.e.* no unexpected (adverse) effects are reported.

3.5 Part 4: Implementation of *Bt* maize specific measures

3.5.1 Information on good agricultural practices on MON 810

100 % (250/250) of the farmers reported to have been informed about the good agricultural practices applicable to MON 810 (Table 80).

98.0 % (245/250) of the farmers considered the training sessions to be either *useful* or *very useful* (Table 81). This information indicates that the great majority of the farmers had been exposed to a valuable training concerning MON 810.

Table 80: Information on good agricultural practices in 2017

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	yes	250	100.0	100.0	100.0
	no	0	0.0	0.0	100.0
Total		250	100.0	100.0	

Table 81: Evaluation of training sessions in 2017

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	very useful	84	33.6	33.6	33.6
	useful	161	64.4	64.4	98.0
	not useful	5	2.0	2.0	100.0
Total		250	100.0	100.0	

3.5.2 Seed

The question "was the bag labeled with accompanying documentation indicating that the product is genetically modified maize MON 810" was answered with *yes* in 100 % (250/250) of the cases. This indicated that the bags were labeled appropriately and that the label and the accompanying documentation were clear to the farmers.

The great majority of the farmers (91.6 %) reported that they are following the label recommendations on the seed bags (Table 82). 21 farmers (8.4 %) admitted that they did not follow the label recommendations. All of these farmers explained that they did not plant a refugee. Deviations from the label recommendations are listed in Appendix A, Table A 14.

Table 82: Compliance with label recommendations in 2017

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	yes	229	91.6	91.6	91.6
	no	21	8.4	8.4	100.0
Total		250	100.0	100.0	

3.5.3 Prevention of insect resistance

85.6 % (214/250) did plant a refuge within their farms or were part of "production areas" in Portugal and comply collectively with this requirement (Table 83, Table A 15). Additionally, 7.6 % (19/250) of the farmers did not plant a refuge because they had less than 5 ha of MON 810 maize planted on their farm (the Insect Resistance Management Plan states that no refuge is required if less than 5 hectares of *Bt* maize are planted). 6.8 % (17/250) of the farmers reported that they did not plant a refuge although having more than 5 ha of maize planted on their farm.

Table 83: Planting of a refuge in 2017

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	yes	214	85.6	85.6	85.6
	no, because the surface of *Bt* maize is < 5 ha	19	7.6	7.6	93.2
	no	17	6.8	6.8	100.0
Total		250	100.0	100.0	

Therefore, 93.2 % (233/250) of the farmers followed the label recommendations.

All cases of not planting a refuge because of a *Bt* maize planted area < 5 ha occurred in Spain (Table 84).

Table 84: Refuge implementation per country in 2017

		Refuge implementation			
	Country	Yes	No, because the area of *Bt* maize is < 5 ha	No	Total
Valid	Spain	200	19	17	236
	Portugal	14	0	0	14
Total		214	19	17	250

As a result of the continuous and intensive training of farmers with regards to implementing a refuge, the overall compliance is again high this year. In Spain 7.2% (17/236) of the farmers who were required to did not plant a refuge, for which three main reasons were given. The first reason was that the farmer had no or not enough information about the technical guidelines and feared the yield losses in conventional maize (8/17, 47.1 %), the second reason was that there were 2 or 3 plots smaller than 5 ha (5/17, 29.4 %), and the third reason was that the refuge was smaller than 20% of MON 810 area (4/17, 23.5). All individual reasons for not planting a refuge are listed in Appendix A, Table A 15.

4 Conclusions

The analysis of 250 questionnaires from a survey of farmers cultivating MON 810 in 2017 in the two MON 810 cultivating European countries, Spain and Portgal, did not reveal unexpected adverse effects that could be associated with maize hybrids containing the genetic modification in MON 810. The sample size was proven to be large enough to significantly reject the hypotheses on adverse effects under the specific 2017 conditions.

The statistically significant effects reported in Part 3 were neither unexpected nor adverse. The corresponding observations correlate to the intended insect protection trait present in MON 810.

This set of data is entered in a database, and complements data collected from the 2006 to 2017 growing seasons. Currently, the database contains data of 3 127 valid questionnaires. As shown in Table 85 and Table 86 the frequency patterns of farmers' answers in 2017 are very similar to those of the previous years. In general the same effects have been observed.

After eleven years of farmer questionnaires, no unexpected (adverse) effects have been indicated. Compared to the cultivation practices in conventional maize, farmers use nearly the same practices for cultivating MON 810. The abscence of damage caused by corn borers on the MON 810 plants renders the plants healthier and provides related benefits to the farmers.

In contrast to the data of the monitoring characters, the data of the influencing factors differ between the years.

Table 85: Overview on the frequency of $Minus^4$ answers of the monitoring characters in 2006 - 2017 in percent [%]. Grey-colored boxes mark cases where Hypothesis (2a) $H_0: p_{Minus} \geq 0.1$ could not be rejected.

Monitoring character[1]	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Time of planting	1.6	3.4	2.7	2.9	1.8	1.2	0.0	0.0	0.4	0.4	0.8	0.0
Time of harvest	2.4	3.8	3.4	2.1	2.2	0.4	0.0	0.0	0.4	0.0	0.0	0.0
Germination vigor	6.0	4.1	1.7	0.8	0.0	0.0	0.4	0.8	0.0	0.0	0.4	0.8
Time to emergence	6.9	3.1	6.4	5.4	4.1	0.8	0.8	0.0	0.0	0.4	4.0	0.0
Time to male flowering	0.4	1.7	4.7	2.1	3.7	0.0	0.8	0.8	0.0	0.0	0.8	0.0
Plant growth and development	6.5	6.9	9.8	5.9	7.0	0.8	1.6	1.2	0.0	1.1	2.0	0.4
Incidence of stalk / root lodging	58.9	36.2	38.6	31.9	35.1	24.5	28.1	17.2	26.8	27.2	33.2	20.8
Time to maturity	2.0	4.8	4.3	2.9	4.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Yield	2.4	3.9	4.4	1.7	1.8	0.0	2.4	2.0	1.5	0.0	0.4	0.4
Occurrence of volunteers	33.9	8.4	11.1	10.8	8.2	6.9	4.2	4.0	1.1	3.8	11.6	5.2
Disease susceptibility	36.1	21.7	34.7	29.3	25.6	19.7	17.3	12.5	5.4	4.2	6.8	2.4
Pest susceptibility	11.1	5.9	18.5	17.2	18.6	17.7	21.3	18.0	16.1	21.8	12.8	8.4
Weed pressure	0.4	2.1	1.7	2.1	4.8	0.0	0.0	0.0	0.0	0.0	0.4	0.4
Occurrence of wildlife[3]	2.9	6.1	7.7	-	-	-	-	-	-	-		-
Occurrence of insects[2]	-	-	-	0.9	0.8	0.9	0.0	0.0	0.0	0.0	0.0	0.0
Occurrence of birds[2]	-	-	-	0.4	1.2	0.4	0.0	0.0	0.4	0.0	0.4	0.0
Occurrence of mammals[2]	-	-	-	0.9	1.1	0.4	0.4	0.4	0.4	0.0	0.4	0.0

[1] Monitoring characters and their categories are defined in section 2.2.
[2] These characters are surveyed since the 2009 season.
[3] This character is surveyed since the 2008 season.
[4] The question on wildlife was asked until 2008. In 2009 it was split into three questions (non target insects, birds, mammals).

Table 86: Overview on the frequency of $Plus$[5] answers of the monitoring characters in 2006 - 2017 in percent [%]. Grey-colored boxes mark cases where Hypothesis (2b) $H_0: p_{Plus} \geq 0.1$ could not be rejected.

Monitoring Character[1]	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Crop rotation[2]	-	-	-	0.8	1.8	0.8	4.4	5.9	3.8	6.5	1.6	1.6
Time of planting	6.0	3.8	2.7	1.3	4.1	1.6	3.6	5.1	4.2	6.5	1.6	1.6
Tillage and planting technique	0.0	0.7	0.0	0.4	0.4	0.0	2.0	2.0	3.1	3.5	1.2	0.4
Insect control practices	48.0	11.9	22.2	18.3	16.2	24.9	17.3	16.4	16.5	14.6	7.6	6.0
Corn borer control practice[3]	-	-	9.8	22.9	15.5	22.9	18.1	16.0	16.1	14.2	7.2	6.0
Weed control practices	0.4	0.3	0.3	0.0	0.4	0.0	0.0	0.0	1.9	0.0	0.0	0.0
Fungal control practices	0.0	1.1	0.3	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fertilizer Application	0.8	0.3	0.0	0.4	0.4	0.0	0.0	2.3	0.4	0.0	0.0	0.0
Irrigation Practices	1.6	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.4	0.0
Time of harvest	24.1	18.6	13.8	7.9	6.6	4.4	4.0	5.1	4.6	4.2	2.0	0.8
Germination vigor	8.0	6.9	11.4	14.6	16.2	5.6	5.6	7.4	11.9	13.0	8.4	6.8
Time to emergence	5.6	3.8	2.0	0.8	0.4	0.0	0.4	0.4	0.0	0.0	0.8	0.4
Time to male flowering	1.6	7.7	3.7	1.7	2.6	2.0	1.2	0.4	0.4	0.0	0.0	0.4
Plant growth and development	1.6	4.8	2.7	2.1	3.7	0.8	2.0	0.8	0.0	0.4	0.4	1.6
Incidence of stalk / root lodging	1.6	0.3	0.3	0.0	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Time to maturity	30.9	25.9	24.0	14.6	16.2	12.9	16.1	12.5	11.5	6.1	14.8	10.8
Yield	68.7	44.8	52.7	56.9	49.8	43.4	43.0	34.8	36.0	50.6	46.8	38.4
Occurrence of volunteers	0.0	1.7	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.4	0.0	0.0
Disease susceptibility	2.0	1.0	0.7	0.4	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pest susceptibility	1.2	1.4	0.7	1.3	0.0	0.0	0.4	0.4	0.4	0.0	0.0	0.0
Weed pressure	0.0	0.3	0.3	0.0	0.4	0.0	0.0	0.4	0.0	0.0	0.0	0.0
Occurrence of wildlife[4]	2.1	2.9	2.4	-	-	-	-	-	-	-		-
Occurrence of insects[2]	-	-	-	0.9	0.4	0.4	0.0	0.0	0.0	0.0	0.0	0.0
Occurrence of birds[2]	-	-	-	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Occurrence of mammals[2]	-	-	-	1.3	1.1	0.4	0.0	0.0	0.0	0.0	0.0	0.0
Performance of animals	0.0	6.7	4.9	8.9	12.3	10.5	10.3	7.7	0.0	0.0	0.0	12.5

[1] Monitoring characters and their categories are defined in section 2.2.[2] These characters are surveyed since the 2009 season.
[3] This character is surveyed since the 2008 season.
[4] The question on wildlife was asked until 2008. In 2009 it was split into three questions (non target insects, birds, mammals).

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List of abbreviations

GM	genetically modified
GMO	genetically modified organism
GMP	genetically modified plant
PMEM	post-market environmental monitoring

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Table A 1: Specifications for $changed$ crop rotation before planting MON 810 (Section 3.4.1.1)

Country	Quest. Nr.	Crop rotation	Comments
Spain	4935	changed	I sow YieldGard after broad bean and Conventional after maize.
Spain	4941		I sow YieldGard after pea and Conventional after barley.
Spain	4989		I sow Conventional after maize and YieldGard, a part after barley and the rest after maize.
Spain	5020		Second harvest YieldGard after barley.

Table A 2: Specifications for different time of planting of MON 810 (Section 3.4.1.2)

Country	Quest. Nr.	Time of planting	Comments aggregate	Comments
Spain	4932	later	short cycle	YieldGard is shorter cycle and I plant it later than Conventional.
Spain	4941			ECB attacks with greater intensity to laters sowings. I plant YieldGard after Conventional.
Spain	4989			I sow a part of YieldGard after harvest barley.
Spain	5020			After Barley, I plant short cycle YieldGard.

Table A 3: Specifications for *changed* tillage and planting technique of MON 810 (Section 3.4.1.3)

Country	Quest. Nr.	Tillage and planting technique	Comments aggregate	Comments
Spain	5020	changed	-	I plant YieldGard in direct seeding because it´s faster.

Table A 4: Insecticides applied in MON 810 (Section 3.4.1.4) differentiated by their use

Active Ingredient	Insecticide as cited by the Farmer	Spain	Portugal	Total
Seed Treatment				
Thiacloprid	Sondio	194	14	208
Sprayed				
Abamectin	Apache, Bersite, Boreal	43	0	43
Alpha-Cypermethrin	Fastac, Permasect	1	1	2
Chlorpyrifos	Chlorpirifos, Pirifos 48, Piritec	39	0	39
Deltamethrin	Decis, Decis Expert	2	1	3
Lambda-cyhalothrin	Atrapa, Karate+, Karate Zeon, Karate King, Judo	7	14	21
Granulated				
Chlorpyrifos	Cloripirifos 5 GR, Pison, Closar 5 GR, Piritec 5 GR, Chas 5 G, Clorifos 5 G	32	0	32
Teflutrin	Force 1.5 G	1	0	1

Table A 5: Explanations for *changed* insect and corn borer control practice in MON 810 (Section 3.4.1.4)

Country	**Quest. Nr.**	**Insecticides in conv. maize**	**Insect control practice in MON 810**	**Explanation of differences in insect control practice**
Spain	4920	yes	changed	I treat Conventional against ECB and not YieldGard.
Spain	5043			I treat Conventional with Coragen 20SC against ECB, and not YieldGard.
Spain	5065			I treat Conventional against ECB and not YieldGard.
Spain	5073			I treat Conventional against ECB and not YieldGard.
Spain	5096			I do an insecticide treatment in Conventional against ECB and not in YieldGard.
Spain	5116			I treat Conventional against ECB and not YieldGard.
Portugal	4878			-1 less insecticide treatment in YG. Seed treatment (Sonido) was equal in YG and Conv.
Portugal	4879			Seed treatment was equal in the different types of maize (YG and Conv.). Farmer made 1 less insecticide treatment in YG.
Portugal	4880			1 less insecticide applicationin the YG. The seed treatment (Sonido) was equal in the in different types of maize.
Portugal	4881			The usual seed treatment application (Sonido) was similar in YG and Conv. Farmer made 1 less insecticide application in YG
Portugal	4883			The farmer applied 1 less insecticide treatments in the Yieldgard maize fields.
Portugal	4885			The farmer made 1 less application insecticide treatments in the Yieldgard maize fields.
Portugal	4886			1 less incecticide application in YG. The seed treatment was equal in the in different types of maize.
Portugal	4887			The seed application treatment was equal in the in different types of maize. 1 less insecticide application treatments in the YG
Portugal	4888			The farmer made 1 less application insecticide treatments in the Yieldgard maize.

Country	Quest. Nr.	Insecticides against corn borers in conv. maize	Corn borer control in MON 810	Explanation of differences in corn borer control practice
Spain	4920	Yes	changed	YieldGard resists ECB. Don´t need to do any treatment whereas I treat Conventional because ECB produces a lot of production loss
Spain	5043			I treat Conventional against ECB and not YieldGard because it is resistant.
Spain	5065			I treat Conventional against ECB and not YieldGard because it is resistant.
Spain	5073			I treat Conventional against ECB and not YieldGard because it is resistant.
Spain	5096			I treat Conventional against ECB and not YieldGard because it is resistant.
Spain	5116			I treated Conventional with Coragen 20 SC and not YieldGard, because resists ECB.
Portugal	4878			No treatment for maize borer in YG maize
Portugal	4879			Farmer made no treatment in the YG (for the control of maize borer). The YG plant is protected from the maize borer.
Portugal	4880			The farmer didn´t make any treatments applications for the control of maize borer in the Yieldgard maize.
Portugal	4881			The farmer didn´t make any treatments applications for the control of maize borer in the Yieldgard maize.
Portugal	4883			The farmer did not apply any treatments for the control of maize borer in the Yieldgard fields.
Portugal	4885			The farmer did not make any applications treatments in the Yieldgard maize.
Portugal	4886			Did not make any applications treatments for the control of maize borer in the Yieldgard maize.
Portugal	4887			no necessity for treatment of maize borer in the YG, great advantage
Portugal	4888			No treatments for control of maize borer in YG, it was not necessary.

Table A 6: Herbicides applied in MON 810 (Section 3.4.1.5)

Active Ingredient	Herbicides as stated by the farmers	Spain	Portugal	Total
(S)-Metolachlor, Terbuthylazine	Primextra Líquido Gold	131	0	131
Isoxaflutole	Spade Flexx/ Spade	85	0	85
Nicosulfuron	Elite Plus 6 OD	66	0	66
Mesotrione, (S)-Metolachlor	Camix	59	0	59
Foramsulfuron, Thiencarbazone-methyl, Cyprosulfamide	MONSOON ACTIVE	26	0	26
Dicamba 48%	Banvel D	24	0	24
Tembotriona 4,4%	Laudis OD	23	0	23
(S)-Metachlor, Mesotrione, Terbuthylazine	Lumax	3	12	15
Mesotriona 7,5%, Nicosulfuron 3%	Elumis 105 OD	12	0	12
Mesotrione	Callisto	8	63	11
Foramsulfuron, Isoxadifen-ethyl	Option	0	10	10
Nicosulfuron	Sajon	9	0	9
2,4-D, Florasulam	Mustang	6	1	7
Bromoxynil	Buctril	6	0	6
Nicosulfuron 4%	Nic-Sar	6	0	6
Nicosulfuron	Samson	1	5	6
Glyphosate	Glifosato 36%	5	0	5
Dimethenamid-P	Spectrum	5	0	5
(S)-Metolachlor, Terbuthylazine	Tyllanex Magnum	5	0	5
Nicosulfuron	Elite M	3	1	4
Aclonifen, Isoxaflutole	Memphis	4	0	4
Fluroxypyr	Starane 20	4	0	4
Nicosulfuron	Elite Plus 6 OD	0	3	3
	Herpan 50	3	0	3
	MCPA 40%	3	0	3
Pendimethalin	Stomp Aqua	3	0	3
Fluroxypyr	Tomahawk	3	0	3
Isoxaflutole	Adengo	0	2	2
Bromoxynil	Bromotril 24 EC	3	0	3
Nicosulfuron	Chaman	2	0	2
Fluroxypyr	Hurler	2	0	2
Aclonifen, Isoxaflutole	Lagon	2	0	2
	Linukey 45 Flow	2	0	2
Rimsulfuron	Principal	2	0	2
Dimetenamida-p 21,25%, Pendimetalina 25%	Wing P	2	0	2
Nicosulfuron	Bandera 4 SC	1	0	1
Dicamba 50%, Prosulfuron 5%	Casper	1	0	1
	Controler T	1	0	1
(S)-Metolachlor, Terbuthylazine	Cuña Plus	1	0	1
Sukotriona	Decano	1	0	1
Bromoxynil	Emblem	1	0	1
	Guardian Extra	1	0	1
	Herbidens	1	0	1
Pethoxamid	Koban 600	1	0	1
Bentazon, Dicamba	Laddok Plus	0	1	1
Bentazon	Laddok	0	1	1
Isoxadifen-ethyl, Tembotrione	Laudis	1	0	1
Nicosulfuron 4%	Nisshin	1	0	1
	Pendalin	1	0	1

Sulcotrione	Pentagon	1	0	1
Metolachlor, Atrwazine	Primextra	0	1	1
Glyphosate	Roundup	1	0	1
	U45 D Complet	1	0	1
Diamethenamid	Wing P	1	0	1

Table A 7: Explanations for different harvest time of MON 810 (Section 3.4.1.9)

Country	Quest. Nr.	Harvest	Comments aggregate	Comments
Spain	4941	later	-	I harvested YieldGard later because I planted it later than Conventional.
Spain	4989	later		I harvest YieldGard later because I plant it later than Conventional.

Table A 8: Explanations for characteristics of MON 810 different from $as\ usual$ (Section 3.4.2)
Grey-colored fields mark answers that are not "as usual".

Country	Quest . Nr.	Germi-nation	Emergence	Male flow-ering	Plant growth	Stalk/-root lodging	Maturity	Yield	Volun-teers	Comments
Spain	4892	less vigourous	delayed	as usual	as usual	as usual	less often	lower yield	as usual	YieldGard emerges later than Conventional, also matures later and this year was less productive.
Spain	4893	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard does not have damages produces by ECB, also plants and ears don´t fall and YieldGard gives more production.
Spain	4895	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard is resistant to ECB, is healthier and produces more than Conventional.
Spain	4897	as usual	as usual	as usual	as usual	less often	as usual	higher yield	less often	YieldGard is healthier and greener than Conventional, does not fall and less volunteers. Everything is harvested and more produc
Spain	4899	as usual	as usual	as usual	as usual	less often	less often	higher yield	less often	YieldGard is healthier, does not fall for its resistance to ECB damages. Also is greener and ripes later. Produces 200 kg/ha mor
Spain	4902	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard is healthier, no ECB damages and gives more "kilos" than Conventional.
Spain	4903	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YieldGard produces more than Conventional because is healthier and it has no ECB damages.
Spain	4904	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YieldGard always produces more than Conventional because it is resistant to ECB damages.
Spain	4908	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard resists ECB, it does not have damages, is healthier, plants and cobs do not fall and produce more than Conventional.
Spain	4911	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YieldGard is more productive than Conventional because it does not have ECB damages.
Spain	4912	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YieldGard is healthier, no ECB damages and gives more "kilos" than Conventional.
Spain	4917	as usual	as usual	as usual	as usual	less often	less often	higher yield	less often	YieldGard does not fall because it has no ECB damages. There less volunteers, it is greener and more productive than Convenitona
Spain	4918	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard is healthier, it has no ECB damages, does not fall and it is more productive than Conventional.
Spain	4919	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard does not fall and produces more than Conventional because it has no ECB damages.
Spain	4923	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard resists ECB, also plants and ears don´t fall and YieldGard gives more production.
Spain	4925	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard is healthier, does not have ECB damages, either plants and ears do not fall and YieldGard is more productive than Conv
Spain	4927	as usual	as usual	as usual	as usual	less often	less often	higher yield	less often	YieldGard does not fall because it has no ECB damages. There are less volunteers, it is greener and more productive than Conveni
Spain	4930	as usual	as usual	as usual	as usual	less often	as usual	higher yield	less often	YG is healthier, doesn't fall. Resists ECB damages. No volunteers, evertyhing is harvested and more productive than Conventional

Spain	4932	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YieldGard is healthier because is resistant to ECB and produces more than Conventional.
Spain	4934	as usual	as usual	as usual	as usual	less often	as usual	higher yield	less often	YG is more productive than Conventional because it doesn't have ECB damages, it does not fall and there are not volunteers.
Spain	4936	as usual	as usual	as usual	as usual	as usual	as usual	as usual	as usual	YieldGard has no ECB attack, it is helthier and more productive than Conventional.
Spain	4937	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YieldGard produces more than Conventional because it is healthier, without ECB damages.
Spain	4938	as usual	as usual	as usual	as usual	less often	less often	higher yield	less often	YieldGard is healthier and greener than Conventional. It has more humidity, ripes later and produces more than Conventional.
Spain	4941	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard does not fall because it has no ECB damages. There are less volunteers, it is greener and more productive than Conveni
Spain	4943	as usual	as usual	as usual	delayed	less often	less often	higher yield	as usual	YG grows slower, is greener, ripes later, doesn't fall, no ECB damages, can harvest everything + more productive than C.
Spain	4944	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YG does not fall because resists ECB, is healthier and produces more than C.
Spain	4945	more vigourous	as usual	as usual	as usual	less often	as usual	higher yield	less often	YG germinates with more vigour, emerges earlier, no ECB damage, doesn't fall, no volunteers and it is more productive than C.
Spain	4947	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YG is healthier, no ECB damages, ears do not fall, can harvest everything and YG produces more than C.
Spain	4948	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	Yieldgard is healthier because resists ECB, It doesn´t fall and produces more than Conventional.
Spain	4949	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YG has no ECB damages, it is greener, more humid and delay the ripening. Also it is more productive than C.
Spain	4950	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard resists ECB, also plants and ears don´t fall and YieldGard gives more production.
Spain	4951	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YG is more productive than C. because it does not have ECB damages, always it is healthier.
Spain	4954	more vigourous	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YG germinates more vigorously, is greener, it does not have ECB damages and produces more than C.
Spain	4955	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard does not fall and produces more than Conventional because it has no ECB damages.
Spain	4957	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YG produces more than Conventional because it is resistant to ECB damages.
Spain	4958	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard produces more than Conventional because it does not fall due to its resistance to ECB damages.
Spain	4960	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard does not fall because it has no ECB damages. There less volunteers, it is greener and more productive than C.
Spain	4961	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YieldGard gives greater production than conventional because is healthier, and it has no ECB damages.
Spain	4965	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard resist ECB, does not fall, it is healthier, everything is harvested and produces more than Conventional.
Spain	4967	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YG is more productive than Conventional because it does not have ECB damages, it is healthier.
Spain	4970	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard is healthier because resists ECB, It doesn´t fall and produces more than Conventional.

Spain	4971	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard is healthier, does not have ECB damages, either plants and ears do not fall and YieldGard is more productive than C.
Spain	4972	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard does not fall and produces more than Conventional because it has no ECB damages.
Spain	4973	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YieldGard is more productive than Conventional because it does not have ECB damages.
Spain	4978	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard is healthier, no ECB damages, does not fall. You can harvest everything and produces more than Conventional.
Spain	4981	as usual	as usual	as usual	as usual	as usual	less often	as usual	as usual	YieldGard harvest has one or two more humidity points than Conventional.
Spain	4983	as usual	as usual	as usual	as usual	less often	less often	higher yield	as usual	YieldGard resist ECB, does not fall, it is healthier, everything is harvested and produces more than Conventional.
Spain	4984	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YieldGard resists ECB, is healthier, does not fall, ripes bit later and gives more production than Conventional.
Spain	4985	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YieldGard always produces more than Conventional because it is resistant to ECB damages.
Spain	4987	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard does not fall because it is resistant to ECB damages. It is more productive than Conventional because it is healthier.
Spain	4988	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YieldGard has no harvest losses due to ECB damages and produces more than Conventional.
Spain	4989	as usual	as usual	as usual	as usual	less often	less often	higher yield	as usual	YieldGard is greener, it has no ECB damages and ripes bit later. YieldGard is more productive than Conventional.
Spain	4991	as usual	as usual	as usual	as usual	less often	as usual	higher yield	less often	YieldGard resists ECB, everything is harvested because it does not fall, less volunteers and more productive than Conventional.
Spain	4995	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YieldGard produces 20% more than Conventional because it is resistant to ECB.
Spain	5004	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YieldGard is healthier, no ECB damages and gives more production than Conventional.
Spain	5005	as usual	as usual	as usual	delayed	as usual	as usual	as usual	as usual	YieldGard grows slower than Conventional.
Spain	5006	as usual	as usual	as usual	as usual	less often	as usual	higher yield	less often	YieldGard produces more than Conventional because it is healthier, without ECB damages. There are not volunteers.
Spain	5009	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YieldGard is more productive than Conventional because resists ECB.
Spain	5010	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YieldGard gives greater production than conventional because is healthier, and it has no ECB damages.
Spain	5011	as usual	as usual	as usual	as usual	as usual	less often	higher yield	as usual	YieldGard is greener, ripes leater, is healthier and produces more than Conventional because resists ECB damages.
Spain	5012	as usual	as usual	as usual	as usual	as usual	as usual	as usual	as usual	YieldGard always produces more than Conventional because it is resistant to ECB damages.
Spain	5014	as usual	as usual	as usual	as usual	as usual	as usual	as usual	as usual	If there was no ECB attack, there would not be differences between YieldGard and Conventional.
Spain	5015	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard does not fall because it has no ECB damages.
Spain	5018	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard resist ECB, does not fall, it is healthier, everything is harvested and produces more than Conventional.

Spain	5020	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard does not fall because it has no ECB damages. There are less volunteers, it is greener and more productive than C.
Spain	5022	as usual	as usual	as usual	as usual	less often	less often	higher yield	less often	YG is healthier and greener than C., ripes later, does not fall and less volunteers. No ECB damages and more productive than C.
Spain	5025	as usual	as usual	as usual	as usual	as usual	as usual	as usual	as usual	No differences between YieldGard and Conventional because there was no ECB attack.
Spain	5027	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YieldGard resists ECB and is more productive than Conventional.
Spain	5028	as usual	as usual	as usual	as usual	less often	as usual	higher yield	less often	YieldGard resists ECB, no damages, does not fall, there are no volunteers and it is more productive than Conventional.
Spain	5031	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard is healthier, no ECB damages. Yielgard ears and plants do not fall and Yielgard is more productive than Conventional.
Spain	5032	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard resist ECB, does not fall, it is healthier, everything is harvested and produces more than Conventional.
Spain	5033	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YieldGard does not fall and produces more than Conventional because it has no ECB damages.
Spain	5039	as usual	as usual	as usual	as usual	less often	less often	higher yield	less often	YG is healthier + greener than C., ripes later, doesn't fall, less volunteers. No ECB damages + more productive than C.
Spain	5042	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YieldGard gives greater production than conventional because is healthier, and it has no ECB damages.
Spain	5043	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YieldGard gives more production than Conventional, even in not intensive ECB attack years.
Spain	5044	as usual	as usual	as usual	as usual	as usual	less often	higher yield	as usual	YieldGard is healthier and greener than Conventional. It has more humidity, ripes later and produces more than Conventional.
Spain	5045	as usual	as usual	as usual	as usual	less often	less often	higher yield	as usual	YieldGard does not fall because it has no ECB damages. It ripes later because it has more humidity.
Spain	5046	as usual	as usual	as usual	as usual	as usual	less often	as usual	as usual	YieldGard ripes later because has more humidity than Conventional, is healthier and greener.
Spain	5050	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard does not fall because resists ECB, is healthier and produces more than Conventional.
Spain	5051	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YieldGard is more productive than Conventional because it does not have ECB damages.
Spain	5056	as usual	as usual	as usual	as usual	as usual	as usual	as usual	as usual	YieldGard is healthier, produces more than Conventional, but YieldGard ripes later because has more humidity
Spain	5057	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YieldGard is more productive than Conventional because it does not have ECB damages.
Spain	5060	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	Everything is harvested with YG because it does not fall, it is more productive than C. because it is resistant to ECB damages.
Spain	5061	as usual	as usual	as usual	as usual	as usual	less often	higher yield	as usual	YieldGard is greener, it has no ECB damages and ripes bit later. YieldGard is more productive than Conventional.
Spain	5063	as usual	as usual	as usual	as usual	as usual	as usual	as usual	as usual	No differences between YieldGard and Conventional because there was no ECB attack.
Spain	5065	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YieldGard is healthier and bit more productive than Conventional.
Spain	5068	as usual	as usual	as usual	as usual	as usual	less often	as usual	as usual	YieldGard is greener, has more humidity and ripes later.

Spain	5069	as usual	as usual	as usual	as usual	as usual	less often	as usual	as usual	YieldGard ripes later because has more humidity than Conventional, is healthier and greener.
Spain	5070	more vigourous	as usual	as usual	accelerated	less often	as usual	higher yield	as usual	YieldGard is more vigorous and developes faster because it is healthier than Conventional, without ECB damages.
Spain	5077	as usual	as usual	as usual	as usual	as usual	less often	higher yield	as usual	YG resists ECB. It is more productive than C. Also YG is greener, with more humidity and delay the ripening some days.
Spain	5078	as usual	as usual	as usual	as usual	as usual	less often	as usual	as usual	YieldGard has more humidity, it is greener and ripes later than Conventional.
Spain	5080	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard does not fall because resists ECB, is healthier and produces more than Conventional.
Spain	5082	as usual	as usual	as usual	as usual	less often	less often	higher yield	as usual	YieldGard resists ECB, is healthier, does not fall, ripes bit later and gives more production than Conventional.
Spain	5085	as usual	as usual	as usual	as usual	as usual	less often	higher yield	as usual	YieldGard is greener, ripes later, is healthier and produces more than Conventional.
Spain	5090	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard resist ECB, does not fall, it is healthier, everything is harvested and produces more than Conventional.
Spain	5102	as usual	as usual	as usual	as usual	as usual	less often	higher yield	as usual	YieldGard has no ECB damages, it is greener, has more humidity and delay the ripening. Also it is more productive than C.
Spain	5110	as usual	as usual	as usual	as usual	less often	less often	higher yield	as usual	YieldGard resists ECB, is healthier, does not fall, ripes later and produces more than Conventional.
Spain	5112	as usual	as usual	as usual	as usual	as usual	less often	as usual	as usual	YieldGard ripes later because has more humidity than Conventional, is healthier and greener.
Spain	5113	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YieldGard is healthier, no ECB damages and gives more "kilos" than Conventional.
Spain	5115	less vigourous	as usual	as usual	delayed	as usual	less often	as usual	as usual	YieldGard has less germintative vigour and grows slower, It has more humidity and ripes later.
Spain	5122	as usual	as usual	delayed	delayed	as usual	less often	higher yield	as usual	YieldGard flowers and grows slower, is healthier and produces more than Conventional because resists ECB damages.
Portugal	4878	more vigourous	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	Greater vigour & productivities.Average yields: 15 190 kg/ha YG, average of 600 kg/ha > Conv. YG's +: sanity & quality
Portugal	4879	more vigourous	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	Average yields of 13 875 kg/ha in the YG, 750 kg/ha average > Conv. High vigour & yields: reflection of high sanity of YG.
Portugal	4880	more vigourous	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	Average yields of 11 790 kg/ha in YG, average of 400-500 kg/ha > Conv. Robustness, vigour, sanity of YG -> better productivities
Portugal	4881	more vigourous	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	Quality + vigour of YG -> higher productivities. Average yields of 14 440 kg/ha in YG, an average of 400 / 500 kg/ha > Conv.
Portugal	4882	more vigourous	as usual	as usual	as usual	as usual	as usual	as usual	as usual	Better vigour & robustness of YGplants. Average yields of 14 300 kg/ha in the YG were similar compared with Conv.
Portugal	4883	more vigourous	as usual	as usual	as usual	as usual	as usual	as usual	as usual	better vigour and good quality of YG. Average yields of 52 000 kg/ha in the YG forage: similar compared with Conv. Forage.
Portugal	4884	more vigourous	as usual	as usual	as usual	as usual	as usual	as usual	as usual	Better vigour, sanity and quality of YG forage. Average yields of 50 000 - 52 000 kg/ha in YG were similar compared with Conv.
Portugal	4885	more vigourous	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	Bigger vigour, productivities -> higher sanity & quality. Average yields of 13 200 kg/ha in YG, an average of 600 kg/ha > Conv.
Portugal	4886	more vigourous	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	higher productivities, vigour, sanity & quality of YG. Average yields of 14 750 kg/ha in YG, , an average of 500 kg/ha > Conv.

Portugal	4887	more vigourous	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YG: better productivities: safe production, sanity. Average yields of 14 650 kg/ha in YG, an average of 750 kg/ha > Conv.
Portugal	4888	more vigourous	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	Superior vigour, productivities of YG -> higher sanity + quality. Average yields of 13 750 kg/ha, average of 350 kg/ha > Conv.
Portugal	4889	more vigourous	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YG had more quality, productions , sanity. Average yields of 13 600 kg/ha in YG, average of 500 kg/ha > Conv.
Portugal	4890	more vigourous	as usual	as usual	as usual	as usual	as usual	as usual	as usual	greater vigour + quality of YG. Average yields of 13 000 kg/ha in YG were similar compared with Conv.
Portugal	4891	more vigourous	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	Quality, robustnesss, vigour, sanity, better productions in YG. Average yields of 15 850 kg/ha, average of 750 kg/ha > Conv.

Table A 9: Additional observation during plant growth of MON 810 (Section 3.4.2)

Country	Quest. Nr.	Comments aggregate	Comments
Spain	4892	No corn borer in 2017/ YieldGard has higher humidity	YieldGard has more degrees of humidity than Conventional maize.
Spain	4896		No differences between YieldGard and Conventional because there was no ECB attack.
Spain	4898		If there are not ECB, I can not see differences between YieldGard and Conventional.
Spain	4899		YieldGard does not fall, so there are less volunteers.
Spain	4901		No differences between YieldGard and Conventional because there was no ECB attack.
Spain	4906		No differences between YieldGard and Conventional because there was no ECB attack.
Spain	4907		No differences between YieldGard and Conventional because there was no ECB attack.
Spain	4910		No differences between YieldGard and Conventional because there was no ECB attack.
Spain	4914		YieldGard always is greener than Conventional.
Spain	4915		If there are not ECB, I can not see differences between YieldGard and Conventional.
Spain	4920		YieldGard always is greener than Conventional.
Spain	4926		No differences between YieldGard and Conventional because there was no ECB attack.
Spain	4928		YieldGard is always greener than the Conventional even in years with few ECB attack as last year.
Spain	4929		Yielgard and Conventional behaved in the same way because there was no ECB damages.
Spain	4935		No differences between YieldGard and Conventional because there was no ECB attack.
Spain	4940		If there are not ECB, I can not see differences between YieldGard and Conventional.
Spain	4942		Given that there was not ECB damages, there was no differences between YieldGard and Conventional.
Spain	4962		If there are not ECB, I can not see differences between YieldGard and Conventional.
Spain	4963		If there are not ECB, I can not see differences between YieldGard and Conventional.
Spain	4966		If there are not ECB, I can not see differences between YieldGard and Conventional.
Spain	4968		No differences between YieldGard y Conventional because there was no ECB attack.
Spain	4969		If there was no ECB attack, there would not be differences between YieldGard and Conventional.
Spain	4974		No differences between YieldGard and Conventional because there was no ECB attack.
Spain	4976		No differences between YieldGard and Conventional because there was no ECB attack.
Spain	4980		If there are not ECB, I can not see differences between YieldGard and Conventional.
Spain	4982		No differences between YieldGard and Conventional because there was no ECB attack.
Spain	4983		YieldGard is greener and ripes later than Conventional.
Spain	4986		If there was no ECB attack, there would not be differences between YieldGard and Conventional.
Spain	4989		YieldGard ensures you have no ECB damage and no loss of crop production.
Spain	4993		If there was no ECB attack, there would not be differences between YieldGard and Conventional.

Spain	4994		No differences between YieldGard and Conventional because there was no ECB attack.
Spain	4995		YieldGard "insures" the harvest.
Spain	4996		No differences between YieldGard and Conventional because there was no ECB attack.
Spain	4997		No differences between YieldGard and Conventional because there was no ECB attack.
Spain	4998		No differences between YieldGard and Conventional because there was no ECB attack.
Spain	5001		If there was no ECB attack, there would not be differences between YieldGard and Conventional.
Spain	5002		No differences between YieldGard and Conventional because there was no ECB attack.
Spain	5007		If there are not ECB, I can not see differences between YieldGard and Conventional.
Spain	5008		No differences between YieldGard and Conventional because there was no ECB attack.
Spain	5011		YieldGard has two more degrees of fumidity in harvest time than the Conventional.
Spain	5015		If there was no YieldGard, we could not plant maize in this region.
Spain	5016		No differences between YieldGard and Conventional because there was no ECB attack.
Spain	5018		You can see always ECB in Conventional maize, but never in YieldGard.
Spain	5021		No differences between YieldGard and Conventional because there was no ECB attack.
Spain	5024		No differences between YieldGard and Conventional because there was no ECB attack.
Spain	5026		Yielgard and Conventional behaved in the same way because there was no ECB damages.
Spain	5032		YieldGard gives you the security of not having crop losses caused by ECB.
Spain	5035		If there was no ECB attack, there would not be differences between YieldGard and conventional.
Spain	5036		No differences between YieldGard and Conventional because there was no ECB attack.
Spain	5037		If there are not ECB, I can not see differences between YieldGard and Conventional.
Spain	5038		No differences between YieldGard and Conventional because there was no ECB attack.
Spain	5039		YieldGard has more humidity than Conventional at the time of harvesting.
Spain	5041		If there was no ECB attack, there would not be differences between YieldGard and conventional.
Spain	5043		YieldGard has more humidity than Conventional.
Spain	5048		No differences between YieldGard and Conventional because there was no ECB attack.
Spain	5051		YieldGard is healthier than Conventional.
Spain	5054		No differences between YieldGard and Conventional because there was no ECB attack.
Spain	5055		No differences between YieldGard and Conventional because there was no ECB attack.
Spain	5058		If there was no ECB attack, there would not be differences between YieldGard and conventional.
Spain	5067		If there are not ECB, I can not see differences between YieldGard and Conventional.
Spain	5071		If there was no ECB attack, there would not be differences between YieldGard and conventional.
Spain	5073		YieldGard harvest has one or two more humidity points than Conventional.
Spain	5074		If there are not ECB, I can not see differences between YieldGard and Conventional.
Spain	5076		If there was no ECB attack, there would not be differences between YieldGard and Conventional.
Spain	5081		YieldGard has more humidity in the stem and leaves than the Conventional.
Spain	5082		YieldGard takes longer to dry, is greener than conventional.

Spain	5084		No differences between YieldGard and Conventional because there was no ECB attack.
Spain	5087		If there was no ECB attack, there would not be differences between YieldGard and Conventional.
Spain	5088		No differences between YieldGard and Conventional because there was no ECB attack.
Spain	5091		If there are not ECB, I can not see differences between YieldGard and Conventional.
Spain	5092		No differences between YieldGard and Conventional because there was no ECB attack.
Spain	5093		No differences between YieldGard and Conventional because there was no ECB attack.
Spain	5095		If there was no ECB attack, there would not be differences between YieldGard and Conventional.
Spain	5098		Given that there were not ECB damages, there were no differences between YieldGard and Conventional.
Spain	5100		This year, no differences between YG and C., probably because we had strong spider attacks that impacted in both.
Spain	5101		This year, no differences between YG and C., probably because we had strong spider attacks that impacted in both.
Spain	5105		This year, no differences between YG and C., probably because we had strong spider attacks that impacted in both.
Spain	5108		This year,no differences between YG and C., probably because we had strong spider attacks that impacted in both.
Spain	5110		YieldGard is greener and it has more humidity than Conventional.
Spain	5114		Given that ther were not ECB damages, there were no differences between YieldGard and Conventional.
Spain	5116		In 2017, I had little impact of ECB.
Spain	5119		No differences between YieldGard y Conventional because there was no ECB attack.
Spain	5122		YieldGard is greener than Conventional
Spain	5126		No differences between YieldGard and Conventional because there was no ECB attack.

Table A 10: Additional comments on disease susceptibility (Section 3.4.3)

Country	Quest. Nr.	Disease susceptibility	Comments aggregate	Comments
Spain	4878	as usual	No differences	Lower presence in the local / region of production of diseases.
Spain	4879	as usual		Nothing to report about diseases susceptibility.
Spain	4880	as usual		Nothing to distinguish in the region of production, did not make any applications.
Spain	4881	as usual		It does not happen in the local / region of production.
Spain	4882	as usual		Presence in the local / region of production of the disease "Cephalosporium" but without any difference in susceptibility.
Spain	4884	as usual		Nothing to report in the region of production.
Spain	4885	as usual		Presence in the local of productionof "Erwinia Zea"without any difference in susceptibility and no need for treatments.
Spain	4887	as usual		Meaningless in the local of production, did not verified nothing about diseases.
Spain	4888	as usual		Nothing to report in what susceptibility diseases concerns.
Spain	4889	as usual		Presence in the region of production of the disease "Erwinia" but meaningless and without any difference in susceptibility.
Portugal	4948	less susceptible	YieldGard less susceptible to Ustilago/ Fusarium	YieldGard has less attack of Fungi than Conventional maize because it has no ECB injuries.
Portugal	4955	less susceptible		YieldGard has less attack of Fungi than Conventional maize because it has no ECB injuries.
Portugal	5070	less susceptible		YieldGard does not have Fusarium attack and the Conventional does.
Portugal	5085	less susceptible		YieldGard does not have Ustilago and Fusarium attack and the Conventional does.
Spain	4883	less susceptible		Presence of diseases like "Fusarium", "Helminthosporium" and "Erwinia". Sanity of YG were reflection on less susceptibility.
Spain	4886	less susceptible		Nothing to report about differences in diseases susceptibility. Did not make any treatments.

Table A 11: Additional comments on insect pest control (Section 3.4.4)

Country	Quest. Nr.	Ostrinia nubilalis	Sesamia spp.	Comments
Spain	4879	very good	very good	Tremendous effectiveness of control the maize borers.
Spain	4880	very good	very good	Tremendous effectiveness.
Spain	4889	very good	very good	Excellent effectiveness.

Table A 12: Additional comments on pest susceptibility (Section 3.4.5)

Country	Quest. Nr.	Pest susceptibility	Order of insect pest	Comments aggregate	Comments
Portugal	4882	as usual		Nothing to report.	Did not find any significant differences on other pest susceptibility.
Spain	4925	less susceptible	Red Spider	YieldGard more resistant in general	YieldGard is healthier and has less Red spider and Aphid attack than Conventional maize.
Spain	4948	less susceptible	Heliothis		YieldGard has less Heliothis and Mithymna attack than C.
Spain	4949	less susceptible	Heliothis		YieldGard has less Heliothis attack than Conventional maize.
Spain	4951	less susceptible	Heliothis		YieldGard has less Helicoperva attack than Conventional.
Spain	4954	less susceptible	Mythimna spp. (Mitima)		YieldGard has less Heliothis and Mithymna attack than Conventional maize.
Spain	4955	less susceptible	Mythimna spp. (Mitima)		YieldGard has less Heliothis and Mithymna attack than Conventional maize.
Spain	5069	less susceptible	Helicoverpa spp.		YieldGard has less Helicoperva attack than Conventional.
Spain	5085	less susceptible	Heliothis		YieldGard has less Helicoperva attack than Conventional.
Portugal	4878	less susceptible	Spodoptera spp.		The better safety production of YG were reflected in the lower susceptibility (more resistant) to the attack of other pests.
Portugal	4879	less susceptible	Agrotis Ipsilon		The lower susceptibility (more resistant) were explain by the quality, sanity and safety production of Yieldgard maize.
Portugal	4880	less susceptible	Agrotis Ipsilon		The resistance to other pests is greater in Yieldgard maize because the sanity of the Yieldgard plants is also greater.
Portugal	4881	less susceptible	Agrotis Ipsilon		The sanity and quality of the Yieldgard maize is the great advantage of Yieldgard maize production
Portugal	4883	less susceptible	Agrotis Ipsilon		Sanity YG was most important reason of the better resistant from the attack of the diferent other pest like Agrotis Ipsilon.
Portugal	4884	less susceptible	Agrotis Ipsilon		The safety production of YG was important and provided lower susceptibility from the attack of the different other pest.
Portugal	4885	less susceptible	Agrotis Ipsilon		This last campaign had lower incidence of pests but it was a little real less susceptible to the attack different other pests.

Portugal	4886	less susceptible	Agrotis Ipsilon		The sanity and quality of Yieldgard maize is so great and high that helps in the fight against other pests.
Portugal	4887	less susceptible	Agrotis Ipsilon		YG resistant to maize borer made YG less susceptible from the attacks of other pests like Agrotis Ipsilon and Spodoptera.
Portugal	4888	less susceptible	Agrotis Ipsilon		YG were also attacked by other pests like Agrotis Ipsilon had higher sanity to resistthe attack of different other pests.
Portugal	4889	less susceptible	Agrotis Ipsilon		Region of production had lower incidence of pests. Despite that the YG was less susceptible to attack of different other pests.
Portugal	4890	less susceptible	Agrotis Ipsilon		Farmer highlighted the large sanity of YG despite this last year the region had a lower incidence of pests in general
Portugal	4891	less susceptible	Agrotis Ipsilon		Production safety of YG was enormous, made the difference and was a great advantage for farmer on other pest susceptibility.

Table A 13: Weeds that occurred in MON 810 (Section 3.4.6)

Name of weed	Frequency
Sorghum halepense	145
Abutilon theophrasti	132
Chenopodium album	107
Amaranthus retroflexus	81
Datura stramonium	53
Xanthium strumarium	32
Solanum nigrum	26
Setaria spp.	26
Cyperus spp.	26
Hordeum sp.	20
Digitaria sanguinalis	15
Echinochloa spp.	15
Xanthium spinosum	14
Echinochloa crus-galli	10
Cynodon dactylon	9
= 85 -> Medicago sativa	5
Avena fatua	4
Portulaca oleracea	4
Raphanus raphanistrum	3
Triticum sp.	3
Panicum spp.	2
Polygonum convolvulus	2
Cirsium arvense	1
Phragmites australis	1
Amaranthus spp.	1
= 12 -> Setaria spp.	1
Rumex spp.	2
Fumaria officinalis	1
Bromus spp.	1
Papaver sp.	1
Veronica hederifolia	1
Zea mays	1
Zea mays ssp. Mexicana	1

Table A 14: Motivations for not complying with the label recommendations (section 3.5.2)

Country	Quest. Nr.	Compliance	Reasons
Spain	4924	no	I have not read label recommendations.
Spain	4948		I did not plant refuge with Conventional maize.
Spain	4981		I planted less surface of refuge than recommended.
Spain	4985		I did not plant refuge in first maize planting.
Spain	4989		I did not plant refuge in second maize planting.
Spain	4998		Only 10% of refuge´s area.
Spain	5004		I did not plant refuge in first planting.
Spain	5013		I did not plant refuge.
Spain	5016		I did not plant refuge.
Spain	5017		I left only 15% instead 20% of refuge area.
Spain	5020		I did not plant refuge in second YieldGard planting.
Spain	5023		I did not plant refuge in second YieldGard planting.
Spain	5026		I did not plant refuge with Conventional.
Spain	5027		Because I did not plant Conventional as refuge.
Spain	5028		I did not plant refuge.
Spain	5048		I did not plant refuge in second YieldGard planting.
Spain	5064		Only 10% of refuge´s area.
Spain	5065		I did not plant refuge in second YieldGard planting.
Spain	5078		I did not plant refuge in YieldGard second planting.
Spain	5111		I did not plant refuge in second YieldGard planting.
Spain	5123		I did not plant refuge.

Table A 15: Motivations for not planting a refuge (section 3.5.3)

Country	Quest. Nr.	Plant refuge?	Reasons
Spain	4921	no	Because I had two plots of less than 5 hectares with YieldGard.
Spain	4922		Because I had two plots of less than 5 hectares with YieldGard.
Spain	4924		I do not know what is "refuge area".
Spain	4948		Because I had 3 plots smaller than 5 Has each one and it is not necessary a refuge area.
Spain	4981		I have small plots and it complicates me the planting.
Spain	4985		I did not plant refuge in first maize planting because plots were too small.
Spain	4998		Because ECB produces me lots of losses in the plots of Conventional, that is why I planted only 10% instead 20%.
Spain	5004		Because ECB reduces a lot the first planting harvest in Conventional.
Spain	5013		Because ECB produces a lot of production losses in the refuge´s harvest.
Spain	5016		Because ECB causes me losses of harvest in the Conventional maize of the refuge.
Spain	5017		I left 15% instead 20% becouse there are small plots and it is difficult to plant.
Spain	5026		Because it complicates the sowing and also because ECB causes crop losses in the Conventional maize of the refuge.
Spain	5027		Because ECB causes me losses of harvest in the Conventional maize of the refuge.
Spain	5028		Because ECB produces a lot of production losses.
Spain	5039		Because I planted as a refuge less than 20% of the area, but I have small plots and ECB gives me a lot of production losses.
Spain	5064		I planted only 10%, not 20% because the neighbours plots of Conventional maize are the refuge.
Spain	5123		I have no enough time to plant.

7 Annex B Questionnaire

2	0	1	7	-	0	1	-	M	A	R	-	E	S	-	0	1	-	0	1	-	0	1
Year				-	Event		-	Partner			-	Country		-Interviewer-				Farmer		-	Area	

EuropaBio Monitoring WG

Farmer Questionnaire

Product: insect protected YieldGard® maize

Farmer personal and confidential data

Name of farmer: ______________________________

Address of farmer: ______________________________

City: ______________________________

Postal code: ______________________________

Name of interviewer: ______________________________

Date of interview (DD / MM / YYYY):_____/______/_________

The personal data of the farmer will be handled in accordance with applicable data protection legislation. The personal data of the farmers may be used for the purpose of interviews necessary for the survey if the farmers have authorised this use as per the data protection legislation.

The questionnaires will be encoded to protect farmers' identity in the survey and confidentiality agreements will be put in place between the different parties (i.e. authorisation holders, licensees, interviewers and analyst) to further enforce this. The identity of a farmer will only be revealed to the authorisation holders if an adverse effect linked to their trait has been identified and needs to be investigated.

Furthermore, the agreements between the different parties will also ensure that any information collected in the questionnaires will not be improperly shared or used.

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Code:

Year ☐☐☐☐ Event ☐☐ Partner ☐☐☐ Country ☐☐ Interviewer ☐☐
Farmer ☐☐ Area ☐☐

Coding explanations:

2	0	1	3	-	0	1	-	M	A	R	-	E	S	-	0	1	-	0	1	-	0	1

Year — Event Code — Partner[1] Code — Country Code — Interviewer[2] Code — Farmer Code — Area Code

Codes:

Event:	01	MON 810
	02	...
Partner[6]:	MON	Monsanto
	MAR	Markin
	AGR	Agro.Ges
	...	...
Country:	ES	Spain
	PT	Portugal
	RO	Romania
	…	
Interviewer[7]:	01 A	
	02 B	
	03 …	

Farmer: incremental counter within the interviewer

Area: incremental counter within the farmer

---

[6] Partner is the organization that implements the survey
[7] Interviewer is the employee from the Partner that is contacting the farmers

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2	0	1	5	-	0	1	-	M	A	R	-	E	S	-	0	1	-	0	1	-	0	1

Year - Event - Partner - Country -Interviewer- Farmer - Area

1 Maize grown area

1.1 Location:

Country: ____

County: ____

1.2 Surrounding environment:

Which of the following would best describe the land usage in the surrounding of the areas planted with YieldGard® maize

- O Farmland
- O Forest or wild habitat
- O Residential or industrial

1.3 Size and number of fields of the maize cultivated area:

Total area of all maize cultivated on farm (ha) _________________

Total area of YieldGard® maize cultivated on farm (ha) _________________

Number of fields cultivated with YieldGard® maize _______________

1.4 Maize varieties grown:

List up to five YieldGard® maize varieties planted this season:

1. ___________________________
2. ___________________________
3. ___________________________
4. ___________________________
5. ___________________________

List up to five conventional varieties planted this season:

1. ___________________________
2. ___________________________
3. ___________________________
4. ___________________________
5. ___________________________

Are you growing any other GM maize varieties this season?[8]

O Yes O No

[8] Note: This question does not need to be asked in the 2013 season.

2	0	1	5	-	0	1	-	M	A	R	-	E	S	-	0	1	-	0	1	-	0	1

Year - Event - Partner - Country -Interviewer- Farmer - Area

1.5 *Soil characteristics of the maize grown area:*

Mark the predominant soil type of the maize grown area (soil texture):

O very fine (clay)
O fine (clay, sandy clay, silty clay)
O medium (sandy clay loam, clay loam, sandy silt)
O medium-fine (silty clay loam, silt loam)loam)
O coarse (sand, loamy sand, sandy loam)
O no predominant soil type (too variable across the maize grown area on the farm)
O I do not know

Characterize soil quality of the maize grown area (fertility):

O below average - poor
O average - normal
O above average -good

Organic carbon content (%) ____________________

1.6 *Local pest and disease pressure in maize:*

Characterize this season's general pest pressure on the maize cultivated area:

Diseases (fungal, viral)	O Low	O As usual	O High
Pests (insects, mites, nematodes)	O Low	O As usual	O High
Weeds	O Low	O As usual	O High

2 Typical agronomic practices to grow maize on your farm

2.1 *Irrigation of maize grown area:*

O Yes O No

If yes, which type of irrigation technique do you apply:

O Gravity O Sprinkler O Pivot O Other

2.2 *Major rotation of the maize grown area:*

previous year: ________________________
two years ago: ________________________

2.3 *Soil tillage practices:*

O No O Yes (mark the time of tillage: O Winter O Spring)

2.4 *Maize planting technique:*

O Conventional planting
O Mulch
O Direct sowing

2.5 Mark all typical weed and pest control practices in maize at your farm:

O Herbicide(s)

8 O Insecticide(s)
If box checked, do you treat against maize borers? O Yes O No

O Fungicide(s)
O Mechanical weed control
O Use of bio control treatments (e.g. Trichogramma)
O Other, please specify: ____________________

2.6 Application of fertilizer to maize grown area:

O Yes O No

2.7 Typical time of maize sowing range (DD:MM – DD:MM):

_________/_________ -- _________/__________

2.8 Typical time of maize harvest range (DD:MM – DD:MM):

Grain maize: _________/_________ -- _________/__________
Forage maize: _________/_________ -- _________/__________

3 Observations of YieldGard® maize

3.1 Agricultural practices in YieldGard® maize (compared to conventional maize)

Did you change your agricultural practices in YieldGard® maize compared to conventional maize? If any of the answers is different from «As usual», please specify the change.

How did you perform your crop rotate for YieldGard® maize compared with conventional maize?

O As usual O Changed, because (*describe the rotation*): _____________

____

____

Did you plant YieldGard® maize earlier or later than conventional maize?

O As usual O Earlier O Later, because: _________________________

2	0	1	5	-	0	1	-	M	A	R	-	E	S	-	0	1	-	0	1	-	0	1

Year - Event - Partner - Country -Interviewer- Farmer - Area

Did you change your soil tillage or maize planting techniques to plant YieldGard® maize?

O As usual O Changed, because: ___________________________________

Full commercial name of insecticides you applied in YieldGard® maize field, including seed treatments:

1. ____
2. ____
3. ____
4. ____

Full commercial name of herbicides you applied in YieldGard® maize field:

1. ____
2. ____
3. ____
4. ____

Full commercial name of fungicides you applied in YieldGard® maize field:

1. ____
2. ____
3. ____
4. ____

In 2013, how were the weed and pest control practices in YieldGard® maize when compared to conventional maize?

Insecticides: O Similar O Different, because: ______________________________

Herbicides: O Similar O Different, because: ______________________________

Fungicides: O Similar O Different, because: ______________________________

In 2013, did you change maize borer control practices in YieldGard® maize when compared to conventional maize?

O Similar O Changed, because: ___________________________________

In 2013, how were the fertilizer application practices in YieldGard® maize when compared to conventional maize?

O Similar O Changed, because:______________________________

In 2013, how were the irrigation practices in YieldGard® maize when compared to conventional maize?

O Similar O Changed, because:______________________________

Did you harvest YieldGard® maize earlier or later than conventional maize?

O Similar O Earlier O Later Because:______________________

3.2 *Characteristics of YieldGard® maize in the field (compared to conventional maize)*

Germination vigour	O As usual	O More vigourous	O Less vigourous
Time to emergence	O As usual	O Accelerated	O Delayed
Time to male flowering	O As usual	O Accelerated	O Delayed
Plant growth and development	O As usual	O Accelerated	O Delayed
Incidence of stalk/root lodging	O As usual	O More often	O Less often
Time to maturity	O As usual	O Accelerated	O Delayed
Yield	O As usual	O Higher yield	O Lower yield
Occurrence of volunteers from previous year planting (if relevant)	O As usual	O More often	O Less often

If any of the answers above is different from «As usual», please specify:
____
____
____
____

Please detail any additional unusual observations regarding the YieldGard® maize maize during its growth:____
____
____

3.3 Characterise the YieldGard® maize susceptibility to disease (compared to conventional maize)

Overall assessment of disease susceptibility of YieldGard® maize compared to conventional maize (fungal, viral diseases):

O As usual O More susceptible[9] O Less susceptible[4]

If the above answer is different from «As usual», please specify the difference in disease susceptibility in the list and the commentary section below:

1. *Fusarium* spp O More O Less
2. *Ustilago maydis = U. zeae* O More O Less
3. xxx O More O Less
4. xxx O More O Less
5. xxx O More O Less
6. Other: ______________________ O More O Less

Additional comments: ____
____
____

3.4 Characterise the INSECT pest control in YieldGard® maize fields (compared to conventional maize)

On the two insects controlled by YieldGard® maize, overall efficacy of the GM varieties on:

1. European corn borer (Ostrinia nubilalis):

   O Very good O Good O Weak O Don't Know

2. Pink borer (Sesamia spp):

   O Very good O Good O Weak O Don't Know

Additional comments: ____
____
____

[9] More susceptible than conventional maize or Less susceptible than conventional maize

3.5 Characterise the YieldGard® maize susceptibility to OTHER pests susceptibility (compared to conventional maize)

Except the two insects mentioned above, overall assessment of pest susceptibility of YieldGard® maize compared to conventional maize (insect, mite, nematode pests):

O A usual O More susceptible O Less susceptible

If the above answer is different from «As usual», please specify the difference in pest susceptibility in the list and the commentary section below:

1. ______________________ O More O Less
2. ______________________ O More O Less
3. ______________________ O More O Less
4. ______________________ O More O Less
5. ______________________ O More O Less

Additional comments: ____

____

3.6 Characterise the weed pressure in YieldGard® maize fields (compared to conventional maize)

Overall assessment of the weed pressure in YieldGard® maize compared to conventional maize:

O As usual O More weeds O Less weeds

List the three most abundant weeds in your YieldGard® maize field:

1. ____________________________________
2. ____________________________________
3. ____________________________________

Were there any unusual observations regarding the occurrence of weeds in YieldGard® maize? ____

____

3.7 Occurrence of wildlife in YieldGard® maize fields (compared to conventional maize)

General impression of the occurrence of wildlife (insects, birds, and mammals) in YieldGard® maize compared to conventional maize fields:

Occurrence of insects (arthropods):

O As usual O More O Less O Do not know

If the answer above is «More» or «Less», please specify your observation:

___

Occurrence of birds:

O As usual O More O Less O Do not know

If the answer above is «More» or «Less», please specify your observation:

___

___

Occurrence of mammals:

O As usual O More O Less O Do not know

If the answer above is «More» or «Less», please specify your observation:

___

___

3.8 Feed use of YieldGard® maize (if previous year experience with this event)

Did you use the YieldGard® maize harvest for animal feed on your farm?

O Yes O No

If "Yes", please give your general impression of the performance of the animals fed YieldGard® maize compared to animals fed conventional maize.

O As usual O Different O Do not know

If the answer above is «Different», please specify your observation:

___

___

___

3.9 Any additional remarks or observations [e.g. from fields planted with event xxxx that were not selected for the survey]

____
____
____
____
____

4 Implementation of Bt-maize specific measures

4.1 Have you been informed on good agricultural practices for YieldGard® maize?

O Yes O No

Only if you answered "Yes", would you evaluate these technical sessions as:

O Very useful O Useful O Not useful

4.2 Seed

Was the seed bag labelled with accompanying specific documentation indicating that the product is genetically modified maize YieldGard® maize?

O Yes O No

Did you comply with the label recommendations on seed bags?

O Yes
O No, because:____
____
____
____

4.3 Prevention of insect resistance

Did you plant a refuge in accordance to the technical guidelines?

O Yes
O No, because the surface of YieldGard® maize planted on the farm is < 5 ha
O No, because ____
____
____
____