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 2019 growing season

Responsibilities:

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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 alleged 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[2] 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 MON 810 cultivating countries Spain and Portugal in 2019. The questionnaires have been completed between February and March 2020. In the 2019 growing season 250 farmers have been surveyed.

2019 data indicate that in comparison to conventional maize plants, MON 810 plants

- had less incidence of stalk/root lodging caused by the inherent protection against certain lepidopteran pests,
- gave a higher yield caused by the better fitness of the plant,
- had lower pest susceptibility.

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.

[2] **Disclaimer**: Monsanto has become the member of the Bayer group as of 21 August 2018. The owner of this report is Bayer Agriculture BV.

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]), Bayer 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 Bayer 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 2019 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, Bayer uses this questionnaire to monitor whether 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	9	-	0	1	-	M	A	R	-	E	S	-	0	1	-	0	0	0	0	1
Year					Event Code			Partner Code				Country Code			Interviewer Code			Farmer ID				

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:	five-digit number identifying a single farmer	

(*e.g.* 2019-01-MAR-ES-01-30003).

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/her own ID so that multiple participitations of the same farmer in the MON 810 monitoring can be tracked.

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/she is cultivating on his/her 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

Usually – given that 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 %.

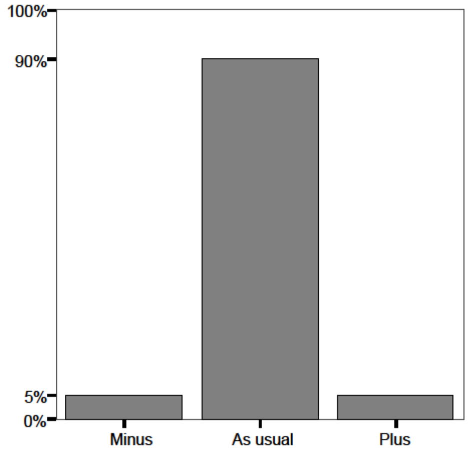

Figure 1: Balanced (expected) baseline distribution of the farmers' answers (no effect)

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)).

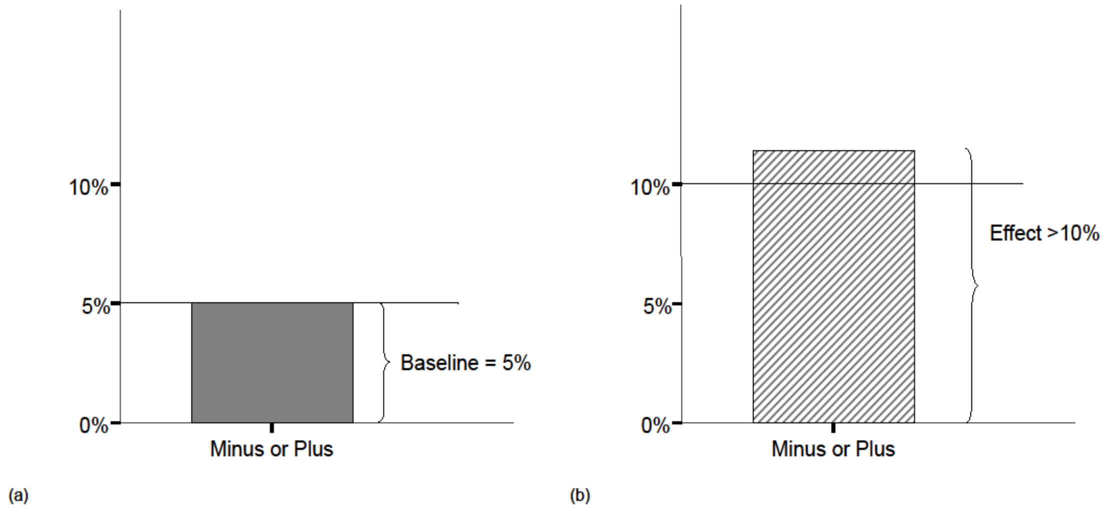

Figure 2: Definition of (a) baseline and (b) effect

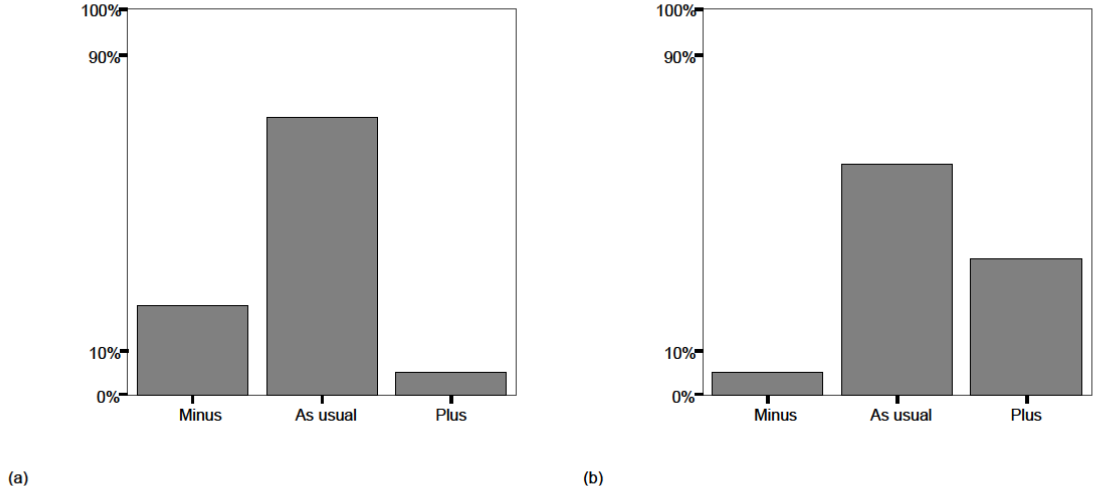

Figure 3: Examples for distributions of farmers' answers indicating an effect (a) > 10 % in category $Minus$ → effect, (b) > 10 % in category $Plus$ → effect

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

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

Therefore, each component of this vector is binomially distributed

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

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

$$H_0^1: p_{As\ usual} \leq 0.9 \quad \text{vs.} \quad H_A^1: p_{As\ usual} > 0.9$$
$$H_0^2: p_{Minus} \geq 0.1 \quad \text{vs.} \quad H_A^2: p_{Minus} < 0.1$$
$$H_0^3: p_{Plus} \geq 0.1 \quad \text{vs.} \quad H_A^3: p_{Plus} < 0.1$$

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 coherent 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 % ($H_0: p_{Minus} \geq 0.1$, $H_0: p_{Plus} \geq 0.1$)

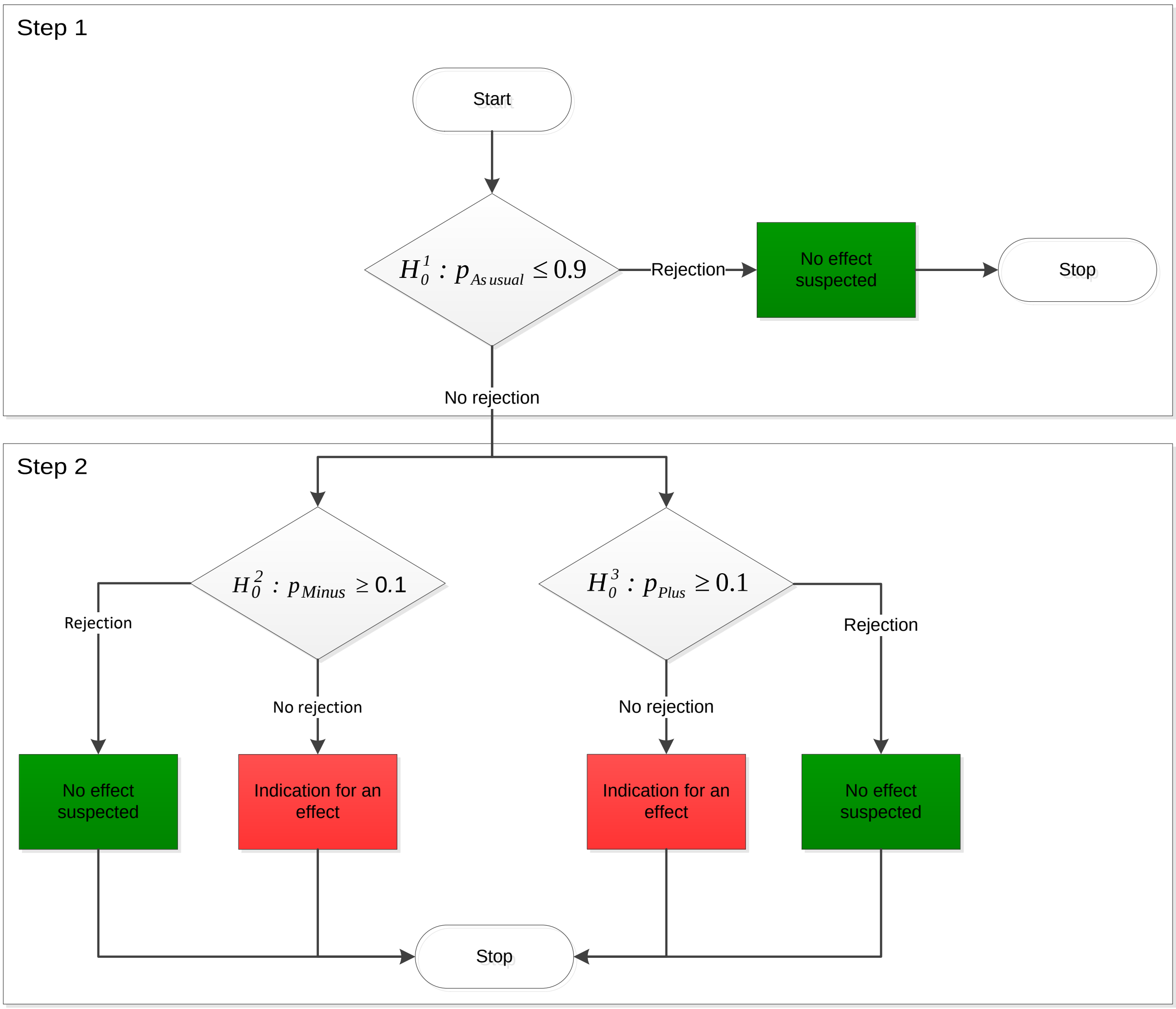

Figure 4: Closed test procedure for the three probabilities of $As\ usual$, $Plus$- and $Minus$-answers

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 (Type I error), the error of the second kind β (Type II error) 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 2019. For Portugal 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 2019

Country	MON 810 area	% of total MON 810 area	No of questionnaires
Portugal	4,718	4.22%	11
Spain	107,127	95.78%	239
Total	**111,845**	**100.00%**	**250**

This procedure was repeated within the countries:

Portugal:

Table 6: Sampling number proportional to cultivated MON810 area in Portugal 2019

Region	MON 810 area	% of country area	Proportional No of questionnaires	Sampling
Norte	56.21	1.19%	0	0
Centro	1,206.22	25.57%	3	3
Lisboa e Vale do Tejo	719.89	15.26%	2	2
Alentejo	2,735.81	57.99%	6	6
Total	**4,718.13**	**100.00%**	**11**	**11**

Due to the relatively small cultivation area of MON 810, Norte was excluded from the monitoring.

Spain:

Table 7: Sampling number proportional to cultivated MON810 area in Spain 2019

Region	MON 810 area	% of country area	Proportional No of questionnaires	Sampling
Andalucia	3,795.00	3.54%	9	9
Aragon + Cataluna	79,075.63	73.81%	177	177
Castilla Leon	286.84	0.27%	1	1
Castilla-La-Mancha + Comunidad de Madrid	3,192.38	2.98%	7	7
Comunidad Foral de Navarra	8,253.37	7.70%	18	18
Comunidad Valenciana	90.00	0.08%	0	0
Extremadura	12,254.74	11.44%	27	27
Islas Baleares	155.79	0.15%	0	0
La Rioja	23.16	0.02%	0	0
Murcia	0.00	0.00%	0	0
Islas Canarias	0.00	0.00%	0	0
Total	**107,126.91**	**100.00%**	**239**	**239**

Due to the relatively small cultivation area of MON 810, Comunidad Valencia, Islas Baleares, La Rioja, Murcia and Islas Canarias were excluded from the monitoring.

Aragón + *Cataluña* and *Castilla-La-Mancha* + *Comunidad de Madrid* were grouped into single regions, respectively, as the seed sales numbers obtained by the respective distributors did not allow for a clear distinction between the regions.

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 2019.

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 %.

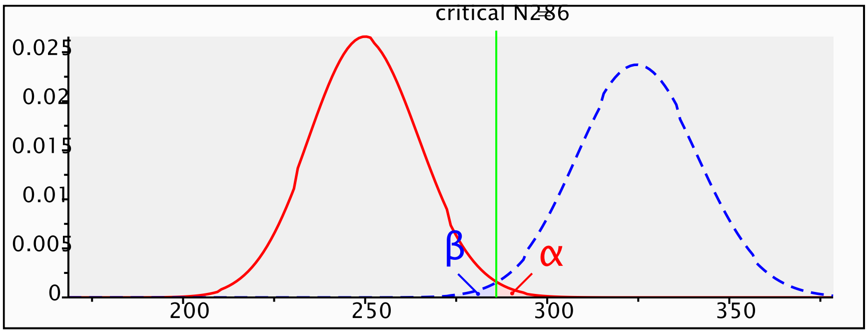

Figure 5: Null ($p = 0.1$) and alternative ($p = 0.13$) binomial distribution functions for a sample size of 2 500 type I and type II errors α and β both 0.01 (graph: *G*Power* Version 3.1.6)

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.

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 February and March 2020. In the 2019 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 2019 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 2019 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	247 (98.8%)	< 0.01			3 (1.2%)	< 0.01
Time of planting	250	247 (98.8%)	< 0.01	0 (0.0%)	< 0.01	3 (1.2%)	< 0.01
Tillage and planting technique	250	249 (99.6%)	< 0.01			1 (0.4%)	< 0.01
Insect control practices	250	243 (97.2%)	< 0.01			7 (2.8%)	< 0.01
Weed control practices	250	249 (99.6%)	< 0.01			1 (0.4%)	< 0.01
Fungal control practices	250	250 (100.0%)	< 0.01			0 (0.0%)	< 0.01
Maize Borer control practice	250	243 (97.2%)	< 0.01			7 (2.8%)	< 0.01
Fertilizer Application	250	250 (100.0%)	< 0.01			0 (0.0%)	< 0.01
Irrigation Practices	250	250 (100.0%)	< 0.01			0 (0.0%)	< 0.01
Time of harvest	250	247 (98.8%)	< 0.01	0 (0.0%)	< 0.01	3 (1.2%)	< 0.01
Germination vigor	250	239 (95.6%)	< 0.01	0 (0.0%)	< 0.01	11 (4.4%)	< 0.01
Time to emergence	250	250 (100.0%)	< 0.01	0 (0.0%)	< 0.01	0 (0.0%)	< 0.01
Time to male flowering	250	250 (100.0%)	< 0.01	0 (0.0%)	< 0.01	0 (0.0%)	< 0.01
Plant growth and development	250	249 (99.6%)	< 0.01	0 (0.0%)	< 0.01	1 (0.4%)	< 0.01
Incidence of stalk / root lodging	250	191 (76.4%)	1.0	59 (23.6%)	1.0	0 (0.0%)	< 0.01
Time to maturity	250	243 (97.2%)	< 0.01	0 (0.0%)	< 0.01	7 (2.8%)	< 0.01
Yield	250	167 (66.8%)	1.0	0 (0.0%)	< 0.01	83 (33.2%)	1.0
Occurrence of volunteers	250	245 (98.0%)	< 0.01	5 (2.0%)	< 0.01	0 (0.0%)	< 0.01
Disease susceptibility	250	245 (98.0%)	< 0.01	5 (2.0%)	< 0.01	0 (0.0%)	< 0.01
Pest susceptibility	250	234 (93.6%)	0.0175	16 (6.4%)	0.0309	0 (0.0%)	< 0.01
Weed pressure	249	249 (100.0%)	< 0.01	0 (0.0%)	< 0.01	0 (0.0%)	< 0.01
Occurrence of insects	250	250 (100.0%)	< 0.01	0 (0.0%)	< 0.01	0 (0.0%)	< 0.01
Occurrence of birds	250	247 (98.8%)	< 0.01	3 (1.2%)	< 0.01	0 (0.0%)	< 0.01
Occurrence of mamals	249	249 (100.0%)	< 0.01	0 (0.0%)	< 0.01	0 (0.0%)	< 0.01
Performance of animals	5	5 (100.0%)	< 0.01			0 (0.0%)	0.590

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	98.8%	97.0%	100.6%	-	-	-	1.2%	0.0%	3.0%
Time of planting	98.8%	97.0%	100.6%	0.0%	0.0%	0.0%	1.2%	0.0%	3.0%
Tillage and planting technique	99.6%	98.6%	100.6%	-	-	-	0.4%	0.0%	1.4%
Insect control practices	97.2%	94.5%	99.9%	-	-	-	2.8%	0.1%	5.5%
Weed control practices	99.6%	98.6%	100.6%	-	-	-	0.4%	0.0%	1.4%
Fungal control practices	100.0%	100.0%	100.0%	-	-	-	0.0%	0.0%	0.0%
Maize Borer control practice	97.2%	94.5%	99.9%	-	-	-	2.8%	0.1%	5.5%
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	98.8%	97.0%	100.6%	0.0%	0.0%	0.0%	1.2%	0.0%	3.0%
Germination vigor	95.6%	92.3%	98.9%	0.0%	0.0%	0.0%	4.4%	1.1%	7.7%
Time to emergence	100.0%	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Time to male flowering	100.0%	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Plant growth and development	99.6%	98.6%	100.6%	0.0%	0.0%	0.0%	0.4%	0.0%	1.4%
Incidence of stalk / root lodging	76.4%	69.5%	83.3%	23.6%	16.7%	30.5%	0.0%	0.0%	0.0%
Time to maturity	97.2%	94.5%	99.9%	0.0%	0.0%	0.0%	2.8%	0.1%	5.5%
Yield	66.8%	59.1%	74.5%	0.0%	0.0%	0.0%	33.2%	25.5%	40.9%
Occurrence of volunteers	98.0%	95.7%	100.3%	2.0%	0.0%	4.3%	0.0%	0.0%	0.0%
Disease susceptibility	98.0%	95.7%	100.3%	2.0%	0.0%	4.3%	0.0%	0.0%	0.0%
Pest susceptibility	93.6%	89.6%	97.6%	6.4%	2.4%	10.4%	0.0%	0.0%	0.0%
Weed pressure	100.0%	100.0%	100.0%	0.0%	0.0%	0.0%	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	98.8%	97.0%	100.6%	1.2%	0.0%	3.0%	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	100.0%	100.0%	100.0%	-	-	-	0.0%	0.0%	0.0%

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.

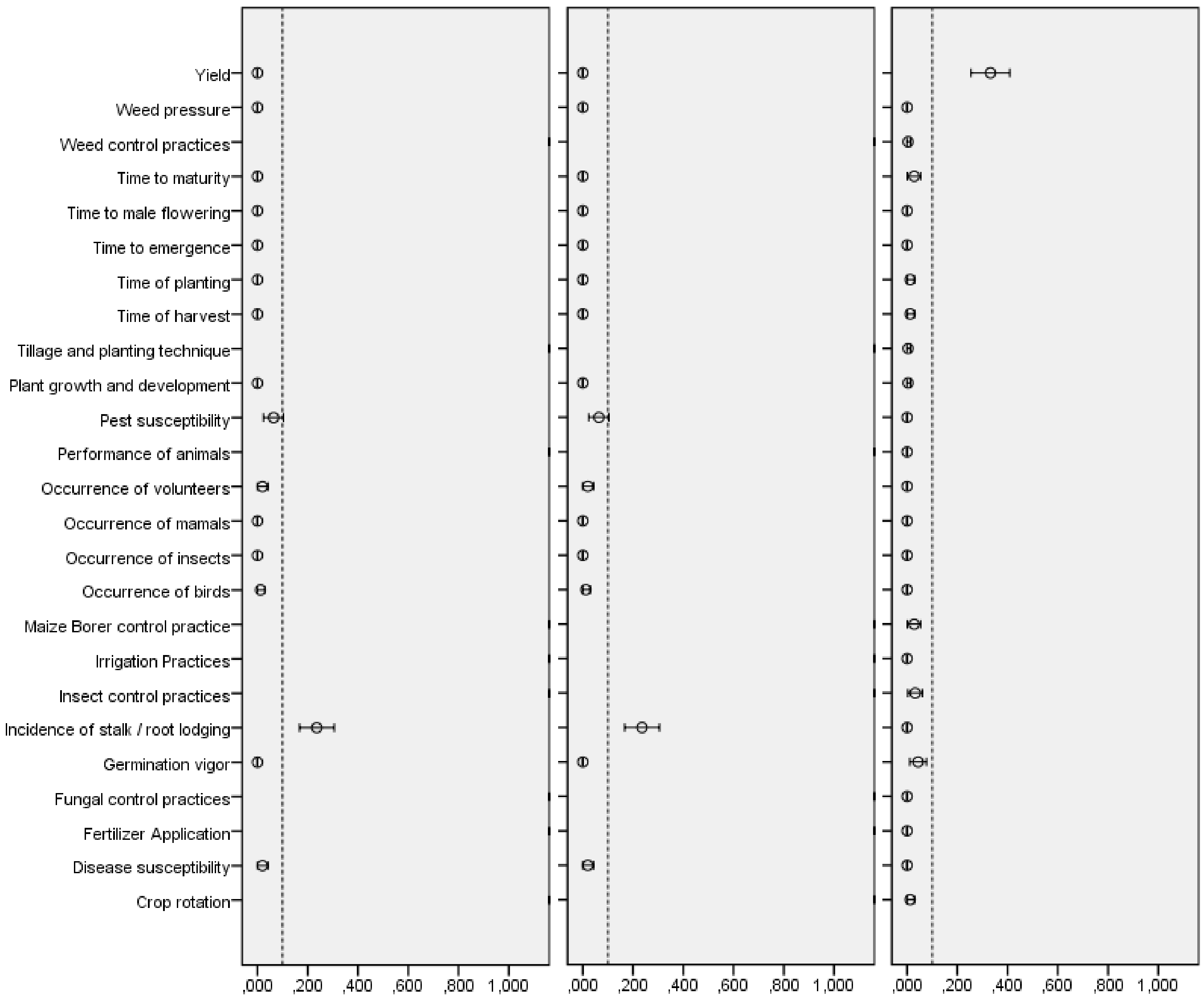

Figure 6: $As\ usual$- , $Plus$- and $Minus$ - answer probabilities of all monitoring characters, point estimates (circle) and 99 % confidence intervals (bars). Vertical dashed line indicates the test thresholds of 0.9 or 0.1, respectively (biological relevance).

Taken together, 2019 data indicate that in comparison to conventional maize, MON 810 plants

- had less incidence of stalk/root lodging,
- gave a higher yield,
- had lower pest susceptibility.

In the following sections the detailed analysis of all parameters surveyed using the questionnaire in 2019 is described and the results are assessed scientifically.

3.1 Sampling and quality and plausibility control

The questionnaires have been completed between February and March 2020. In the 2019 growing season 250 farm questionnaires have been collected.

In Spain, the largest market, the surveys (239) were performed by Instituto Markin, SL[3], in Portugal the surveys (11) were performed by Agro.Ges - Sociedade de Estudos e Projectos[4]. These companies have an established experience in agricultural surveys.

In Spain, 432 farmers were contacted, 193 did not respond for the following reasons: because they did not grow MON810 in 2019 (69), they did not grow maize in 2019 (64), they grew MON810 in 2019 but refused to sign the consent form (21), they grew MON810 in 2019 but refused to answer the interview (20), they were absent or could not be localized (10) they were retired (9). The response rate was 55.3%. 69 interviewed farmers took part in the survey for the first time. According to the sampling scheme, the farmers came from the following regions:

Table 10: Number of farmers interviewed in Spain 2019

Region		**No of farmers**
Cataluña - Aragón		177
Lérida	70	
Huesca	84	
Zaragoza	23	
Navarra		18
Navarra	18	
Extremadura		28
Badajoz	13	
Cáceres	15	
Andalucía		9
Sevilla	9	
Castilla- La Mancha		7
Albacete	6	
Cuenca	1	
Total		**239**

In Portugal, none of the contacted farmers refused to participate. The response rate was 100%. 5 interviewed farmers took part in the survey for the first time. According to the sampling scheme, the farmers came from the following regions:

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

Table 11: Number of farmers interviewed in Portugal 2019

Region	No of farmers
North	0
Center	3
Lisbon and Tagus Valley	2
Alentejo	6
Total	**11**

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 3,627 cases (questionnaires) for 14 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, 250 for 2017, 250 for 2018 and 250 for 2019.

3.2 Part 1: Maize grown area

3.2.1 Location

In 2019, 250 questionnaires were surveyed in the cultivation areas of MON 810 in Spain and Portugal. With an area of 107,127 ha in Spain and 4,718 ha in Portugal, these two countries represent MON 810 cultivators in Europe. Of these areas, 4.7 % and 19.6 % 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 2019 (dark grey areas) and the distribution of the monitoring sites (numbers) per region.

Table 12: MON 810 cultivation and monitored areas in 2019

Country	Total planted MON 810 area (ha)	Monitored MON 810 area (ha)	Monitored MON 810 area / total planted MON 810 area (%)
Spain	107,127	5,012	4.7%
Portugal	4,718	923	19.6%
Total	111,845	5,935	5.3%

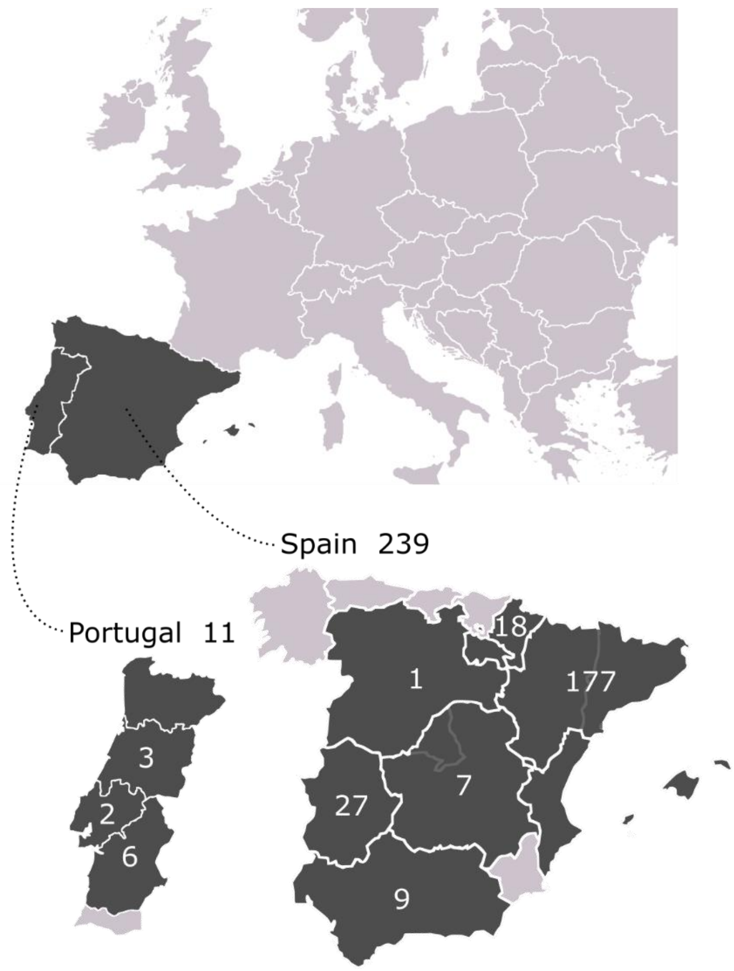

Figure 7: Number of sampling sites (white numbers) within the cultivation areas (filled dark grey) of MON 810 in Europe in 2019.

3.2.2 Surrounding environment

The farmers were asked to describe the land usage in the surrounding of the areas planted with maize. All (250/250) were surrounded by farmland (Table 13, Figure 8).

Table 13: Land usage in the surrounding of the areas planted with MON 810 in Europe in 2019

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	Farmland	250	100.0	100.0	100.0
	Forest or wild habitat	0	0.0	0.0	100.0
	Residential or industrial	0	0.0	0.0	100.0
	Total	**250**	**100.0**	**100.0**	

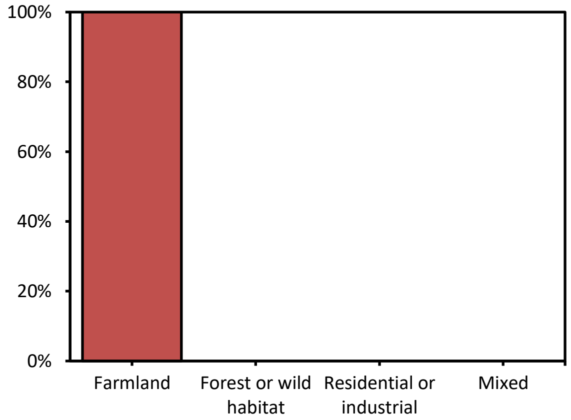

Figure 8: Land usage in the surrounding of the areas planted with MON 810 in Europe in 2019

3.2.3 Size and number of fields of the maize cultivated area

The size of the total maize area at the farms in 2019 ranged from 1 to 8,186 hectares. The average MON 810 areas per surveyed farmer in 2019 were 21.0 ha in Spain and 83.9 ha in Portugal, respectively. Details on the cultivation areas of maize per farmer from 2006 to 2019 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**	**Max**	**Mean**	**Min**	**Max**	**Mean**	**Min**	**Max**
Spain	all maize	34.2	2.0	300.0	33.6	2.0	300.0	33.0	1.0	320.0	41.6	1.5	1,000.0
	MON 810	23.9	1.0	240.0	24.7	2.0	220.0	21.8	1.0	278.0	27.7	1.0	700.0
France	all maize	-	-	-	-	-	-	-	-	-	-	-	-
	MON 810	-	-	-	-	-	-	-	-	-	-	-	-
Portugal	all maize	78.4	9.0	377.0	95.9	10.0	377.0	96.7	10.0	300.0	103.7	10.0	537.0
	MON 810	53.9	1.5	264.0	54.2	2.0	264.0	61.5	1.5	240.0	58.4	1.0	240.0
Czech Republic	all maize	355.7	2.2	2,000.0	409.9	45.0	900.0	492.2	8.4	2,000.0	454.0	9.3	1,300.0
	MON 810	112.7	2.0	654.0	146.0	20.0	640.0	108.6	6.6	230.0	95.8	7.3	250.0
Slovakia	all maize	594.9	150.0	859.6	986.0	447.6	1,700.0	862.9	862.9	862.9	-	-	-
	MON 810	184.2	60.0	400.7	103.0	48.1	140.8	169.0	169.0	169.0	-	-	-
Germany	all maize	-	-	-	-	-	-	-	-	-	-	-	-
	MON 810	-	-	-	-	-	-	-	-	-	-	-	-
Romania	all maize	196.9	20.0	1,100.0	180.3	65.0	700.0	124.0	20.0	500.0	749.0	548.0	950.0
	MON 810	32.9	0.1	284.0	32.8	2.5	99.0	21.6	0.0	59.3	227.8	55.6	400.0
Poland	all maize	61.1	19.0	150.0	61.8	10.0	180.0	-	-	-	-	-	-
	MON 810	23.8	1.5	100.0	25.3	1.0	130.0	-	-	-	-	-	-

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	40.7	45.4	579	45.4	1.0	700	45.4	1.0	800
	MON 810	34.0	1.0	1,445	25.8	33.8	400	33.8	1.0	600	33.8	1.0	681
France	all maize	-	-	-	-	-	-	-	-	-	-	-	-
	MON 810	-	-	-	-	-	-	-	-	-	-	-	-
Portugal	all maize	111.7	10.0	800	109.6	128.8	728	128.8	37.0	180	128.8	19.0	374
	MON 810	64.3	1.0	640	66.3	75.0	582	75.0	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	-	-	-	-	-	-	-	-	-	-	-	-

Table 14 (cont): Maize area (ha) per surveyed farmer in 2018 and 2019

		2018			2019		
Country	**Total Area (ha)**	**Mean**	**Min**	**Max**	**Mean**	**Min**	**Max**
Spain	all maize	21.0	0.8	100.0	31.1	1.5	322.0
	MON 810	15.7	0.8	83.0	21.0	1.5	261.0
France	all maize	-	-	-	-	-	-
	MON 810	-	-	-	-	-	-
Portugal	all maize	95.9	10.0	370	182.3	7.0	614.0
	MON 810	53.4	4.0	220	83.9	1.0	369.0
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 2019.

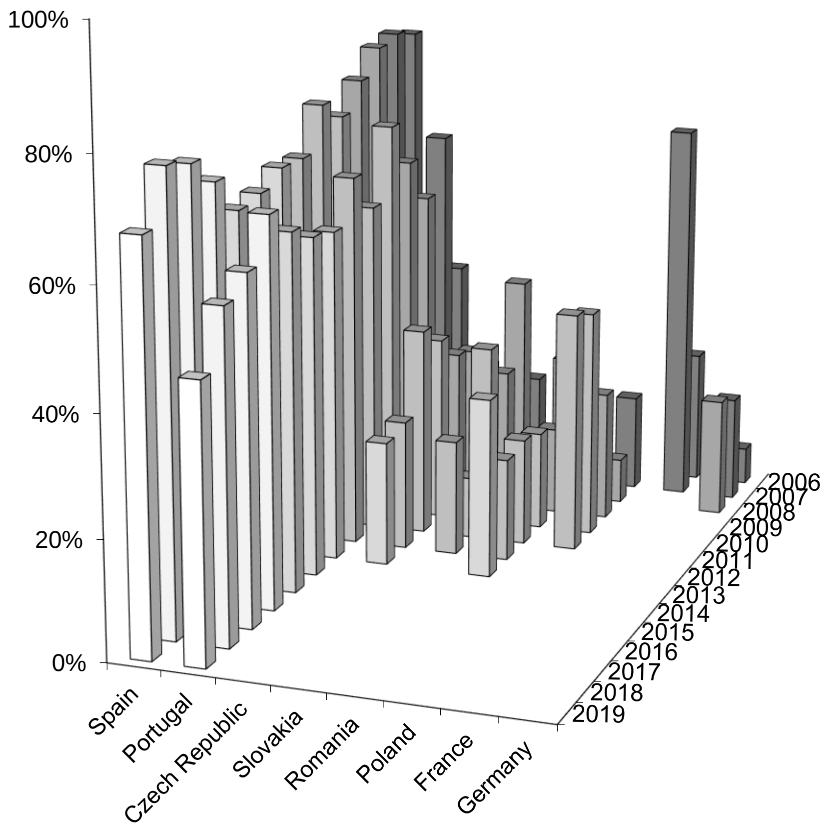

Figure 9: Mean percentage of MON 810 cultivation area of total maize area per farmer in 2006 - 2019 (surveyed countries only)

In 2019, MON 810 was cultivated on 1 - 65 fields per farm. On average, every farmer cultivated MON 810 on 4.44 fields (Table 15).

Table 15: Number of fields with MON 810 in 2019

Valid N	Mean	Minimum	Maximum	Sum
249	4.44	1	65	1105

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 2019. 40 different MON 810 varieties and 62 different conventional maize varieties were listed. The most frequently listed varieties (at least 6 times) with their respective frequencies are listed in Table 16.

Table 16: Names of most frequent MON 810 and conventional maize varieties in 2019

MON 810 maize		Conventional maize	
Variety	**Frequency**	**Variety**	**Frequency**
P 0937 Y	62	P 0937	47
DKC 6729 YG	51	P 1921	32
P 1570 Y	48	DKC 6980	32
P 1921 Y	37	DKC 5031	29
DKC 5032 YG	35	P 1570	29
DKC 6631 YG	18	DKC 6728	20
DKC 5741 YG	14	DKC5741	15
DKC 6351 YG	13	P 0933	14
MAS 69 YG	12	P 1574	8
Kendras YG	10	Kayras	6
P 1574 Y	10	ES Zoom	6
P 0933 Y	9	Kefieros	6
LG 30690 YG	8		
ES Zoom YG	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 and Figure 10 summarize the reported soil types of the maize grown area.

Table 17: Predominant soil type of maize grown area in 2019

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	very fine	2	0.8	0.8	0.8
	fine	49	19.6	19.6	20.4
	medium	127	50.8	50.8	71.2
	medium-fine	50	20.0	20.0	91.2
	coarse	14	5.6	5.6	96.8
	no predominant soil type	8	3.2	3.2	100.0
Total		**250**	**100.0**	**100.0**	

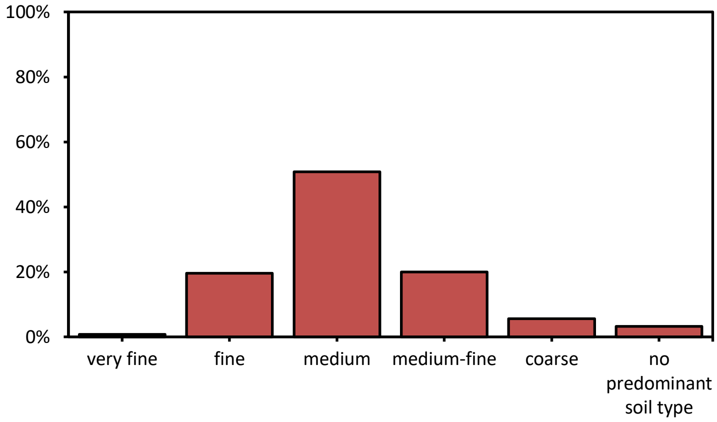

Figure 10: Predominant soil type of maize grown area in 2019

Farmers' responses regarding the soil quality of the maize-grown areas are given in Table 18 and Figure 11. 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 2019

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	below average - poor	2	0.8	0.8	0.8
	average - normal	188	75.2	75.2	76.0
	above average - good	60	24.0	24.0	100.0
Total		**250**	**100.0**	**100.0**	

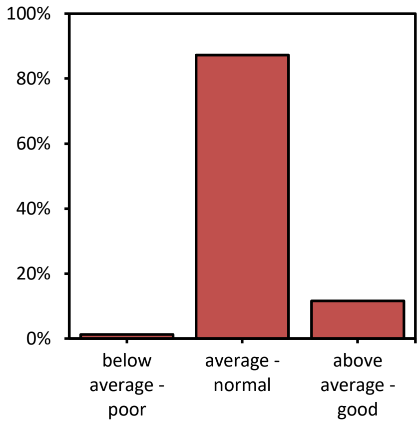

Figure 11: Soil quality of the maize grown area as assessed by the farmers in 2019

124 farmers were able to specify the humus content (not a commonly known measure all over Europe), which ranged from 0.0 % to 3.0 % with a mean of 1.7 % (Table 19). 126 farmers did not specify the humus content.

Table 19: Humus content (%) in 2019

Valid N	Mean	Minimum	Maximum	Missing N
124	1.7	0.0	3.0	126

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 data point at any environmental influence on 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 96.4 % (241/250) of the farmers (Table 20, Figure 12).

Table 20: Farmers assessment of the local disease pressure (fungal, viral) in 2019

		Frequency	**Percent**	**Valid percentages**	**Accumulated percentages**
Valid	low	100	40.0	40.0	40.0
	as usual	141	56.4	56.4	96.4
	high	9	3.6	3.6	100.0
Total		**250**	**100.0**	**100.0**	

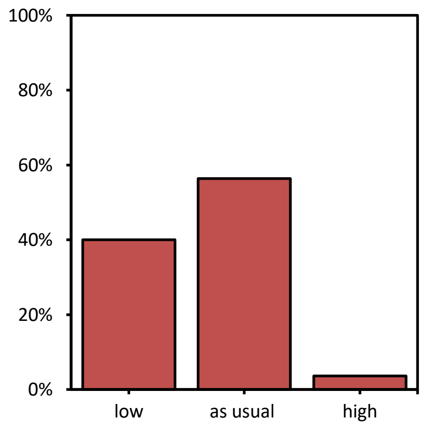

Figure 12: Farmers assessment of the local disease pressure (fungal, viral) in 2019

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

Regarding the local pest pressure (insects, mites, nematodes), 47.6 % (122/250) of the farmers evaluated it to be *low* or *as usual* and 52.4 % (131/250) evaluated it to be *high* (Table 21, Figure 13).

Table 21: Farmers assessment of the local pest pressure (insects, mites, nematodes) in 2019

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	low	37	14.8	14.8	14.8
	as usual	82	32.8	32.8	47.6
	high	131	52.4	52.4	100.0
Total		**250**	**100.0**	**100.0**	

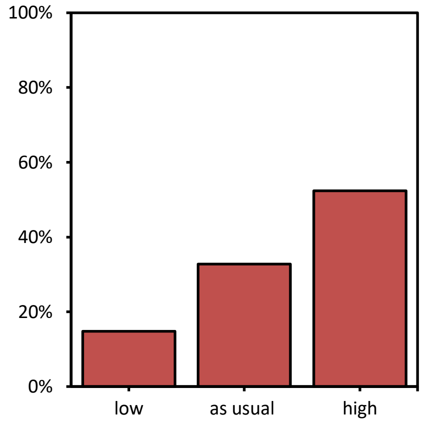

Figure 13: Farmers assessment of the local pest pressure (insects, mites, nematodes) in 2019

3.2.6.3 Local weed pressure as assessed by the farmers

96.8 % (242/250) assessed the local weed pressure to be *low* or *as usual* and 3.2 % (8/250) evaluated it to be *high* (Table 22, Figure 14).

Table 22: Farmers assessment of the local weed pressure in 2019

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	low	17	6.8	6.8	6.8
	as usual	225	90.0	90.0	96.8
	high	8	3.2	3.2	100.0
Total		**250**	**100.0**	**100.0**	

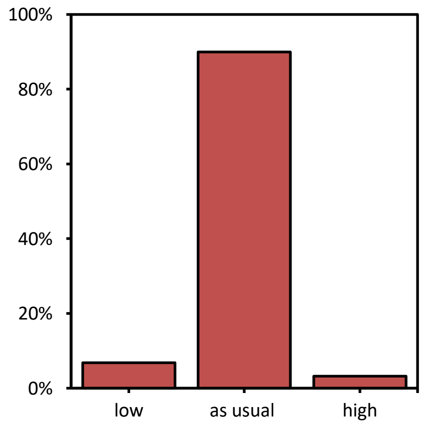

Figure 14: Farmers assessment of the local weed pressure in 2019

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 2019

		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 farmers used Sprinkler (49.6 %) or Gravity (33.6 %) irrigation followed by Pivot (10.4 %). The remaining 16 farmers used more than one of the named systems or other types of irrigation (Table 24, Figure 15).

Table 24: Irrigation types of maize grown area in 2019

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	Sprinkler	124	49.6	49.6	49.6
	Gravity	84	33.6	33.6	83.2
	Pivot	26	10.4	10.4	93.6
	other	14	5.6	5.6	99.2
	Gravity and Pivot	1	0.4	0.4	99.6
	Sprinkler and Pivot	1	0.4	0.4	100.0
Total		**250**	**100.0**	**100.0**	

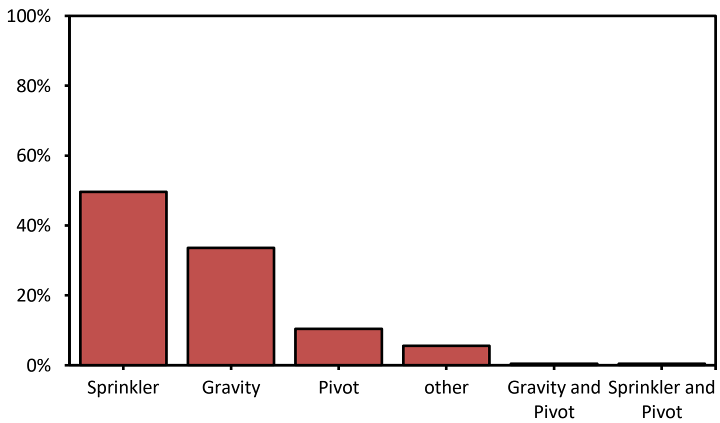

Figure 15: Irrigation types of maize grown area in 2019

3.3.2 Major rotation of maize grown area

The main crop rotation within three years is *maize-maize-maize* followed by *wheat-maize-maize*, *barley-maize-maize* and *maize-barley-maize*. More crop rotations were mentioned, but all with frequencies lower than 20 (Table 25).

Table 25: Major rotation of maize grown area before 2019 planting season (two years ago and previous year) sorted by frequency.

	Two years ago	Previous year	Frequency	Valid Percentage	Accumulated percentage
Valid	maize	maize	95	38.5	38.5
	wheat	maize	30	12.1	12.1
	barley	maize	22	8.9	8.9
	maize	barley	20	8.1	8.1
	maize	wheat	10	4.0	4.0
	maize	tomato	9	3.6	3.6
	maize	pea	7	2.8	2.8
	maize	cotton	5	2.0	2.0
	alfalfa	maize	4	1.6	1.6
	tomato	maize	4	1.6	1.6
	alfalfa	alfalfa	4	1.6	1.6
	wheat	wheat	4	1.6	1.6
	barley	barley	3	1.2	1.2
	pea	maize	2	0.8	0.8
	onion	wheat	2	0.8	0.8
	ryegrass	ryegrass	2	0.8	0.8
	vegetables	maize	1	0.4	0.4
	no cultivation	maize	1	0.4	0.4
	cotton	maize	1	0.4	0.4
	maize / ryegrass	maize	1	0.4	0.4
	sunflower	maize	1	0.4	0.4
	tomato	rape	1	0.4	0.4
	maize	vegetables	1	0.4	0.4
	barley	vegetables	1	0.4	0.4
	no cultivation	no cultivation	1	0.4	0.4
	tomato	cotton	1	0.4	0.4
	pea / potato	Potato / Cabbage / Pea	1	0.4	0.4
	Oat / Tomato	Oat / Tomato	1	0.4	0.4
	maize	beans	1	0.4	0.4
	pea / potato / cabbage	potatoe / pea	1	0.4	0.4
	pea / cabbage / potato	potatoe / pea	1	0.4	0.4
	multiple	pea	1	0.4	0.4
	pea	barley	1	0.4	0.4
	maize	sunflower	1	0.4	0.4
	tomato	sunflower	1	0.4	0.4
	alfalfa	wheat	1	0.4	0.4
	barley	ryegrass	1	0.4	0.4
	maize	onion	1	0.4	0.4
	tomato	tomato	1	0.4	0.4
	pea	spinach	1	0.4	0.4
Total			**250**	**100.0**	

3.3.3 Soil tillage practices

The farmers were asked to answer whether they performed soil tillage. 97.2 % (243/250) said *yes* (Table 26, Figure 16) while 2.8 % (7/250) answered *no*.

Table 26: Soil tillage practices in 2019

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	yes	243	97.2	97.2	97.2
	no	7	2.8	2.8	100.0
Total		**250**	**100.0**	**100.0**	

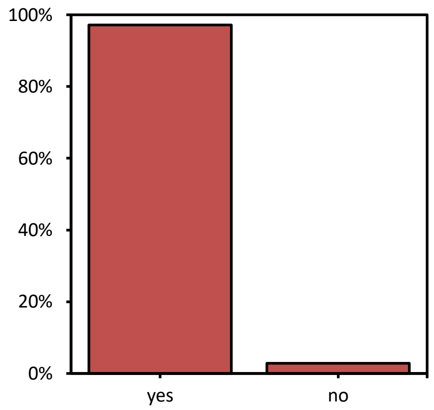

Figure 16: Soil tillage practices in 2019

All farmers who said *yes* specified the time of tillage. 10.7 % (26/243) performed it in *winter*, 89.3 % (217/243) in *spring* and no one in *winter and spring* (Table 27, Figure 17).

Table 27: Time of tillage in 2019

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	winter	26	10.4	10.7	10.7
	spring	217	86.8	89.3	100.0
	winter & spring	0	0.0	0.0	100.0
	Total	243	97.2	100.0	
Missing	no statement	7	2.8		
Total		250	100.0		

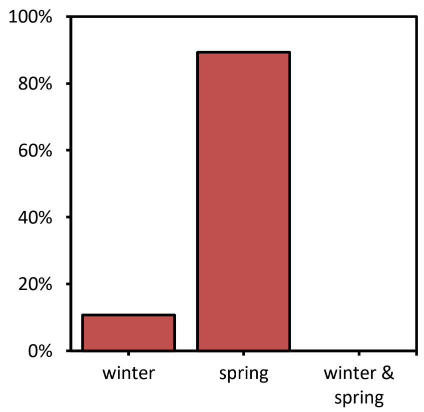

Figure 17: Time of tillsage in 2019

3.3.4 Maize planting technique

95.2 % (238/250) of the farmers used *conventional* maize planting techniques, 2.8 % (7/250) *direct sowing* and 2.0 % (5/250) used *mulch* (Table 28, Figure 18).

Table 28: Maize planting technique in 2019

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	conventional planting	238	95.2	95.2	95.2
	direct sowing	7	2.8	2.8	98.0
	mulch	5	2.0	2.0	100.0
Total		**250**	**100.0**	**100.0**	

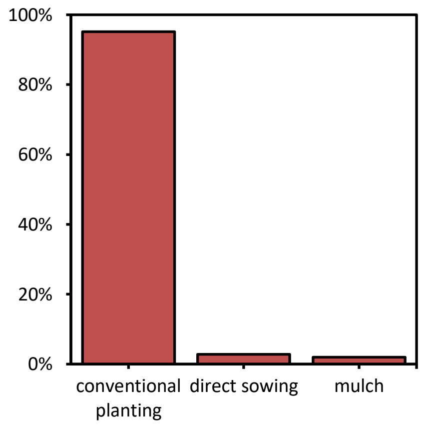

Figure 18: Maize planting technique in 2019

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 97.2 % of the farmers (243/250) applied *insecticides* and 2.8 % (7/243) of them applied *insecticides against corn borers*. 3.2 % of the farmers (8/250) used *mechanical weed control*. All of the farmers (250/250) used *herbicides*. None of the farmers used *fungicides* or *biocontrol treatment* (Table 29).

Table 29: Typical weed and pest control practices in maize in 2019

Insecticide(s)		**Frequency**	**Percent**
	yes	243	97.2
	no	7	2.8
Total		250	250
Insecticide(s) against Corn Borer		**Frequency**	**Percent**
	yes	7	2.8
	no	236	94.4
	Total	243	
Missing	no statement	7	2.8
Total		250	250
Use of biocontrol treatments		**Frequency**	**Percent**
	yes	0	0.0
	no	250	100.0
Total		250	100.0
Herbicide(s)		**Frequency**	**Percent**
	yes	250	100.0
	no	0	0.0
Total		250	100.0
Mechanical weed control		**Frequency**	**Percent**
	yes	8	3.2
	no	242	96.8
Total		250	250
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

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

Table 30: Application of fertilizer to maize grown area in 2019

		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 28 Feburary 2019 to 10 July 2019 (Table 31).

Table 31: Typical time of maize sowing in 2019

	Minimum	Maximum	Mean	Valid N
Sowing from	28.02.2019	01.07.2019	16.04.2019	250
Sowing till	10.03.2019	10.07.2019	08.05.2019	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 2019 to 20 February 2020 and for forage maize from 15 July 2019 to 11 November 2019 (Table 32).

Table 32: Typical time of maize harvest in 2019

	Minimum	Maximum	Mean	Valid N
Harvest grain maize from	20.08.2019	10.02.2020	21.10.2019	238
Harvest grain maize till	25.08.2019	20.02.2020	15.11.2019	238
Harvest forage maize from	15.07.2019	15.10.2019	16.09.2019	29
Harvest forage maize till	20.07.2019	10.11.2019	02.10.2019	29

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 98.8 % (247/250) of the cases (Table 33, Figure 19). 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 2019

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	as usual	247	98.8	98.8	98.8
	changed	3	1.2	1.2	100.0
Total		**250**	**100.0**	**100.0**	

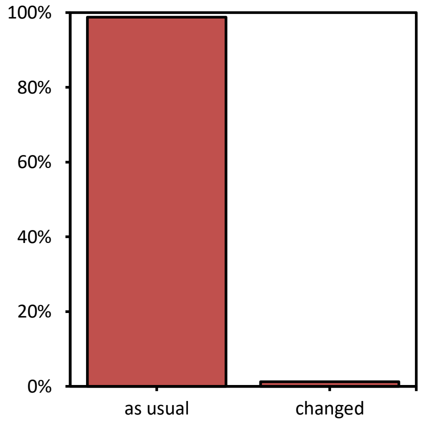

Figure 19: Crop rotation of MON 810 compared to conventional maize in 2019

(1) The valid percentage of $as\ usual$ crop rotation (98.8 %) is significantly greater than 90 %. The resulting p-value is less than the level of significance $\alpha = 0.01$ (Table 34). 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 2019

N valid	$As\ usual$	p-value for $p_{As\ usual}$ = 0.9	$Minus$	p-value for p_{Minus} = 0.1	$Plus$	p-value for p_{Plus} = 0.1
250	247 (98.8%)	< 0.01	-	-	3 (1.2%)	< 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
98.8%	97.0%	100.6%	-	-	-	1.2%	0.0%	3.0%

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 98.8 % (247/250) of the farmers (Table 35, Figure 20). 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 2019

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	earlier	0	0.0	0.0	0.0
	as usual	247	98.8	98.8	98.8
	later	3	1.2	1.2	100.0
Total		**250**	**100.0**	**100.0**	

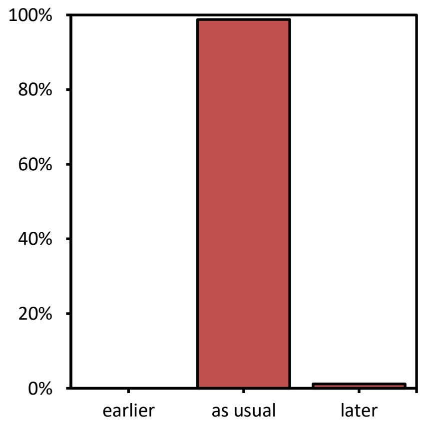

Figure 20: Time of planting of MON 810 compared to conventional maize in 2019

(1) The valid percentage of $as\ usual$ time of planting (98.8 %) is significantly greater than 90 %. The resulting p-value is less than the level of significance $\alpha = 0.01$ (Table 36). 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 2019

N valid	$As\ usual$	p-value for $p_{As\ usual} = 0.9$	$Minus$	p-value for $p_{Minus} = 0.1$	$Plus$	p-value for $p_{Plus} = 0.1$
250	247 (98.8%)	< 0.01	0 (0.0%)	< 0.01	3 (1.2%)	< 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
98.8%	97.0%	100.6%	0.0%	0.0%	0.0%	1.2%	0.0%	3.0%

3.4.1.3 Tillage and planting techniques

One of the farmers (0.4 %) changed their tillage and planting techniques of MON 810 compared to those used for conventional maize (Table 37, Figure 21). The single farmer answering $changed$ gave the following explanation: "I do direct sowing for YieldGard after barley and for the conventional maize conventional sowing after maize".

Table 37: Tillage and planting techniques for MON 810 compared to conventional maize in 2019

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	as usual	249	99.6	99.6	249
	changed	1	0.4	100.0	1
Total		**250**	**100.0**	**100.0**	

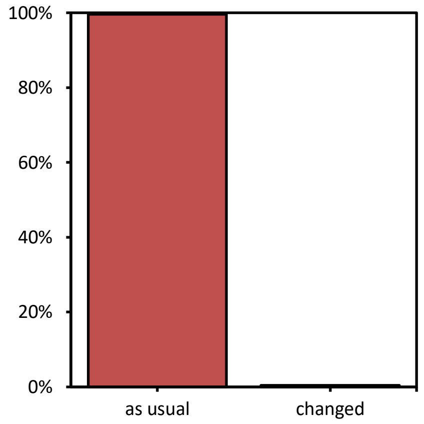

Figure 21: Tillage and planting techniques for MON 810 compared to conventional maize in 2019

(1) The valid percentage of $as\ usual$ tillage and planting techniques (99.6 %) is significantly greater than 90 %. The resulting p-value is less than the level of significance $\alpha = 0.01$ (Table 38). 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 2019

N valid	$As\ usual$	p-value for $p_{As\ usual}$ = 0.9	$Minus$	p-value for p_{Minus} = 0.1	$Plus$	p-value for p_{Plus} = 0.1
250	249 (99.6%)	< 0.01	-	-	1 (0.4%)	< 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
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 3. MON 810 received insecticide treatments mainly through seed coatings, for which Thiacloprid was the major active ingredient in 2019. Abamectin and Lambda-cyhalothrin were the most used active ingredients for spraying, while Chlorpyrifos or Lambda-cyhalothrin were the most commonly used active ingredients in granulate insecticides.

All farmers were asked to describe their insect control practice in MON 810 compared to conventional maize. 96.8 % (242/250) specified no change in practice, while 3.2 % (8/250) used a $different$ program (Table 39, Figure 22).

Table 39: Use of insect control in MON 810 compared to conventional maize in 2019

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	as usual	242	96.8	96.8	96.8
	changed	8	3.2	3.2	100.0
Total		**250**	**100.0**	**100.0**	

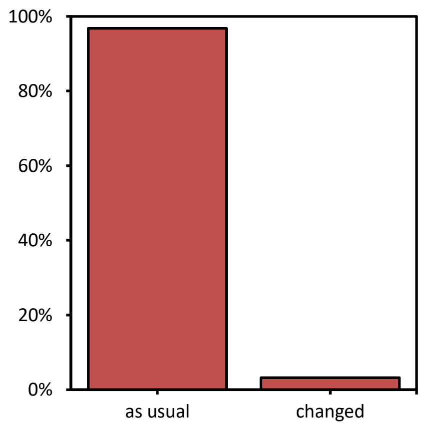

Figure 22: Insect control practice of MON 810 compared to conventional maize in 2019

(1) The valid percentage of $as\ usual$ insect control practice (96.8 %) is significantly greater than 90 %. The resulting p-value is less than the level of significance $\alpha = 0.01$ (Table 40) The null hypothesis $p_{as\ usual} \leq 0.9$ is rejected with a power of 100%.

No 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 2019

N valid	$As\ usual$	p-value for $p_{As\ usual}$ = 0.9	$Minus$	p-value for p_{Minus} = 0.1	$Plus$	p-value for p_{Plus} = 0.1
250	242 (96.8%)	< 0.01	-	-	8 (3.2%)	< 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
96.8%	93.9%	99.7%	-	-	-	3.2%	0.3%	6.1%

All but one farmer who 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 23). All individual explanations are given in Appendix A, Table A 4.

Table 41: Insect control practice compared to conventional maize in the context of the general use of insecticides in 2019

		Insect control practice in MON 810		
		as usual	changed	**Total**
Do you usually use insecticides? (section 3.3.5)	yes	235	8	**243**
	no	7	0	**7**
Total		**242**	**8**	**250**

Table 42: Corn Borer control practice compared to conventional maize in the context of the general use of insecticides against Corn Borer in 2019

		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	7	**7**
	no	236	0	**236**
	no statement	7	0	**7**
Total		**243**	**7**	**250**

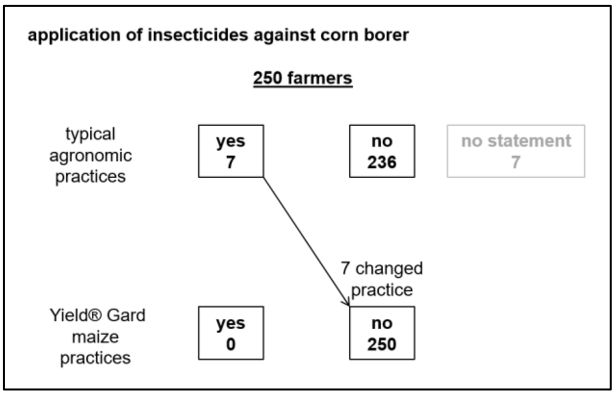

Figure 23: Change of insect control practice in MON 810 compared to conventional maize in 2019

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 5. A wide number of herbicides and actives were used. The main actives of herbicides that were cited by the farmers are:

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

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 2019 compared to conventional maize. 99.6% of the farmers used the same weed control in MON 810 compared to conventional maize, while a single farmer changed the weed control (Table 43, Figure 24). The single farmer (from Spain) applying a different weed control practice stated "*I treat YG with a pre-emergence herbicide and conventional with two herbicides in pre-emergence and after in post-emeregence*".

Table 43: Use of weed control in MON 810 compared to conventional maize in 2019

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	as usual	249	99.6	99.6	99.6
	changed	1	0.4	0.4	100.0
Total		**250**	**100.0**	**100.0**	

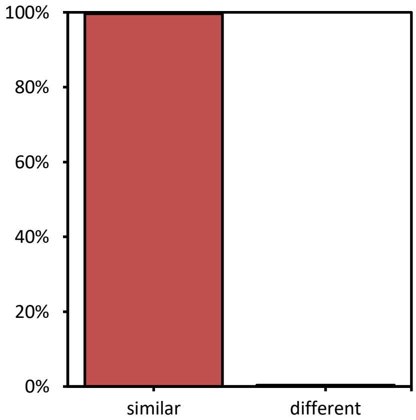

Figure 24: Use of weed control in MON 810 compared to conventional maize in 2019

(1) The valid percentage of $as\ usual$ weed control practice (99.6 %) is significantly greater than 90 %. The resulting p-value is less than the level of significance $\alpha = 0.01$ (Table 44). The null hypothesis $p_{as\ usual} \leq 0.9$ is rejected with a power of 100%.

No effect on weed control practice is indicated.

Table 44: Test results as well as 99% confidence intervals for $p_{As\ usual}$, p_{Minus} and p_{Plus} probabilities of weed control in MON 810 compared to conventional maize in 2019

N valid	$As\ usual$	p-value for $p_{As\ usual} = 0.9$	$Minus$	p-value for $p_{Minus} = 0.1$	$Plus$	p-value for $p_{Plus} = 0.1$
250	249 (99.6%)	< 0.01	-	-	1 (0.4%)	< 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
99.6%	98.6%	100.6%	-	-	-	0.4%	0.0%	1.4%

3.4.1.6 Fungal control practice

Since in 2019 no farmer declared to use a fungicide, no statement about the most common active ingredient in fungicides can be made.

None of the farmers changed their fungal control practice of MON 810 compared to that of conventional maize (Table 45).

Table 45: Use of fungicides on MON 810 compared to conventional maize in 2019

		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 fungal control practice is indicated.

3.4.1.7 Fertilizer application practice

None of the farmers changed their fertilizer application practice of MON 810 compared to that of conventional maize (Table 46).

Table 46: Use of fertilizer in MON 810 compared to conventional maize in 2019

		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

None of the farmers changed their irrigation practice of MON 810 compared to that of conventional maize (Table 47).

Table 47: Irrigation practice in MON 810 compared to conventional maize in 2019

		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**	

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. 247 of them (98.8 %) responded that they did not change the harvesting date for MON 810. 3 farmers (1.2 %) harvested $later$ (Table 48, Figure 25). The complete individual feedback of the farmers for a changed harvesting time is given in Appendix A, Table A 6.

Table 48: Harvest of MON 810 compared to conventional maize in 2019

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	earlier	0	0.0	0.0	0.0
	as usual	247	98.8	98.8	98.8
	later	3	1.2	1.2	100.0
Total		**250**	**100.0**	**100.0**	

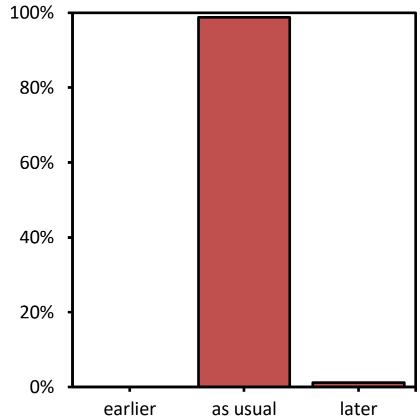

Figure 25: Harvest of MON 810 compared to conventional maize in 2019

(1) The valid percentage of $as\ usual$ harvest of MON 810 (98.8 %) is significantly greater than 90 %. The resulting p-value is less than the level of significance $\alpha = 0.01$ (Table 49). The null hypothesis $p_{as\ usual} \leq 0.9$ is rejected with a power of 100%.

No effect on the harvest time is indicated.

Table 49: 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 2019

N valid	$As\ usual$	p-value for $p_{As\ usual} = 0.9$	$Minus$	p-value for $p_{Minus} = 0.1$	$Plus$	p-value for $p_{Plus} = 0.1$
250	247 (98.8%)	< 0.01	0 (0.0%)	< 0.01	3 (1.2%)	< 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
98.8%	97.0%	100.6%	0.0%	0.0%	0.0%	1.2%	0.0%	3.0%

Assessment of differences in agricultural practice in MON 810 (compared to conventional maize)

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, irrigation practice and insect and corn borer control practice.

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

3.4.2.1 Germination vigour

While 11 farmers (4.4 %) assessed the germination of MON 810 to be $more\ vigorous$, 95.6 % (239/250) found it to be $as\ usual$ (Table 50, Figure 26). Individual explanations for the observations of the farmers are given in Appendix A, Table A 7.

Table 50: Germination of MON 810 compared to conventional maize in 2019

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	less vigourous	0	0.0	0.0	0.0
	as usual	239	95.6	95.6	95.6
	more vigourous	11	4.4	4.4	100.0
Total		**250**	**100.0**	**100.0**	

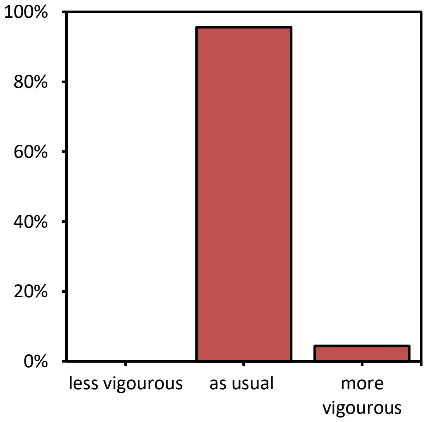

Figure 26: Harvest of MON 810 compared to conventional maize in 2019

(1) The valid percentage of $as\ usual$ germination vigor (95.6 %) is significantly greater than 90 %. The resulting p-value is less than the level of significance $\alpha = 0.01$ (Table 51). The null hypothesis $p_{as\ usual} \leq 0.9$ is rejected with a power of 91%.

No effect on the germination vigor is indicated.

Table 51: 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 2019

N valid	$As\ usual$	p-value for $p_{As\ usual} = 0.9$	$Minus$	p-value for $p_{Minus} = 0.1$	$Plus$	p-value for $p_{Plus} = 0.1$
250	239 (95.6%)	< 0.01	0 (0.0%)	< 0.01	11 (4.4%)	< 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
95.6%	92.3%	98.9%	0.0%	0.0%	0.0%	4.4%	1.1%	7.7%

3.4.2.2 Time to emergence

All of the farmers found the time to emergence to be $as\ usual$ (Table 52). The individual explanation for this observation is given in Appendix A, Table A 7.

Table 52: Time to emergence of MON 810 compared to conventional maize in 2019

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	accelerated	0	0.0	0.0	0.0
	as usual	250	100.0	100.0	100.0
	delayed	0	0.0	0.0	100.0
Total		**250**	**100.0**	**100.0**	

No effect on time to emergence is indicated.

3.4.2.3 Time to male flowering

All of the farmers assessed the time to male flowering to be $as\ usual$ (Table 53). Individual explanations for these observations are given in Appendix A, Table A 7.

Table 53: Time to male flowering of MON 810 compared to conventional maize in 2019

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	accelerated	0	0.0	0.0	0.0
	as usual	250	100.0	100.0	100.0
	delayed	0	0.0	0.0	100.0
Total		**250**	**100.0**	**100.0**	

No effect on time to male flowering is indicated.

3.4.2.4 Plant growth and development

Plant growth and development was assessed to be $delayed$ by one farmer (0.4 %) and to be $as\ usual$ in 99.6 % (249/250) of all cases (Table 54, Figure 27). Individual explanations for these observations are given in Appendix A, Table A 7.

Table 54: Plant growth and development of MON 810 compared to conventional maize in 2019

		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**	

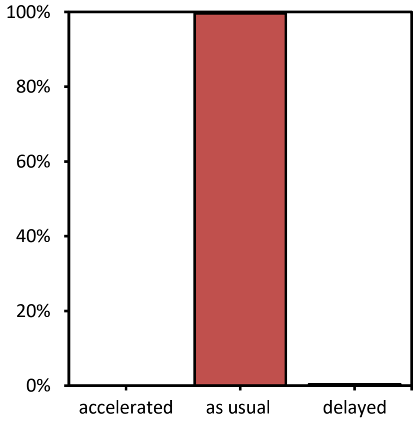

Figure 27: Plant growth and development of MON 810 compared to conventional maize in 2019

(1) The valid percentage of $as\ usual$ plant growth and development (99.6 %) is significantly greater than 90 %. The resulting p-value is less than the level of significance $\alpha = 0.01$ (Table 55). The null hypothesis $p_{as\ usual} \leq 0.9$ is rejected with a power of 100%.

No effect on plant growth and development is indicated.

Table 55: 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 2019

N valid	$As\ usual$	p-value for $p_{As\ usual} = 0.9$	$Minus$	p-value for $p_{Minus} = 0.1$	$Plus$	p-value for $p_{Plus} = 0.1$
250	249 (99.6%)	< 0.01	0 (0.0%)	< 0.01	1 (0.4%)	< 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
99.6%	98.6%	100.6%	0.0%	0.0%	0.0%	0.4%	0.0%	1.4%

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 23.6 % (59/250) of all cases and $as\ usual$ in 76.4 % (191/250) (Table 56, Figure 28). Individual explanations for these observations are given in Appendix A, Table A 7.

Table 56: Incidence of stalk/root lodging of MON 810 compared to conventional maize in 2019

		Frequency	**Percent**	**Valid percentages**	**Accumulated percentages**
Valid	less often	59	23.6	23.6	23.6
	as usual	191	76.4	76.4	100.0
	more often	0	0.0	0.0	100.0
Total		**250**	**100.0**	**100.0**	

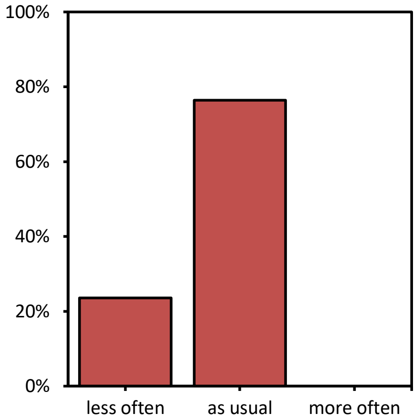

Figure 28: Incidence of stalk/root lodging of MON 810 compared to conventional maize in 2019

(1) The valid percentage of $as\ usual$ incidence of stalk/root lodging (76.4 %) is less than 90 %. The resulting p-value is larger than the level of significance $\alpha = 0.01$ (Table 57) and therefore, the corresponding null hypothesis $p_{as\ usual} \leq 0.9$ could not be rejected.

(2) The valid percentage of $less$ incidence of stalk/root lodging (23.6 %) exceeds the 10 % threshold. The resulting p-value is larger than the level of significance $\alpha = 0.01$ (Table 57) and therefore, the corresponding null hypothesis $p_{less\ often} \geq 0.1$ could not be rejected.

The valid percentage of $more$ incidence of stalk/root lodging (0.0 %) is significantly smaller than 10 %. The resulting p-value is smaller than the level of significance $\alpha = 0.01$ (Table 57). The null hypothesis $p_{more\ often} \geq 0.1$ is rejected with a power of 100%.

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

Table 57: 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 2019

N valid	$As\ usual$	p-value for $p_{As\ usual}$ = 0.9	$Minus$	p-value for p_{Minus} = 0.1	$Plus$	p-value for p_{Plus} = 0.1
250	191 (76.4%)	1.0	59 (23.6%)	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
76.4%	69.5%	83.3%	23.6%	16.7%	30.5%	0.0%	0.0%	0.0%

3.4.2.6 Time to maturity

2.8 % (7/250) of the farmers assessed the time to maturity to be $delayed$ for MON 810 and $as\ usual$ in 97.2 % (243/250) (Table 58, Figure 29). Individual explanations for these observations are given in Appendix A, Table A 7.

Table 58: Time to maturity of MON 810 compared to conventional maize in 2019

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	accelerated	0	0.0	0.0	0.0
	as usual	243	97.2	97.2	97.2
	delayed	7	2.8	2.8	100.0
Total		**250**	**100.0**	**100.0**	

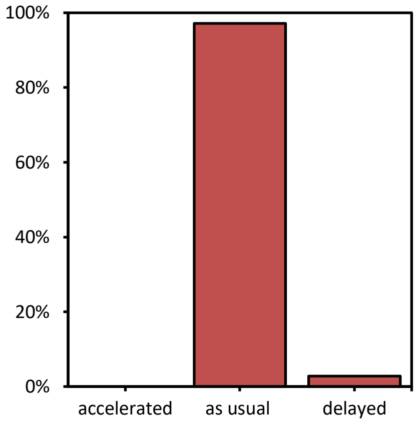

Figure 29: Time to maturity of MON 810 compared to conventional maize in 2019

(1) The valid percentage of $as\ usual$ time to maturity (97.2 %) is significantly greater than 90 %. The resulting p-value is less than the level of significance $\alpha = 0.01$ (Table 59). The null hypothesis $p_{as\ usual} \leq 0.9$ is rejected with a power of 85%.

No effect on time to maturity is indicated.

Table 59: 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 2019

N valid	$As\ usual$	p-value for $p_{As\ usual} = 0.9$	$Minus$	p-value for $p_{Minus} = 0.1$	$Plus$	p-value for $p_{Plus} = 0.1$
250	243 (97.2%)	< 0.01	0 (0.0%)	< 0.01	7 (2.8%)	< 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
97.2%	94.5%	99.9%	0.0%	0.0%	0.0%	2.8%	0.1%	5.5%

3.4.2.7 Yield

Yield was found to be $higher$ in 33.2 % (83/250) and $as\ usual$ in 66.8 % (167/255) of all cases (Table 60, Figure 30). Individual explanations for these observations are given in Appendix A, Table A 7.

Table 60: Yield of MON 810 compared to conventional maize in 2019

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	lower yield	0	0.0	0.0	0.0
	as usual	167	66.8	66.8	66.8
	higher yield	83	33.2	33.2	100.0
Total		**250**	**100.0**	**100.0**	

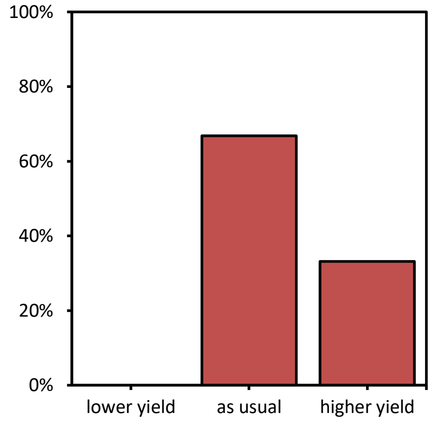

Figure 30: Yield of MON 810 compared to conventional maize in 2019

(1) The valid percentage of $as\ usual$ yield (66.8 %) is smaller than 90 %. The resulting p-value is larger than the level of significance $\alpha = 0.01$ (Table 61) and therefore, the corresponding null hypothesis $p_{as\ usual} \leq 0.9$ could not be rejected.

(2) The valid percentage of $lower$ yield (0.0 %) is significantly smaller than 10 %. The resulting p-value is smaller than the level of significance $\alpha = 0.01$ (Table 61). The null hypothesis $p_{lower\ yield} \geq 0.1$ is rejected with a power of 100%.

The valid percentage of $higher$ yield (33.2 %) exceeds the 10 % threshold. The resulting p-value is greater than the level of significance $\alpha = 0.01$ (Table 61) and therefore, the corresponding null hypothesis $p_{higher\ yield} \geq 0.1$ could not be rejected.

An effect on yield of MON 810 is indicated.

Table 61: 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 2019

N valid	$As\ usual$	p-value for $p_{As\ usual}$ = 0.9	$Minus$	p-value for p_{Minus} = 0.1	$Plus$	p-value for p_{Plus} = 0.1
250	167 (66.8%)	1.0	0 (0.0%)	< 0.01	83 (33.2%)	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
66.8%	59.1%	74.5%	0.0%	0.0%	0.0%	33.2%	25.5%	40.9%

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 2.0 % (5/250) and $as\ usual$ in 98.0 % (245/250) of all cases (Table 62, Figure 31). Individual explanations for these observations are given in Appendix A, Table A 7.

Table 62: Occurrence of MON 810 volunteers compared to conventional maize in 2019

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	less often	5	2.0	2.0	2.0
	as usual	245	98.0	98.0	100.0
	more often	0	0.0	0.0	100.0
Total		**250**	**100.0**	**100.0**	

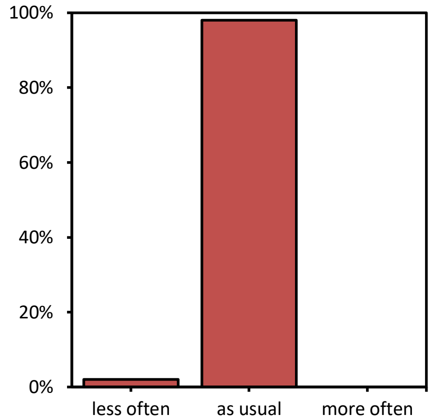

Figure 31: Occurrence of MON 810 volunteers compared to conventional maize in 2019

(1) The valid percentage of $as\ usual$ occurrence of volunteers (98.0 %) is significantly greater than 90 %. The resulting p-value is smaller than the level of significance $\alpha = 0.01$ (Table 63). The null hypothesis $p_{as\ usual} \leq 0.9$ is rejected with a power of 77%.

No effect on occurrence of MON 810 volunteers is indicated.

Table 63: 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 2019

N valid	$As\ usual$	p-value for $p_{As\ usual} = 0.9$	$Minus$	p-value for $p_{Minus} = 0.1$	$Plus$	p-value for $p_{Plus} = 0.1$
250	245 (98.0%)	< 0.01	5 (2.0%)	< 0.01	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
98.0%	95.7%	100.3%	2.0%	0.0%	4.3%	0.0%	0.0%	0.0%

Assessment of differences in the characteristics of MON 810 in the field (compared to conventional maize)

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

- an unchanged 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 unchanged 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].

Corn borer damage affects especially yield negatively, therefore the differences in yield 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.

All additional observations during plant growth are listed in Appendix A, Table A 8.

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

Farmers assessed MON 810 to be $less\ susceptible$ to diseases in 2.0 % (5/250) of the time (Table 64, Figure 32).

Table 64: Disease susceptibility in MON 810 compared to conventional maize in 2019

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	less susceptible	5	2.0	2.0	2.0
	as usual	245	98.0	98.0	100.0
	more susceptible	0	0.0	0.0	100.0
Total		**250**	**100.0**	**100.0**	

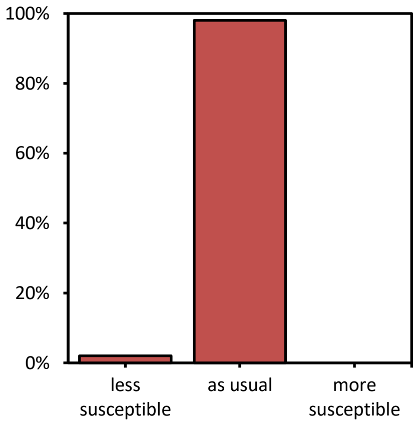

Figure 32: Disease susceptibility of MON 810 compared to conventional maize in 2019

(1) The valid percentage of $as\ usual$ disease susceptibility (98.0 %) is greater than 90 %. The resulting p-value is greater than the level of significance $\alpha = 0.01$ (Table 65) The null hypothesis $p_{as\ usual} \leq 0.9$ is rejected with a power of 100%.

No effect on disease susceptibility is indicated.

Table 65: 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 2019

N valid	$As\ usual$	p-value for $p_{As\ usual} = 0.9$	$Minus$	p-value for $p_{Minus} = 0.1$	$Plus$	p-value for $p_{Plus} = 0.1$
250	245 (98.0%)	< 0.01	5 (2.0%)	< 0.01	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
98.0%	95.7%	100.3%	2.0%	0.0%	4.3%	0.0%	0.0%	0.0%

The 5 farmers that answered different from $as\ usual$ were asked to specify the difference in disease susceptibility by listing the diseases with an explanation. Table 66 lists the reported diseases with an assessment of the disease susceptibility of MON 810 compared to conventional maize. This list shows that the different susceptibility was attributed to a lower susceptibility to *Fusariosis* (0.8 %, 2/250), *Hongos generos fusarium* 0.4 %, 1/250*), Ustilago maydis* (0.4 %, 1/250) and *Sphacelotheca reiliana (*0.4 %, 1/250).

Table 66: Specification of differences in disease susceptibility in MON 810 compared to conventional maize in 2019

Group	Species	More	Less
Fungus	*Fusariosis*	0	2
	Hongos generos fusarium	0	1
	Ustilago maydis	0	1
	Sphacelotheca reiliana	0	1

Additional comments on disease susceptibility are given in Appendix A, Table A 9.

Assessment of differences in disease susceptibility in MON 810 fields (compared to conventional maize)

The 5 farmers reported less disease susceptibility to some fungal species, specified as *Fusariosis*, *Hongos generos fusarium, Ustilago maydis* and *Sphacelotheca reiliana.*

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' comments (Appendix A, Table A 9) 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 67, Figure 33).

Table 67: Insect pest control of *O. nubilalis* in MON 810 in 2019

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	weak	0	0.0	0.0	0.0
	good	36	14.4	14.4	14.4
	very good	214	85.6	85.6	100.0
Total		**250**	**100.0**	**100.0**	

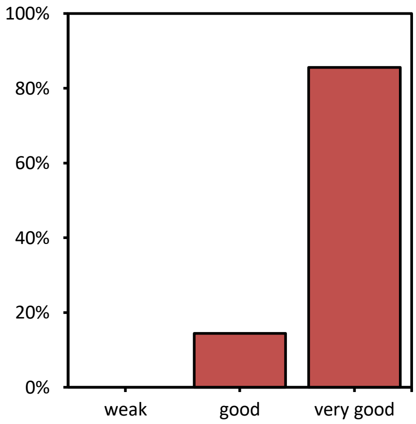

Figure 33: Insect pest control of *Ostrinia nubilalis* in MON 810 in 2019

100.0 % (250/250) of the farmers attested a *good* or *very good* control of *Sesamia* spp. (Pink Borer) (Table 68, Figure 34).

Table 68: Insect pest control of *Sesamia* spp. in MON 810 in 2019

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	weak	0	0.0	0.0	0.0
	good	36	14.4	14.4	14.4
	very good	214	85.6	85.6	100.0
Total		**250**	**100.0**		

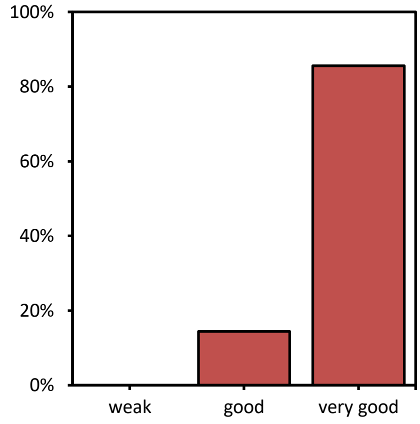

Figure 34: Insect pest control of *Sesa mia* spp. in MON 810 in 2019

Additional comments on insect pest control are listed in Appendix A, Table A 10.

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 6.4 % (16/250) of all cases (Table 69, Figure 35).

Table 69: Pest susceptibility of MON 810 compared to conventional maize in 2019

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	less susceptible	16	6.4	6.4	6.4
	as usual	234	93.6	93.6	100.0
	more susceptible	0	0.0	0.0	100.0
Total		**250**	**100.0**		

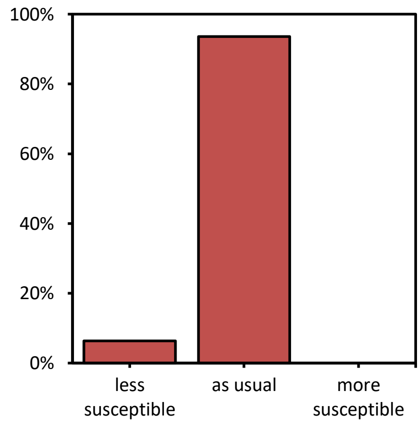

Figure 35: Pest susceptibility of MON 810 compared to conventional maize in 2019

(1) The valid percentage of $as\ usual$ susceptibility (93.6 %) is greater than 90 %. However, the resulting p-value is larger than the level of significance $\alpha = 0.01$ (Table 70) and therefore, the corresponding null hypothesis $p_{as\ usual} \leq 0.9$ could not be rejected.

(2) The valid percentage of $lower$ susceptibility (6.4 %) is significantly smaller than 10 %. The resulting p-value is smaller than the level of significance $\alpha = 0.01$ (Table 70). The null hypothesis $p_{lower\ yield} \geq 0.1$ is rejected with a power of 36%.

The valid percentage of $higher$ susceptibility (0.0 %) is significantly smaller than 10 %. The resulting p-value is smaller than the level of significance $\alpha = 0.01$ (Table 70). The null hypothesis $p_{lower\ yield} \geq 0.1$ is rejected with a power of 100%.

No effect on pest susceptibility of MON 810 is indicated.

Table 70: 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 2019

N valid	$As\ usual$	p-value for $p_{As\ usual}$ = 0.9	$Minus$	p-value for p_{Minus} = 0.1	$Plus$	p-value for p_{Plus} = 0.1
250	234 (93.6%)	0.018	16 (6.4%)	0.031	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
93.6%	89.6%	97.6%	6.4%	2.4%	10.4%	0.0%	0.0%	0.0%

The 16 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 71 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 71: Specification of differences in pest susceptibility in MON 810 compared to conventional maize in 2019

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	241 (96.4%)	< 0.01	9 (3.6%)	< 0.01	0 (0.0%)	< 0.01
	Spodoptera Frugiperda	250	244 (97.6%)	< 0.01	6 (2.4%)	< 0.01	0 (0.0%)	< 0.01
	Heliothis	250	245 (98.0%)	< 0.01	5 (2.0%)	< 0.01	0 (0.0%)	< 0.01
	Mythimna spp. (Mitima)	250	248 (99.2%)	< 0.01	2 (0.8%)	< 0.01	0 (0.0%)	< 0.01
Coleoptera	Diabrotica / Agriotes	250	246 (98.4%)	< 0.01	4 (1.6%)	< 0.01	0 (0.0%)	< 0.01

What becomes clear in Table 71 is that for all listed pests

(1) the valid percentages of $as\ usual$ pest susceptibility in MON 810 compared to conventional maize in 2019 are greater than 90 %. The resulting p-values are smaller than the level of significance $\alpha = 0.01$. The null hypotheses $p_{as\ usual} \leq 0.9$ could be rejected with a power of 98 %, 100 %, 100 %, 100 %, and 100 % for *Agrotis ipsilon, Spodoptera frugiperda, Heliothis, Mythimna spp. (Mitima),* and Diabrotica / Agriotes, 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 11.

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

The data suggests 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 farmers (249/249) found the weed pressure to be *as usual* in MON 810 fields compared to conventional fields (Table 72).

Table 72: Weed pressure in MON 810 compared to conventional maize in 2019

		Frequency	**Percent**	**Valid percentages**	**Accumulated percentages**
Valid	less weeds	0	0.0	0.0	0.0
	as usual	249	99.6	100.0	100.0
	more weeds	0	0.0	0.0	100.0
	Total	249	99.6	100.0	
	No statement	1	0.4		
Total		**250**	**100.0**		

No effect on weed pressure is indicated.

The farmers were asked to name the three most abundant weeds in their MON 810 fields. Weeds that were listed more than 25 times are:

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

All named weeds and the corresponding frequencies of nomination are listed in Appendix A,Table A 12.

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

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

All farmers (250/250) assessed the occurrence of non target insects in MON 810 fields to be $as\ usual$ (Table 73).

Table 73: Occurrence of non target insects in MON 810 compared to conventional maize in 2019

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	less	0	0.0	0.0	0.0
	as usual	250	100.0	100.0	100.0
	more	0	0.0	0.0	100.0
Total		**250**	**100.0**	**100.0**	

No effect on the occurrence of non target insects is indicated.

3.4.7.2 Occurrence of birds

Three farmers (1.2%) assessed the occurrence of non target birds in MON 810 fields to be $less$, while 98.8% (247/250) farmers found it to be $as\ usual$ (Table 74).

Table 74: Occurrence of birds in MON 810 compared to conventional maize in 2019

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	less	3	1.2	1.2	1.2
	as usual	247	98.8	98.8	100.0
	more	0	0.0	0.0	100.0
Total		**250**	**100.0**		

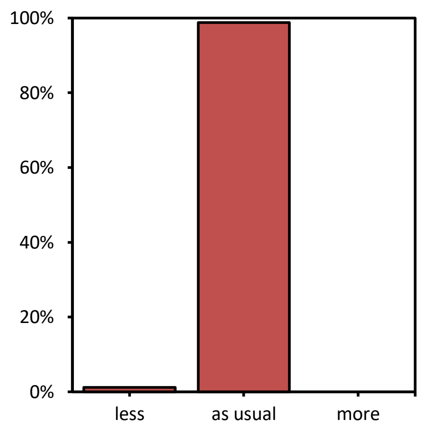

Figure 36: Occurrence of birds in MON 810 compared to conventional maize in 2019

(1) The valid percentage of $as\ usual$ occurrence of birds (98.8 %) is greater than 90 %. The resulting p-value is greater than the level of significance $\alpha = 0.01$ (Table 75) The null hypothesis $p_{as\ usual} \leq 0.9$ is rejected with a power of 100%.

No effect on occurrence of birds is indicated.

Table 75: Test results as well as 99% confidence intervals for $p_{As\ usual}$, p_{Minus} and p_{Plus} probabilities of occurrence of birds in MON 810 compared to conventional maize in 2019

N valid	*As usual*	p-value for $p_{As\ usual}$ = 0.9	*Minus*	p-value for p_{Minus} = 0.1	*Plus*	p-value for p_{Plus} = 0.1
250	247 (98.8%)	< 0.01	3 (1.2%)	< 0.01	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
98.8%	97.0%	100.6%	1.2%	0.0%	3.0%	0.0%	0.0%	0.0%

3.4.7.3 Occurrence of mammals

All farmers (249/249) assessed the occurrence of non target mammals in MON 810 fields to be *as usual* (Table 76). One farmer did not know.

Table 76: Occurrence of mammals in MON 810 compared to conventional maize in 2019

		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	
	No statement	1	0.4		
	Do not know	0	0.0		
Total		**250**	**100.0**		

No effect on the occurrence of mammals is indicated.

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 mostly unchanged for non target insects, birds and mammals. Only three of the farmers stated that they found a lower bird occurence. All additional comments given by farmers in this regard can be found in Table A 13.

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)

1.6 % (4/250) of the farmers used the harvest of MON 810 to feed their animals (Table 77, Figure 37). 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 1.6 % of the surveyed farmers fed MON 810, however, there are no strong data supporting this assumption.

Table 77: Use of MON 810 harvest for animal feed in 2019

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	yes	4	1.6	1.6	1.6
	no	246	98.4	98.4	100.0
Total		**250**	**100.0**	**100.0**	

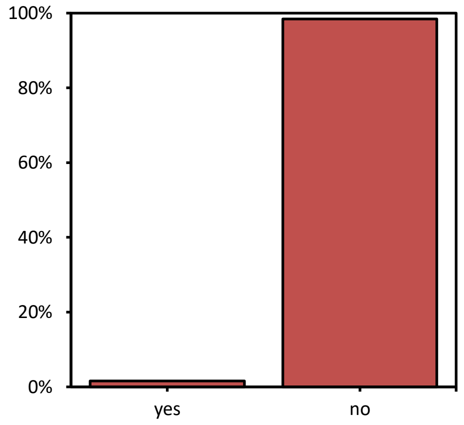

Figure 37: Use of MON 810 harvest for animal feed in 2019

Out of the 4 farmers who did feed the harvest of MON 810 to their animals, 100.0 % (4/4) found the performance of their animals to be *as usual* when compared to animals fed with conventional maize (Table 78).

Table 78: Performance of animals fed MON 810 compared to animals fed conventional maize in 2019

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	as usual	5	100.0	100.0	100.0
	changed	0	0.0	0.0	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 2019 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

99.6 % (249/250) of the farmers reported to have been informed about the good agricultural practices applicable to MON 810 (Table 79).

97.2 % (242/249) of the farmers considered the training sessions to be either *useful* or *very useful* (Table 80 and Figure 38). This information indicates that the great majority of the farmers had been exposed to a valuable training concerning MON 810.

Table 79: Information on good agricultural practices in 2019

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	yes	249	99.6	99.6	99.6
	no	1	0.4	0.4	100.0
Total		**250**	**100.0**	**100.0**	

Table 80: Evaluation of training sessions in 2019

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	very useful	39	15.6	15.7	15.7
	useful	203	81.2	81.5	97.2
	not useful	7	2.8	2.8	100.0
	Total	249	99.6	100.0	
Missing	no statement	1	0.4		
Total		**250**	**100.0**		

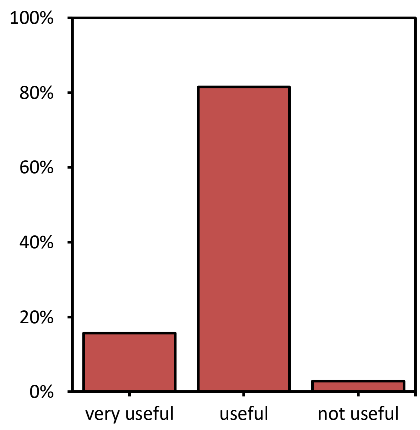

Figure 38: Evaluation of training sessions in 2019

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 (94.8 %) reported that they are following the label recommendations on the seed bags (Table 81 and Figure 39). 13 farmers (5.2 %) 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 81: Compliance with label recommendations in 2019

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	yes	237	94.8	94.8	94.8
	no	13	5.2	5.2	100.0
Total		**250**	**100.0**	**100.0**	

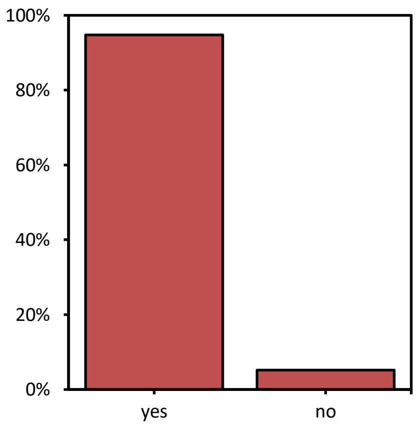

Figure 39: Compliance with label recommendations in 2019

3.5.3 Prevention of insect resistance

84.0 % (210/250) of the farmers did plant a refuge within their farms (Table 82, Figure 40). Additionally, 10.8 % (27/250) 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). 5.2 % (13/250) of the farmers reported that they did not plant a refuge although having more than 5 ha of maize planted on their farm.

Table 82: Planting of a refuge in 2019

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	yes	210	84.0	84.0	84.0
	no, because the surface of Bt maize is < 5 ha	27	10.8	10.8	94.8
	no	13	5.2	5.2	100.0
Total		**250**	**100.0**	**100.0**	

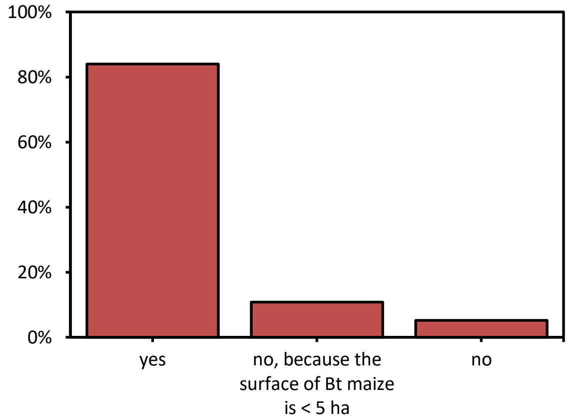

Figure 40: Planting of a refuge in 2019

Therefore, 94.8 % (237/250) 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 83).

Table 83: Refuge implementation per country in 2019

		Refuge implementation			
	Country	**Yes**	**No, because the area of *Bt* maize is < 5 ha**	**No**	**Total**
Valid	Spain	199	27	13	239
	Portugal	11	0	0	11
Total		210	27	13	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 6.1% (13/212) of the farmers who were required to did not plant a refuge, for which two main reasons were given. The first reason was that they feared the yield losses in conventional maize (8/13, 61.5 %), while the second reason was that they had small plots which complicates the sowing (4/13, 30.8 %). All individual reasons for not planting a refuge are listed in Appendix A, Table A 15.

The locations of the *Bt*-maize fields and total number of farmers where no refuges were planted were as follows: Lerida (8 farmers), Huesca (2 farmers), Caceres (1 farmer), Sevilla (1 farmer) and Zaragoza (1 farmer). Further information cannot be provided due to personal data protection obligations (privacy regulations).

4 Conclusions

The analysis of 250 questionnaires from a survey of farmers cultivating MON 810 in 2019 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 2019 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 2019 growing seasons. Currently, the database contains data of 3,627 valid questionnaires. As shown in Table 84 and Table 85 the frequency patterns of farmers' answers in 2019 are similar to those of the previous years in the sense that no new effects have been observed. Instead, it can be noted that the number of results significantly different from $as\ usual$ is relatively low, compared to the years before 2018 and similar to 2018. Further notice, however, that the frequencies in Table 84 and Table 85 had been going down continuously over the last years, so that this is not an unexpected outcome.

After fourteen 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 84: Overview on the frequency of $Minus$[5] answers of the monitoring characters in 2006 - 2019 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	2018	2019
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	0.4	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	0.4	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	0.4	0.0
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	0.0	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	0.0	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	1.2	0.0
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	24.0	23.6
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	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	0.4	0.0
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	5.2	2.0
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	0.8	2.0
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	5.2	6.4
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	0.0	0.0
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	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	0.0	1.2
Occurrence of mammals[2]	-	-	-	0.9	1.1	0.4	0.4	0.4	0.4	0.0	0.4	0.0	0.0	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 85: Overview on the frequency of $Plus^6$ answers of the monitoring characters in 2006 - 2019 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	2018	2019
Crop rotation[2]	-	-	-	0.8	1.8	0.8	4.4	5.9	3.8	6.5	1.6	1.6	0.8	1.2
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	1.6	1.2
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	0.0	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	2.4	3.2
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	0.4	2.8
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	0.0	0.4
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	2.4	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	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	0.0	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	1.2	1.2
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	5.6	4.4
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	0.4	0.0
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	0.4	0.0
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	1.2	0.4
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	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	4.8	2.8
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	27.6	33.2
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	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	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	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	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	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	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	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	0.0	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).

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List of abbreviations

GM	genetically modified
GMO	genetically modified organism
GMP	genetically modified plant

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6 Annex A Tables of free entries

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

Country	Quest. Nr.	Crop rotation	Comments
Spain	5466	changed	I plant YieldGard after barley and I plant conventional after maize
Spain	5522		I plant YieldGard after barley and I plant conventional after maize
Spain	5575		I plant YieldGard after vetch and I plant conventional after maize

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	5466	later	short cycle	YieldGard is short cycle and I plant it later than long cycle conventional
Spain	5522			I plant YieldGard after conventional because it is short cycle
Spain	5575			YieldGard is short cycle and I plant it later than long cycle conventional

Table A 3: 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	201	11	212
Sprayed				
Abamectin	Apache, Asteria, Bersite, Romectin, Vargas 1.8 EC	59	0	59
Acetamiprid	Epik	1	0	1
Chlorantraniliprole	Coragen 20 SC	1	0	1
Chlorpyrifos	Clorpirifos 48, Dursban Proactive	4	0	4
Deltamethrin	Decis	0	1	1
Dimethoate	Quimato 40	2	0	2
Flupyradifurone	Sivanto Prime	1	0	1
Hexitiazox	Jalisco	11	0	11
Lambda-cyhalothrin	Aikido, Atlas, Judo, Karate King, Karate Zeon, Seranggar	5	14	19
Granulated				
Chlorpyrifos	Chas 5 G, Clorifos 5 G, Piritec 5 G, Pison	44	0	44
Lambda-cyhalothrin	TRIKA Lambda 1	21	0	21
Teflutrin	Force 1.5 G	2	0	2

Table A 4: 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	5408	yes	changed	There was ECB attack, I treated conventional with Ampligo. In case of YieldGard it was not necessary because it is resistant to ECB
Spain	5466			YieldGard is treated with Sonido and conventional with a soil insectide.
Spain	5522			I do not treat YieldGard against ECB but conventional yes
Spain	5566			I treat conventional against ECB but no YieldGard because is resistant
Portugal	5378			The farmer producer did not apply any treatments in the YieldGard maize for the control of maize borer.
Portugal	5384			The farmer did not apply any treatments in the YieldGard maize for control of maize borer. The YieldGard plant is protect for maize borer
Portugal	5385			The farmer producer did not apply any treatments in the YieldGard maize for the control of maize borer.
Portugal	5386			The farmer producer did not apply any kind of treatments in the YieldGard maize for the control of maize borer.

Table A 5: Herbicides applied in MON 810 (Section 3.4.1.5)

Active Ingredient	Herbicides as stated by the farmers	Spain	Portugal	Total
(S)-Metolachlor 31,25% + Terbutilazina 18,75%	Primextra Líquido Gold	91	0	91
Isoxaflutol 22,5% + Tiencarbazona-Metil 9%	Adengo	80	0	80
Mesotrione 4% + (S)-Metolachlor 40%	Camix	51	0	51
Nicosulfuron 6%	Elite Plus 6 OD	43	0	43
Mesotrione 3,75% + Terbutilazina 18,75% + (S)-Metolachlor 31,25%	Lumax	22	10	32
Dicamba 48%	Banvel D	28	0	28
Isoxaflutol 24%	Spade Flexx	25	0	25
Tembotriona 4,4%	Laudis OD	22	0	22
2,4-D 30% + Florasulam 0,62%	Mustang	6	5	11
Nicosulfuron	PANTANI	11	0	11
Fluroxipir 20%	Arbiter	9	0	9
Nicosulfuron	Nicosulfuron 4%	9	0	9
Dicamba 55% + Nicosulfuron 9,2% + Rimsulfuron 2,3%	Principal Plus	9	0	9
Fluroxipir 33,3%	Starane HL	8	0	8
Fluroxipir 20%	Fluroxipir 20%	7	0	7
Nicosulfuron	Sajon	7	0	7
Mesotrione 7,73%, Nicosulfuron 3%	Elumis	6	0	6
Dicamba 70%	Minerve	6	0	6
Dimetenamida-p 21,25%, Pendimetalina 25%	Wing P	6	0	6
Glyphosate 36%	Glyphosate 36%	5	0	5
Sulcotrione	Sudoku	0	5	5
Foramsulfuron 3% + Tiencarbazona Metil 1%	Monsoon Active	4	0	4
Nicosulfuron 4%	Nic-Sar	4	0	4
Foramsulfuron, Isoxadifen-ethyl	Option	0	4	4
Mesotrione	Callisto	0	3	3
Nicosulfuron, Terbuthylazine	Winner Top	0	3	3
Sulcotrione	Zeus	0	3	3
Bromoxynil	Buctril	2	0	2
Dicamba 50%, Prosulfuron 5%	Casper	2	0	2
Mesotriona 5% + Terbutilazina 32,6%	Cuna Pro	2	0	2
Fluroxypyr	Hurler	2	0	2
Aclonifen, Isoxaflutol	Memphis	2	0	2
Nicosulfuron, Terbuthylazine	Nicoter	0	2	2
Dicamba 31,25% + Mesotriona 15% + Nicosulfuron 10%	Nikita	2	0	2
Glifosato 36%	Roundup Ultra Plus	2	0	2
Flufenacet, Terbuthylazine	Aspect	0	1	1
Bromoxinil 23,5%	Bromoxan	1	0	1
Nicosulfuron 24%	Chaman Forte	1	0	1
Glifosato 48%	Dicamba 480 SL	1	0	1
Dicamba 48%	Dimbo 480 SL	1	0	1
Nicosulfuron 4%	Elite M	1	0	1
Mesotriona 7,5% + Nicosulfuron 3%	Elumis	1	0	1
Fluroxipir 20%	Fluxyr 200 EC	1	0	1
MCPA 40%	Grotex	1	0	1
Fluroxipir 20%	Hudson 20 EC	1	0	1
Nicosulfuron 4%	Kelvin	1	0	1
Isoxadifen-ethyl, Tembotrione	Laudis	0	1	1
Dimethenamid-P, Terbutylazin	Link Combi	0	1	1
Isoxaflutol 24%	Memphis Flexx	1	0	1
Nicosulfuron 24%	Milagro	1	0	1
Pendimethalin	Pendimentalina 33	1	0	1
Pethoxamid	Successor 600	1	0	1
2,4-D 60%	U 46 D Complet	1	0	1
Nicosulfuron 4%	Victus	1	0	1
Pendimethalin, Dimethenamid-P	Wing P	1	0	1

Table A 6: Explanations for different harvest time of MON 810 (Section 3.4.1.9)

Country	Quest. Nr.	Harvest	Comments aggregate	Comments
Spain	5466	later	Later planting and harvesting	YieldGard is short cycle, I plant it later than conventional and I also harvest it later
Spain	5522	later		YieldGard is short cycle, I plant it later than conventional and I also harvest it later
Spain	5575	later		I plant YieldGard later than conventional and I also harvest it later

Table A 7: 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	5397	as usual	as usual	as usual	as usual	as usual	as usual	as usual	as usual	YieldGard and conventional behaved in a similar way because there was not ECB's attack
Spain	5405	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YieldGard is healthier, without ECB´s damages and it produces the 8% more than conventional
Spain	5406	as usual	as usual	as usual	as usual	less often	as usual	as usual	as usual	YieldGard is resistant to ECB and it does not fall but this season the YieldGard´s yield has been similar to the conventional´s yield
Spain	5407	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard does not fall because it does not have ECB´s damages and it produces more than conventional
Spain	5408	as usual	as usual	as usual	delayed	less often	delayed	higher yield	less often	YieldGard is healthier, without ECB´s damages, it grows slower, it is more green and it maturates somewhat later, it does not fall and give more kilos than conventional
Spain	5411	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YieldGard is healthier and it produces more than conventional
Spain	5417	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard does not have ECB´s damages, it does not fall and it produces more than the conventional
Spain	5418	as usual	as usual	as usual	as usual	less often	as usual	as usual	as usual	YieldGard does not fall because it does not have ECB´s damages
Spain	5423	as usual	as usual	as usual	as usual	less often	delayed	higher yield	as usual	YieldGard does not present ECB´s damages, it does not fall, it ripens a little bit later and it is more productive than conventional
Spain	5424	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard does not fall because it does not have ECB´s damages, everything is harvested and it gives more kilos than the conventional
Spain	5427	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YieldGard is healthier, without ECB´s damages and it produces more than conventional
Spain	5433	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YieldGard produces more than the conventional because it does not have ECB´s damages
Spain	5434	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard does not fall because it does not have ECB´s damages and it produces more than conventional
Spain	5435	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YieldGard is resistant to ECB, it is healthier and it gives more kilos than conventional
Spain	5436	as usual	as usual	as usual	as usual	less often	delayed	higher yield	as usual	YieldGard is healthier, without ECB´s damages, it maturates somewhat later, it does not fall and it produces more than conventional
Spain	5438	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YieldGard does not have ECB´s damages, it is healthier and it gives more kilos than the conventional
Spain	5440	as usual	as usual	as usual	as usual	less often	delayed	higher yield	as usual	YieldGard does not fall, it is more green and it delays maturation for a few days and it gives more kilos than conventional because it does not have ECB's
Spain	5442	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YieldGard is more productive than the conventional because it does not have ECB´s damages

Spain	5443	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard does not have ECB´s damages, it does not fall and it produces more than the conventional
Spain	5444	as usual	as usual	as usual	as usual	less often	delayed	higher yield	as usual	YieldGard is resistant to ECB, it does not fall, it delays maturation and it is more productive than conventional
Spain	5445	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard is healthier because is resistant to ECB, it does not fall and it produces more than conventional
Spain	5447	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard does not have ECB´s damages, it does not fall, everything is harvested and it produces more than the conventional
Spain	5452	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard is healthier because is resistant to ECB, it does not fall and it produces more than conventional
Spain	5455	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard does not have ECB´s damages, it does not fall and it is more productive than conventional
Spain	5457	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard is healthier, without ECB´s damages, it does not fall and it gives more kilos than conventional
Spain	5458	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard produces more than conventional and it does not fall because it is resistant to ECB
Spain	5459	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard is healthier, it does not have ECB´s damages, it does not fall, everything is harvested and it gives more kilos than conventional
Spain	5461	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard does not fall and it produces more than conventional because it does not have ECB´s damages
Spain	5462	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard without ECB´s damages, it is healthier, it does not fall and it is more productive than conventional
Spain	5463	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard does not fall because it does not have ECB´s damages and it produces more than conventional
Spain	5465	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard is resistant to ECB, it does not fall and always it gives a yield greater than conventional
Spain	5466	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard is healthier, without ECB´s damages, it does not fall and it gives more kilos than conventional
Spain	5467	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YieldGard is more productive than the conventional because it does not have ECB´s damages
Spain	5468	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YieldGard is resistant to ECB, it is healthier and it gives more kilos than conventional
Spain	5469	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YieldGard produces more than the conventional because it does not have ECB´s damages
Spain	5471	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard without ECB´s damages, it does not fall and it gives more kilos than conventional
Spain	5472	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard is healthier, without ECB´s damages, it does not fall and it produces more than conventional
Spain	5475	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard without ECB´s damages, it does not fall and it gives more yield than conventional
Spain	5477	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard does not fall and it produces more than conventional because it does not have ECB´s damages
Spain	5480	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard is resistant to ECB, it does not fall, everything is havested and it gives more kilos than conventional
Spain	5482	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard does not fall and it produces more than conventional because it is resistant to ECB

Spain	5483	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard does not have ECB´s damages, it does not fall and it is more productive than conventional
Spain	5484	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard does not fall and it gives more kilos than conventional because it is healthier, without ECB´s damages
Spain	5485	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard is healthier because it is resistant to ECB, it does not fall and it produces more than the convenventional
Spain	5486	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard does not fall and it produces more than conventional because it does not have ECB´s damages
Spain	5489	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard does not fall, everything is harvested and it produces more than conventional because it does not have ECB´s damages
Spain	5491	as usual	as usual	as usual	as usual	less often	delayed	higher yield	less often	YieldGard does not present ECB´s damages and it does not fall, it is more green and it maturates somewhat later, there are no volunteers a year after and gives more kilos than conventional
Spain	5492	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YieldGard does not have ECB´s damages and it produces more than conventional
Spain	5493	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard does not fall and it produces more than conventional because it does not have ECB´s damages
Spain	5495	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard is resistant to ECB, it does not fall and it produces more than conventional
Spain	5496	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YieldGard is more productive than the conventional because it is resistant to ECB
Spain	5498	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YieldGard is more productive than the conventional because it does not have ECB´s damages
Spain	5499	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard does not fall and it gives more kilos than conventional because it is resistant to ECB
Spain	5500	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YieldGard does not have ECB´s damages and it produces more than conventional
Spain	5502	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard does not have ECB´s damages, it does not fall, it is healthier and it produces more than conventional
Spain	5504	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard does not fall and it gives more kilos than conventional because it does not have ECB´s damages
Spain	5505	as usual	as usual	as usual	as usual	less often	as usual	higher yield	less often	YieldGard does not fall and there are no volunteers a year after, it is healthier, without ECB´s damages and gives more kilos than conventional
Spain	5511	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard does not have ECB´s damages, it does not fall and it produces more than conventional
Spain	5512	as usual	as usual	as usual	as usual	less often	as usual	higher yield	less often	YieldGard is healthier, it is more green, it does not present ECB´s damages, it does not fall and there are no volunteers a year after, everything is harvested and gives more kilos than conventional
Spain	5513	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard does not fall and it is more productive than conventional because it does not have ECB´s damages
Spain	5516	as usual	as usual	as usual	as usual	as usual	delayed	higher yield	as usual	YieldGard is healthier because it is resistant to ECB, it is more green and it delays maturation for a few days and produces more than conventional
Spain	5518	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YieldGard is healthier, without ECB´s damages and it is more productive than conventional
Spain	5519	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard does not fall and it gives more kilos than conventional because it is resistant to ECB

Spain	5523	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard does not fall and it produces more than conventional because it does not have ECB´s damages
Spain	5525	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard does not fall and it gives more kilos than conventional because it is resistant to ECB
Spain	5528	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard does not fall and it produces more than conventional because it does not have ECB´s damages
Spain	5536	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 and it gives more kilos than conventional
Spain	5541	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YieldGard does not have ECB´s damages and it produces more than conventional
Spain	5544	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard does not have ECB´s damages, it does not fall and it is more productive than conventional
Spain	5550	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard is resistant to ECB, it does not fall and it produces more than the conventional
Spain	5552	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard is healthier, without ECB´s damages, it does not fall and it gives more kilos than conventional
Spain	5553	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YieldGard is healthier because it is resistant to ECB and it produces more kilos than conventional
Spain	5559	as usual	as usual	as usual	as usual	less often	as usual	higher yield	less often	YieldGard does not present ECB´s damages, it does not fall and there are no volunteers a year after and it gives more kilos than conventional
Spain	5564	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YieldGard produces more than the conventional because it does not have ECB´s damages
Spain	5568	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard does not fall and it produces more than conventional because it is resistant to ECB
Spain	5574	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YieldGard is more productive than conventional because it is resistant to ECB
Spain	5575	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard is healthier, it does not fall, everything is harvested and it gives more kilos than conventional
Spain	5577	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YieldGard produces more than conventional because it does not have ECB´s damages
Spain	5600	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YieldGard gives more kilos than conventional because it is healthier, without ECB´s damages
Spain	5604	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YieldGard produces more than conventional because it does not have ECB´s damages
Spain	5608	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard is healthier, it does not fall and it is more productive than conventional because it is resistant to ECB
Spain	5609	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard does not fall, everything is harvested and it gives more kilos than conventional because it does not have ECB´s damages
Spain	5615	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard is resistant to ECB, it does not fall, everything is harvested and it produces more than the conventional
Spain	5622	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YieldGard gives more kilos than conventional because it is healthier, without ECB´s damages
Portugal	5378	more vigourous	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	The sanity and robustness of the Yieldgard maize were distinct and also good strength. The average yields of 17 051 kg/ha in the Yieldgard dry maize, an average of 1000 kg/ha higher compared with conventional maize.
Portugal	5379	more vigourous	as usual	as usual	as usual	as usual	as usual	as usual	as usual	Higher roustness, vigour, quality and sanity in the Yieldgard maize. In that last campaign the average yields of 14 750 kg/ha in the Yieldgard dry maize

										and the average yields of 45 000 kg/ha in the Yieldgard forage maize were similar compared with conventional forage maize.
Portugal	5380	more vigourous	as usual	as usual	as usual	as usual	as usual	as usual	as usual	The consistency, robustness and vigour of the Yieldgard Maize were significant and evident in the Yieldgard maize fields. The average yields of 13 000 kg/ha in the Yieldgard dray maize, were similar compared with conventional maize
Portugal	5381	more vigourous	as usual	as usual	as usual	as usual	as usual	as usual	as usual	The higher quality of maize grain and robustness vigour were the advantages of the yieldgard maize. The average yields of 12 800 kg/ha in the Yieldgard dry maize, were similar compared with conventional maize
Portugal	5382	more vigourous	as usual	as usual	as usual	as usual	as usual	as usual	as usual	The good resistance of Yieldgard maize to fight the bad weather conditions like the strong wind gusts and heavy rains were always important. The average yields of 12 200 kg/ha in the Yieldgard dray maize, were similar compared with conventional maize.
Portugal	5383	more vigourous	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	Good yields of production in the Yieldgard maize. The average yields of 15 000 kg/ha in the Yieldgard dry maize, were an average of 3500 kg/ha higher compared with conventional maize (conventional maize with shorter cycle). Higher sanity and uality of Yieldgard maize were the main agronomical characteristics. Good robustness and vigour also.
Portugal	5384	more vigourous	as usual	as usual	as usual	as usual	as usual	as usual	as usual	The quality of the maize grain and the health and sanity of the maize were the main assets to choose the Yieldgard maize. The average xyields of 11 450 kg/ha in the Yieldgard dry maize, were similar compared with conventional maize.
Portugal	5385	more vigourous	as usual	as usual	as usual	as usual	as usual	as usual	as usual	The safety production and quality of Yieldgard maize were very important and huge. The average yields of 11 700 kg/ha in the Yieldgard dry maize, were similar compared with conventional maize.
Portugal	5386	more vigourous	as usual	as usual	as usual	as usual	as usual	as usual	as usual	Large vigour, strong robustness and good quality were the advantages mentioned and the most important agronomical characteristics of the Yieldgard maize. The average yields of 15 300 kg/ha in the Yieldgard dry maize, were similar compared with conventional maize.
Portugal	5387	more vigourous	as usual	as usual	as usual	as usual	as usual	as usual	as usual	Quality, robustness, strength and sanity of Yieldgard maize were the main agronomical characteristics. Amazing safety production of the Yieldgard maize. The average yields of 15 300 kg/ha in the Yieldgard dry maize, were similar compared with conventional maize.
Portugal	5388	more vigourous	as usual	as usual	as usual	as usual	as usual	as usual	as usual	Higher strength and vigour of the Yieldgard maize. Good quality of the Yieldgard forage maize. The average yields of 45 000 kg/h in the Yieldgard forage maize were similar compared with conventional forage maize.

Table A 8: Additional observation during plant growth of MON 810 (Section 3.4.2)

Country	Quest. Nr.	Comments aggregate	Comments
Spain	5390	no corn borer in 2019	There was not ECB's attack therefore there were not differences between YieldGard and conventional
Spain	5392		There were not differences between YieldGard and conventional because there was not ECB's attack
Spain	5395		There were not differences between YieldGard and conventional because there was not ECB's attack
Spain	5400		There was not ECB's attack therefore there were not differences between YieldGard and conventional
Spain	5402		There were not differences between YieldGard and conventional because there was not ECB's attack
Spain	5404		There was not ECB's attack and YieldGard and conventional developed in the same way
Spain	5408		There was not ECB's attack therefore there were not differences between YieldGard and conventional
Spain	5412		YieldGard has more moisture than conventional
Spain	5415		There were not differences between YieldGard and conventional because there was not ECB's attack
Spain	5418		Bad year of maize production due to adverse weather conditions, very high temperatures
Spain	5419		There has been very little ECB attack and has not influenced production
Spain	5421		YieldGard and conventional behaved in a similar way because there was not ECB's attack
Spain	5423		There was not ECB's attack therefore there were not differences between YieldGard and conventional
Spain	5439		YieldGard is healthier and with more moisture than conventional
Spain	5440		There was not ECB's attack and YieldGard and conventional developed in the same way
Spain	5466		There were not differences between YieldGard and conventional because there was not ECB's attack
Spain	5473		There was not ECB's attack therefore there were not differences between YieldGard and conventional
Spain	5476		YieldGard is healthier than conventional and with more moisture
Spain	5491		YieldGard has more moisture than conventional
Spain	5512		There were not differences between YieldGard and conventional because there was not ECB's attack
Spain	5517		YieldGard and conventional behaved in a similar way because there was not ECB's attack
Spain	5522		There was not ECB's attack this year
Spain	5531		YieldGard's grain has more moisture than the conventional
Spain	5532		There was not ECB's attack therefore there were not differences between YieldGard and conventional
Spain	5535		YieldGard has more moisture than conventional
Spain	5539		There was not ECB's attack therefore there were not differences between YieldGard and conventional
Spain	5543		YieldGard has more moisture than conventional
Spain	5556		There were not differences between YieldGard and conventional because there was not ECB's attack
Spain	5559		There was not ECB's attack and YieldGard and conventional developed in the same way
Spain	5563		There was not ECB's attack therefore there were not differences between YieldGard and conventional
Spain	5567		There were not differences between YieldGard and conventional because there was not ECB's attack
Spain	5571		There was not ECB's attack this year
Spain	5579		There was not ECB's attack in the area therefore there were not differences between YieldGard and conventional
Spain	5580		There were not differences between YieldGard and conventional because there was not ECB's attack
Spain	5581		YieldGard and conventional behaved in a similar way because there was not ECB's attack
Spain	5583		There was not ECB's attack this year
Spain	5586		There was no ECB or differences betweeen YieldGard and conventional
Spain	5588		YieldGard has one or two more moisture's degrees than the conventional
Spain	5589		There was not ECB's attack therefore there were not differences between YieldGard and conventional
Spain	5596		YieldGard is greener than conventional, with more moisture
Spain	5598		There were not differences between YieldGard and conventional because there was not ECB's attack
Spain	5599		There was not ECB's attack this year

Spain	5602		There was not ECB´s attack this year but it does have red spider attack that has done a lot of damage to both YieldGard and conventional
Spain	5605		There was not ECB's attack therefore there were not differences between YieldGard and conventional
Spain	5609		There was not ECB's attack
Spain	5611		There was not ECB's attack and YieldGard and conventional developed in the same way
Spain	5616		There were no ECB problems but there were red spider and virosis problems that reduced the production of YieldGard and conventional by 15%
Spain	5620		There was not ECB's attack this year
Spain	5623		There was not ECB's attack and YieldGard and conventional developed in the same way
Spain	5505		There was not ECB's attack this year
Spain	5584	other	There were not differences between YieldGard and conventional because there was not ECB's attack
Spain	5625		YieldGard and conventional behaved in a similar way because there was not ECB's attack
Spain	5399	YieldGard is healthier with more moisture	There was not ECB's attack this year
Spain	5426		There were not differences between YieldGard and conventional because there was not ECB's attack
Spain	5430		It has been a year of a major spider attack that has reduced the production of YieldGard and conventional
Spain	5478		There was not ECB's attack this year
Spain	5494		There was not ECB's attack therefore there were not differences between YieldGard and conventional
Spain	5507		There was not ECB's attack therefore there were not differences between YieldGard and conventional
Spain	5515		There were not differences between YieldGard and conventional because there was not ECB's attack
Spain	5548		YieldGard and conventional behaved in a similar way because there was not ECB's attack
Spain	5613		There were not differences between YieldGard and conventional because there was not ECB's attack

Table A 9: Additional comments on disease susceptibility (Section 3.4.3)

Country	Quest. Nr.	Disease susceptibility	Comments aggregate	Comments
Portugal	5378	as usual	no significant diseases to report in the region	Low incidence of diseases in the total productive maize area. Nothing to report about diseases susceptibility (difficult to analyze the susceptibility).
Portugal	5379	as usual		Higher presence in the local of production of the disease ""Cephalosporium Maydis"" but completely normal and without any difference in susceptibility.
Portugal	5380	as usual		In the farmer region of production was nothing significant about the diseases to report. Very lower presence in the region of production of diseases.
Portugal	5381	as usual		Didn't check nothing in the region of production about diseases. It was nothing significant about diseases susceptibility.
Portugal	5382	as usual		Strictly nothing to report about diseases in the region of production total area.
Portugal	5383	as usual		Without any difference in diseases susceptibility between the various types of maize despite the pronounced presence in the local of production of the disease "Cephalosporium Maydis".
Portugal	5384	as usual		Without any difference in diseases susceptibility. However that was a higher presence in the local of production of the diseases "Cephalosporium Maydis".
Portugal	5385	as usual		About diseases susceptibility was nothing significant to report between the various types of maize - yieldgard and conventional Lower presence on the region of production of diseases.
Portugal	5386	as usual		The farmer did not verify nothing significant about diseases susceptibility and any difference in diseases susceptibility.
Portugal	5387	as usual		Presence in the farmer local of production of the disease ""Cephalosporium Maydis"" but without any difference in susceptibillity between the yieldgard and the conventional maize.
Portugal	5388	as usual		Was nothing significant about the diseases to report in the region of production. Very lower presence in the region of production of diseases.
Spain	5464	less susceptible	YieldGard has smaller Fusarium damages	Yieldgard was less attacked by Sphacelotheca than the conventional was YieldGard is healthier and resists fungal attack better than conventional
Spain	5480	less susceptible		YieldGard has less problems of virus like MDMV and MRDV than conventional There is more attack of virus like MDMV and MRDV in conventional maize because it is on the edges of the plot and more exposed to fly attacks which is the transmitter
Spain	5525	less susceptible		YieldGard is healthier and it has not Fusarium damages but conventional one does Conventional has ECB and also Fusarium damages. YieldGard is healthier.
Spain	5528	less susceptible		YieldGard has not ECB injuries and it has less Fusarium attack than conventional YieldGard is healthier than conventional and it suffers less attack by fungi such as Fusarium
Spain	5576	less susceptible		YieldGard grains have less Fusarium attack than conventional grains YieldGard grains are healthier, with less fungal attack than conventional ones

Table A 10: Additional comments on insect pest control (Section 3.4.4)

Country	Quest. Nr.	Ostrinia nubilalis	Sesamia spp.	Comments
Spain	5502	very good	very good	YieldGard is very effective against ECB
Portugal	5378	very good	very good	The combat and effectiveness is evident of the maize borers in the yieldgard maize, total and very efficient.
Portugal	5379	very good	very good	Total and fantastic effective control in the maize borers in the yieldgard maize. The sanity of the Yieldgard maize is higher.
Portugal	5380	very good	very good	The control of maize borers is notorious and totally accurate. (lower presence in the local / region of production of the maize borers)
Portugal	5381	very good	very good	The control of the maize borers was an asset of Yieldgard maize.
Portugal	5382	very good	very good	Very good effectiveness in the control of borers in the yieldgard fields.
Portugal	5383	very good	very good	Excellent control of the maize borers. Was one of the reasons for choosing yieldgard maize.
Portugal	5384	very good	very good	Tremendous added value for the farmer in the control of borers in the Yieldgard maize.
Portugal	5385	very good	very good	Total efficiency and control of the maize borers wich improved the sanity of the yieldgard plants.
Portugal	5386	very good	very good	Effective and total control of maize borers in the yieldgard maize.
Portugal	5387	very good	very good	Quality and Effective in the control of the maize borers in the yieldgard maize. Huge added value for the farmer.
Portugal	5388	very good	very good	Total efficiency, amazing added value in the control of borers in the Yieldgard maize.

Table A 11: Additional comments on pest susceptibility (Section 3.4.5)

Country	Quest. Nr.	Pest susceptibility	Order of insect pest	Comments aggregate	Comments
Portugal	5380	less susceptible	Agrotis Ipsilon, Diabrotica / Agriotes, Spodoptera Frugiperda	good sanity of YieldGard improved its resistance	The region of production had a very lower incidence of pests in the total area of maize. Difficult to analyze the susceptibility of other pests.
Portugal	5381	less susceptible	Diabrotica / Agriotes, Agrotis Ipsilon	good sanity of YieldGard improved its resistance	YieldGard has less damage from Heliothis attack than conventional
Portugal	5382	less susceptible	Diabrotica / Agriotes	good sanity of YieldGard improved its resistance	There is more Heliothis attack in the conventional than in the YieldGard
Portugal	5383	less susceptible	Agrotis Ipsilon, Spodoptera Frugiperda, Diabrotica / Agriotes	good sanity of YieldGard improved its resistance	YieldGard has not Heliothis damages and the conventional does
Portugal	5384	less susceptible	Agrotis Ipsilon, Spodoptera Frugiperda	good sanity of YieldGard improved its resistance	YieldGard has not Mythimna damages and the conventional does
Portugal	5385	less susceptible	Agrotis Ipsilon	good sanity of YieldGard improved its resistance	YieldGard has less Heliothis attack than the conventional
Portugal	5386	less susceptible	Spodoptera Frugiperda, Agrotis Ipsilon	good sanity of YieldGard improved its resistance	YieldGard has less Mythimna and Heliothis attack than the conventional
Portugal	5388	less susceptible	Agrotis Ipsilon, Spodoptera Frugiperda	good sanity of YieldGard improved its resistance	The capacity to resist to other pests is always higher despite this last campaign the region of production had a very lower incidence of pests in general.
Portugal	5378	less susceptible	Agrotis Ipsilon, Spodoptera Frugiperda	low incidence makes it hard to judge	The sanity and resistance in the control of maize borers were higher. The fact that the Yieldgard maize was resistant to the attack of the maize borer pest made the Yieldgard plants less susceptible from the attack of other pests.
Portugal	5379	as usual	-	low incidence makes it hard to judge	The quality and sanity of the Yieldgard maize was higher and important to combat the attack of the diferent other pests. The capacity to resist to other pests is always better.
Portugal	5387	less susceptible	Agrotis Ipsilon	low incidence makes it hard to judge	Good sanity and production security of the Yieldgard maize were the most important reasons.
Spain	5397	less susceptible	Heliothis	YieldGard showed less damage	The fact that the Yieldgard maize was resistant to the attack of the maize borer pest made the Yieldgard plants with higher sanity and consequently less susceptible from the attacks of other pests.
Spain	5402	less susceptible	Heliothis	YieldGard showed less damage	The sanity of the yieldgard maize was higher and reflected in other pests despite this last campagn the region of production had a lower incidence of pests.
Spain	5512	less susceptible	Heliothis	YieldGard showed less damage	The sanity of the Yieldgard maize made the difference and improved the better resistant from the attack of the diferent other pests. This last year the region of production had a very lower incidence of pests in general.
Spain	5525	less susceptible	Mythimna spp. (Mitima)	YieldGard showed less damage	The sanity of the Yieldgard maize was evident and obvious and made the safety production more efficient.
Spain	5576	less susceptible	Heliothis	YieldGard showed less damage	This last year the region of production had a lower incidence of pests in general. Difficult to analyze the susceptibility to other pests.
Spain	5577	less susceptible	Mythimna spp. (Mitima), Heliothis	YieldGard showed less damage	The sanity and the production security of the yieldgard maize were always higher.

Table A 12: Weeds that occurred in MON 810 (Section 3.4.6)

Name of weed	**Frequency**
Sorghum halepense	165
Chenopodium album	118
Abutilon theophrasti	115
Amaranthus retroflexus	110
Xanthium strumarium	40
Datura stramonium	37
Setaria spp.	27
Echinochloa spp.	23
Cyperus spp.	20
Digitaria sanguinalis	17
Echinochloa crus-galli	15
Solanum nigrum	10
Cynodon dactylon	6
Hordeum sp.	6
Xanthium spinosum	6
Phragmites australis	5
Malva spp.	5
Portulaca oleracea	5
Galium spp.	3
Panicum spp.	3
Medicago sativa	2
Rumex spp.	2
Lolium spp.	2
Avena fatua	1
Polygonum persicaria	1
Zea mays	1
Trifolium sp.	1
Cichorium endivia	1
Sinapis arvensis	1
Bromus spp.	1

Table A 13: Additional comments on occurrence of wildlife (Section 3.4.7)

Country	Quest. Nr.	Insect occurence	Bird occurence	Mammal occurence	Comments
Portugal	5378	As usual	As usual	As usual	Without any difference of susceptibility between diferent types of maize - Yieldgard and Conventional. Large presence and occurrence of wild boars in the maize fields of the region
Portugal	5379	As usual	As usual	As usual	Strong presence of wild boars in the maize fields - Yieldgard and Conventional - of the region. Without any difference of susceptibility between the different types of maize fields.
Portugal	5383	As usual	As usual	As usual	Without any difference of susceptibility between the maize fields - Yieldgard and Conventional. Despite that higher presence and occurrence of wild boars in the maize fields - Yieldgard and Conventional - of the region.
Spain	5416	As usual	More	As usual	-
Spain	5425	As usual	More	As usual	There is more presence of birds in the conventional, especially magpies. It may be because conventional is on the edge.
Spain	5430	As usual	More	As usual	There is more presence of sparrows in the conventional than in the YieldGard

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

Country	Quest. Nr.	Compliance	Reasons
Spain	5400	no	I did not read the label recommendations
Spain	5415		I did not plant refuge
Spain	5466		I did not plant refuge
Spain	5496		I did not plant refuge
Spain	5509		I did not plant refuge
Spain	5560		I did not plant refuge
Spain	5571		I did not plant refuge
Spain	5573		I did not plant refuge
Spain	5575		I did not plant refuge in the second planting maize
Spain	5586		I did not plant refuge
Spain	5594		I did not plant refuge
Spain	5595		I did not plant refuge
Spain	5605		I did not plant refuge in the second planting maize

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

Country	Quest. Nr.	Plant refuge?	Reasons
Spain	5400	no	I do not know the technical regulations, I did not read the label recommendations
Spain	5415		Because ECB causes many crop losses in the conventional maize
Spain	5466		Because ECB greatly reduces production of conventional maize in late plantings
Spain	5496		Because I have small plots and it is difficult to sow and because ECB produces large yield losses in the conventional maize
Spain	5509		Because ECB produces yield losses in the conventional maize
Spain	5560		Because I have small plots and it is difficult to sow
Spain	5571		Because I have small plots and it is difficult to sow
Spain	5573		Because I have small plots and it is difficult to sow
Spain	5575		I did not plant refuge in the second planting of YieldGard maize because ECB produces large yield losses in the late planting
Spain	5586		Because I have small plots and it is difficult to sow
Spain	5594		Because ECB produces large yield losses
Spain	5595		Because ECB produces large yield losses
Spain	5605		ECB produces large yield losses in the refuge of conventional maize

7 Annex B Questionnaire

EuropaBio
The European Association for Bioindustries

2	0	1	9	-	0	1	-	M	A	R	-	E	S	-	0	1	-	1	1	1	1	1

Year - Event - Partner - Country -Interviewer- Farmer ID

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 ☐☐☐☐☐

Coding explanations:

2	0	1	9	-	0	1	-	M	A	R	-	E	S	-	0	1	-	1	1	1	1	1

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

Codes:

Event:	01	MON 810
	02	...
Partner[7]:	MON	Monsanto
	MAR	Markin
	AGR	Agro.Ges
	...	...
Country:	ES	Spain
	PT	Portugal
	RO	Romania
	…	
Interviewer[8]:	01 A	
	02 B	
	03 …	

Farmer: unique ID for each farmer

---

[7] Partner is the organization that implements the survey

[8] Interviewer is the employee from the Partner that is contacting the farmers

2	0	1	9	-	0	1	-	M	A	R	-	E	S	-	0	1	-	1	1	1	1	1

Year - Event - Partner - Country -Interviewer- Farmer ID

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?[9]

O Yes O No

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

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: _________________________

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

O As usual O Changed, because: ________________________________

2	0	1	9	-	0	1	-	M	A	R	-	E	S	-	0	1	-	1	1	1	1	1

Year - Event - Partner - Country -Interviewer- Farmer ID

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[10] 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: ____

____

____

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

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

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 ______________________________

____
____
____