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 2020 growing season

Responsibilities:

Data management and statistical analysis:

BioMath GmbH
Friedrich-Barnewitz-Straße 8
D - 18119 Rostock-Warnemünde
Germany

Sponsor:

Bayer Agriculture BV
Jan Emiel Mommaertslaan, 14
B-1831, Diegem
Belgium

2021-10-05

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

BioMath

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 2020. The questionnaires have been completed between February and March 2021. In the 2020 growing season 252 farmers have been surveyed.

2020 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 2020 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	2	0	-	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:	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.* 2020-01-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 %.

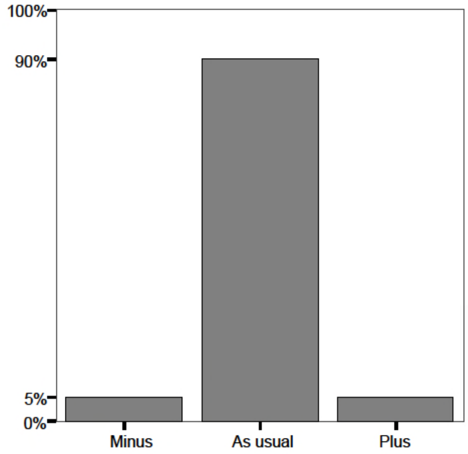


Figure 1: Balanced (expected) baseline distribution of the farmers' answers (no effect)

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)).

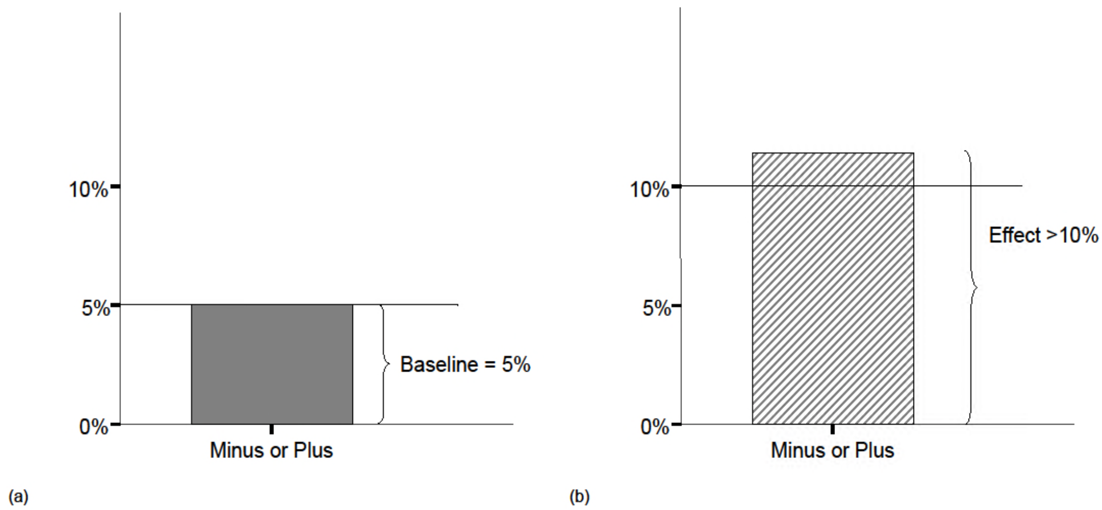
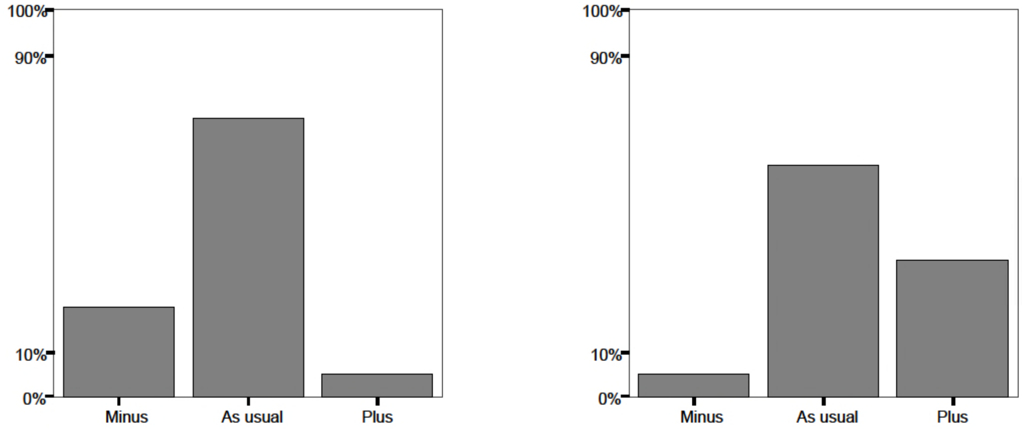


Figure 2: Definition of (a) baseline and (b) effect



(a) (b)

Figure 3: Examples for distributions of farmers' answers indicating an effect (a) > 10 % in category $Minus \rightarrow$ effect, (b) > 10 % in category $Plus \rightarrow$ 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 closed under intersection 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 $H_0^1\colon p_{As\ usual} \leq 0.9$ 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 $H_0^1\colon p_{As\ usual} \leq 0.9$ 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 % ($H_0\colon p_{As\ usual} \leq 0.9$)
- Step (2): Test of the p_{Minus} probabilities and p_{Plus} probabilities

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

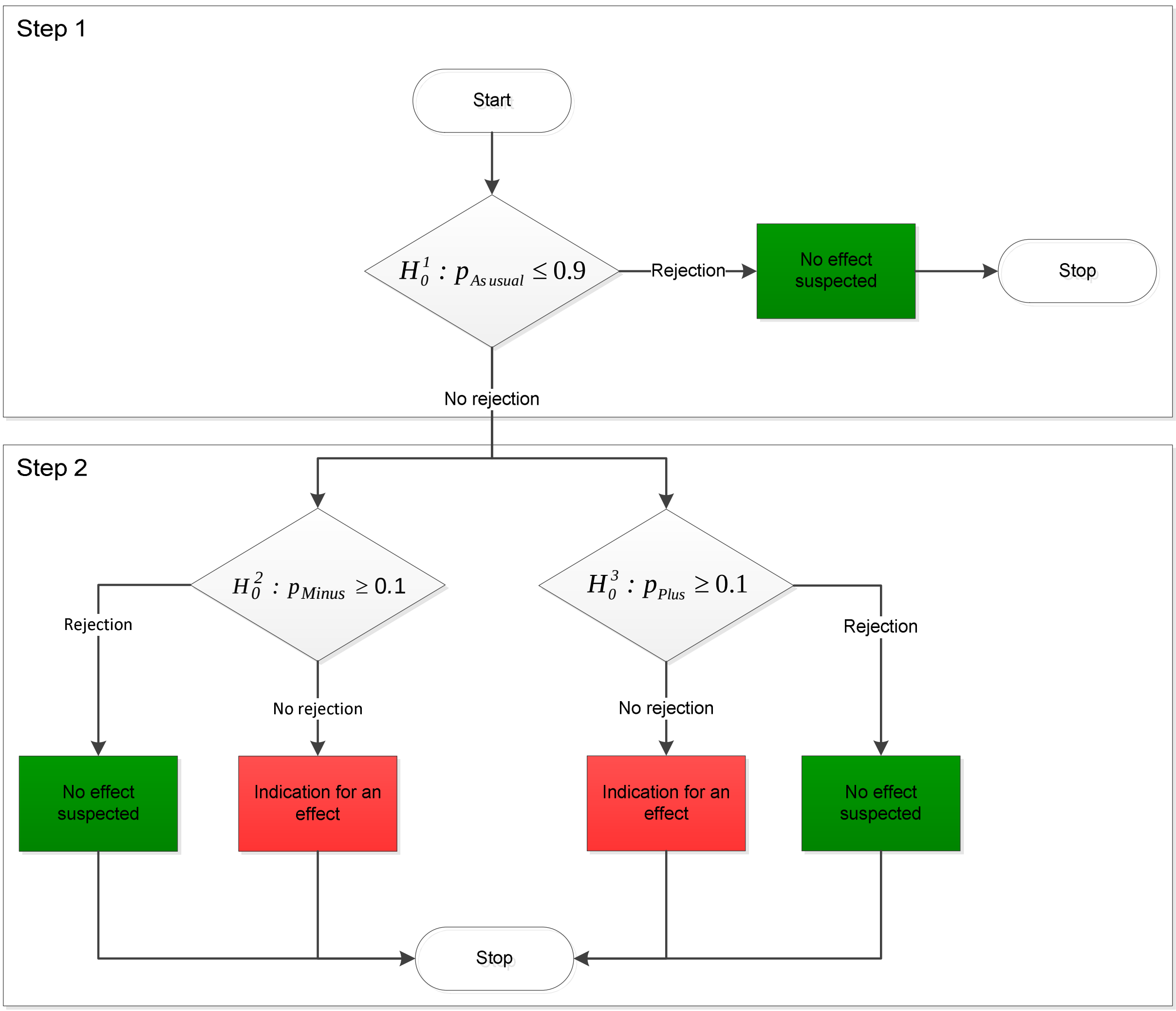


Figure 4: Closed test procedure for the three probabilities of $As\ usual$, $Plus$- and $Minus$-answers

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

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

1. The frequencies of the farmer responses for the three categories are calculated. The calculation of frequencies and their percentages is done both on the basis of all and on the basis of valid answers. When farmers gave no statement, answers are accounted as missing values and therefore not considered valid. As a consequence, the "valid percentages" state the proportions of actually known answers, whereas the "percentages" only specify the proportions of the categories within the whole answer spectrum, including no answers. Additionally, the accumulated valid percentages are calculated to illustrate the distribution function and for quality control reasons.
2. The frequencies of $As\,usual$, $Plus$- and $Minus$- answers are statistically tested according to the closed principle test procedure as described above (in case of questions that allow for only two answers like *e.g. Crop Rotation's* “as usual”/”changed”, only $As\,usual$- and $Plus$- answer frequencies are tested accordingly).
   The resulting p-values are compared to a level of significance $\alpha = 0.01$. If the p-value is smaller than $\alpha = 0.01$, the corresponding null hypothesis is rejected. If the p-value is larger than $\alpha = 0.01$, respective hypothesis cannot be rejected.
   - In case Hypothesis (1) with $p_{As\,usual} \leq 0.9$ is rejected, no effect is indicated.
   - In case Hypothesis (1) with $p_{As\,usual} \leq 0.9$ cannot be rejected, but both hypotheses (2) with $p_{Minus} \geq 0.1$ and $p_{Plus} \geq 0.1$ can be rejected, no effect is indicated.
   - In case Hypothesis (1) with $p_{As\,usual} \leq 0.9$ cannot be rejected and at least one of the hypotheses (2) cannot be rejected either, an effect is indicated.

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

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

2.5 Sample size determination and selection

The sample size determination of the survey was done for a period of 10 years (authorization period). It was based on the exact binomial test. It depends on the threshold for the test, the error of the first kind α (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 5 shows the cultivation areas of 2020. 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 2020

Country	MON 810 area	% of total MON 810 area	No of questionnaires
Portugal	4,216	4.12 %	10
Spain	98,152	95.88 %	240
Total	**102,367**	**100.00 %**	**250**

This procedure was repeated within the countries:

Portugal:

Table 6: Sampling number proportional to cultivated MON810 area in Portugal 2020

Region	MON 810 area	% of country area	Proportional No of questionnaires	Sampling
Norte	42.21	1.00 %	0 %	0
Centro	1,156.87	27.44 %	30 %	3
Lisboa e Vale do Tejo	432.50	10.26 %	10 %	1
Alentejo	2,583.96	61.30 %	60 %	6
Total	**4,215.54**	**100.00 %**	**100.00 %**	**10**

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 2020

Region	MON 810 area	% of country area	Proportional No of questionnaires	Sampling
Andalucia	2,723.95	2.78 %	2.92 %	7
Aragon + Cataluna	72,827.89	74.20 %	74.58 %	179
Castilla Leon	347.37	0.35 %	0.42 %	1
Castilla-La-Mancha + Comunidad de Madrid	2,680.10	2.73 %	2.50 %	6
Comunidad Foral de Navarra	8,309.68	8.47 %	8.33 %	20
Comunidad Valenciana	335.26	0.34 %	0.42 %	1
Extremadura	10,718.37	10.92 %	10.83 %	26
Islas Baleares	160.00	0.16 %	0 %	0
La Rioja	22.63	0.02 %	0 %	0
Murcia	26.32	0.03 %	0 %	0
Islas Canarias	0.00	0 %	0 %	0
Total	**98,151.57**	**100.00 %**	**100.00 %**	**240**

Due to the relatively small cultivation area of MON 810, Islas Baleares, La Rioja, Murcia and Islas Canarias would be 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 - under the given circumstances - the monitoring area was as proportional as possible to and as representative as possible of the total regional area under GM cultivation.in 2020.

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 %.

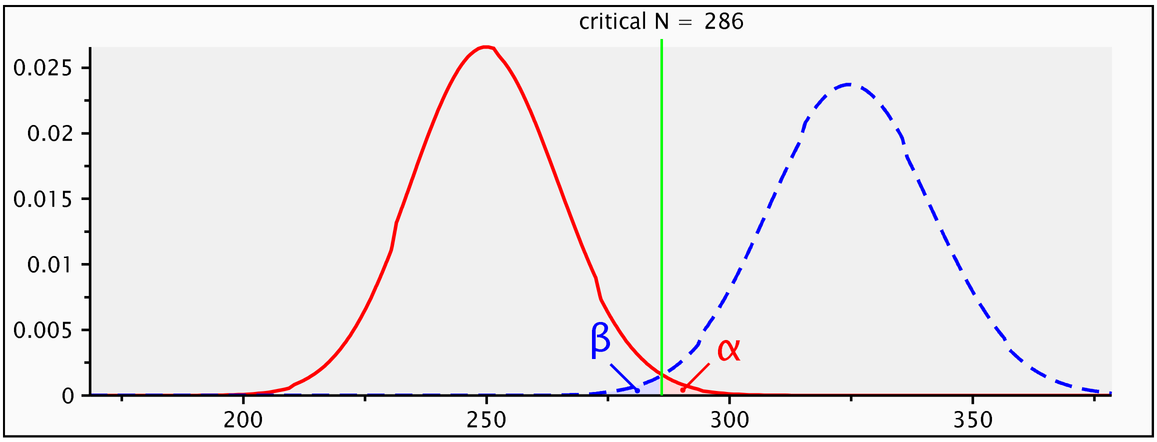


Figure 5: Null ($p = 0.1$) and alternative ($p = 0.13$) binomial distribution functions for a sample size of 2 500 type I and type II errors α and β both 0.01 (graph: *G*Power* Version 3.1.6)

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 2021. In the 2020 growing season 252 farm questionnaires have been collected. Quality and plausibility control confirmed that all 252 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 2020 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 2020 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	252	248 (98.4%)	< 0.01			4 (1.6%)	< 0.01
Time of planting	252	247 (98.0%)	< 0.01	0 (0.0%)	< 0.01	5 (2.0%)	< 0.01
Tillage and planting technique	252	251 (99.6%)	< 0.01			1 (0.4%)	< 0.01
Insect control practices	252	246 (97.6%)	< 0.01			6 (2.4%)	< 0.01
Weed control practices	252	251 (99.6%)	< 0.01			1 (0.4%)	< 0.01
Fungal control practices	251	251 (100.0%)	< 0.01			0 (0.0%)	< 0.01
Maize Borer control practice	252	246 (97.6%)	< 0.01			6 (2.4%)	< 0.01
Fertilizer Application	252	252 (100.0%)	< 0.01			0 (0.0%)	< 0.01
Irrigation Practices	252	252 (100.0%)	< 0.01			0 (0.0%)	< 0.01
Time of harvest	252	248 (98.4%)	< 0.01	0 (0.0%)	< 0.01	4 (1.6%)	< 0.01
Germination vigor	252	240 (95.2%)	< 0.01	0 (0.0%)	< 0.01	12 (4.8%)	< 0.01
Time to emergence	252	252 (100.0%)	< 0.01	0 (0.0%)	< 0.01	0 (0.0%)	< 0.01
Time to male flowering	252	251 (99.6%)	< 0.01	0 (0.0%)	< 0.01	1 (0.4%)	< 0.01
Plant growth and development	252	248 (98.4%)	< 0.01	0 (0.0%)	< 0.01	4 (1.6%)	< 0.01
Incidence of stalk / root lodging	252	201 (79.8%)	1.0	51 (20.2%)	1.0	0 (0.0%)	< 0.01
Time to maturity	252	243 (96.4%)	< 0.01	0 (0.0%)	< 0.01	9 (3.6%)	< 0.01
Yield	252	182 (72.2%)	1.0	0 (0.0%)	< 0.01	70 (27.8%)	1.0
Occurrence of volunteers	252	250 (99.2%)	< 0.01	2 (0.8%)	< 0.01	0 (0.0%)	< 0.01
Disease susceptibility	251	246 (98.0%)	< 0.01	5 (2.0%)	< 0.01	0 (0.0%)	< 0.01
Pest susceptibility	250	232 (92.8%)	0.0513	18 (7.2%)	0.0808	0 (0.0%)	< 0.01
Weed pressure	252	252 (100.0%)	< 0.01	0 (0.0%)	< 0.01	0 (0.0%)	< 0.01
Occurrence of insects	252	252 (100.0%)	< 0.01	0 (0.0%)	< 0.01	0 (0.0%)	< 0.01
Occurrence of birds	252	251 (99.6%)	< 0.01	0 (0.0%)	< 0.01	0 (0.0%)	< 0.01
Occurrence of mamals	252	252 (100.0%)	< 0.01	0 (0.0%)	< 0.01	0 (0.0%)	< 0.01
Performance of animals	6	6 (100.0%)	< 0.01			0 (0.0%)	0.531

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

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

Monitoring character	$p_{As\ usual}$	lower 99 % confidence limit	upper 99 % confidence limit	p_{Minus}	lower 99 % confidence limit	upper 99 % confidence limit	p_{Plus}	lower 99 % confidence limit	upper 99 % confidence limit
Crop rotation	98.4%	96.4%	100.4%	-	-	-	1.6%	0.0%	3.6%
Time of planting	98.0%	95.8%	100.3%	0.0%	0.0%	0.0%	2.0%	0.0%	4.2%
Tillage and planting technique	99.6%	98.6%	100.6%	-	-	-	0.4%	0.0%	1.4%
Insect control practices	97.6%	95.1%	100.1%	-	-	-	2.4%	0.0%	4.9%
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	97.6%	95.1%	100.1%	-	-	-	2.4%	0.0%	4.9%
Fertilizer Application	100.0%	100.0%	100.0%	-	-	-	0.0%	0.0%	0.0%
Irrigation Practices	100.0%	100.0%	100.0%	-	-	-	0.0%	0.0%	0.0%
Time of harvest	98.4%	96.4%	100.4%	0.0%	0.0%	0.0%	1.6%	0.0%	3.6%
Germination vigor	95.2%	91.8%	98.7%	0.0%	0.0%	0.0%	4.8%	1.3%	8.2%
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	99.6%	98.6%	100.6%	0.0%	0.0%	0.0%	0.4%	0.0%	1.4%
Plant growth and development	98.4%	96.4%	100.4%	0.0%	0.0%	0.0%	1.6%	0.0%	3.6%
Incidence of stalk / root lodging	79.8%	73.2%	86.3%	20.2%	13.7%	26.8%	0.0%	0.0%	0.0%
Time to maturity	96.4%	93.4%	99.4%	0.0%	0.0%	0.0%	3.6%	0.6%	6.6%
Yield	72.2%	65.0%	79.5%	0.0%	0.0%	0.0%	27.8%	20.5%	35.0%
Occurrence of volunteers	99.2%	97.8%	100.6%	0.8%	0.0%	2.2%	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	92.8%	88.6%	97.0%	7.2%	3.0%	11.4%	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	99.6%	98.6%	100.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Occurrence of mamals	100.0%	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Performance of animals	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.

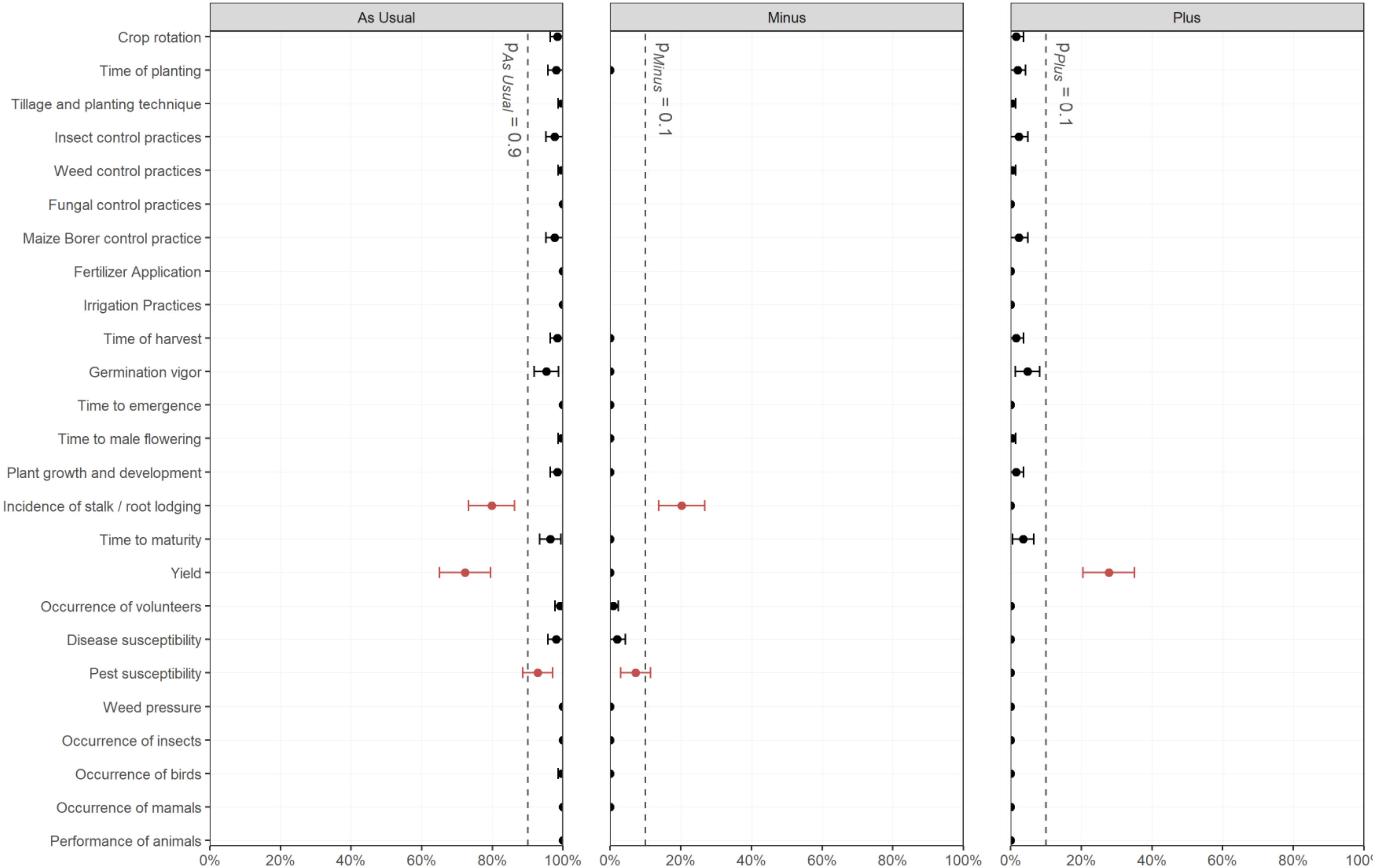


Figure 6: $As\ usual$- , $Minus$- and $Plus$ - answer probabilities of all monitoring characters, point estimates (circle) and 99 % confidence intervals (bars). Vertical dashed line indicates the test thresholds of 0.9 or 0.1, respectively (biological relevance). Probabilities whose confidence intervals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

Taken together, 2020 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 2020 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 2021. In the 2020 growing season 252 farm questionnaires have been collected.

In Spain, the largest market, the surveys (240) were performed by Instituto Markin, SL[3], in Portugal the surveys (12) were performed by Agro.Ges - Sociedade de Estudos e Projectos[4]. These companies have an established experience in agricultural surveys.

In Spain, 427 farmers were contacted, 187 did not respond for the following reasons: because they did not grow MON810 in 2020 (71), they did not grow maize in 2020 (58), they grew MON810 in 2020 but refused to answer the interview (37), they were absent or could not be localized (11) they were retired (10). The response rate was 56.2 %. 49 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 2020

Region	No of farmers
Cataluña - Aragón	179
Extremadura	26
Navarra	21
Andalucía	7
Castilla - La Mancha	7
Total	**240**

As can be seen, there are minor deviations from the sampling scheme regarding the regional allocation (Table 7), which was due to practical reasons: Instead of one interviewed farmer in Castilla Leon and Communidad Valencia, respectively, no farmers were interviewed in these two regions. Instead, an additional farmer was interviewed in both Navarra and Castilla – La Mancha.

In Portugal, none of the contacted farmers refused to participate. The response rate was 100 %. Of the interviewed farmers, 4 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 2020

Region	No of farmers
Center	4
Lisbon and Tagus Valley	2
Alentejo	6
Total	**12**

As can be seen, compared to the sampling scheme (Table 6) there is one additional interviewed farmer in Center and Lisbon and one in Tagus Valley, leading to 12 instead of 10 interviewed farmers in Portugal and thus 252 instead of 250 questionnaires.

The quality and plausibility control confirmed that all 252 questionnaires could be considered for analysis. The high quality of the questionnaires can also be ascribed to the interviewer training.

The database currently contains 3,879 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, 250 for 2019 and 252 for 2020.

3.2 Part 1: Maize grown area

3.2.1 Location

In 2020, 252 questionnaires were surveyed in the cultivation areas of MON 810 in Spain and Portugal. With an area of 98,152 ha in Spain and 4,216 ha in Portugal, these two countries represent MON 810 cultivators in Europe. Of these areas, 6.6 % and 13.2 % 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 2020 (dark grey areas) and the distribution of the monitoring sites (numbers) per region.

Table 12: MON 810 cultivation and monitored areas in 2020

Country	Total planted MON 810 area (ha)	Monitored MON 810 area (ha)	Monitored MON 810 area / total planted MON 810 area (%)
Spain	98,152	6,469	6.6 %
Portugal	4,216	557	13.2 %
Total	102,368	7,026	6.9 %

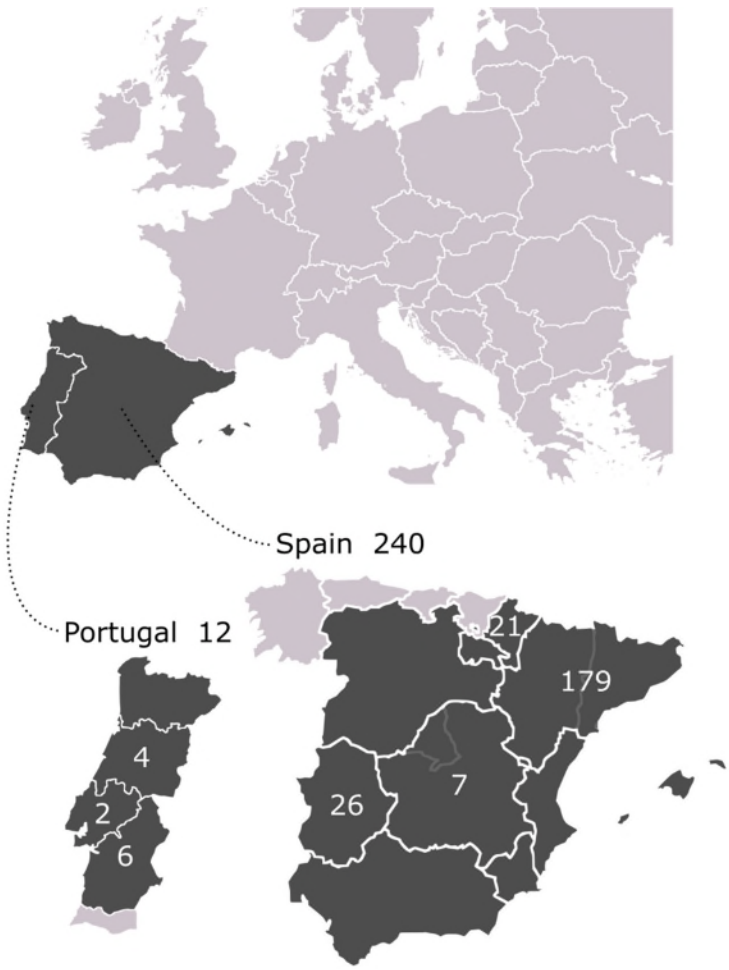


Figure 7: Number of sampling sites (white numbers) within the cultivation areas (filled dark grey) of MON 810 in Europe in 2020.

3.2.2 Surrounding environment

The farmers were asked to describe the land usage in the surrounding of the areas planted with maize. All (252/252) 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 2020

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	Farmland	252	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	252	100.0	100.0	

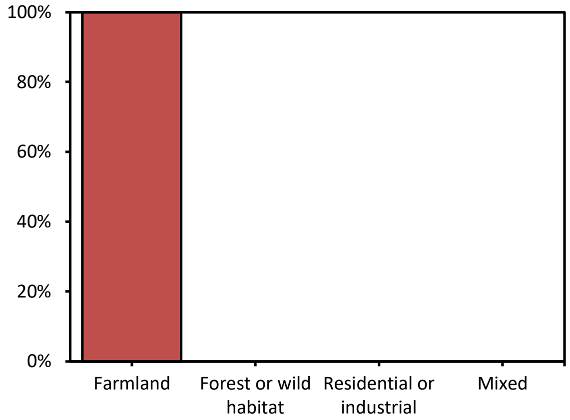


Figure 8: Land usage in the surrounding of the areas planted with MON 810 in Europe in 2020

3.2.3 Size and number of fields of the maize cultivated area

The size of the total maize area at the farms in 2020 ranged from 1 to 833 hectares. The average MON 810 areas per surveyed farmer in 2020 were 27.0 ha in Spain and 46.4 ha in Portugal, respectively. Details on the cultivation areas of maize per farmer from 2006 to 2020 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 2020

		2018			2019			2020		
Country	**Total Area (ha)**	**Mean**	**Min**	**Max**	**Mean**	**Min**	**Max**	**Mean**	**Min**	**Max**
Spain	all maize	21.0	0.8	100	31.1	1.5	322	36.9	1.0	1000
	MON 810	15.7	0.8	83	21.0	1.5	261	27.0	1.0	833
France	all maize	-	-	-	-	-	-	-	-	-
	MON 810	-	-	-	-	-	-	-	-	-
Portugal	all maize	95.9	10.0	370	182.3	7.0	614	141.3	7.0	585
	MON 810	53.4	4.0	220	83.9	1.0	369	46.4	2.0	234
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 2020.

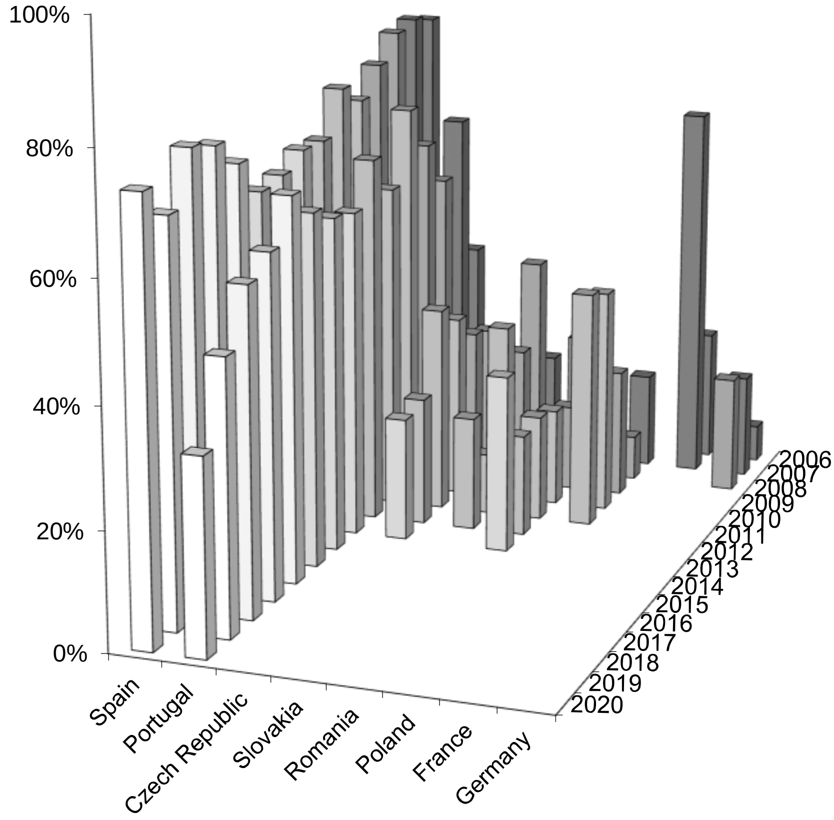


Figure 9: Mean percentage of MON 810 cultivation area of total maize area per farmer in 2006 - 2020 (surveyed countries only)

In 2020, MON 810 was cultivated on 1 - 70 fields per farm. On average, every farmer cultivated MON 810 on 4.79 fields (Table 15).

Table 15: Number of fields with MON 810 in 2020

Valid N	Mean	Minimum	Maximum	Sum
252	4.79	1	70	1208

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 2020. 43 different MON 810 varieties and 71 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 2020

MON 810 maize		**Conventional maize**	
Variety	**Frequency**	**Variety**	**Frequency**
P 0937 Y	87	P 0937	80
DKC 5032 YG	51	DKC 6980	45
DKC 6729 YG	45	DKC 5031	40
P 1570 Y	29	P 1524	25
P 1921 Y	18	P 1570	19
P 1524 Y	17	P 1921	16
DKC 4796 YG	10	P 1574	12
LG 30490 YG	9	P 0933	11
P 0725 Y	8	P 0725	9
P 1574 Y	8	DKC 4795	8
P 1524	8	DKC 6728	7
P 0312 Y	8	DKC5741	7
Kefieros YG	8	P 0312	7
MAS 69 YG	7		
P 0933 Y	6		
DKC 6631 YG	6		
Portbou 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 2020

		Frequency	**Percent**	**Valid percentages**	**Accumulated percentages**
Valid	very fine	2	0.8	0.8	0.8
	fine	75	29.8	29.8	30.6
	medium	106	42.1	42.1	72.6
	medium-fine	8	3.2	3.2	75.8
	coarse	22	8.7	8.7	84.5
	no predominant soil type	38	15.1	15.1	99.6
	I do not know	1	0.4	0.4	100.0
Total		**252**	**100.0**	**100.0**	

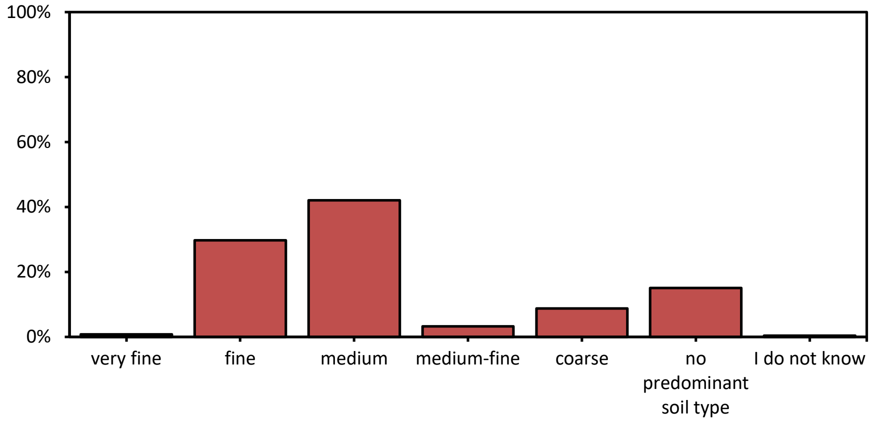


Figure 10: Predominant soil type of maize grown area in 2020

Farmers' responses regarding the soil quality of the maize-grown areas are given in Table 18 and Figure 11. 99.6 % (251/252) 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 2020

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	below average - poor	1	0.4	0.4	0.4
	average - normal	183	72.6	72.6	73.0
	above average - good	68	27.0	27.0	100.0
Total		**252**	**100.0**	**100.0**	

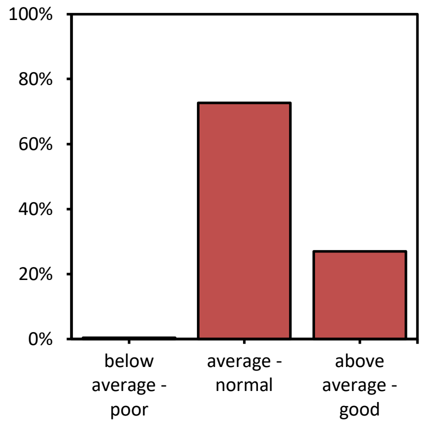


Figure 11: Soil quality of the maize grown area as assessed by the farmers in 2020

112 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 1.2 % (Table 19). 140 farmers did not specify the humus content.

Table 19: Humus content (%) in 2020

Valid N	Mean	Minimum	Maximum	Missing N
112	1.2	0	3.0	140

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 95.6 % (241/252) of the farmers (Table 20, Figure 12).

Table 20: Farmers assessment of the local disease pressure (fungal, viral) in 2020

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	low	30	11.9	11.9	11.9
	as usual	211	83.7	83.7	95.6
	high	11	4.4	4.4	100.0
Total		**252**	**100.0**	**100.0**	

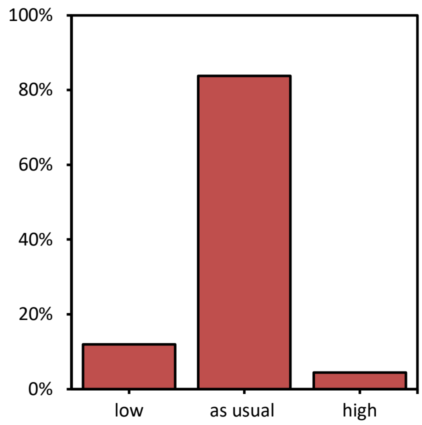


Figure 12: Farmers assessment of the local disease pressure (fungal, viral) in 2020

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

Regarding the local pest pressure (insects, mites, nematodes), 86.5 % (218/252) of the farmers evaluated it to be low or $as\ usual$ and 13.5 % (34/252) evaluated it to be $high$ (Table 21, Figure 13).

Table 21: Farmers assessment of the local pest pressure (insects, mites, nematodes) in 2020

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	low	32	12.7	12.7	12.7
	as usual	186	73.8	73.8	86.5
	high	34	13.5	13.5	100.0
Total		**252**	**100.0**	**100.0**	

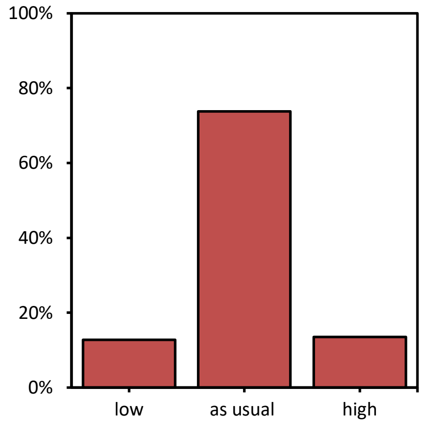


Figure 13: Farmers assessment of the local pest pressure (insects, mites, nematodes) in 2020

3.2.6.3 Local weed pressure as assessed by the farmers

99.2 % (250/252) assessed the local weed pressure to be low or $as\ usual$ and 0.8 % (2/252) evaluated it to be $high$ (Table 22, Figure 14).

Table 22: Farmers assessment of the local weed pressure in 2020

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	low	5	2.0	2.0	2.0
	as usual	245	97.2	97.2	99.2
	high	2	0.8	0.8	100.0
Total		**252**	**100.0**	**100.0**	

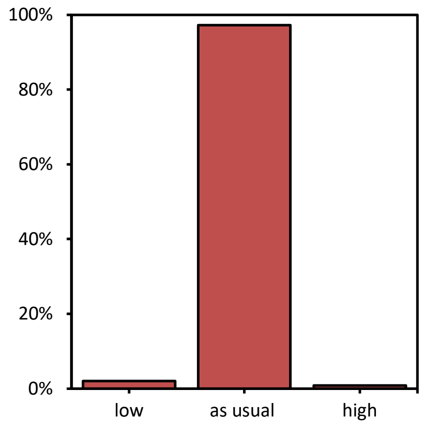


Figure 14: Farmers assessment of the local weed pressure in 2020

3.3 Part 2: Typical agronomic practices to grow maize

3.3.1 Irrigation of maize grown area

100.0 % (252/252) 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 2020

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	yes	252	100.0	100.0	100.0
	no	0	0.0	0.0	100.0
Total		**252**	**100.0**	**100.0**	

Most of the farmers used Sprinkler (64.7 %) or Gravity (27.4 %) irrigation followed by Pivot (6.7 %). The remaining 3 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 2020

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	Sprinkler	163	64.7	64.7	64.7
	Gravity	69	27.4	27.4	92.1
	Pivot	17	6.7	6.7	98.8
	other	1	0.4	0.4	99.2
	Gravity and Sprinkler	1	0.4	0.4	99.6
	Gravity and Pivot	1	0.4	0.4	100.0
Total		**252**	**100.0**	**100.0**	

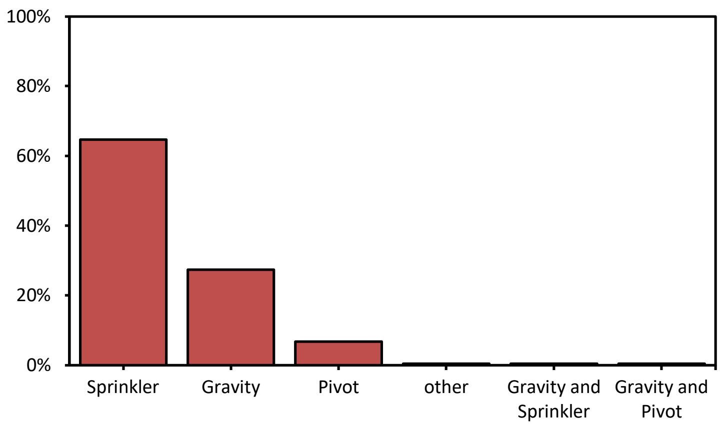


Figure 15: Irrigation types of maize grown area in 2020

3.3.2 Major rotation of maize grown area

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

Table 25: Major rotation of maize grown area before 2020 planting season (two years ago and previous year) sorted by frequency.

	Two years ago	Previous year	Frequency	Valid Percentage	Accumulated percentage
Valid	maize	maize	76	30.3	30.3
	maize	barley	35	13.9	44.2
	maize	wheat	22	8.8	53.0
	wheat	maize	17	6.8	59.8
	maize	pea	13	5.2	64.9
	barley	maize	13	5.2	70.1
	alfalfa	maize	8	3.2	73.3
	ryegrass	ryegrass	4	1.6	74.9
	pea	maize	4	1.6	76.5
	maize	beans	3	1.2	77.7
	wheat	wheat	3	1.2	78.9
	alfalfa	alfalfa	3	1.2	80.1
	alfalfa	barley	2	0.8	80.9
	maize	tobaco	2	0.8	81.7
	pea	wheat	2	0.8	82.5
	fallow	maize	2	0.8	83.3
	oats	sunflower	2	0.8	84.1
	wheat	sugar beet	1	0.4	84.5
	rice	rice	1	0.4	84.9
	sunflower	barley	1	0.4	85.3
	sunflower	wheat	1	0.4	85.7
	alfalfa	wheat	1	0.4	86.1
	beans	pea	1	0.4	86.5
	potatoe / pea	potato / pea / oat	1	0.4	86.9
	pea	barley	1	0.4	87.3
	barley	vetch	1	0.4	87.6
	barley	pea	1	0.4	88.0
	Potato / Cabbage / Pea	cabbage / potato	1	0.4	88.4
	wheat	beans	1	0.4	88.8
	cauliflower	maize	1	0.4	89.2
	potato / pea / cabbage	potato / cabbage / pea / oat	1	0.4	89.6
	triticale	barley	1	0.4	90.0
	oats	wheat	1	0.4	90.4
	potato / pea / wheat / lucerne / ryegrass	potato / pea / wheat / lucerne / oat	1	0.4	90.8
	watermelon	maize	1	0.4	91.2
	chard	wheat	1	0.4	91.6
	tobaco	maize	1	0.4	92.0
	pepper	pepper	1	0.4	92.4
	tomato	tomato	1	0.4	92.8
	wheat	vetch	1	0.4	93.2
	wheat	cauliflower	1	0.4	93.6
	wheat	fallow	1	0.4	94.0
	wheat	barley	1	0.4	94.4
	ryegrass	maize	1	0.4	94.8
	pea / potato	Potato / Cabbage / Pea	1	0.4	95.2
	vetch	maize	1	0.4	95.6
	ryegrass	triticale	1	0.4	96.0
	prairie	prairie	1	0.4	96.4
	maize	barley / peas	1	0.4	96.8
	vegetables	vegetables	1	0.4	97.2
	maize	cotton	1	0.4	97.6
	maize	potato / wheat	1	0.4	98.0
	maize	watermelon	1	0.4	98.4
	maize	tomato	1	0.4	98.8
	maize	legumes	1	0.4	99.2
	maize	pepper	1	0.4	99.6
	maize	sugar beet	1	0.4	100.0
Total			**252**	**100.0**	

3.3.3 Soil tillage practices

The farmers were asked to answer whether they performed soil tillage. 96.8 % (244/252) said yes (Table 26, Figure 16) while 3.2 % (8/252) answered no.

Table 26: Soil tillage practices in 2020

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	yes	244	96.8	96.8	96.8
	no	8	3.2	3.2	100.0
Total		**252**	**100.0**	**100.0**	

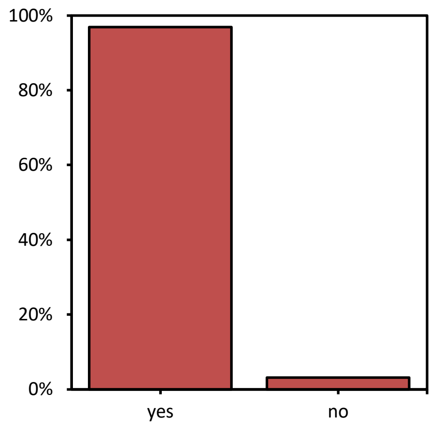


Figure 16: Soil tillage practices in 2020

All farmers who said yes specified the time of tillage. 0.4 % (1/244) performed it in $winter$, 99.6 % (243/244) in $spring$ and no one in $winter\ and\ spring$ (Table 27, Figure 17).

Table 27: Time of tillage in 2020

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	winter	1	0.4	0.4	0.4
	spring	243	96.4	99.6	100.0
	winter & spring	0	0.0	0.0	100.0
	Total	244	96.8	100.0	
Missing	no statement	8	3.2		
Total		252	100.0		

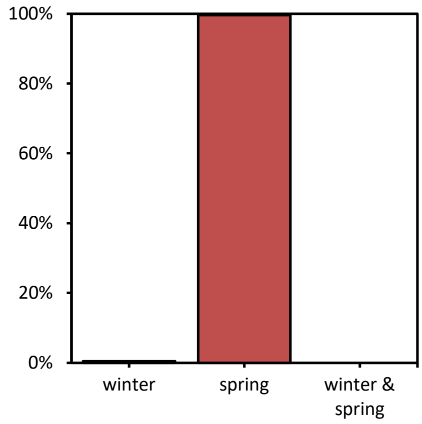


Figure 17: Time of tillsage in 2020

3.3.4 Maize planting technique

88.5 % (223/252) of the farmers used *conventional* maize planting techniques, 8.7 % (22/252) *mulch* and 2.8 % (7/252) used *direct sowing* (Table 28, Figure 18).

Table 28: Maize planting technique in 2020

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	conventional planting	223	88.5	88.5	88.5
	mulch	22	8.7	8.7	97.2
	direct sowing	7	2.8	2.8	100.0
Total		**252**	**100.0**	**100.0**	

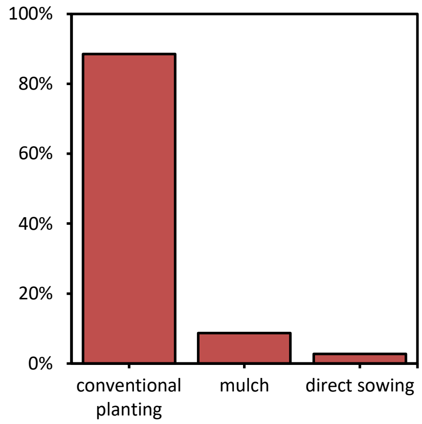


Figure 18: Maize planting technique in 2020

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 97.6 % of the farmers (246/252) applied $insecticides$ and 2.4 % (6/246) of them applied $insecticides\ against\ corn\ borer$. 2.0 % (5/252) of the farmers made $use\ of\ biological\ treatments$. All of the farmers (252/252) used $herbicides$. None of the farmers used $fungicides$ or $mechanical\ weed\ control$ (Table 29).

Table 29: Typical weed and pest control practices in maize in 2020

Insecticide(s)		**Frequency**	**Percent**
	yes	246	97.6
	no	6	2.4
Total		252	100.0
Insecticide(s) against Corn Borer		**Frequency**	**Percent**
	yes	6	2.4
	no	240	95.2
	Total	246	
Missing	no statement	6	2.4
Total		252	100.0
Use of biocontrol treatments		**Frequency**	**Percent**
	yes	5	2.0
	no	247	98.0
Total		252	100.0
Herbicide(s)		**Frequency**	**Percent**
	yes	252	100.0
	no	0	0.0
Total		252	100.0
Mechanical weed control		**Frequency**	**Percent**
	yes	0	0.0
	no	252	100.0
Total		252	100.0
Fungicide(s)		**Frequency**	**Percent**
	yes	0	0.0
	no	252	100.0
Total		252	100.0
Other		**Frequency**	**Percent**
	yes	0	0.0
	no	252	100.0
Total		252	100.0

3.3.6 Application of fertilizer to maize grown area

All of the farmers (252/252) applied fertilizer to the maize grown area (Table 30).

Table 30: Application of fertilizer to maize grown area in 2020

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	yes	252	100.0	100.0	100.0
	no	0	0.0	0.0	100.0
Total		**252**	**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 15 Feburary 2020 to 30 June 2020 (Table 31).

Table 31: Typical time of maize sowing in 2020

	Minimum	Maximum	Mean	Valid N
Sowing from	15.02.2020	20.06.2020	19.04.2020	252
Sowing till	15.03.2020	30.06.2020	18.05.2020	252

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 01 August 2020 to 31 December 2020 and for forage maize from 01 August 2020 to 30 December 2020 (Table 32).

Table 32: Typical time of maize harvest in 2020

	Minimum	Maximum	Mean	Valid N
Harvest grain maize from	01.08.2020	20.12.2020	19.10.2020	239
Harvest grain maize till	30.08.2020	31.12.2020	19.11.2020	239
Harvest forage maize from	01.08.2020	01.12.2020	18.09.2020	21
Harvest forage maize till	05.09.2020	30.12.2020	15.10.2020	21

3.4 Part 3: Observations of MON 810

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

3.4.1.1 Crop rotation

The crop rotation for MON 810 was specified to be $as\ usual$ in 98.4 % (248/252) 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 2020

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	as usual	248	98.4	98.4	98.4
	changed	4	1.6	1.6	100.0
Total		**252**	**100.0**	**100.0**	

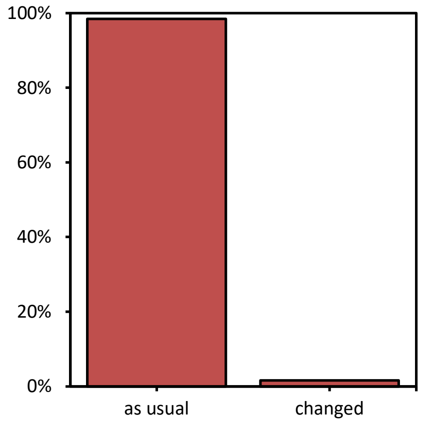


Figure 19: Crop rotation of MON 810 compared to conventional maize in 2020

(1) The valid percentage of $as\ usual$ crop rotation (98.4 %) is significantly greater than 90 %. The resulting p-value is smaller 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 2020

N valid	$As\ usual$	p-value for $p_{As\ usual} = 0.9$	$Minus$	p-value for $p_{Minus} = 0.1$	$Plus$	p-value for $p_{Plus} = 0.1$
252	248 (98.4 %)	< 0.01	-	-	4 (1.6 %)	< 0.01

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

3.4.1.2 Time of planting

The time of planting of MON 810 was specified to be $as\ usual$ compared to conventional maize by 98.0 % (247/252) 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 2020

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	earlier	0	0.0	0.0	0.0
	as usual	247	98.0	98.0	98.0
	later	5	2.0	2.0	100.0
Total		**252**	**100.0**	**100.0**	

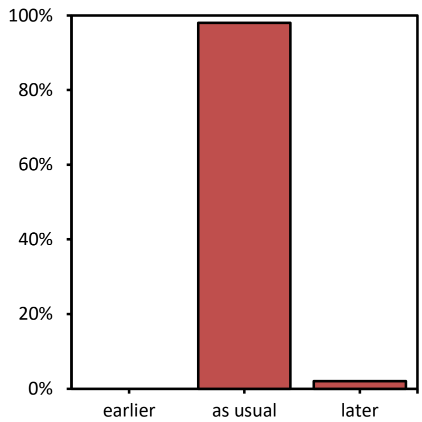


Figure 20: Time of planting of MON 810 compared to conventional maize in 2020

(1) The valid percentage of $as\ usual$ time of planting (98.0 %) is significantly greater than 90 %. The resulting p-value is smaller 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 2020

N valid	$As\ usual$	p-value for $p_{As\ usual} = 0.9$	$Minus$	p-value for $p_{Minus} = 0.1$	$Plus$	p-value for $p_{Plus} = 0.1$
252	247 (98.0 %)	< 0.01	0 (0.0 %)	< 0.01	5 (2.0 %)	< 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 %	95.8 %	100.3 %	0.0 %	0.0 %	0.0 %	2.0 %	0.0 %	4.2 %

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 conventional sowing for conventional maize and minimum tillage for YieldGard because I plant it later”.

Table 37: Tillage and planting techniques for MON 810 compared to conventional maize in 2020

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	as usual	251	99.6	99.6	99.6
	changed	1	0.4	0.4	100.0
Total		**252**	**100.0**	**100.0**	

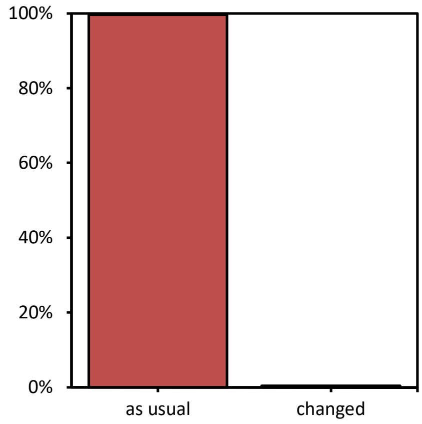


Figure 21: Tillage and planting techniques for MON 810 compared to conventional maize in 2020

(1) The valid percentage of *as usual* tillage and planting techniques (99.6 %) is significantly greater than 90 %. The resulting p-value is smaller 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 2020

N valid	*As usual*	p-value for $p_{As\ usual} = 0.9$	*Minus*	p-value for $p_{Minus} = 0.1$	*Plus*	p-value for $p_{Plus} = 0.1$
252	251 (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 2020. Abamectin, Lambda-cyhalothrin and Deltamethrin were the most used active ingredients for spraying, while Chlorpyrifos and 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. 97.6 % (246/252) specified no change in practice, while 2.4 % (6/252) $changed$ their program (Table 39, Figure 22).

Table 39: Use of insect control in MON 810 compared to conventional maize in 2020

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	as usual	246	97.6	97.6	97.6
	changed	6	2.4	2.4	100.0
Total		**252**	**100.0**	**100.0**	

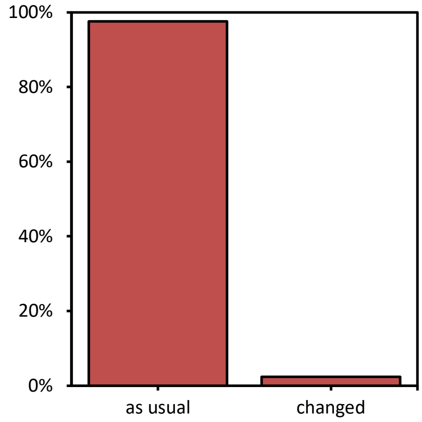


Figure 22: Insect control practice of MON 810 compared to conventional maize in 2020

(1) The valid percentage of $as\ usual$ insect control practice (97.6 %) is significantly greater than 90 %. The resulting p-value is smaller 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 2020

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
252	246 (97.6 %)	< 0.01	-	-	6 (2.4 %)	< 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
97.6 %	95.1 %	100.1 %	-	-	-	2.4 %	0.0 %	4.9 %

When asked whether the farmers usually use insecticides in conventional maize, 246 stated that they did, while 6 farmers said they usually don't. Additionally, 6 of the 246 farmers stated that they changed their insect control practice in MON 810, meaning that with MON 810 they do not use insecticides (Table

41). Furthermore, when investigating the question whether the farmers usually use insecticides specifically against corn borers, it can be seen that the mentioned 6 farmers with changed insecticide control practices specifically changed their corn borer control practice, as it is not necessary in MON 810 (Table 42). 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 2020

		Insect control practice in MON 810		
		as usual	changed	**Total**
Do you usually use insecticides? (section 3.3.5)	yes	240	6	**246**
	no	6	0	**6**
Total		**246**	**6**	**252**

Table 42: Corn Borer control practice compared to conventional maize in the context of the general use of insecticides against Corn Borer in 2020

		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	6	**6**
	no	240	0	**240**
Total		**246**	**6**	**246**

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
- Terbuthylazine
- Isoxaflutole
- Thiencarbazone-methyl
- 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 2020 compared to conventional maize. 99.6 % (251/252) 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 23). The single farmer (from Spain) applying a different weed control practice stated “I apply the herbicide in post-emergence in the YiedGard maize and I apply the herbicide in pre-emergence in the conventional”.

Table 43: Use of weed control in MON 810 compared to conventional maize in 2020

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	as usual	251	99.6	99.6	99.6
	changed	1	0.4	0.4	100.0
Total		**252**	**100.0**	**100.0**	

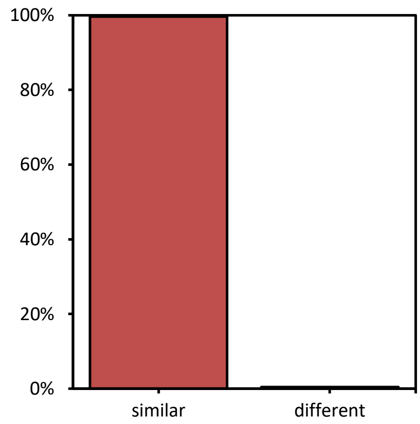


Figure 23: Use of weed control in MON 810 compared to conventional maize in 2020

(1) The valid percentage of $as\ usual$ weed control practice (99.6 %) is significantly greater than 90 %. The resulting p-value is smaller 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 2020

N valid	$As\ usual$	p-value for $p_{As\ usual} = 0.9$	$Minus$	p-value for $p_{Minus} = 0.1$	$Plus$	p-value for $p_{Plus} = 0.1$
252	251 (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 2020 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 2020

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	as usual	251	99.6	100.0	100.0
	changed	0	0.0	0.0	100.0
	Total	**251**	**99.6**	**100.0**	
Missing	No statement	1	0.4		
Total		252	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 2020

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	as usual	252	100.0	100.0	100.0
	changed	0	0.0	0.0	100.0
Total		**252**	**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 2020

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	as usual	252	100.0	100.0	100.0
	changed	0	0.0	0.0	100.0
Total		**252**	**100.0**	**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. 98.4 % of them (248/252) responded that they did not change the harvesting date for MON 810. The remaining 4 farmers (1.2 %) harvested *later* (Table 48, Figure 24). 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 2020

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	earlier	0	0.0	0.0	0.0
	as usual	248	98.4	98.4	98.4
	later	4	1.6	1.6	100.0
Total		**252**	**100.0**	**100.0**	

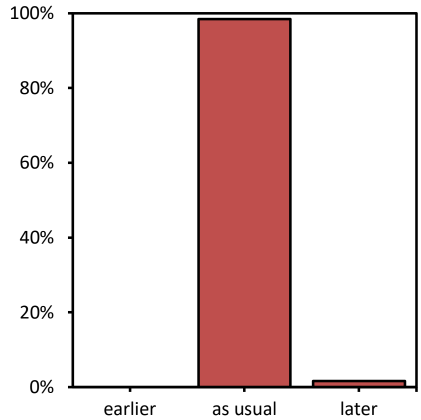


Figure 24: Harvest of MON 810 compared to conventional maize in 2020

(1) The valid percentage of $as\ usual$ harvest of MON 810 (98.4 %) is significantly greater than 90 %. The resulting p-value is smaller 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 2020

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
252	248 (98.4 %)	< 0.01	0 (0.0 %)	< 0.01	4 (1.6 %)	< 0.01

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

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 12 farmers (4.8 %) assessed the germination of MON 810 to be $more\ vigorous$, 95.2 % (240/252) found it to be $as\ usual$ (Table 50, Figure 25). 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 2020

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	less vigourous	0	0.0	0.0	0.0
	as usual	240	95.2	95.2	95.2
	more vigourous	12	4.8	4.8	100.0
Total		**252**	**100.0**	**100.0**	

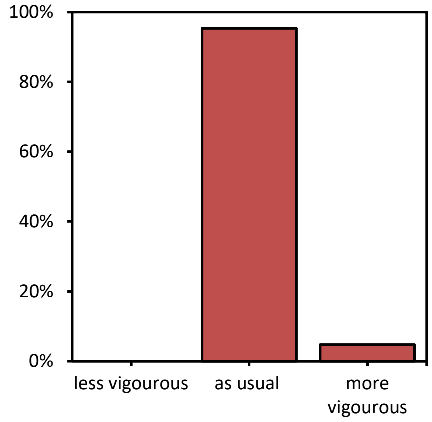


Figure 25: Harvest of MON 810 compared to conventional maize in 2020

(1) The valid percentage of $as\ usual$ germination vigor (95.2 %) is significantly greater than 90 %. The resulting p-value is smaller 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 85 %.

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 2020

N valid	$As\ usual$	p-value for $p_{As\ usual} = 0.9$	$Minus$	p-value for $p_{Minus} = 0.1$	$Plus$	p-value for $p_{Plus} = 0.1$
252	240 (95.2 %)	< 0.01	0 (0.0 %)	< 0.01	12 (4.8 %)	< 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
95.2 %	91.8 %	98.7 %	0.0 %	0.0 %	0.0 %	4.8 %	1.3 %	8.2 %

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 2020

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	accelerated	0	0.0	0.0	0.0
	as usual	252	100.0	100.0	100.0
	delayed	0	0.0	0.0	100.0
Total		**252**	**100.0**	**100.0**	

No effect on time to emergence is indicated.

3.4.2.3 Time to male flowering

All but one farmer (99.6 %; 251/252) assessed the time to male flowering to be $as\ usual$ (Table 53). The single farmer gave $delayed$ as an answer. 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 2020

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	accelerated	0	0.0	0.0	0.0
	as usual	251	99.6	99.6	99.6
	delayed	1	0.4	0.4	100.0
Total		**252**	**100.0**	**100.0**	

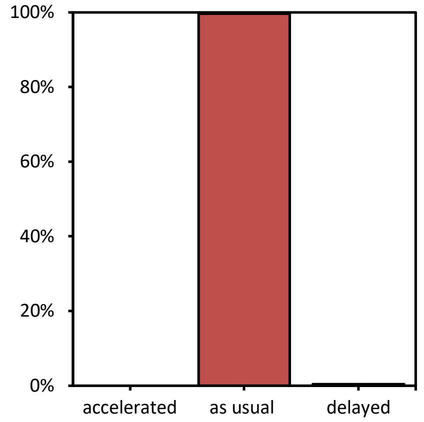


Figure 26: Time to male flowering of MON 810 compared to conventional maize in 2020

(1) The valid percentage of $as\ usual$ time to male flowering (99.6 %) is significantly greater than 90 %. The resulting p-value is smaller 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 time to male flowering is indicated.

Table 54: Test results as well as 99 % confidence intervals for $p_{As\ usual}$, p_{Minus} and p_{Plus} probabilities of time to male flowering in MON 810 compared to conventional maize in 2020

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
252	251 (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 %

3.4.2.4 Plant growth and development

Plant growth and development was assessed to be *delayed* by 4 farmer (1.6 %) and to be *as usual* in 98.4 % (248/252) of all cases (Table 55, Figure 27). Individual explanations for these observations are given in Appendix A, Table A 7.

Table 55: Plant growth and development of MON 810 compared to conventional maize in 2020

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	accelerated	0	0.0	0.0	0.0
	as usual	248	98.4	98.4	98.4
	delayed	4	1.6	1.6	100.0
Total		**252**	**100.0**	**100.0**	

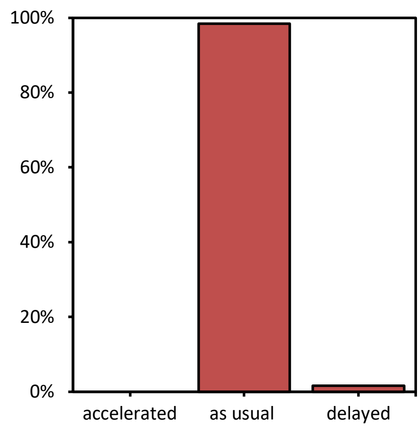


Figure 27: Plant growth and development of MON 810 compared to conventional maize in 2020

(1) The valid percentage of *as usual* plant growth and development (98.4 %) is significantly greater than 90 %. The resulting p-value is smaller than the level of significance $\alpha = 0.01$ (Table 56). 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 56: Test results as well as 99 % confidence intervals for $p_{As\ usual}$, p_{Minus} and p_{Plus} probabilities of plant growth and development in MON 810 compared to conventional maize in 2020

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
252	248 (98.4 %)	< 0.01	0 (0.0 %)	< 0.01	4 (1.6 %)	< 0.01

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

3.4.2.5 Incidence of stalk/root lodging

Incidence of stalk/root lodging was assessed to be $less$ in MON 810 compared to conventional maize in 20.2 % (51/252) of all cases and $as\ usual$ in 79.8 % (201/252) (Table 57, Figure 28). Individual explanations for these observations are given in Appendix A, Table A 7.

Table 57: Incidence of stalk/root lodging of MON 810 compared to conventional maize in 2020

		Frequency	**Percent**	**Valid percentages**	**Accumulated percentages**
Valid	less often	51	20.2	20.2	20.2
	as usual	201	79.8	79.8	100.0
	more often	0	0.0	0.0	100.0
Total		**252**	**100.0**	**100.0**	

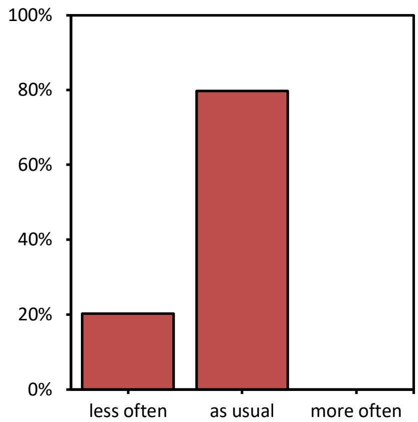


Figure 28: Incidence of stalk/root lodging of MON 810 compared to conventional maize in 2020

(1) The valid percentage of $as\ usual$ incidence of stalk/root lodging (79.8 %) is less than 90 %. The resulting p-value is larger than the level of significance $\alpha = 0.01$ (Table 58) and therefore, the corresponding null hypothesis $p_{as\ usual} \leq 0.9$ could not be rejected.

(2) The valid percentage of $less$ incidence of stalk/root lodging (20.2 %) exceeds the 10 % threshold. The resulting p-value is larger than the level of significance $\alpha = 0.01$ (Table 58) and therefore, the corresponding null hypothesis $p_{less\ often} \geq 0.1$ could not be rejected.

The 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 58). 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 58: Test results as well as 99 % confidence intervals for $p_{As\ usual}$, p_{Minus} and p_{Plus} probabilities of incidence of stalk/root lodging in MON 810 compared to conventional maize in 2020

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
252	201 (79.8%)	1.0	51 (20.2%)	1.0	0 (0.0%)	< 0.01

$p_{As\ usual}$	lower 99 % confidence limit	upper 99 % confidence limit	p_{Minus}	lower 99 % confidence limit	upper 99 % confidence limit	p_{Plus}	lower 99 % confidence limit	upper 99 % confidence limit
79.8 %	73.2 %	86.3 %	20.2 %	13.7 %	26.8 %	0.0 %	0.0 %	0.0 %

3.4.2.6 Time to maturity

3.6 % (9/252) of the farmers assessed the time to maturity to be *delayed* for MON 810 and *as usual* in 96.4 (243/252) (Table 59, Figure 29). Individual explanations for these observations are given in Appendix A, Table A 7.

Table 59: Time to maturity of MON 810 compared to conventional maize in 2020

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	accelerated	0	0.0	0.0	0.0
	as usual	243	96.4	96.4	96.4
	delayed	9	3.6	3.6	100.0
Total		**252**	**100.0**	**100.0**	

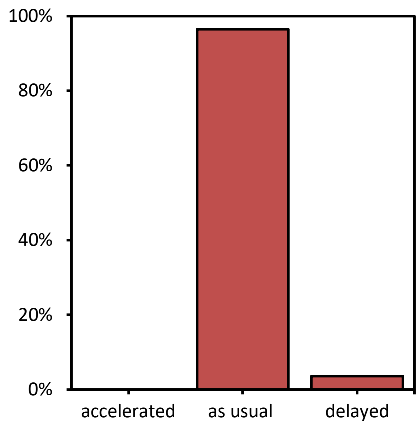


Figure 29: Time to maturity of MON 810 compared to conventional maize in 2020

(1) The valid percentage of *as usual* time to maturity (96.4 %) is significantly greater than 90 %. The resulting p-value is smaller than the level of significance $\alpha = 0.01$ (Table 60). The null hypothesis $p_{as\ usual} \leq 0.9$ is rejected with a power of 98 %.

No effect on time to maturity is indicated.

Table 60: Test results as well as 99 % confidence intervals for $p_{As\ usual}$, p_{Minus} and p_{Plus} probabilities of time to maturity in MON 810 compared to conventional maize in 2020

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
252	243 (96.4 %)	< 0.01	0 (0.0 %)	< 0.01	9 (3.6 %)	< 0.01

$p_{As\ usual}$	lower 99 % confidence limit	upper 99 % confidence limit	p_{Minus}	lower 99 % confidence limit	upper 99 % confidence limit	p_{Plus}	lower 99 % confidence limit	upper 99 % confidence limit
96.4 %	93.4 %	99.4 %	0.0 %	0.0 %	0.0 %	3.6 %	0.6 %	6.6 %

3.4.2.7 Yield

Yield was found to be $higher$ in 27.8 % (70/252) and $as\ usual$ in 72.2 % (182/252) of all cases (Table 61, Figure 30). Individual explanations for these observations are given in Appendix A, Table A 7.

Table 61: Yield of MON 810 compared to conventional maize in 2020

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	lower yield	0	0.0	0.0	0.0
	as usual	182	72.2	72.2	72.2
	higher yield	70	27.8	27.8	100.0
Total		**252**	**100.0**	**100.0**	

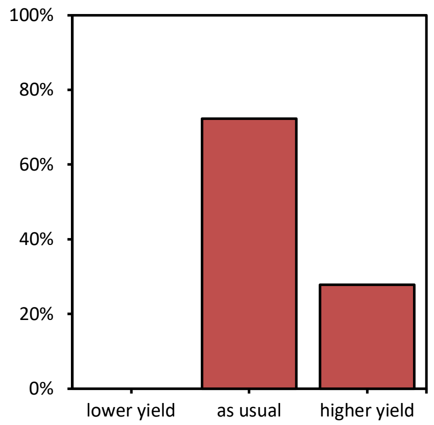


Figure 30: Yield of MON 810 compared to conventional maize in 2020

(1) The valid percentage of $as\ usual$ yield (72.2 %) is smaller than 90 %. The resulting p-value is larger than the level of significance $\alpha = 0.01$ (Table 62) and therefore, the corresponding null hypothesis $p_{as\ usual} \leq 0.9$ could not be rejected.

(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 62). The null hypothesis $p_{lower\ yield} \geq 0.1$ is rejected with a power of 100 %.

The valid percentage of $higher$ yield (27.8 %) exceeds the 10 % threshold. The resulting p-value is greater than the level of significance $\alpha = 0.01$ (Table 62) and therefore, the corresponding null hypothesis $p_{higher\ yield} \geq 0.1$ could not be rejected.

An effect on yield of MON 810 is indicated.

Table 62: Test results as well as 99 % confidence intervals for $p_{As\ usual}$, p_{Minus} and p_{Plus} probabilities of yield in MON 810 compared to conventional maize in 2020

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
252	182 (72.2%)	1.0	0 (0.0%)	< 0.01	70 (27.8%)	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
72.2 %	65.0 %	79.5 %	0.0 %	0.0 %	0.0 %	27.8 %	20.5 %	35.0 %

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 0.8 % (2/252) and *as usual* in 99.2 % (250/252) of all cases (Table 63, Figure 31). Individual explanations for these observations are given in Appendix A, Table A 7.

Table 63: Occurrence of MON 810 volunteers compared to conventional maize in 2020

		Frequency	**Percent**	**Valid percentages**	**Accumulated percentages**
Valid	less often	2	0.8	0.8	0.8
	as usual	250	99.2	99.2	100.0
	more often	0	0.0	0.0	100.0
Total		**252**	**100.0**	**100.0**	

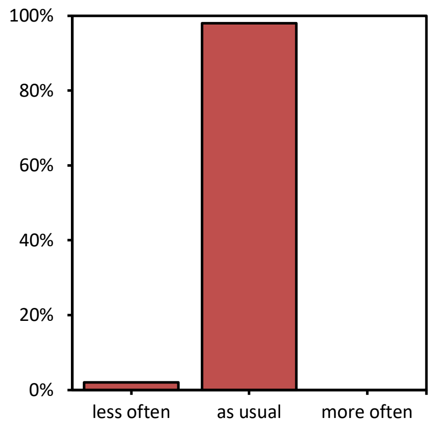


Figure 31: Occurrence of MON 810 volunteers compared to conventional maize in 2020

(1) The valid percentage of *as usual* occurrence of volunteers (99.2 %) is significantly greater than 90 %. The resulting p-value is smaller than the level of significance $\alpha = 0.01$ (Table 64). The null hypothesis $p_{as\ usual} \leq 0.9$ is rejected with a power of 100 %.

No effect on occurrence of MON 810 volunteers is indicated.

Table 64: Test results as well as 99 % confidence intervals for $p_{As\ usual}$, p_{Minus} and p_{Plus} probabilities of occurrence of volunteers in MON 810 compared to conventional maize in 2020

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
252	250 (99.2 %)	< 0.01	2 (0.8 %)	< 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
99.2 %	97.8 %	100.6 %	0.8 %	0.0 %	2.2 %	0.0 %	0.0 %	0.0 %

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

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

- an unchanged germination,
- an unchanged time to emergence,
- an unchanged time to male flowering,
- an unchanged plant growth and development,
- a **<u>less frequent</u>** incidence of stalk/root lodging,
- a unchanged time to maturity,
- a **<u>higher</u>** 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 % (5/252) of the time (Table 65, Figure 32).

Table 65: Disease susceptibility in MON 810 compared to conventional maize in 2020

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	less susceptible	5	2.0	2.0	2.0
	as usual	246	97.6	98.0	100.0
	more susceptible	0	0.0	0.0	100.0
	Total	**251**	**99.6**	**100.0**	
Missing	No statement	1	0.4		
Total		252	100.0		

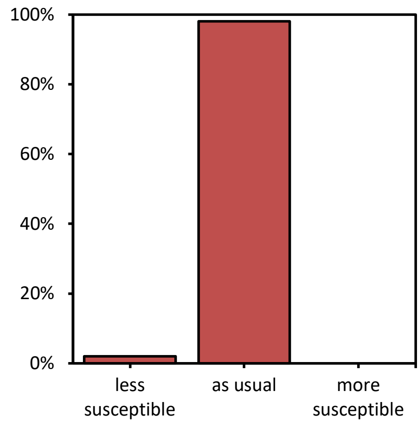


Figure 32: Disease susceptibility of MON 810 compared to conventional maize in 2020

(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 66) The null hypothesis $p_{as\ usual} \leq 0.9$ is rejected with a power of 100 %.

No effect on disease susceptibility is indicated.

Table 66: Test results as well as 99 % confidence intervals for $p_{As\ usual}$, p_{Minus} and p_{Plus} probabilities of disease susceptibility in MON 810 compared to conventional maize in 2020

N valid	$As\ usual$	p-value for $p_{As\ usual} = 0.9$	$Minus$	p-value for $p_{Minus} = 0.1$	$Plus$	p-value for $p_{Plus} = 0.1$
251	246 (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 67 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* (1.2 %, 3/251), *Hongos generos fusarium* (1.2 %, 3/251), *Ustilago maydis* (1.2 %, 3/251), *Sphacelotheca reiliana* (1.2 %, 3/251) and to *Maize Dwarf Mosaic Virus/Maize Rough Dwarf Virus* (0.4 %, 1/251).

Table 67: Specification of differences in disease susceptibility in MON 810 compared to conventional maize in 2020

Group	Species	More	Less
Fungus	*Fusariosis*	0	3
	Hongos generos fusarium	0	3
	Ustilago maydis	0	3
	Sphacelotheca reiliana	0	3
Virus	*Maize Dwarf Mosaic Virus, Maize Rough Dwarf Virus*	0	1

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

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

Three of the 5 farmers reported less disease susceptibility to some fungal species, specified as *Fusariosis*, *Hongos generos fusarium, Ustilago maydis* and *Sphacelotheca reiliana*, while one of them reported less disease susceptibility to *Maize Dwarf Mosaic Virus or Maize Rough Dwarf Virus.*

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 % (251/251) of the cases (Table 68, Figure 33).

Table 68: Insect pest control of *O. nubilalis* in MON 810 in 2020

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	weak	0	0.0	0.0	0.0
	good	12	4.8	4.8	4.8
	very good	239	94.8	95.2	100.0
	Total	**251**	**99.6**	**100.0**	
Missing	No statement	1	0.4		
	Do not know	0	0.0		
Total		252	100.0		

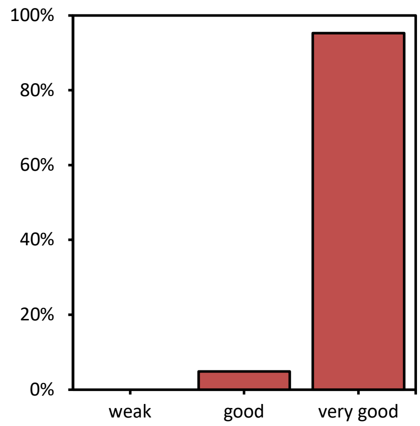


Figure 33: Insect pest control of *Ostrinia nubilalis* in MON 810 in 2020

100.0 % (251/251) of the farmers attested a $good$ or $very\ good$ control of *Sesamia* spp. (Pink Borer) (Table 69, Figure 34).

Table 69: Insect pest control of *Sesamia* spp. in MON 810 in 2020

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	weak	0	0.0	0.0	0.0
	good	12	4.8	4.8	4.8
	very good	239	94.8	95.2	100.0
	Total	**251**	**99.6**	**100.0**	
Missing	No statement	0	0.0		
	Do not know	1	0.4		
Total		252	100.0		

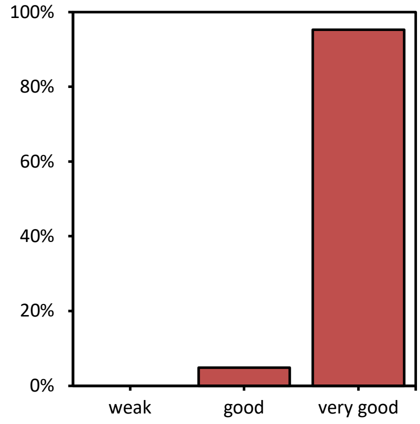


Figure 34: Insect pest control of *Sesa mia* spp. in MON 810 in 2020

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 7.1 % (18/250) of all cases (Table 70, Figure 35).

Table 70: Pest susceptibility of MON 810 compared to conventional maize in 2020

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	less susceptible	18	7.1	7.2	7.2
	as usual	232	92.1	92.8	100.0
	more susceptible	0	0.0	0.0	100.0
	Total	**250**	**99.2**	**100.0**	
Missing	No statement	2	0.8		
Total		252	100.0		

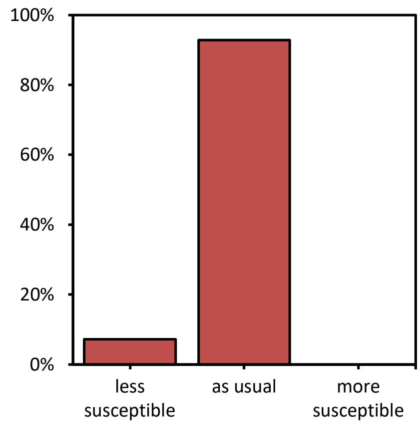


Figure 35: Pest susceptibility of MON 810 compared to conventional maize in 2020

(1) The valid percentage of $as\ usual$ susceptibility (92.8 %) is greater than 90 %. However, the resulting p-value is larger than the level of significance $\alpha = 0.01$ (Table 71) and therefore, the corresponding null hypothesis $p_{as\ usual} \leq 0.9$ could not be rejected.

(2) The valid percentage of $lower$ susceptibility (7.2 %) is smaller than 10 %. However, the resulting p-value is larger than the level of significance $\alpha = 0.01$ (Table 71) and therefore, the corresponding null hypothesis $p_{lower\ yield} \geq 0.1$ could not be rejected.

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 71). The null hypothesis $p_{lower\ yield} \geq 0.1$ is rejected with a power of 100 %.

An effect on pest susceptibility of MON 810 is indicated.

Table 71: Test results as well as 99 % confidence intervals for $p_{As\ usual}$, p_{Minus} and p_{Plus} probabilities of pest susceptibility in MON 810 compared to conventional maize in 2020

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	232 (92.8 %)	0.0513	18 (7.2 %)	0.081	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
92.8 %	88.6 %	97.0 %	7.2 %	3.0 %	11.4 %	0.0 %	0.0 %	0.0 %

The 18 farmers that answered different from *as usual* were asked to specify the observed difference in pest susceptibility by listing respective pests with an explanation. Table 72 lists the reported pests with an assessment of the pest susceptibility of MON 810, compared to conventional maize. This list shows that the lower pest susceptibility was predominantly attributed to a lower susceptibility to pests of the order Lepidoptera.

Table 72: Specification of differences in pest susceptibility in MON 810 compared to conventional maize in 2020

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	239 (95.6 %)	< 0.01	11 (4.4 %)	< 0.01	0 (0.0 %)	< 0.01
	Mythimna spp. (Mitima)	250	243 (97.2 %)	< 0.01	7 (2.8 %)	< 0.01	0 (0.0 %)	< 0.01
	Spodoptera Frugiperda	250	246 (98.4 %)	< 0.01	4 (1.6 %)	< 0.01	0 (0.0 %)	< 0.01
	Heliothis	250	246 (98.4 %)	< 0.01	4 (1.6 %)	< 0.01	0 (0.0 %)	< 0.01
	Helicoverpa zea	250	249 (99.6 %)	< 0.01	1 (0.4 %)	< 0.01	0 (0.0 %)	< 0.01
Coleoptera	Diabrotica / Agriotes	250	245 (98.0 %)	< 0.01	5 (2.0 %)	< 0.01	0 (0.0 %)	< 0.01

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

(1) the valid percentages of $as\ usual$ pest susceptibility in MON 810 compared to conventional maize in 2020 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.

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

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 (252/252) found the weed pressure to be *as usual* in MON 810 fields compared to conventional fields (Table 73).

Table 73: Weed pressure in MON 810 compared to conventional maize in 2020

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	less weeds	0	0.0	0.0	0.0
	as usual	252	100.0	100.0	100.0
	more weeds	0	0.0	0.0	100.0
Total		**252**	**100.0**	**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:

- *Chenopodium album*
- *Sorghum halepense*
- *Abutilon theophrasti*
- *Amaranthus retroflexus*
- *Datura stramonium*
- *Setaria spp.*
- *Xanthium strumarium*
- *Hordeum sp.*

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

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

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

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

3.4.7.1 Occurrence of non target insects

All farmers (252/252) assessed the occurrence of non target insects in MON 810 fields to be $as\ usual$ (Table 74).

Table 74: Occurrence of non target insects in MON 810 compared to conventional maize in 2020

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	less	0	0.0	0.0	0.0
	as usual	252	100.0	100.0	100.0
	more	0	0.0	0.0	100.0
Total		**252**	**100.0**	**100.0**	

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

3.4.7.2 Occurrence of birds

One farmer assessed the occurrence of non target birds in MON 810 fields to be $more$, while 99.6 % (251/252) farmers found it to be $as\ usual$ (Table 75).

Table 75: Occurrence of birds in MON 810 compared to conventional maize in 2020

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	less	0	0.0	0.0	0.0
	as usual	251	99.6	99.6	99.6
	more	1	0.4	0.4	100.0
Total		**252**	**100.0**		

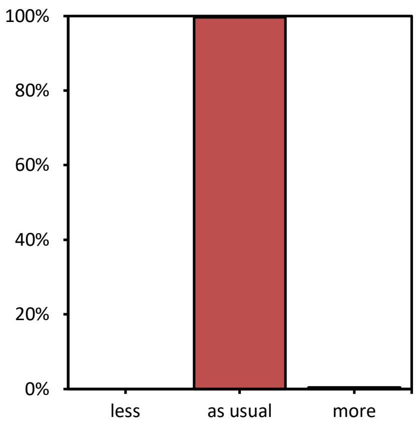


Figure 36: Occurrence of birds in MON 810 compared to conventional maize in 2020

(1) The valid percentage of $as\ usual$ occurrence of birds (99.6 %) is greater than 90 %. The resulting p-value is greater than the level of significance $\alpha = 0.01$ (Table 76) 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 76: 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 2020

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
252	251 (99.6 %)	< 0.01	0 (0.0 %)	< 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
99.6 %	98.6 %	100.6 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %

3.4.7.3 Occurrence of mammals

All farmers (252/252) assessed the occurrence of non target mammals in MON 810 fields to be *as usual* (Table 77). One farmer did not know.

Table 77: Occurrence of mammals in MON 810 compared to conventional maize in 2020

		Frequency	**Percent**	**Valid percentages**	**Accumulated percentages**
Valid	less	0	0.0	0.0	0.0
	as usual	252	100.0	100.0	100.0
	more	0	0.0	0.0	100.0
Total		**252**	**100.0**	**100.0**	

No effect on the occurrence of mammals is indicated.

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

The occurrence of wildlife in MON 810 is reported to be mostly unchanged for non target insects, birds and mammals. Only one of the farmers stated that they found a higher 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)

2.4 % (6/252) of the farmers used the harvest of MON 810 to feed their animals (Table 78, 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, which would explain why only 2.4 % of the surveyed farmers fed MON 810. However, there are no strong data supporting this assumption.

Table 78: Use of MON 810 harvest for animal feed in 2020

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	yes	6	2.4	2.4	2.4
	no	246	97.6	97.6	100.0
Total		**252**	**100.0**	**100.0**	

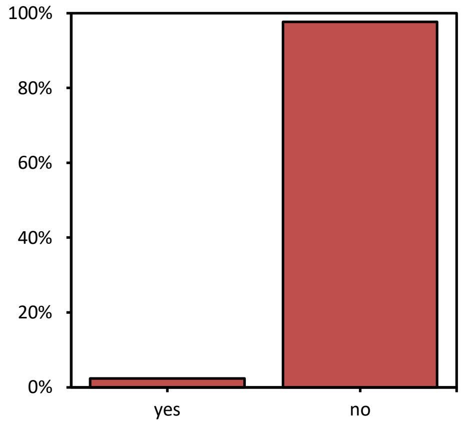


Figure 37: Use of MON 810 harvest for animal feed in 2020

Out of the 6 farmers who did feed the harvest of MON 810 to their animals, 100.0 % (6/6) found the performance of their animals to be *as usual* when compared to animals fed with conventional maize (Table 79).

Table 79: Performance of animals fed MON 810 compared to animals fed conventional maize in 2020

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	as usual	6	100.0	100.0	100.0
	changed	0	0.0	0.0	100.0
Total		**6**	**100.0**	**100.0**	

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

<u>Assessment of differences in feed use of MON 810 (if previous year experience with MON 810)</u>

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

3.4.9 Any additional remarks or observations

In the 2020 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

All (252/252) of the farmers reported to have been informed about the good agricultural practices applicable to MON 810 (Table 80).

98.4 % (248/252) of the farmers considered the training sessions to be either $useful$ or $very\ useful$ (Table 81 and Figure 38). This information indicates that the great majority of the farmers had been exposed to a valuable training concerning MON 810.

Table 80: Information on good agricultural practices in 2020

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	yes	252	100.0	100.0	100.0
	no	0	0.0	0.0	100.0
Total		**252**	**100.0**	**100.0**	

Table 81: Evaluation of training sessions in 2020

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	very useful	109	43.3	43.3	43.3
	useful	139	55.2	55.2	98.4
	not useful	4	1.6	1.6	100.0
Total		**252**	**100.0**	**100.0**	

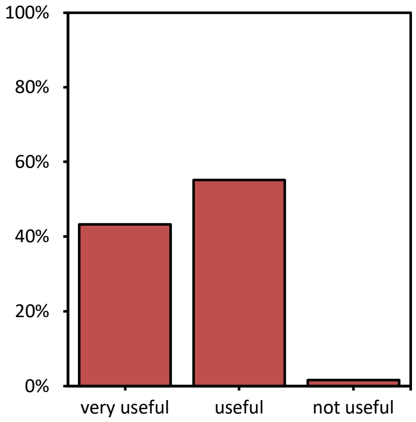


Figure 38: Evaluation of training sessions in 2020

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 100.0 % (252/252) of the cases. This indicates in all cases the bags were labeled appropriately and that the label and the accompanying documentation were clear to the farmers.

Table 82: Perception of seed bag label recommendations in 2020

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	yes	252	100.0	100.0	100.0
	no	0	0.0	0.0	100.0
Total		**252**	**100.0**	**100.0**	

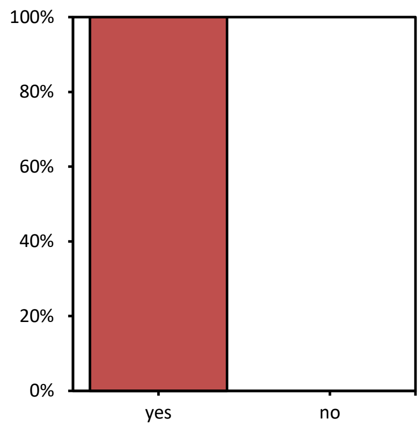


Figure 39: Perception of seed bag label recommendations in 2020

The great majority of the farmers (97.6 %; 246/252) reported that they are following the label recommendations on the seed bags (Table 83 and Figure 40). 6 farmers (2.4 %) admitted that they did not follow the label recommendations. All of these farmers explained that they did not plant a refuge. Deviations from the label recommendations are listed in Appendix A, Table A 14.

Table 83: Compliance with label recommendations in 2020

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	yes	246	97.6	97.6	97.6
	no	6	2.4	2.4	100.0
Total		**252**	**100.0**	**100.0**	

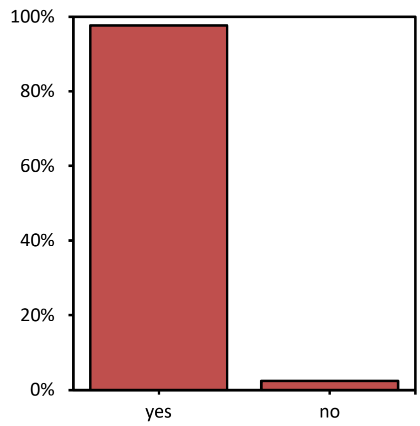


Figure 40: Compliance with label recommendations in 2020

3.5.3 Prevention of insect resistance

88.5 % (223/252) of the farmers planted a refuge within their farms (Table 84, Figure 41). 9.1 % (23/252) 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). 2.4 % (6/252) of the farmers reported that they did not plant a refuge although having more than 5 ha of maize planted on their farm.

Table 84: Planting of a refuge in 2020

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	yes	223	88.5	88.5	88.5
	no, because the area of Bt maize is < 5 ha	23	9.1	9.1	97.6
	no	6	2.4	2.4	100.0
Total		**252**	**100.0**	**100.0**	

Figure 41: Planting of a refuge in 2020

Therefore, 97.6 % (246/252) 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 85).

Table 85: Refuge implementation per country in 2020

		Refuge implementation			
	Country	**Yes**	**No, because the area of *Bt* maize is < 5 ha**	**No**	**Total**
Valid	Spain	211	23	6	240
	Portugal	12	0	0	12
Total		223	23	6	252

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 and has increased compared to last year. In Spain, 2.8 % (6/217) of the farmers who were required to did not plant a refuge, for which three main reasons were given. The first reason was that they feared the yield losses in conventional maize (3/6; 50.0 %), the second reason was that they had conventional maize as neighbouring plots (2/6; 33.3 %) and one farmer stated that the planting would be too complicated (1/6, 16.7 %). 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 although they should have been were as follows: Huesca (3 farmers), Sevilla (2 farmer) and Lérida (1 farmer). Further information cannot be provided due to personal data protection obligations (privacy regulations).

4 Conclusions

The analysis of 252 questionnaires from a survey of farmers cultivating MON 810 in 2020 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 2020 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 2020 growing seasons. Currently, the database contains data of 3,879 valid questionnaires. As shown in Table 86 and Table 87 the frequency patterns of farmers' answers in 2020 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 86 and Table 87 had been going down continuously over the last years, so that this is not an unexpected outcome.

After fiveteen 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 86: Overview on the frequency of $Minus$[5] answers of the monitoring characters in 2006 - 2020 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	2020
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	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	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	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	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	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	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	20.2
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	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	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	0.8
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	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	7.2
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	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	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	0.0
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	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 87: Overview on the frequency of $Plus$[6] answers of the monitoring characters in 2006 - 2020 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	2020
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	1.6
Time of planting	6.0	3.8	2.7	1.3	4.1	1.6	3.6	5.1	4.2	6.5	1.6	1.6	1.6	1.2	2.0
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	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	2.4
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	2.4
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	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	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	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	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	1.6
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	4.8
Time to emergence	5.6	3.8	2.0	0.8	0.4	0.0	0.4	0.4	0.0	0.0	0.8	0.4	0.4	0.0	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	0.4
Plant growth and development	1.6	4.8	2.7	2.1	3.7	0.8	2.0	0.8	0.0	0.4	0.4	1.6	1.2	0.4	1.6
Incidence of stalk / root lodging	1.6	0.3	0.3	0.0	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	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	3.6
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	27.8
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	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	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	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	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	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	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	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	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).

5 Bibliography

[Bakan, 2002] Bakan B, Melcion D, Richard-Molard D, Cahagnier B (2002): *Fungal growth and Fusarium mycotoxin content in isogenic traditional maize and genetically modified maize grown in France and Spain*. Journal of Agricultural and Food Chemistry 50(4): 728-731.

[Beißner, 2006] Beißner L, Wilhelm R, Schiemann J. (2006) *Current research activities to develop and test questionnaires as a tool for the General Surveillance of important crop plants*. J. Verb. Lebensm. 1: 95-97.

[Berensmeier, 2006] Berensmeier A, Schmidt K, Beißner L, Schiemann J, Wilhelm R (2006): *Statistical analysis of farm questionnaires to search for differences between GM- and non-GM-maize*. J. Verb. Lebensm. 1: 80-84.

[Berensmeier, 2007] Berensmeier A, Schmidt K (2007): ``*Good Monitoring Practice'' - Quality control measures for farm questionnaires*. J. Verb. Lebensm. 2: 56-58.

[Bondzio, 2008] Bondzio A, Stumpff F, Schön J, Martens H, Einspanier R (2008): *Impact of Bacillus thuringiensis toxin Cry1Ab on rumen epithelial cells (REC) - a new in vitro model for safety assessment of recombinant food compounds*. Food and Chemical Toxicology 46(6):1976-1984.

[Buzoianu, 2012] Buzoianu SG, Walsh MC, Rea MC, Cassidy JP, Ross RP, Gardiner GE, Lawlor PG (2012): *Effect of feeding genetically modified Bt MON 810 maize to \~40-day-old pigs for 110 days on growth and health indicators*. Animal 6(10), 1609-1619.

[Cademo, 2006] CADEMO light for Windows 3.27 (2006). BioMath GmbH, Rostock, Germany.

[Coll, 2008] Coll A, Nadal A, Palaudelmàs M, Messeguer J, Melé E, Puigdomènech P, Pla M (2008): *Lack of repeatable differential expression patterns between MON 810 and comparable commercial varieties of maize*. Plant Molecular Biology 68(1-2), 105-117.

[Coll, 2009] Coll A, Nadal A, Collado R, Capellades G, Messeguer J, Melé E, Palaudelmàs M, Pla M. (2009): *Gene expression profiles of MON 810 and comparable non-GM maize varieties cultured in the field are more similar than are those of conventional lines*. Transgenic Research 18(5), 801-808.

[Coll, 2010] Coll A, Nadal A, Collado R, Capellades G, Kubista M, Messeguer J, Pla M (2010): *Natural variation explains most transcriptomic changes among maize plants of MON 810 and comparable non-GM varieties subjected to two N-fertilization farming practices*. Plant Molecular Biology 73(3), 349-362.

[Coll, 2011] Coll A, Nadal A, Rossignol M, Puigdomènech P, Pla M (2011): *Proteomic analysis of MON 810 and comparable non-GM maize varieties grown in agricultural fields*}. Transgenic Research 20(4), 939-949.

[Dowd, 2000] Dowd, P.F. (2000): *Indirect reduction of ear molds and associated mycotoxins in Bacillus thuringiensis corn under controlled and open field conditions: utility and limitations*. Journal of Economic Entomology 93(6), 1669-1679.

[EFSA, 2006a] EFSA (2006): *Guidance document of the Scientific Panel on Genetically Modified Organisms for the Risk Assessment of Genetically Modified Plants and Derived Food and Feed*. The EFSA Journal 99: 1-94.

[EFSA, 2006b] EFSA (2006): *Opinion of the Scientific Panel on Genetically Modified Organisms on the Post Market Environmental Monitoring (PMEM) of genetically modified plants*. The EFSA Journal 319: 1-27.

[EFSA, 2009] EFSA (2009): *Scientific Opinion of the Panel on Genetically Modified Organisms on applications (EFSA-GMO-RX-MON810) for the renewal of authorisation for the continued marketing of (1) existing food and food ingredients produced from genetically modified insect resistant maize MON 810; (2) feed consisting of and/or containing maize MON 810, including the use of seed for cultivation; and of (3) food and feed additives, and feed materials produced from maize MON 810, all under Regulation (EC) No 1829/2003 from Monsanto*. The EFSA Journal 1149, 1-85.

[Hammond, 2003] Hammond B, Campbell K, Pilcher C, Robinson A, Melcion D, Cahagnier B, Richard J, Sequeira J, Cea J, Tatli F, Grogna R, Pietri A, Piva G, Rice L (2003): *Reduction of fumonisin mycotoxins in Bt corn*. Toxicologist 72(S-1):1217.

[Lundgren, 2009] Lundgren JG, Gassmann AJ, Bernal J, Duan JJ, Ruberson J (2009): *Ecological compatibility of GM crops and biological control*. Crop Protection 28, 1017-1030.

[Marcus, 1976] Marcus R, Peritz KB, Gabriel KR (1976): *On closed testing procedures with special reference to ordered analysis of variance*. Biometrika, 63: 655-660.

[Marvier, 2007] Marvier M, McCreedy C, Regetz J, Kareiva P (2007): *A meta-analysis of effects of Bt cotton and maize on nontarget invertebrates*. Science 316: 1475-1477.

[Maurer, 1995] Maurer W, Hothorn LA, Lehmacher W (1995): *Multiple comparisons in drug clinical trials and preclinical assays with a priori ordered hypotheses*. Biometrie in der chemisch-pharmazeutischen Industrie (ed. J Vollmar). Vol. 6, Fischer Stuttgart.

[Munkvold, 1999] Munkvold GP, Hellmich RL, Rice LG (1999): *Comparison of Fumonisin concentrations in kernels of transgenic Bt maize hybrids and nontransgenic hybrids*. Plant Disease 83(2): 130-138.

[Musser, 2003] Musser FR, Shelton, AM (2003) *Bt Sweet Corn and Selective Insecticides: Impacts on Pests and Predators*. Journal of Economic Entomology 96 (1), 71-80.

[OJEC, 1995] Official Journal of the European Communities, 23 November 1995: *Directive 95/46/EC of the European Parliament and of the Council of 24 Oktober 1995 on the protection of individuals with regard to the processing of personal data and on the free movement of such data*. L 281/31.

[OJEC, 1998] Official Journal of the European Communities, 05 May 1998: Commission *Decision of 22 April 1998 concerning the placing on the market of genetically modified maize (Zea mays L. line MON 810), pursuant to Council Directive 90/220/EEC*. L 131/32.

[OJEC, 2001] Official Journal of the European Communities, 17 April 2001: *Directive 2001/18/EC of the European Parliament and of the Council of 12 March 2001 on the deliberate release into the environment of genetically modified organisms and repealing Council Directive 90/220/EEC*. L 106/1.

[OJEC, 2002a] Official Journal of the European Communities, 30 July 2002: *Commission Decision of 24 July 2002 establishing guidance notes supplementing Annex II to Directive 2001/18/EC of the European Parliament and of the Council on the deliberate release into the environment of genetically modified organisms and repealing Council Directive 90/220/EEC (notified under document number C(2002) 2715)*. L 200/22.

[OJEC, 2002b] Official Journal of the European Communities, 18 October 2002: *Council Decision of 3 October 2002 establishing guidance notes supplementing Annex VII to Directive 2001/18/EC of the European Parliament and of the Council on the deliberate release into the environment of genetically modified organisms and repealing Council Directive 90/220/EEC*. L 280/27.

[OJEC, 2003] Official Journal of the European Communities, 18 October 2003: *Regulation (EC) No 1829/2003 of the European Parliament and of the Council of 22 September 2003 on genetically modified food and feed*. L 268/1.

[Rasch, 2007a] Rasch D, Herrendörfer G, Bock J, Victor N, Guiard V (2007): *Verfahrensbibliothek Versuchsplanung und -auswertung*. Oldenbourg Verlag München.

[Rasch, 2007b] Rasch D, Verdooren LR, Gowers JI (2007): *The Design and Analysis of Experiments and Surveys*. Oldenbourg Verlag München.

[Romeis, 2006] Romeis J, Meissle M, Bigler F (2006): *Transgenic crops expressing Bacillus thuringiensis toxins and biological control*. Nature Biotechnology 24(1), 63-71.

[Romeis, 2008] Romeis, J; Shelton, AM; Kennedy, GG (Editors) (2008*): Integration of Insect-Resistant Genetically Modified Crops within IPM Programs*. Progress in Biological Control. Springer Netherlands.

[Sanvido, 2004] Sanvido O, Bigler F, Widmer F, Winzeler M (2004): *Monitoringkonzept für den Anbau von transgenen Pflanzen*. Agrarforschung 11 (1): 10-15.

[Sanvido, 2005] Sanvido O, Widmer F, Winzeler M, Bigler F (2005): *A conceptual framework for the design of environmental post-market monitoring of genetically modified plants*. Environ. Biosafety Res. 4: 13-27.

[Schiemann, 2006] Schiemann J, Wilhelm R, Beißner L, Schmidtke J, Schmidt K (2006): *Data acquisition by farm questionnaires and linkage to other sources of data*. J. Verb. Lebensm. 1: 26-29.

[Schmidt, 2004] Schmidt K, Schmidtke J, Wilhelm R, Beißner L, Schiemann J (2004): *Biometrische Auswertung des Fragebogens zum Monitoring des Anbaus gentechnisch veränderter Maissorten - Statistische Beurteilung von Fragestellungen des GVO-Monitoring*. Nachrichtenbl. Deut. Pflanzenschtzd. 56(9): 206-212.

[Schmidt, 2006] Schmidt K, Beißner L, Schiemann J, Wilhelm R (2006): *Methodology and Tools for Data Acquisition and Statistical Analysis*. J. Verb. Lebensm. 1: 21-25.

[Schmidt, 2008] Schmidt K, Wilhelm R, Schmidtke J, Beißner L, Mönkemeyer W, Böttinger P, Sweet J, Schiemann, J (2008): *Farm questionnaires for monitoring genetically modified crops: a case study using GM maize*. Environmental Biosafety Research 7: 163-179.

[Schmidtke, 2006] Schmidtke J, Schmidt K (2006): *Data management and data base implementation for GMO monitoring*. J. Verb. Lebensm. 1: 92-94.

[Schneider, 2001] Schneider B (2001): *Methoden der Planung und Auswertung klinischer Studien*. in: Rasch D (Hrsg.): Anwendungen der Biometrie in Medizin, Landwirtschaft und Mikrobiologie, BioMath GmbH, Rostock.

[Shimada, 2003] Shimada N, Kim YS, Miyamoto K, Yoshioka M, Murata H (2003): *Effects of Bacillus thuringiensis Cry1Ab toxin on mammalian cells*. The Journal of veterinary medical science / the Japanese Society of Veterinary Science 65(2):187-91.

[Shimada, 2006a] Shimada N, Murata H, Mikami O, Yoshioka M, Guruge KS, Yamanaka N, Nakajima Y, Miyazaki S. (2006): *Effects of feeding calves genetically modified corn bt11: a clinico-biochemical study*. The Journal of veterinary medical science / the Japanese Society of Veterinary Science 68(10):1113-5.

[Shimada, 2006b] Shimada N, Miyamoto K, Kanda K, Murata H. (2006): *Bacillus thuringiensis insecticidal Cry1ab toxin does not affect the membrane integrity of the mammalian intestinal epithelial cells: An in vitro study*. In vitro cellular and developmental Biology. Animal 42(1-2):45-9.

[SPSS, 2003] SPSS for Windows. Rel. 12.0.0 (2003). Chicago: SPSS Inc.

[Steinke, 2010] Steinke K, Guertler P, Paul V, Wiedemann S, Ettle T, Albrecht C, Meyer HH, Spiekers H, Schwarz FJ (2010): *Effects of long-term feeding of genetically modified corn (event MON 810) on the performance of lactating dairy cows*. Journal of Animal Physiology and Animal Nutrition (Berl) 94(5), e185-93.

[Stumpff, 2007] Stumpff F, Bondzio A, Einspanier R, Martens H. (2007): *Effects of the Bacillus thuringiensis toxin Cry1Ab on membrane currents of isolated cells of the ruminal epithelium*. The Journal of Membrane Biology 219(1-3):37-47.

[Walsh, 2012] Walsh MC, Buzoianu SG, Rea MC, O'Donovan O, Gelencsér E, Ujhelyi G, Ross RP, Gardiner GE, Lawlor PG (2012): *Effects of feeding Bt MON 810 maize to pigs for 110 days on peripheral immune response and digestive fate of the cry1Ab gene and truncated Bt toxin*. PLoS One 7(5), e36141.

[Wilhelm, 2002] Wilhelm R, Beißner L, Schiemann J (2002): *Gestaltung des Monitoring der Auswirkungen gentechnisch veränderter Pflanzen im Agrarökosystem*. Gesunde Pflanzen 54 (6): 194-206.

[Wilhelm, 2003] Wilhelm R, Beißner L, Schiemann J (2003): *Konzept zur Umsetzung eines GVO-Monitoring in Deutschland*. Nachrichtenbl. Deut. Pflanzenschtzd. 55 (11): 258-272.

[Wilhelm, 2004] Wilhelm R, Beißner L, Schmidt K, Schmidtke J, Schiemann J (2004): *Monitoring des Anbaus gentechnisch veränderter Pflanzen - Fragebögen zur Datenerhebung bei Landwirten*. Nachrichtenbl. Deut. Pflanzenschutzd. 56 (8): 184-188.

[Wolfenbarger, 2008] Wolfenbarger LL, Naranjo SE, Lundgren JG, Bitzer RJ, Watrud LS (2008): *Bt Crop Effects on Functional Guilds of Non-Target Arthropods: A Meta-Analysis*. PLoS One 3: e2118.

[Wu, 2006] Wu F (2006): *Mycotoxin reduction in Bt corn: potential economic, health, and regulatory impacts*. Transgenic Research 15: 277-289.

List of abbreviations

GM	genetically modified
GMO	genetically modified organism
GMP	genetically modified plant

List of tables

List of figures

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	5717	changed	I plant YieldGard after potato and I plant conventional after wheat
Spain	5718		I plant YieldGard after potato and I plant conventional after barley
Spain	5755		I plant YieldGard after peas and I plant conventional after maize
Spain	5785		I plant YieldGard after peas 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	5717	later	short cycle	I plant YieldGard after conventional because it is shorter cycle
Spain	5718			I plant short cycle YieldGard later than conventional
Spain	5755			I plant YieldGard after conventional in second planting maize
Spain	5762			Because YieldGard is shorter cycle than conventional
Spain	5785			YieldGard is shorter cycle than 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	193	0	193
Prothioconazole	LumiGEN	0	12	12
Sprayed				
Abamectin	Apache, Asteria, Marisol, Safran, Vargas 1.8 EC	86	0	86
Cipermethrin	Cibelte 10 LE	1	0	1
Deltamethrin	Decis, Decis Evo, Deltagri, Delta EC, Deltaplan, Super-Delta	14	1	15
Hexitiazox	Exitox, Jalisco	5	0	0
Lambda-cyhalothrin	Atlas, Atrapa, Judo, Karate King, Karate Zeon, Kenotrin	8	15	23
Granulated				
Chlorpyrifos	Chas 5 G, Cloripirfos 5 GR, Piritec 5 GR, Pison,	30	0	30
Lambda-cyhalothrin	Kenotrin Geo, TRIKA Lambda 1, Pointer Geo	29	0	29
Teflutrin	Force 1.5 G	3	0	3

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 for differences in insect control practice	Explanation for differences in corn borer control practice
Spain	5749	yes	changed	I treat conventional against ECB but no YieldGard because is resistant	I treat conventional against ECB but no YieldGard
Spain	5763			I treat conventional against ECB but no YieldGard	I treat conventional against ECB but no YieldGard
Spain	5852			I do not treat YieldGard against ECB but conventional yes	I treat conventional against ECB but no YieldGard
Portugal	5632			The farmer didn´t apply any treatments in YG for the control of maize borer.	The seed treatment (Lumigen) was equally applied in YG & Conventional. The farmer applied 1 less insecticide treatment in YG.
Portugal	5634			No treatments in the Yieldgard maize for the control of maize borer.	1 less application insecticide treatment in YG. Lumigen was equally applied in YG and conventional
Portugal	5635			No treatments in the Yieldgard maize for the control of maize borer.	1 less insecticide treatment in YG. Lumigen was equally applied in YG & conventional.

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
Therbuthylazin + Bromoxynil	Zeagran	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	5717	later	Later planting and harvesting	I plant YieldGard later and I harvest it later
Spain	5718	later		I plant YieldGard later and I also harvest it later
Spain	5762	later		I plant YieldGard later than conventional and I harvest it later
Spain	5785	Later		I plant YieldGard later and I harvest it later than conventional

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	5640	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	5642	as usual	as usual	as usual	as usual	as usual	as usual	as usual	as usual	There was not ECB's attack therefore there were not differences between YieldGard and conventional
Spain	5645	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard produces more than conventional because is resistant to ECB, it is healthier and it does not fall
Spain	5646	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	5651	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	5652	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard gives more kilos than conventional because is resistant to ECB and it does not fall
Spain	5656	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard does not fall because does not have ECB´s damages and it is more productive than conventional
Spain	5657	as usual	as usual	as usual	as usual	less often	delayed	higher yield	as usual	YieldGard is healthier, it ismore green, it maturates somewhat later, it does not fall and it gives more kilos than conventional
Spain	5666	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard does not fall because does not have ECB´s damages, it is healthier and produces more than conventional
Spain	5668	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YieldGard is more productive than conventional because is resistant to ECB
Spain	5669	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YieldGard is healthier, it does not have ECB´s damages and it gives more kilos than conventional
Spain	5670	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard does not fall because is resistant to ECB and it gives more production than conventional
Spain	5671	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YieldGard gives more kilos than conventional because does not have ECB´s damages
Spain	5673	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	5674	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 gives more kilos than conventional
Spain	5678	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YieldGard produces more than conventional because does not have ECB´s damages
Spain	5681	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	5682	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YieldGard gives more kilos than conventional because does not have ECB´s damages
Spain	5683	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard does not fall because does not have ECB´s damages and produces 10 % more than conventional
Spain	5684	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 produces more than conventional

Spain	5685	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YieldGard gives more kilos than conventional because does not have ECB´s damages
Spain	5686	as usual	as usual	as usual	as usual	as usual	as usual	as usual	as usual	There were not differences between YieldGard and conventional because there was not ECB's attack
Spain	5689	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard does not fall because is healthier, without ECB´s damages and it produces 10 % more than conventional
Spain	5691	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 is more productive than conventional
Spain	5692	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard is healthier, without ECB´s damages, everything is harvested and it gives more kilos than conventional
Spain	5694	as usual	as usual	as usual	as usual	less often	delayed	higher yield	as usual	YieldGard is healthier, it ismore green, it maturates somewhat later, it does not fall and it produces 30 % more than conventional
Spain	5696	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	5701	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard does not fall because is resistant to ECB and it produces more than conventional
Spain	5702	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YieldGard produces 20 % more than conventional because does not have ECB´s damages
Spain	5703	as usual	as usual	as usual	as usual	less often	delayed	higher yield	as usual	YieldGard maturates somewhat later because is healthier, it is more green, with more moisture, it does not fall because is resistant to ECB and it gives more kilos than conventional
Spain	5707	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	5715	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	5717	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	5719	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YieldGard produces more than conventional because is healthier, without ECB´s damages
Spain	5721	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 produces more than conventional
Spain	5726	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard does not fall because does not have ECB´s damages, everything is harvested and it produces more than conventional
Spain	5728	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, everything is harvested and it gives more production than conventional
Spain	5729	as usual	as usual	delayed	delayed	less often	delayed	higher yield	less often	YieldGard flowers and develops more slowly, it is more green and it maturates somewhat later, it is healthier, it does not fall and there are less volunteers the following year and it produces more than conventional
Spain	5730	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard does not fall because is resistant to ECB, it is healthier and it gives more kilos than conventional
Spain	5731	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	5733	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard does not fall and is more productive than conventional because does not have ECB´s damages
Spain	5734	as usual	as usual	as usual	as usual	less often	delayed	higher yield	as usual	YieldGard is healthier, it ismore green, it maturates somewhat later, it does not fall and it produces more than conventional

Spain	5735	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, it is healthier and it gives more kilos than conventional
Spain	5741	as usual	as usual	as usual	as usual	less often	as usual	as usual	as usual	YieldGard does not have ECB´s damages and it does not fall
Spain	5749	as usual	as usual	as usual	as usual	less often	delayed	higher yield	as usual	YieldGard is healthier, it ismore green, it maturates somewhat later, it does not fall and it produces more than conventional
Spain	5753	as usual	as usual	as usual	delayed	less often	delayed	higher yield	as usual	YieldGard grows slower, it is more green, it maturates later, it is healthier, it does not fall and it is more productive than conventional
Spain	5755	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard does not fall because does not have ECB´s damages, everything is harvested and it gives more kilos than conventional
Spain	5760	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 gives more production than conventional
Spain	5761	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YieldGard gives more kilos than conventional because is healthier, without ECB´s damages
Spain	5766	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard does not fall and produces more than conventional because does not have ECB´s damages
Spain	5767	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 gives more kilos than conventional
Spain	5773	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, it is healthier and it produces more than conventional
Spain	5780	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	5790	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard does not fall because does not have ECB´s damages and it gives more kilos than conventional
Spain	5792	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard produces more kilos than conventional because is healthier and it does not fall because is resistant to ECB
Spain	5795	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YieldGard does not have ECB´s damages and is more productive than conventional
Spain	5802	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard does not fall because is healthier, without ECB´s damages, everything is harvested and it produces more than conventional
Spain	5803	as usual	as usual	as usual	as usual	less often	as usual	as usual	as usual	YieldGard does not fall because is resistant to ECB although production has been similar to that of conventional
Spain	5810	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 1.000 kg/ha more than conventional
Spain	5812	as usual	as usual	as usual	as usual	less often	as usual	as usual	as usual	YieldGard does not fall because is resistant to ECB
Spain	5820	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard does not fall and produces more than conventional because does not have ECB´s damages
Spain	5821	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 gives more kilos than conventional
Spain	5826	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	5827	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 is more productive than conventional
Spain	5834	as usual	as usual	as usual	delayed	less often	delayed	higher yield	as usual	YieldGard delays growth and maturation for a few days, it does not fall, it is healthier and it gives more kilos than conventional
Spain	5841	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard does not fall because does not have ECB´s damages and produces more than conventional

Spain	5855	as usual	as usual	as usual	delayed	less often	delayed	higher yield	less often	YieldGard does not have ECB´s damages, it does not fall and there are less volunteers a year after, it delays growth and maturation and it produces more than conventional
Spain	5858	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard does not fall because is resistant to ECB and it produces more than conventional
Spain	5862	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 gives more kilos than conventional
Spain	5868	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YieldGard is more productive than conventional because does not have ECB´s damages
Spain	5869	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard does not fall because is healthier, without ECB´s damages and it produces more than conventional
Spain	5870	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 gives more kilos than conventional
Spain	5872	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard does not fall because does not have ECB´s damages and produces more than conventional
Spain	5873	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YieldGard gives more kilos than conventional because is resistant to ECB
Spain	5874	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard does not fall because is resistant to ECB and it produces more than conventional
Spain	5878	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YieldGard is healthier, it is more green, with more moisture, without ECB´s damages, it does not fall and it gives more kilos than conventional
Portugal	5628	more vigorous	as usual	as usual	as usual	as usual	as usual	as usual	as usual	12850 kg / ha yield
Portugal	5629	more vigorous	as usual	as usual	as usual	as usual	as usual	as usual	as usual	The average yields of 12 700 kg/ha in the Yieldgard dry maize, were similar compared with conventional maize.
Portugal	5630	more vigorous	as usual	as usual	as usual	as usual	as usual	as usual	as usual	The average yields of 12 800 kg/ha in the YG dry maize, were similar compared with conventional maize.
Portugal	5631	more vigorous	as usual	as usual	as usual	as usual	as usual	as usual	as usual	The average yields of 13 000 kg/ha in YG dry maize, were similar compared with conventional maize.
Portugal	5632	more vigorous	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	The average yields of 12 282 kg/ha in the Yieldgard dry maize, an average of 400 kg/ha higher compared with conventional maize.
Portugal	5633	more vigorous	as usual	as usual	as usual	as usual	as usual	as usual	as usual	This last campaign the average yields of 14 250 kg/ha in the Yieldgard dry maize average yields of 48 500 kg/ha in the Yieldgard forage maize were similar compared with conventional forage maize.
Portugal	5634	more vigorous	as usual	as usual	as usual	as usual	as usual	as usual	as usual	The average yields of 12 000 kg/ha in the Yieldgard dry maize, were similar compared with conventional maize.
Portugal	5635	more vigorous	as usual	as usual	as usual	as usual	as usual	as usual	as usual	The average yields of 14 300 kg/ha in the Yieldgard dry maize, were similar compared with conventional maize.
Portugal	5636	more vigorous	as usual	as usual	as usual	as usual	as usual	as usual	as usual	The average yields of 11 250 kg/ha in the Yieldgard dry maize, were similar compared with conventional maize. The average yields of 40 000 kg/ha in the Yieldgard forage maize were similar compared with conventional forage maize.
Portugal	5637	more vigorous	as usual	as usual	as usual	as usual	as usual	as usual	as usual	Average yields of 42 000 kg/ha in YG forage maize were similar compared with conventional forage maize.
Portugal	5638	more vigorous	as usual	as usual	as usual	as usual	as usual	as usual	as usual	The average yields of 40 000 kg/ha in the yieldgard forage maize were similar compared with conventional forage maize.
Portugal	5639	more vigorous	as usual	as usual	as usual	as usual	as usual	as usual	as usual	The average yields of 48 500 kg/ha in YG 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	5655	no corn borer in 2020	There was not ECB's attack therefore there were not differences between YieldGard and conventional
Spain	5663		There was not ECB's attack therefore there were not differences between YieldGard and conventional
Spain	5698		There was not ECB's attack therefore there were not differences between YieldGard and conventional
Spain	5710		There was not ECB's attack therefore there were not differences between YieldGard and conventional
Spain	5712		There were not differences between YieldGard and conventional because there was not ECB's attack
Spain	5714		YieldGard and conventional behaved in a similar way because there was not ECB's attack
Spain	5723		There was not ECB's attack therefore there were not differences between YieldGard and conventional
Spain	5737		Very weak ECB attack that has not resulted in harvest losses in the conventional maize
Spain	5739		There was not ECB's attack and YieldGard and conventional developed in the same way
Spain	5741		Weak ECB attack that did not affect to conventional production
Spain	5747		There was not ECB's attack therefore there were not differences between YieldGard and conventional
Spain	5758		There was not ECB's attack therefore there were not differences between YieldGard and conventional
Spain	5776		The ECB attack was very weak and tere were not differences between YieldGard and conventional
Spain	5778		Without differences between YieldGard and conventional because there was not ECB´s attack
Spain	5784		When there is not ECB there are not differences between YieldGard and conventional
Spain	5786		There was not ECB's attack therefore there were not differences between YieldGard and conventional
Spain	5789		There were not differences between YieldGard and conventional because there was not ECB's attack
Spain	5794		There were not differences between YieldGard and conventional because there was not ECB's attack
Spain	5801		YieldGard and conventional behaved in a similar way because there was not ECB's attack
Spain	5808		There was not ECB's attack and YieldGard and conventional developed in the same way
Spain	5814		There were not differences between YieldGard and conventional because there was not ECB's attack
Spain	5816		There were not differences between YieldGard and conventional because there was not ECB's attack
Spain	5818		When there is not ECB´s attack there are not differences between YieldGard and conventional
Spain	5832		When there is not ECB there are not differences between YieldGard and conventional
Spain	5838		There were not differences between YieldGard and conventional because there was not ECB's attack
Spain	5843		There was not ECB's attack therefore there were not differences between YieldGard and conventional
Spain	5846		YieldGard and conventional behaved in a similar way because there was not ECB's attack
Spain	5850		There was not ECB's attack therefore there were not differences between YieldGard and conventional
Spain	5852		When there is not ECB there are not differences between YieldGard and conventional
Spain	5859		Without differences between YieldGard and conventional because there was not ECB´s attack
Spain	5861		There was not ECB's attack therefore there were not differences between YieldGard and conventional
Spain	5867		There was not ECB therefore there were not differences between YieldGard and conventional
Spain	5765	Spotted corn borer but no damage	I saw ECB worms in the ears of DKC5032YG variety although they did not cause any damage
Spain	5653	YieldGard looks healthier with more moisture	YieldGard is greener, healthier than conventional
Spain	5729		YieldGard has more moisture than conventional at harvest time
Spain	5749		YieldGard has 1-2 moisture´s degrees more than the conventional
Spain	5753		YieldGard has 1-2 moisture´s degrees more than the conventional at harvest time
Spain	5834		YieldGard has 1-2 moisture´s degrees more than the conventional at harvest time
Spain	5855		YieldGard is greener, with more moisture than conventional
Spain	5869		YieldGard is greener and it has one or two more moisture's degrees than the conventional
Spain	5874		YieldGard has 1-2 moisture´s degrees more at harvest time
Spain	5876		YieldGard is greener, with more moisture´s degrees than the conventional at harvest time
Portugal	5628		Excellent vigour, quality and sanity of YG.

Portugal	5629		Robustness and vigour of the YG maize were important and maize is more resistant to adverse weather conditions in the YG fields
Portugal	5630		YG is strong, vigorous and has good quality of the grain maize.
Portugal	5631		Higher sanity, good vigour & maize is more resistant to adverse weather conditions were the most important characteristics.
Portugal	5632		The vigour, consistence, strenght and sanity of the Yieldgard maize were importants.
Portugal	5633		The yieldgard maize contrast for the higher vigour, quality, sanity and resistant to adverse weather conditions.
Portugal	5634		Agronomical characteristics of YG in the fields were the large vigour, quality and sanity, which were quite evident.
Portugal	5635		The main consistence vigour, quality, sanity, and safety production were the advantages characteristics of YG.
Portugal	5636		The vigour and strength were the main agronomical characteristics verified in the fields. The sanity was also important.
Portugal	5637		Sublime vigour of the yieldgard maize, good sanity and quality of the Yieldgard forage maize.
Portugal	5638		Strength, quality and vigour of the YG forage maize were the agronomical characteristics of YG.
Portugal	5639		The Yieldgard forage maize had good quality and high sanity.

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

Country	Quest. Nr.	Disease susceptibility	Comments aggregate	Comments
Portugal	5628	as usual	no significant diseases to report in the region	In the agricultural production area didn´t verify any relevant about the diseases to report.
Portugal	5629	as usual		Didn't verify nothing in the region of production about diseases. No difference about diseases susceptibility.
Portugal	5630	as usual		No check in the region of production about diseases. It was nothing significant to indicate about diseases susceptibility.
Portugal	5631	as usual		Lower presence in the region of production of diseases. Nothing to comment about diseases in the region of production area.
Portugal	5632	as usual		Large sanity of YG; lower incidence of diseases in the total productive maize area. No report about diseases susceptibility
Portugal	5634	as usual		No susceptibility in the fields of maize. Nothing to comment. Despite that the producer verified a little presence in geral in the local of production of the disease "Cephalosporium Maydis"
Portugal	5635	as usual		Lower presence in the region of production of diseases in general ("Cephalosporium Maydis" exceptionally verified). Nothing relevant to report between the various types of maize (yieldgard and conventional).
Portugal	5637	as usual		Without any difference in susceptibility in the fields. The farmer did not verify nothing significant about diseases susceptibility in the maize fields.
Portugal	5638	as usual		Slight presence of the disease "Cephalosporium Maydis" but no difference in susceptibility between YG and conventional.
Portugal	5639	as usual		Nothing to record in their productive maize fields about the diseases in the region of production.
Portugal	5633	as usual	Only minor presence of "Cephalosporium Maydis"	No record in their productive maize fields about diseases in the region of production.
Portugal	5636	as usual		Nothing was identified and visualized about the diseases to report in the maize fields of production.
Spain	5652	less susceptible	YieldGard has smaller Fusarium damages	YieldGard has less attack of Fusarium, Ustilago and other fungi because is healthier, without ECB injuries
Spain	5657	less susceptible		YieldGard has not ECB´s damages and it has less fungal attack than conventional YieldGard has not ECB injuries and it has less attack of Fusarium, Ustilago and other fungi
Spain	5691	less susceptible		YieldGard has less problems of virus (MDMV and MRDV) than conventional YieldGard is healthier, without ECB´s damages and it has less virus attack than conventional
Spain	5703	less susceptible		YieldGard has not ECB injuries and it has less Fusarium attack than conventional YieldGard has not ECB injuries and the Fusarium problems are minor than conventional maize
Spain	5875	less susceptible		YieldGard has not ECB injuries and it has less fungal attack than conventional YieldGard is healthier and it has less fungal attack such as Ustilago or Fusarium than conventional

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

Country	Quest. Nr.	Ostrinia nubilalis	Sesamia spp.	Comments
Spain	5652	very good	very good	YieldGard has fewer pathways for fungal entry because it has not ECB injuries
Spain	5765	do not know	do not know	Presence of ECB in the ears of DKC5032YG and DKC5031 varieties, without causing damages
Portugal	5628	very good	very good	The combat and control of maize borers was excellent and totally guaranteed.
Portugal	5629	very good	very good	Control of maize borers was real and notourius, general lower presence in the region of production of the maize borers.
Portugal	5630	very good	very good	Fantastic control of the maize borers. It was an evident characteristic in the YG maize fields
Portugal	5631	very good	very good	Good control and effectiveness combat in the control of borers in YG fields despite lower presence in the region of production
Portugal	5632	very good	very good	The effectiveness is evident and total of the maize borers in YG, completely proven in the maize fields.
Portugal	5633	very good	very good	Eficient combat & evident effective control in maize borers in YG. Great added value for the farmer.
Portugal	5634	very good	very good	The combat was completely efficiency of the maize borers wich improved the sanity of YG. Despite that his last maize campaign, the region of production had a very lower incidence of pests in general.
Portugal	5635	very good	very good	Total control and efficiency in the combat of the maize borers. It was an evident characteristic in the maize fields.
Portugal	5636	very good	very good	Safety production in the control of the maize borers in the yieldgard maize fields. This last campaign the region of production had a lower incidence of pests in general.
Portugal	5637	very good	very good	Good control of borers and safety production in the Yieldgard maize fields. Lower incidence of pests in general.
Portugal	5638	very good	very good	Good control of borers and safety production in the YG maize fields. Lower incidence of pests in general.
Portugal	5639	very good	very good	The control of borers in the yieldgard maize fields were total and secure.

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	5629	Less susceptible	Agrotis Ipsilon, Diabrotica / Agriotes	good sanity of YieldGard improved its resistance	Larger sanity of YG & iresistance to attack of maize borer pest made YG less susceptible from the attacks of other pests.
Portugal	5630	Less susceptible	Agrotis Ipsilon, Diabrotica / Agriotes, Spodoptera Frugiperda		Lower incidence of pests in the area of maize fields; better resistance and less susceptible to the attack by other pests
Portugal	5631	Less susceptible	Agrotis Ipsilon, Diabrotica / Agriotes		The sanity of the YG is the most value characteristic of YG maize for the producer, is always higher.
Portugal	5634	Less susceptible	Agrotis Ipsilon, Helicoverpa zea		Production safety and sanity of YG were always a bit higher and so less susceptible to the attack by other pests.
Portugal	5637	Less susceptible	Agrotis Ipsilon, Diabrotica / Agriotes		This last maize campaign had a very lower incidence of pests in general in the region of production. However the sanity of the yieldgard maize were always higher.
Portugal	5638	Less susceptible	Agrotis Ipsilon		This last maize campaign had a very lower incidence of pests in general in the region of production. However the sanity of the yieldgard maize were always higher.
Portugal	5633	As usual	-	low incidence makes it hard to judge	Nothing to report about the susceptibility of other pests. In this campaign of maize the region of production had a very lower incidence of pests in the total area of maize.
Portugal	5628	Less susceptible	Diabrotica / Agriotes, Agrotis Ipsilon, Spodoptera Frugiperda	YieldGard had fewer attacks/damages	Lower incidence of pests in maize. Sanity & resistance in control of maize borers & other pests were higher & efficient.
Portugal	5635	Less susceptible	Agrotis Ipsilon		Resistance to the attack of the maize borer pest made YG less susceptible from the attacks of other pests like Agrotis Ipsilon. The sanity of the Yieldgard maize was evident in the maize fields.
Portugal	5636	Less susceptible	Agrotis Ipsilon, Spodoptera Frugiperda		Resistant to the attack of the maize borer pest, the sanity of YG was higher; YG less susceptible from attacks of other pests
Portugal	5639	Less susceptible	Agrotis Ipsilon		Effective control of the attack of maize borer pest made YG less susceptible from attack of other pests like Abutilon Ipsilon
Spain	5703	Less susceptible	Mythimna spp. (Mitima)		YieldGard has less Mithymna attack than the conventional
Spain	5827	Less susceptible	Mythimna spp. (Mitima)		YieldGard has less Mithymna attack than the conventional
Spain	5829	Less susceptible	Mythimna spp. (Mitima)		There is less Mithymna attack in the YieldGard than the convenctional
Spain	5840	Less susceptible	Mythimna spp. (Mitima), Heliothis		Conventional has Mithymna and Heliothis attack and YieldGard does not
Spain	5853	Less susceptible	Heliotis zea, Mythimna spp. (Mitima)		YieldGard has less Heliothis and Mithymna attack than the conventional
Spain	5855	Less susceptible	Mythimna spp. (Mitima), Heliotis zea		There is less Heliothis and Mithymna attack in the YieldGard
Spain	5875	Less susceptible	Heliothis, Mythimna spp. (Mitima)		There is less Heliothis and Mithymna attack in the YieldGard than the conventional

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

Name of weed	**Frequency**
Chenopodium album	151
Sorghum halepense	141
Abutilon theophrasti	107
Amaranthus retroflexus	71
Datura stramonium	55
Setaria spp.	41
Xanthium strumarium	33
Hordeum sp.	28
Malva spp.	21
Cyperus spp.	18
Solanum nigrum	17
Echinochloa spp.	15
Digitaria sanguinalis	13
Xanthium spinosum	9
Cynodon dactylon	5
Echinochloa crus-galli	5
Cirsium arvense	3
Lolium spp.	3
Alopecurus spp.	2
Avena fatua	2
Medicago sativa	2
Portulaca oleracea	2
Sinapis spp.	2
Triticum sp.	2
Convolvulus arvense	1
Oryza sativa	1
Polygonum aviculare	1
Polygonum persicaria	1
Rumex spp.	1
Sorghum sudanense	1
Veronica spp.	1
Vicia faba	1

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

Country	Quest. Nr.	Bird occurence	Mammal occurence	Comments
Portugal	5632	As usual	As usual	No difference of susceptibility between YG & conventional. Large presence & occurrence of wild boars in the fields.
Spain	5687	More	As usual	-

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

Country	Quest. Nr.	Compliance	Comment
Spain	5717	no	I did not plant refuge
Spain	5718		I did not plant refuge
Spain	5759		I did not plant refuge
Spain	5783		I did not plant refuge
Spain	5809		I did not plant refuge
Spain	5857		I did not plant refuge

Table A 15: Motivations for not planting a refuge (section 0)

Country	Quest. Nr.	Plant refuge?	Reasons
Spain	5717	no	ECB produces large yield losses
Spain	5718		There is conventional maize in the neighboring fields
Spain	5759		Because ECB produces large yield losses in the conventional maize
Spain	5783		It complicates the planting for me
Spain	5809		There is conventional maize planted in the neighboring fields
Spain	5857		Large yield losses in the conventional maize a cause of ECB attacks

7 Annex B Questionnaire

2	0	2	0	-	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.

Code:

Year ☐☐☐☐ Event ☐☐ Partner ☐☐☐ Country ☐☐ Interviewer ☐☐

Farmer ☐☐☐☐☐

Coding explanations:

2	0	2	0	-	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]: 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

EuropaBio
The European Association for Bioindustries

2	0	2	0	-	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: ___________________________________

EuropaBio
The European Association for Bioindustries

2	0	2	0	-	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 area of YieldGard® maize planted on the farm is < 5 ha
O No, because ____

____
____
____