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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 2021 growing season

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

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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 2021. The questionnaires have been completed between February and March 2022. In the 2021 growing season 251 farmers have been surveyed.

2021 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.

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 2021 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	1	-	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.* 2021-01-MAR-ES-01-30003).

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

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

Furthermore, within the database each farmer has his/her own ID so that multiple participitations of the same farmer in the MON 810 monitoring can be tracked.

2.1.3 Training of interviewers

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

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

2.2 Definition of monitoring characters

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

Table 1: Monitoring characters and corresponding protection goals

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

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

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

Table 2: Monitoring characters and their categories

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

2.3 Definition of influencing factors

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

Table 3: Monitored influencing factors

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

2.4 Definition of baselines, effects and statistical test procedure

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

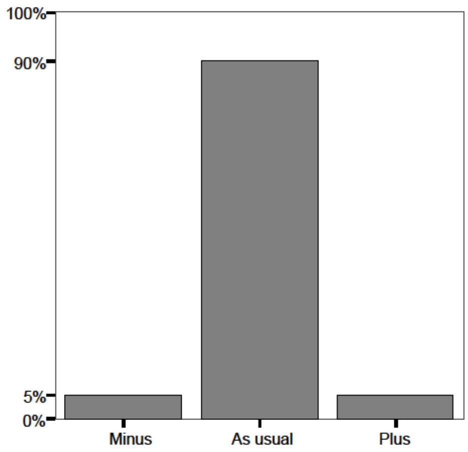

Figure 1: Balanced (expected) baseline distribution of the farmers' answers (no effect)

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

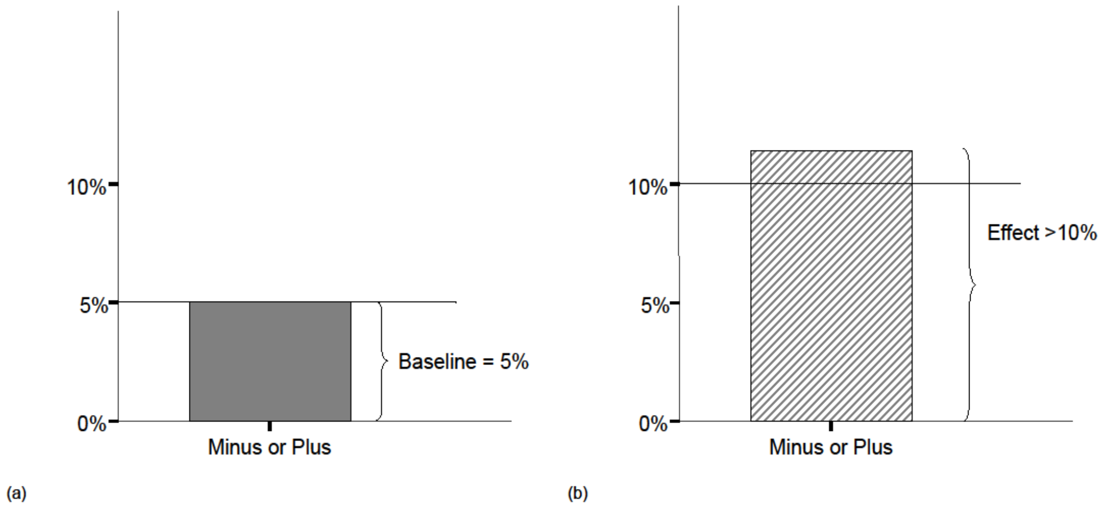

Figure 2: Definition of (a) baseline and (b) effect

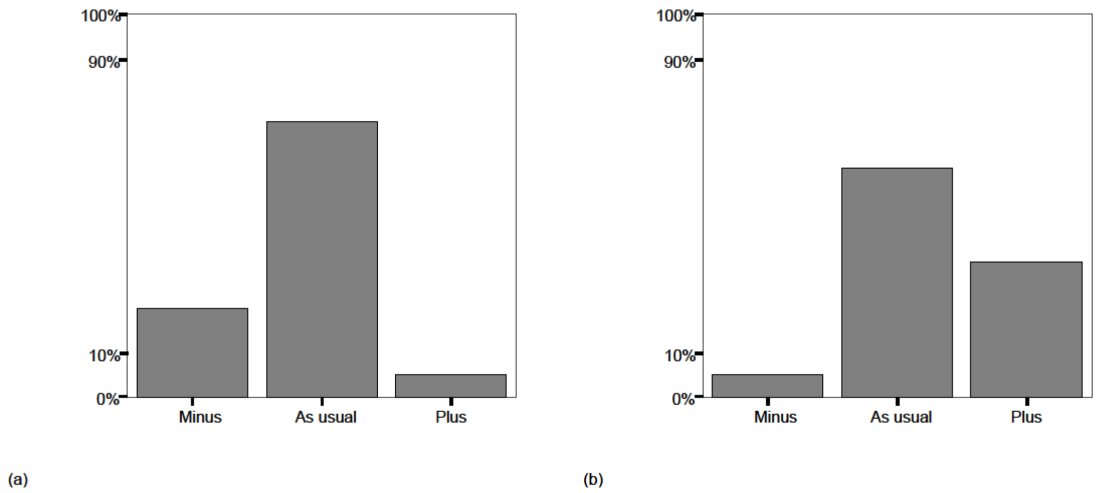

Figure 3: Examples for distributions of farmers' answers indicating an effect (a) > 10 % in category $Minus \rightarrow$ effect, (b) > 10 % in category $Plus \rightarrow$ effect

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 <u>closed under intersection</u> because

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

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

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

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

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

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

- Step (1): Test of the probability $p_{As\ usual}$ (usually the largest probability)
  Null hypothesis: GMP cultivation has an effect, the probability of getting $As\ usual$ -answers is smaller than 90 % ($H_0: p_{As\ usual} \leq 0.9$)
- Step (2): Test of the p_{Minus} probabilities and p_{Plus} probabilities
  Null hypothesis: GMP cultivation has an effect, the probability of getting $Minus$- or $Plus$-answers is larger than 10 % ($H_0: p_{Minus} \geq 0.1$, $H_0: p_{Plus} \geq 0.1$)

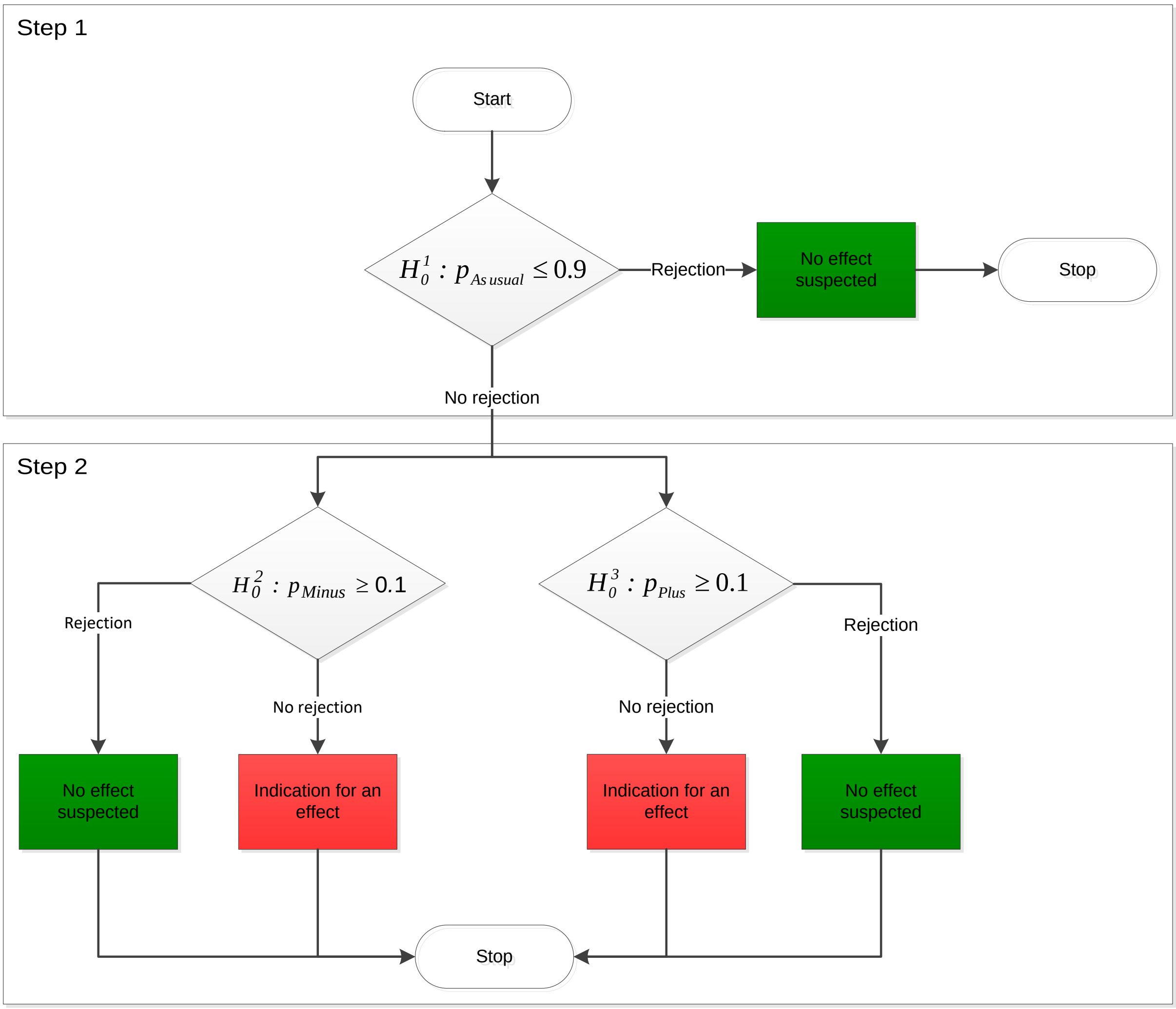

Figure 4: Closed test procedure for the three probabilities of $As\ usual$, $Plus$- and $Minus$-answers

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

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

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

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

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

2.5 Sample size determination and selection

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

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

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

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

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

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

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

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

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

In a second step, a quota considering

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

is applied.

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

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

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

Table 5 shows the cultivation areas of 2021. 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 2021

Country	MON 810 area	% of total MON 810 area	No of questionnaires
Portugal	4,313.01	4.27 %	11
Spain	96,605.87	95.73 %	239
Total	**100,918.88**	**100.00 %**	**250**

This procedure was repeated within the countries:

Portugal:

Table 6: Sampling number proportional to cultivated MON810 area in Portugal 2021

Region	MON 810 area	% of country area	Sampling	Proportional No of questionnaires
Norte	76.87	1.8%	0	0 %
Centro	1,047.66	24.3%	3	27.3 %
Lisboa e Vale do Tejo	821.50	19.0%	2	18.2 %
Alentejo	2,366.98	54.9%	6	54.5 %
Total	**4,313.01**	**100.0%**	**11**	**100.00 %**

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 2021

Region	MON 810 area	% of country area	Sampling	Proportional No of questionnaires
Andalucia	1,773.68	1.8%	5	2.1%
Aragon + Cataluna	73,200.87	75.8%	182	76.2%
Castilla Leon	398.95	0.4%	1	0.4%
Castilla-La-Mancha + Comunidad de Madrid	2,979.21	3.1%	7	2.9%
Comunidad Foral de Navarra	9,074.47	9.4%	22	9.2%
Comunidad Valenciana	95.26	0.1%	0	0.0%
Extremadura	8,894.47	9.2%	22	9.2%
Islas Baleares	168.95	0.2%	0	0.0%
La Rioja	1.05	0.0%	0	0.0%
Murcia	18.95	0.0%	0	0.0%
Islas Canarias	0.00	0.0%	0	0.0%
Total	**96,605.86**	**100.0%**	**239**	**100.0%**

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 2021.

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 %.

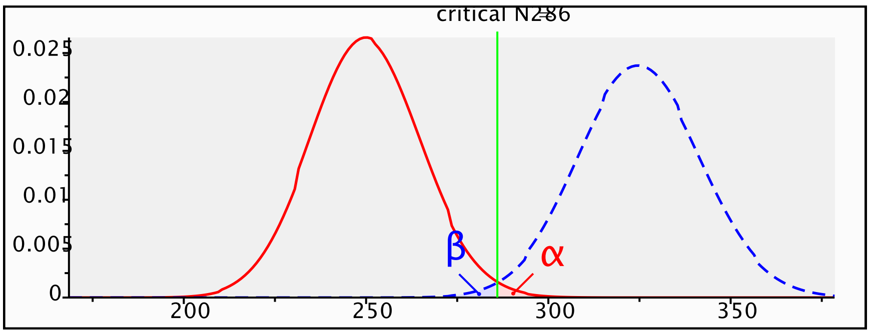

Figure 5: Null ($p = 0.1$) and alternative ($p = 0.13$) binomial distribution functions for a sample size of 2 500 type I and type II errors α and β both 0.01 (graph: *G*Power* Version 3.1.6)

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 2022. In the 2021 growing season 251 farm questionnaires have been collected. Quality and plausibility control confirmed that all 251 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 2021 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 2021 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	251	246 (98.0%)	< 0.01			5 (2.0%)	< 0.01
Time of planting	251	246 (98.0%)	< 0.01	0 (0.0%)	< 0.01	5 (2.0%)	< 0.01
Tillage and planting technique	251	246 (98.0%)	< 0.01			5 (2.0%)	< 0.01
Insect control practices	251	240 (95.6%)	< 0.01			11 (4.4%)	< 0.01
Weed control practices	251	251 (100.0%)	< 0.01			0 (0.0%)	< 0.01
Fungal control practices	251	251 (100.0%)	< 0.01			0 (0.0%)	< 0.01
Maize Borer control practice	251	241 (96.0%)	< 0.01			10 (4.0%)	< 0.01
Fertilizer Application	251	251 (100.0%)	< 0.01			0 (0.0%)	< 0.01
Irrigation Practices	251	251 (100.0%)	< 0.01			0 (0.0%)	< 0.01
Time of harvest	251	246 (98.0%)	< 0.01	0 (0.0%)	< 0.01	5 (2.0%)	< 0.01
Germination vigor	251	238 (94.8%)	< 0.01	0 (0.0%)	< 0.01	13 (5.2%)	< 0.01
Time to emergence	251	250 (99.6%)	< 0.01	1 (0.4%)	< 0.01	0 (0.0%)	< 0.01
Time to male flowering	251	251 (100.0%)	< 0.01	0 (0.0%)	< 0.01	0 (0.0%)	< 0.01
Plant growth and development	251	248 (98.8%)	< 0.01	0 (0.0%)	< 0.01	3 (1.2%)	< 0.01
Incidence of stalk / root lodging	251	211 (84.1%)	1.0	40 (15.9%)	1.0	0 (0.0%)	< 0.01
Time to maturity	251	240 (95.6%)	< 0.01	0 (0.0%)	< 0.01	11 (4.4%)	< 0.01
Yield	251	178 (70.9%)	1.0	0 (0.0%)	< 0.01	73 (29.1%)	1.0
Occurrence of volunteers	251	246 (98.0%)	< 0.01	5 (2.0%)	< 0.01	0 (0.0%)	< 0.01
Disease susceptibility	251	251 (100.0%)	< 0.01	0 (0.0%)	< 0.01	0 (0.0%)	< 0.01
Pest susceptibility	251	236 (94.0%)	< 0.01	15 (6.0%)	0.0167	0 (0.0%)	< 0.01
Weed pressure	251	251 (100.0%)	< 0.01	0 (0.0%)	< 0.01	0 (0.0%)	< 0.01
Occurrence of insects	248	248 (100.0%)	< 0.01	0 (0.0%)	< 0.01	0 (0.0%)	< 0.01
Occurrence of birds	247	247 (100.0%)	< 0.01	0 (0.0%)	< 0.01	0 (0.0%)	< 0.01
Occurrence of mamals	247	247 (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	98.0%	95.7%	100.3%	-	-	-	2.0%	0.0%	4.3%
Time of planting	98.0%	95.7%	100.3%	0.0%	0.0%	0.0%	2.0%	0.0%	4.3%
Tillage and planting technique	98.0%	95.7%	100.3%	-	-	-	2.0%	0.0%	4.3%
Insect control practices	95.6%	92.3%	98.9%	-	-	-	4.4%	1.1%	7.7%
Weed control practices	100.0%	100.0%	100.0%	-	-	-	0.0%	0.0%	0.0%
Fungal control practices	100.0%	100.0%	100.0%	-	-	-	0.0%	0.0%	0.0%
Maize Borer control practice	96.0%	92.8%	99.2%	-	-	-	4.0%	0.8%	7.2%
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	98.0%	95.7%	100.3%	0.0%	0.0%	0.0%	2.0%	0.0%	4.3%
Germination vigor	94.8%	91.2%	98.4%	0.0%	0.0%	0.0%	5.2%	1.6%	8.8%
Time to emergence	99.6%	98.6%	100.6%	0.4%	0.0%	1.4%	0.0%	0.0%	0.0%
Time to male flowering	100.0%	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Plant growth and development	98.8%	97.0%	100.6%	0.0%	0.0%	0.0%	1.2%	0.0%	3.0%
Incidence of stalk / root lodging	84.1%	78.1%	90.0%	15.9%	10.0%	21.9%	0.0%	0.0%	0.0%
Time to maturity	95.6%	92.3%	98.9%	0.0%	0.0%	0.0%	4.4%	1.1%	7.7%
Yield	70.9%	63.5%	78.3%	0.0%	0.0%	0.0%	29.1%	21.7%	36.5%
Occurrence of volunteers	98.0%	95.7%	100.3%	2.0%	0.0%	4.3%	0.0%	0.0%	0.0%
Disease susceptibility	100.0%	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Pest susceptibility	94.0%	90.2%	97.9%	6.0%	2.1%	9.8%	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	100.0%	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Occurrence of mamals	100.0%	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Performance of animals	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.

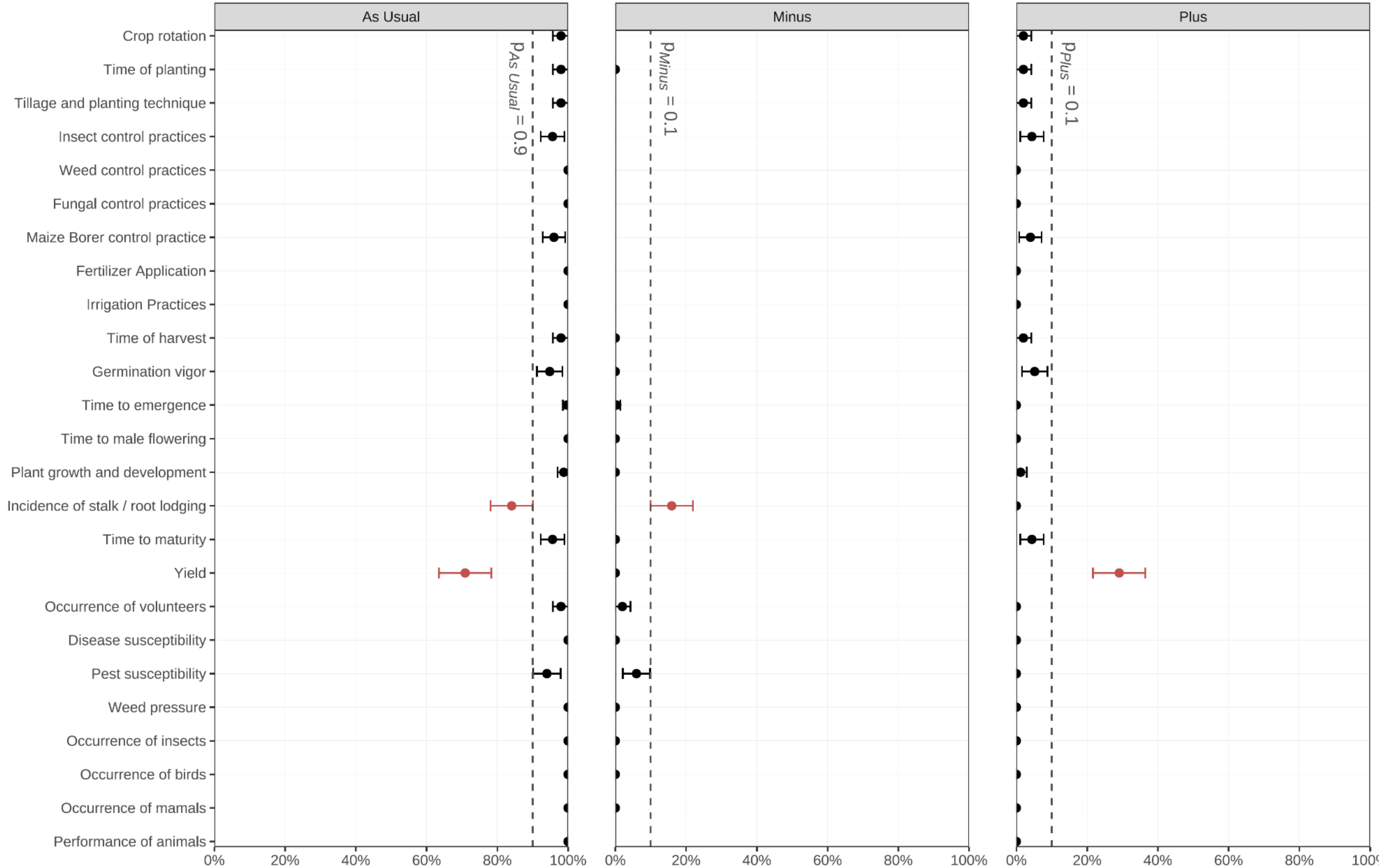

Figure 6: $As\ usual$-, $Minus$- and $Plus$ - answer probabilities of all monitoring characters, point estimates (circle) and 99 % confidence intervals (bars). Vertical dashed line indicates the test thresholds of 0.9 or 0.1, respectively (biological relevance). Probabilities whose confidence intervals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

Taken together, 2021 data indicate that in comparison to conventional maize, MON 810 plants

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

In the following sections the detailed analysis of all parameters surveyed using the questionnaire in 2021 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 2022. In the 2021 growing season 251 farm questionnaires have been collected.

In Spain, the largest market, the surveys (239) 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, 396 farmers were contacted, 157 did not respond for the following reasons: because they did not grow MON810 in 2021 (69), they did not grow maize in 2021 (51), they grew MON810 in 2021 but refused to answer the interview (25), they were absent or could not be localized (7) they were retired (5). The response rate was 60.4 %. 38 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 2021

Region	No of farmers
Cataluña - Aragón	183
Extremadura	22
Navarra	22
Andalucía	5
Castilla - La Mancha	7
Total	**239**

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 no farmers were interviewed in this regions. Instead, an additional farmer was interviewed in Cataluña - Aragón.

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

Table 11: Number of farmers interviewed in Portugal 2021

Region	No of farmers
Center	3
Lisbon and Tagus Valley	2
Alentejo	7
Total	**12**

[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

As can be seen, compared to the sampling scheme (Table 6) there is one additional interviewed farmer in Alentejo, leading to 12 instead of 11 interviewed farmers in Portugal and thus 251 instead of 250 questionnaires.

The quality and plausibility control confirmed that all 251 questionnaires could be considered for analysis. The high quality of the questionnaires can also be ascribed to the interviewer training.

The database currently contains 4,130 cases (questionnaires) for 15 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, 252 for 2020 and 251 for 2021.

3.2 Part 1: Maize grown area

3.2.1 Location

In 2021, 251 questionnaires were surveyed in the cultivation areas of MON 810 in Spain and Portugal. With an area of 96,606 ha in Spain and 4,313 ha in Portugal, these two countries represent MON 810 cultivators in Europe. Of these areas, 5.7 % and 11.5 % 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 2021 (dark grey areas) and the distribution of the monitoring sites (numbers) per region.

Table 12: MON 810 cultivation and monitored areas in 2021

Country	Total planted MON 810 area (ha)	Monitored MON 810 area (ha)	Monitored MON 810 area / total planted MON 810 area (%)
Spain	96,606	5,528	5.7%
Portugal	4,313	495	11.5%
Total	100,919	6,023	6.0%

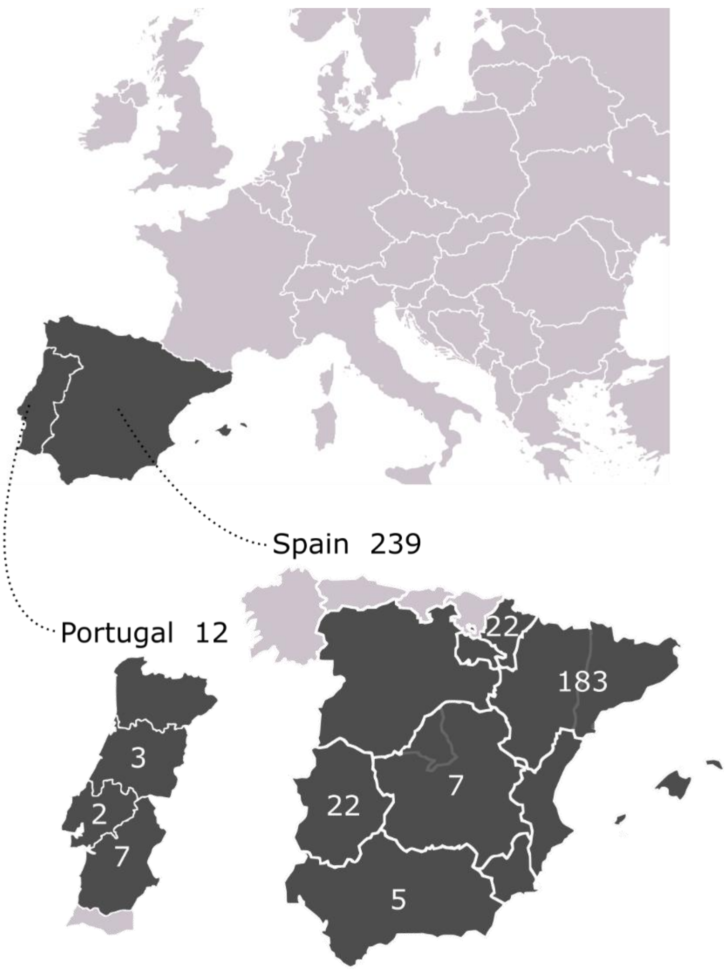

Figure 7: Number of sampling sites (white numbers) within the cultivation areas (filled dark grey) of MON 810 in Europe in 2021.

3.2.2 Surrounding environment

The farmers were asked to describe the land usage in the surrounding of the areas planted with maize. All (251/251) were surrounded by farmland (Table 13, Figure 8).

Table 13: Land usage in the surrounding of the areas planted with MON 810 in 2021

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	Farmland	251	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	251	100.0	100.0	

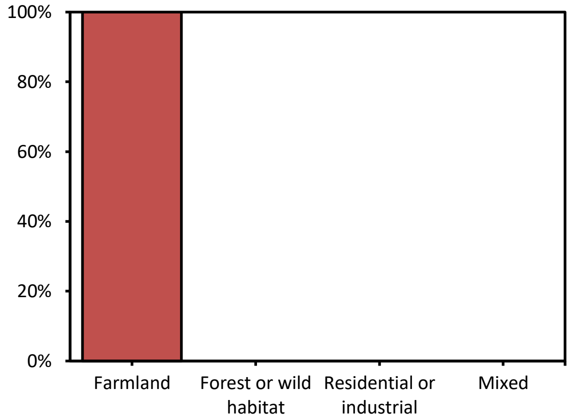

Figure 8: Land usage in the surrounding of the areas planted with MON 810 in 2021

3.2.3 Size and number of fields of the maize cultivated area

The size of the total maize area at the farms in 2021 ranged from 1 to 532 hectares. The average MON 810 areas per surveyed farmer in 2021 were 23.1 ha in Spain and 41.3 ha in Portugal, respectively. Details on the cultivation areas of maize per farmer from 2006 to 2021 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, 2019, 2020 and 2021

		2018			2019			2020			2021		
Country	**Total Area (ha)**	**Mean**	**Min**	**Max**	**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	33.7	1.8	320
	MON 810	15.7	0.8	83	21.0	1.5	261	27.0	1.0	833	23.1	1	225
France	all maize	-	-	-	-	-	-	-	-	-	-	-	-
	MON 810	-	-	-	-	-	-	-	-	-	-	-	-
Portugal	all maize	95.9	10.0	370	182.3	7.0	614	141.3	7.0	585	144.2	9	532
	MON 810	53.4	4.0	220	83.9	1.0	369	46.4	2.0	234	41.3	2	220
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 2021.

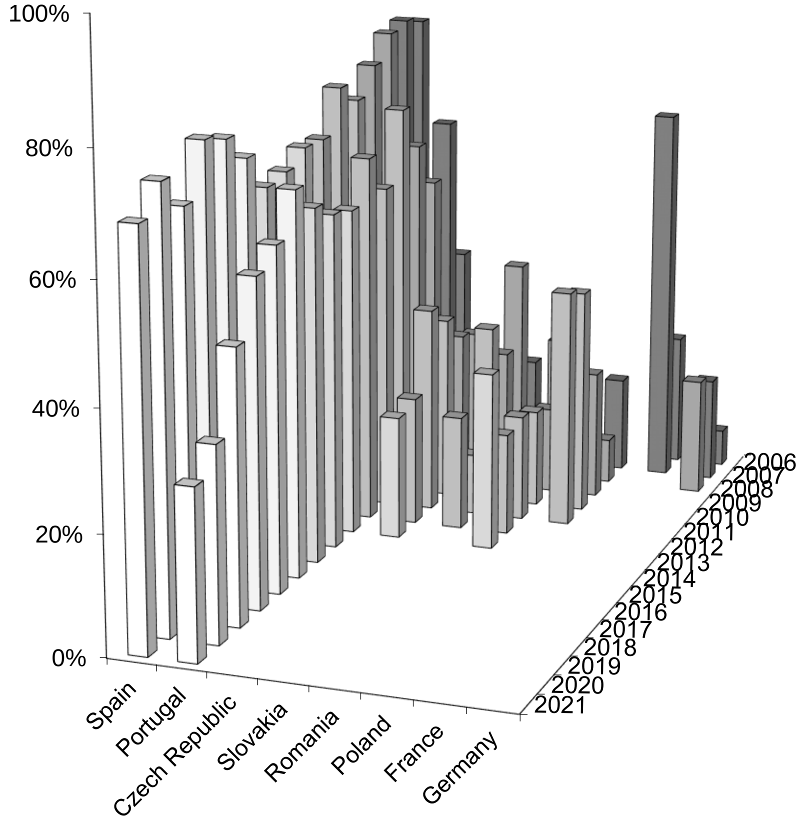

Figure 9: Mean percentage of MON 810 cultivation area of total maize area per farmer in 2006 - 2021 (surveyed countries only)

In 2021, MON 810 was cultivated on 1 - 50 fields per farm. On average, every farmer cultivated MON 810 on 5.37 fields (Table 15).

Table 15: Number of fields with MON 810 in 2021

Valid N	Mean	Minimum	Maximum	Sum
251	5.37	1	50	1349

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 2021. 37 different MON 810 varieties and 62 different conventional maize varieties were listed. The most frequently listed varieties (at least 6 times) with their respective frequencies are listed in Table 16.

Table 16: Names of most frequent MON 810 and conventional maize varieties in 2021

MON 810 maize		Conventional maize	
Variety	**Frequency**	**Variety**	**Frequency**
P 0937 Y	80	P 0937	80
DKC 5032 YG	49	P 1570	46
P 1570 Y	45	DKC 5031	39
P 1524 Y	25	DKC 6980	31
DKC 6729 YG	24	P 1524	28
P 1921 Y	14	P 1921	13
Kefieros YG	11	Kefieros	13
DKC 6041 YG	10	DKC 6728	12
Portbou YG	10	Portbou	9
DKC 6351 YG	8	DKC5741	7
MAS 69 YG	7	DKC 6040	6
DKC 5741 YG	7	DKC 6450	6
		MAS 68K	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 2021

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	very fine	2	0.8	0.8	0.8
	fine	39	15.5	15.5	16.3
	medium	106	42.2	42.2	58.6
	medium-fine	31	12.4	12.4	70.9
	coarse	40	15.9	15.9	86.9
	no predominant soil type	33	13.1	13.1	100.0
Total		**251**	**100.0**	**100.0**	

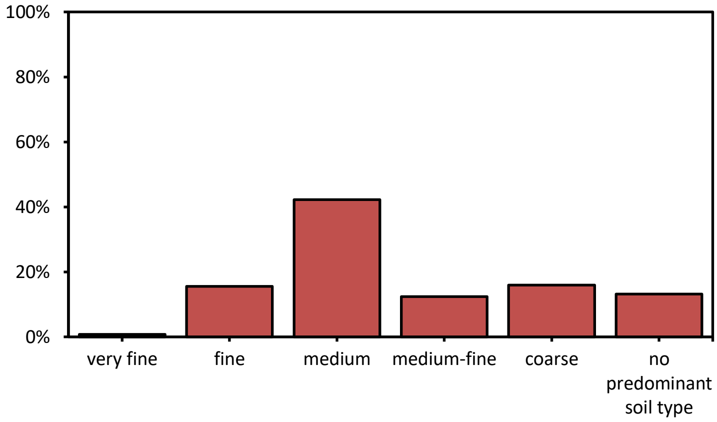

Figure 10: Predominant soil type of maize grown area in 2021

Farmers' responses regarding the soil quality of the maize-grown areas are given in Table 18 and Figure 11. 99.6 % (250/251) 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 2021

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	below average - poor	1	0.4	0.4	0.4
	average - normal	169	67.3	67.3	67.7
	above average - good	81	32.3	32.3	100.0
Total		**251**	**100.0**	**100.0**	

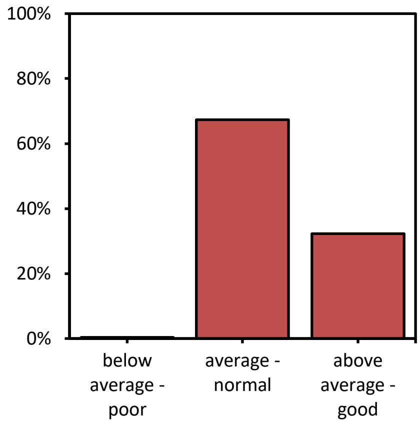

Figure 11: Soil quality of the maize grown area as assessed by the farmers in 2021

77 farmers were able to specify the humus content (not a commonly known measure all over Europe), which ranged from 1.0 % to 3.0 % with a mean of 2.0 % (Table 19). 174 farmers did not specify the humus content.

Table 19: Humus content (%) in 2021

Valid N	Mean	Minimum	Maximum	Missing N
77	2.0	1	3	174

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 100 % (251/251) of the farmers (Table 20, Figure 12).

Table 20: Farmers assessment of the local disease pressure (fungal, viral) in 2021

		Frequency	**Percent**	**Valid percentages**	**Accumulated percentages**
Valid	low	105	41.8	41.8	41.8
	as usual	146	58.2	58.2	100.0
	high	0	0.0	0.0	100.0
Total		**251**	**100.0**	**100.0**	

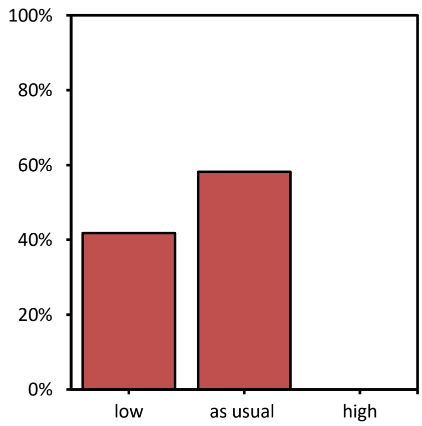

Figure 12: Farmers assessment of the local disease pressure (fungal, viral) in 2021

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

Regarding the local pest pressure (insects, mites, nematodes), 100 % (251/251) of the farmers evaluated it to be *low* or *as usual* (Table 21, Figure 13).

Table 21: Farmers assessment of the local pest pressure (insects, mites, nematodes) in 2021

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	low	112	44.6	44.6	44.6
	as usual	139	55.4	55.4	100.0
	high	0	0.0	0.0	100.0
Total		**251**	**100.0**	**100.0**	

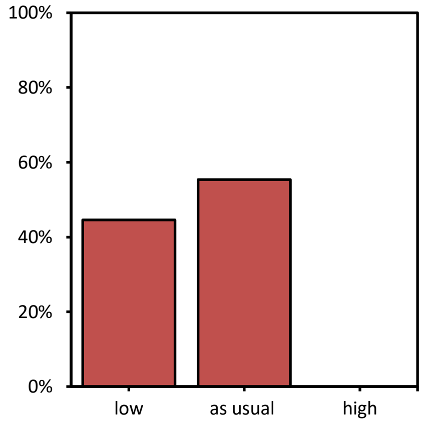

Figure 13: Farmers assessment of the local pest pressure (insects, mites, nematodes) in 2021

3.2.6.3 Local weed pressure as assessed by the farmers

99.2 % (250/251) assessed the local weed pressure to be low or $as\ usual$ and 0.8 % (2/251) evaluated it to be $high$ (Table 22, Figure 14).

Table 22: Farmers assessment of the local weed pressure in 2021

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	low	15	6.0	6.0	6.0
	as usual	234	93.2	93.2	99.2
	high	2	0.8	0.8	100.0
Total		**251**	**100.0**	**100.0**	

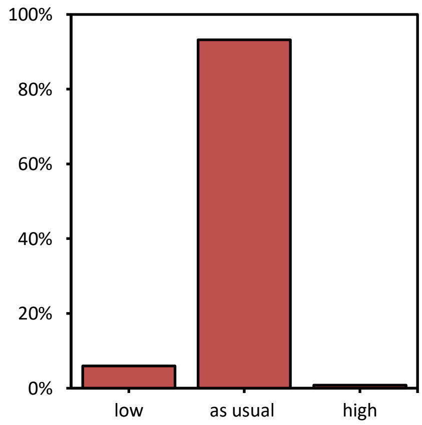

Figure 14: Farmers assessment of the local weed pressure in 2021

3.3 Part 2: Typical agronomic practices to grow maize

3.3.1 Irrigation of maize grown area

100.0 % (251/251) 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 2021

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	yes	251	100.0	100.0	100.0
	no	0	0.0	0.0	100.0
Total		**251**	**100.0**	**100.0**	

Most of the farmers used Sprinkler (53.4 %) or Gravity (33.5 %) irrigation followed by Pivot (9.6 %). The remaining 9 farmers used other types of irrigation (Table 24, Figure 15).

Table 24: Irrigation types of maize grown area in 2021

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	Sprinkler	134	53.4	53.4	53.4
	Gravity	84	33.5	33.5	86.9
	Pivot	24	9.6	9.6	96.4
	other	9	3.6	3.6	100.0
Total		**251**	**100.0**	**100.0**	

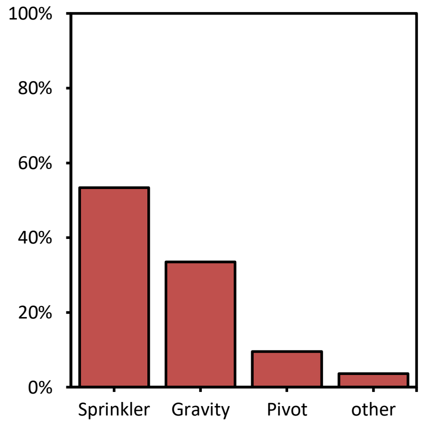

Figure 15: Irrigation types of maize grown area in 2021

3.3.2 Major crop rotation of maize grown area

The main crop rotation within three years is *maize-maize-maize* followed by *maize-maize-barley* and *maize-barley-maize and maize-wheat-maize*. More crop rotations were mentioned, but all with frequencies lower than 15, as can be seen in Table 25.

Table 25: Major rotation of maize grown area before 2021 planting season (two years ago and previous year) sorted by frequency.

	Two years ago	Previous year	Frequency	Valid Percentage	Accumulated percentage
Valid	Maize	Maize	88	35.1	35.1
	Maize	Barley	51	20.3	55.4
	Barley	Maize	18	7.2	62.5
	Wheat	Maize	17	6.8	69.3
	Maize	Wheat	12	4.8	74.1
	Alfalfa	Alfalfa	8	3.2	77.3
	Maize	Alfalfa	7	2.8	80.1
	Pea	Maize	6	2.4	82.5
	Tomato	Maize	5	2.0	84.5
	Maize	Pea	3	1.2	85.7
	Barley	Wheat	3	1.2	86.9
	Maize	Broccoli	2	0.8	87.6
	Ryegrass	Maize	2	0.8	88.4
	Sunflower	Maize	2	0.8	89.2
	Vetch	Maize	2	0.8	90.0
	Beans	Wheat	2	0.8	90.8
	Wheat	Alfalfa	1	0.4	91.2
	Maize	Apple Tree	1	0.4	91.6
	Broccoli	Barley	1	0.4	92.0
	Cabbage / Pea / Potato	Cabbage / Oat / Potato / Pea	1	0.4	92.4
	Cabbage / Pea / Broad Beans / Potato	Cabbage / Potato / Pea	1	0.4	92.8
	Wheat	Canola	1	0.4	93.2
	Cotton	Cotton	1	0.4	93.6
	Maize	Cotton	1	0.4	94.0
	Canola	Maize	1	0.4	94.4
	Cotton	Maize	1	0.4	94.8
	Pea / Barley	Maize	1	0.4	95.2
	Pea / Vetch	Maize	1	0.4	95.6
	Potato	Maize	1	0.4	96.0
	Ryegrass / Oat	Oat / Ryegrass / Tomato	1	0.4	96.4
	Pea	Pea	1	0.4	96.8
	Pea / Potato / Cabbage / Wheat / Lucerne / Oat	Pea / Potato / Wheat / Lucerne / Ryegrass / Oat	1	0.4	97.2
	Pea / Potato	Potato / Cabbage	1	0.4	97.6
	Maize	Ryegrass	1	0.4	98.0
	Ryegrass	Ryegrass	1	0.4	98.4
	Tobacco	Ryegrass	1	0.4	98.8
	Maize	Tomato	1	0.4	99.2
	Maize	Triticale	1	0.4	99.6
	Cauliflower	Wheat	1	0.4	100.0
Total			**251**	**100.0**	

3.3.3 Soil tillage practices

The farmers were asked to answer whether they performed soil tillage. 93.6 % (235/251) said yes (Table 26, Figure 16) while 6.4 % (16/251) answered no.

Table 26: Soil tillage practices in 2021

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	yes	235	93.6	93.6	93.6
	no	16	6.4	6.4	100.0
Total		**251**	**100.0**	**100.0**	

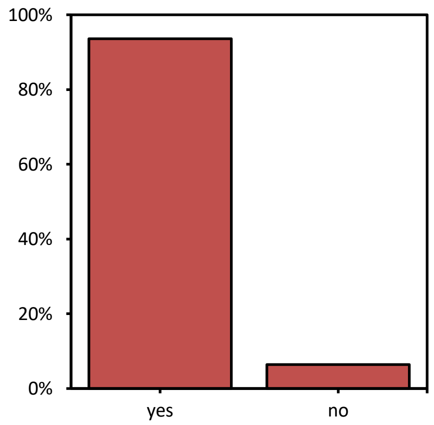

Figure 16: Soil tillage practices in 2021

All farmers who said yes specified the time of tillage. 77.0 % (181/235) performed it in $winter$, 21.5 % (54/235) in $spring$ and no one in $winter\ and\ spring$ (Table 27, Figure 17).

Table 27: Time of tillage in 2021

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	winter	181	72.1	77.0	77.0
	spring	54	21.5	23.0	100.0
	winter & spring	0	0.0	0.0	100.0
	Total	235	93.6	100.0	
Missing	no statement	16	6.4		
Total		251	100.0		

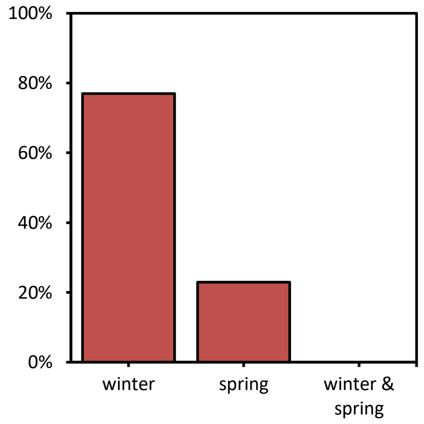

Figure 17: Time of tillsage in 2021

3.3.4 Maize planting technique

88.0 % (221/251) of the farmers used *conventional* maize planting techniques, 8.0 % (20/251) *mulch* and 4.0 % (10/251) used *direct sowing* (Table 28, Figure 18).

Table 28: Maize planting technique in 2021

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	conventional planting	221	88.0	88.0	88.0
	direct sowing	20	8.0	8.0	96.0
	mulch	10	4.0	4.0	100.0
Total		**251**	**100.0**	**100.0**	

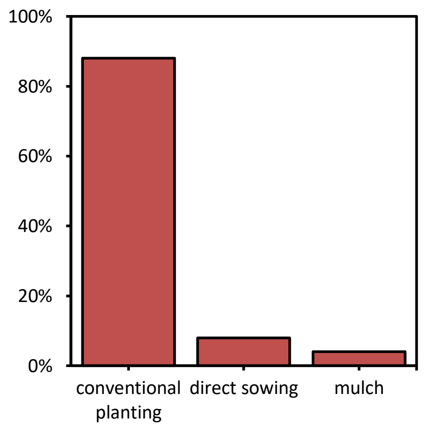

Figure 18: Maize planting technique in 2021

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 90.0 % of the farmers (226/251) applied insecticides and 4.4 % (11/226) of them applied insecticides against corn borer. One farmer (0.4 %) applied mechanical weed control. All of the farmers (251/251) used $herbicides$. None of the farmers used biocontrol treatments, fungicides or other treatments (Table 29).

Table 29: Typical weed and pest control practices in maize in 2021

Insecticide(s)		**Frequency**	**Percent**
	yes	226	90.0
	no	25	10.0
Total		251	100.0
Insecticide(s) against Corn Borer		**Frequency**	**Percent**
	yes	11	4.4
	no	215	85.7
	Total	226	
Missing	no statement	25	10.0
Total		251	100.0
Use of biocontrol treatments		**Frequency**	**Percent**
	yes	0	0.0
	no	251	100.0
Total		251	100.0
Herbicide(s)		**Frequency**	**Percent**
	yes	251	100.0
	no	0	0.0
Total		251	100.0
Mechanical weed control		**Frequency**	**Percent**
	yes	1	0.4
	no	250	99.6
Total		251	100.0
Fungicide(s)		**Frequency**	**Percent**
	yes	0	0.0
	no	251	100.0
Total		251	100.0
Other		**Frequency**	**Percent**
	yes	0	0.0
	no	251	100.0
Total		251	100.0

3.3.6 Application of fertilizer to maize grown area

All of the farmers (251/251) applied fertilizer to the maize grown area (Table 30).

Table 30: Application of fertilizer to maize grown area in 2021

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	yes	251	100.0	100.0	100.0
	no	0	0.0	0.0	100.0
Total		**251**	**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 March 2021 to 30 June 2021 (Table 31).

Table 31: Typical time of maize sowing in 2021

	Minimum	Maximum	Mean	Valid N
Sowing from	15.03.2021	20.06.2021	15.04.2021	251
Sowing till	30.03.2021	30.06.2021	12.05.2021	251

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 grain maize ranged from 15 August 2021 to 31 December 2021 and for forage maize from 15 August 2021 to 10 November 2021 (Table 32).

Table 32: Typical time of maize harvest in 2021

	Minimum	Maximum	Mean	Valid N
Harvest grain maize from	15.08.2021	20.12.2021	18.10.2021	245
Harvest grain maize till	30.08.2021	31.12.2021	14.11.2021	245
Harvest forage maize from	15.08.2021	25.10.2021	20.09.2021	16
Harvest forage maize till	30.08.2021	10.11.2021	08.10.2021	16

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 98.0 % (246/251) 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 2021

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	as usual	246	98.0	98.0	98.0
	changed	5	2.0	2.0	100.0
Total		**251**	**100.0**	**100.0**	

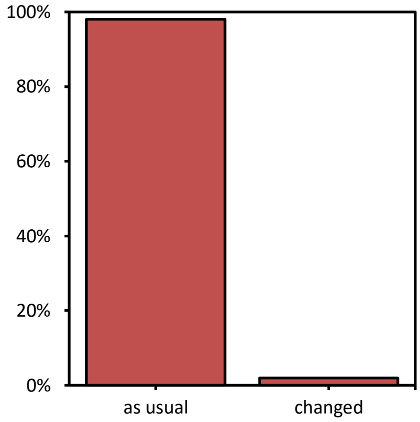

Figure 19: Crop rotation of MON 810 compared to conventional maize in 2021

(1) The valid percentage of $as\ usual$ crop rotation (98.0 %) 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 2021

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

$p_{As\ usual}$	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%

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 % (246/251) 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 2021

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	earlier	0	0.0	0.0	0.0
	as usual	246	98.0	98.0	98.0
	later	5	2.0	2.0	100.0
Total		**251**	**100.0**	**100.0**	

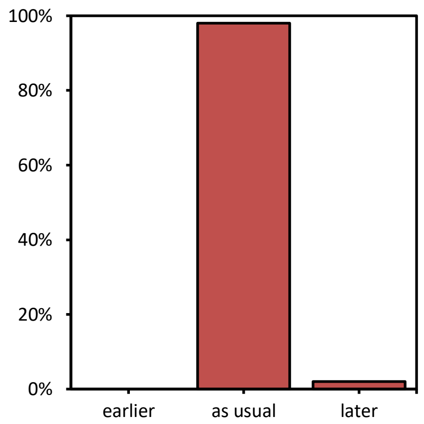

Figure 20: Time of planting of MON 810 compared to conventional maize in 2021

(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 2021

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	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%	95.7%	100.3%	0.0%	0.0%	0.0%	2.0%	0.0%	4.3%

3.4.1.3 Tillage and planting techniques

Five farmers (2.0 %) changed their tillage and planting techniques of MON 810 compared to those used for conventional maize (Table 37, Figure 21). All five farmers answering $changed$ stated that they plant MON 810 wird direct sowing and conventional maize with conventional sowing.

Table 37: Tillage and planting techniques for MON 810 compared to conventional maize in 2021

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	as usual	246	98.0	98.0	98.0
	changed	5	2.0	2.0	100.0
Total		**251**	**100.0**	**100.0**	

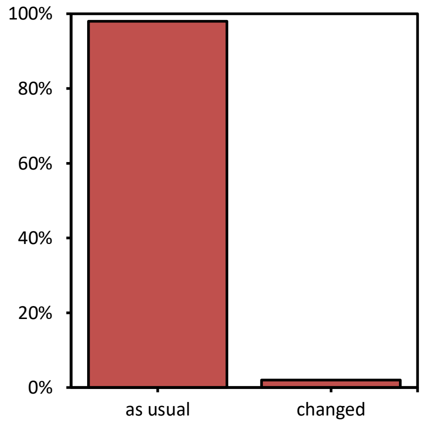

Figure 21: Tillage and planting techniques for MON 810 compared to conventional maize in 2021

(1) The valid percentage of $as\ usual$ tillage and planting techniques (98.0%) 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 2021

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

$p_{As\ usual}$	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%

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 sprayed, for which Abamectin was the major active ingredient in 2021.

Cypermethrin and Lambda-cyhalothrin were the most used active ingredients for granulate insecticides, while Teflutrin were the most commonly used active ingredients in seed coatings.

All farmers were asked to describe their insect control practice in MON 810 compared to conventional maize. 95.6 % (240/251) specified no change in practice, while 4.4 % (11/251) $changed$ their program (Table 39, Figure 22).

Table 39: Use of insect control in MON 810 compared to conventional maize in 2021

		Frequency	**Percent**	**Valid percentages**	**Accumulated percentages**
Valid	as usual	240	95.6	95.6	95.6
	changed	11	4.4	4.4	100.0
Total		**251**	**100.0**	**100.0**	

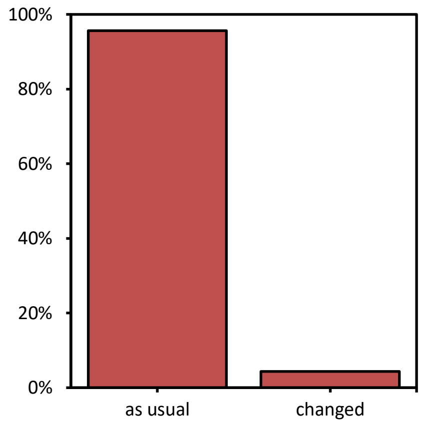

Figure 22: Insect control practice of MON 810 compared to conventional maize in 2021

(1) The valid percentage of $as\ usual$ insect control practice (95.6 %) 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 91 %.

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 2021

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	240 (95.6%)	< 0.01	-	-	11 (4.4%)	< 0.01

$p_{As\ usual}$	lower 99 % confidence limit	upper 99 % confidence limit	p_{Minus}	lower 99 % confidence limit	upper 99 % confidence limit	p_{Plus}	lower 99 % confidence limit	upper 99 % confidence limit
95.6%	92.3%	98.9%	-	-	-	4.4%	1.1%	7.7%

When asked whether the farmers usually use insecticides in conventional maize, 226 stated that they did, while 25 farmers said they usually don't. Additionally, 11 of the 226 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 11 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 2021

		Insect control practice in MON 810		
		as usual	changed	**Total**
Do you usually use insecticides? (section 3.3.5)	yes	215	11	226
	no	25	0	25
Total		**240**	**11**	**251**

Table 42: Corn Borer control practice compared to conventional maize in the context of the general use of insecticides against Corn Borer in 2021

		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	11	11
	no	215	0	215
Total		**215**	**11**	**226**

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
- Nicosulfuron
- Mesotrione

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

None of the farmers changed their weed control practice of MON 810 compared to that of conventional maize (Table 43).

Table 43: Use of weed control in MON 810 compared to conventional maize in 2021

		Frequency	**Percent**	**Valid percentages**	**Accumulated percentages**
Valid	as usual	251	100.0	100.0	100.0
	changed	0	0.0	0.0	100.0
Total		**251**	**100.0**	**100.0**	

No effect on weed control practice is indicated.

3.4.1.6 Fungal control practice

Since in 2021 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 44).

Table 44: Use of fungicides on MON 810 compared to conventional maize in 2021

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	as usual	251	100.0	100.0	100.0
	changed	0	0.0	0.0	100.0
Total		**251**	**100.0**	**100.0**	

No effect on fungal control practice is indicated.

3.4.1.7 Fertilizer application practice

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

Table 45: Use of fertilizer in MON 810 compared to conventional maize in 2021

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	as usual	251	100.0	100.0	100.0
	changed	0	0.0	0.0	100.0
Total		**251**	**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 46).

Table 46: Irrigation practice in MON 810 compared to conventional maize in 2021

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	as usual	251	100.0	100.0	100.0
	changed	0	0.0	0.0	100.0
Total		**251**	**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. 98.0 % of them (246/251) responded that they did not change the harvesting date for MON 810. The remaining 5 farmers (2.0 %) harvested *later* (Table 47, Figure 23). The complete individual feedback of the farmers for a changed harvesting time is given in Appendix A, Table A 6.

Table 47: Harvest of MON 810 compared to conventional maize in 2021

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	earlier	0	0.0	0.0	0.0
	as usual	246	98.0	98.0	98.0
	later	5	2.0	2.0	100.0
Total		**251**	**100.0**	**100.0**	

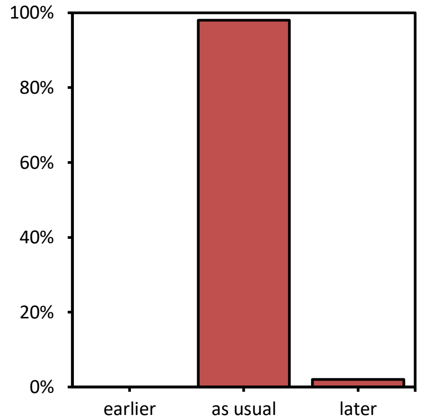

Figure 23: Harvest of MON 810 compared to conventional maize in 2021

(1) The valid percentage of $as\ usual$ harvest of MON 810 (98.0 %) is significantly greater than 90 %. The resulting p-value is smaller than the level of significance $\alpha = 0.01$ (Table 48). 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 48: Test results as well as 99 % confidence intervals for $p_{As\ usual}$, p_{Minus} and p_{Plus} probabilities of harvesting time in MON 810 compared to conventional maize in 2021

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	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%	95.7%	100.3%	0.0%	0.0%	0.0%	2.0%	0.0%	4.3%

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 13 farmers (5.2 %) assessed the germination of MON 810 to be $more\ vigorous$, 94.8 % (238/251) found it to be $as\ usual$ (Table 49, Figure 24). Individual explanations for the observations of the farmers are given in Appendix A, Table A 7.

Table 49: Germination vigour of MON 810 compared to conventional maize in 2021

		Frequency	**Percent**	**Valid percentages**	**Accumulated percentages**
Valid	less vigourous	0	0.0	0.0	0.0
	as usual	238	94.8	94.8	94.8
	more vigourous	13	5.2	5.2	100.0
Total		**251**	**100.0**	**100.0**	

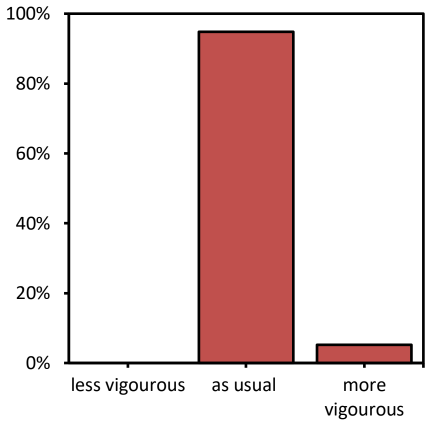

Figure 24: Germination vigour of MON 810 compared to conventional maize in 2021

(1) The valid percentage of $as\ usual$ germination vigor (94.8 %) is significantly greater than 90 %. The resulting p-value is smaller than the level of significance $\alpha = 0.01$ (Table 50). The null hypothesis $p_{as\ usual} \leq 0.9$ is rejected with a power of 77 %.

No effect on the germination vigor is indicated.

Table 50: Test results as well as 99 % confidence intervals for $p_{As\ usual}$, p_{Minus} and p_{Plus} probabilities of germination vigour in MON 810 compared to conventional maize in 2021

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	238 (94.8%)	< 0.01	0 (0.0%)	< 0.01	13 (5.2%)	< 0.01

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

3.4.2.2 Time to emergence

All except one farmer found the time to emergence to be $as\ usual$ (Table 51, Figure 25). The individual explanation for this observation is given in Appendix A, Table A 7.

Table 51: Time to emergence of MON 810 compared to conventional maize in 2021

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	accelerated	1	0.4	0.4	0.4
	as usual	250	99.6	99.6	100.0
	delayed	0	0.0	0.0	100.0
Total		**251**	**100.0**	**100.0**	

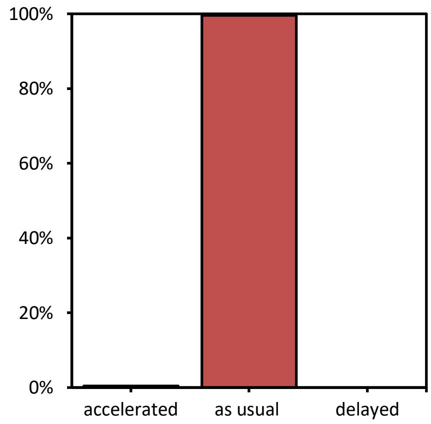

Figure 25: Time to emergence of MON 810 compared to conventional maize in 2021

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

No effect on the time to emergence is indicated.

Table 52: Test results as well as 99 % confidence intervals for $p_{As\ usual}$, p_{Minus} and p_{Plus} probabilities of time to emergence in MON 810 compared to conventional maize in 2021

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	250 (99.6%)	< 0.01	1 (0.4%)	< 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%	0.4%	0.0%	1.4%	0.0%	0.0%	0.0%

3.4.2.3 Time to male flowering

All farmers (251/251) assessed the time to male flowering to be $as\ usual$ (Table 53). Individual explanations for these observations are given in Appendix A, Table A 7.

Table 53: Time to male flowering of MON 810 compared to conventional maize in 2021

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	accelerated	0	0.0	0.0	0.0
	as usual	251	100.0	100.0	100.0
	delayed	0	0.0	0.0	100.0
Total		**251**	**100.0**	**100.0**	

No effect on time to male flowering is indicated.

3.4.2.4 Plant growth and development

Plant growth and development was assessed to be $delayed$ by 3 farmers (1.2 %) and to be $as\ usual$ in 98.8 % (248/251) of all cases (Table 54, Figure 26). Individual explanations for these observations are given in Appendix A, Table A 7.

Table 54: Plant growth and development of MON 810 compared to conventional maize in 2021

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	accelerated	0	0.0	0.0	0.0
	as usual	248	98.8	98.8	98.8
	delayed	3	1.2	1.2	100.0
Total		**251**	**100.0**	**100.0**	

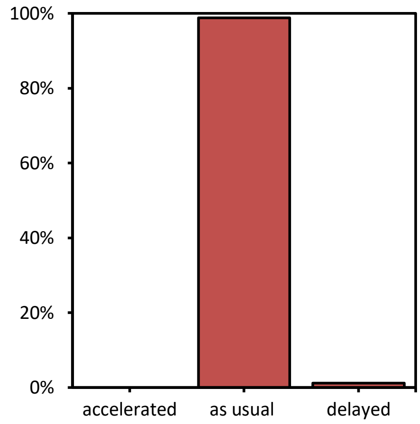

Figure 26: Plant growth and development of MON 810 compared to conventional maize in 2021

(1) The valid percentage of $as\ usual$ plant growth and development (98.8 %) is significantly greater than 90 %. The resulting p-value is smaller than the level of significance $\alpha = 0.01$ (Table 55). The null hypothesis $p_{as\ usual} \leq 0.9$ is rejected with a power of 100 %.

No effect on plant growth and development is indicated.

Table 55: Test results as well as 99 % confidence intervals for $p_{As\ usual}$, p_{Minus} and p_{Plus} probabilities of plant growth and development in MON 810 compared to conventional maize in 2021

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	248 (98.8%)	< 0.01	0 (0.0%)	< 0.01	3 (1.2%)	< 0.01

$p_{As\ usual}$	lower 99 % confidence limit	upper 99 % confidence limit	p_{Minus}	lower 99 % confidence limit	upper 99 % confidence limit	p_{Plus}	lower 99 % confidence limit	upper 99 % confidence limit
98.8%	97.0%	100.6%	0.0%	0.0%	0.0%	1.2%	0.0%	3.0%

3.4.2.5 Incidence of stalk/root lodging

Incidence of stalk/root lodging was assessed to be *less often* in MON 810 compared to conventional maize in 15.9 % (40/251) of all cases and *as usual* in 84.1 % (211/251) (Table 56, Figure 27). Individual explanations for these observations are given in Appendix A, Table A 7.

Table 56: Incidence of stalk/root lodging of MON 810 compared to conventional maize in 2021

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	less often	40	15.9	15.9	15.9
	as usual	211	84.1	84.1	100.0
	more often	0	0.0	0.0	100.0
Total		**251**	**100.0**	**100.0**	

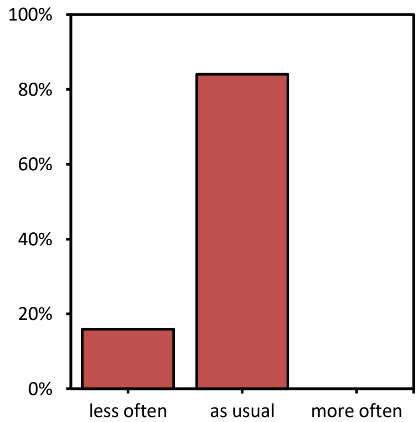

Figure 27: Incidence of stalk/root lodging of MON 810 compared to conventional maize in 2021

(1) The valid percentage of $as\ usual$ incidence of stalk/root lodging (84.1 %) is less than 90 %. The resulting p-value is larger than the level of significance $\alpha = 0.01$ (Table 57) and therefore, the corresponding null hypothesis $p_{as\ usual} \leq 0.9$ could not be rejected.

(2) The valid percentage of $less$ incidence of stalk/root lodging (15.9 %) exceeds the 10 % threshold. The resulting p-value is larger than the level of significance $\alpha = 0.01$ (Table 57) and therefore, the corresponding null hypothesis $p_{less\ often} \geq 0.1$ could not be rejected.

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

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

Table 57: Test results as well as 99 % confidence intervals for $p_{As\ usual}$, p_{Minus} and p_{Plus} probabilities of incidence of stalk/root lodging in MON 810 compared to conventional maize in 2021

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	211 (84.1%)	1.0	40 (15.9%)	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
84.1%	78.1%	90.0%	15.9%	10.0%	21.9%	0.0%	0.0%	0.0%

3.4.2.6 Time to maturity

4.4 % (11/251) of the farmers assessed the time to maturity to be *delayed* for MON 810 and *as usual* in 95.6 (240/251) (Table 58, Figure 28). Individual explanations for these observations are given in Appendix A, Table A 7.

Table 58: Time to maturity of MON 810 compared to conventional maize in 2021

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	accelerated	0	0.0	0.0	0.0
	as usual	240	95.6	95.6	95.6
	delayed	11	4.4	4.4	100.0
Total		**251**	**100.0**	**100.0**	

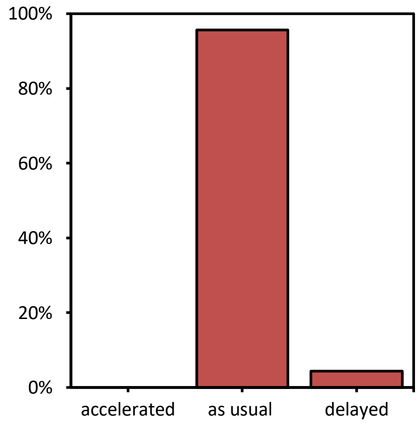

Figure 28: Time to maturity of MON 810 compared to conventional maize in 2021

(1) The valid percentage of *as usual* time to maturity (95.6 %) is significantly greater than 90 %. The resulting p-value is smaller than the level of significance $\alpha = 0.01$ (Table 59). The null hypothesis $p_{as\ usual} \leq 0.9$ is rejected with a power of 91 %.

No effect on time to maturity is indicated.

Table 59: Test results as well as 99 % confidence intervals for $p_{As\ usual}$, p_{Minus} and p_{Plus} probabilities of time to maturity in MON 810 compared to conventional maize in 2021

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	240 (95.6%)	< 0.01	0 (0.0%)	< 0.01	11 (4.4%)	< 0.01

$p_{As\ usual}$	lower 99 % confidence limit	upper 99 % confidence limit	p_{Minus}	lower 99 % confidence limit	upper 99 % confidence limit	p_{Plus}	lower 99 % confidence limit	upper 99 % confidence limit
95.6%	92.3%	98.9%	0.0%	0.0%	0.0%	4.4%	1.1%	7.7%

3.4.2.7 Yield

Yield was found to be $higher$ in 29.1 % (73/251) and $as\ usual$ in 70.9 % (178/251) of all cases (Table 60, Figure 29). Individual explanations for these observations are given in Appendix A, Table A 7.

Table 60: Yield of MON 810 compared to conventional maize in 2021

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	lower yield	0	0.0	0.0	0.0
	as usual	178	70.9	70.9	70.9
	higher yield	73	29.1	29.1	100.0
Total		**251**	**100.0**	**100.0**	

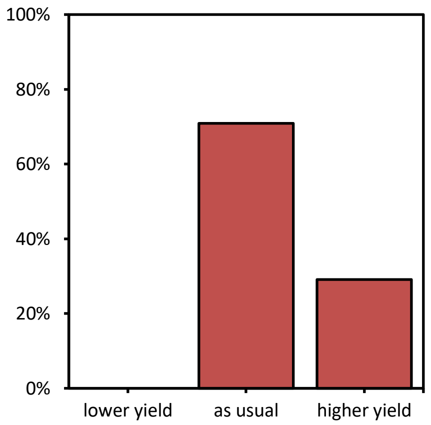

Figure 29: Yield of MON 810 compared to conventional maize in 2021

(1) The valid percentage of $as\ usual$ yield (70.9 %) is smaller than 90 %. The resulting p-value is larger than the level of significance $\alpha = 0.01$ (Table 61) and therefore, the corresponding null hypothesis $p_{as\ usual} \leq 0.9$ could not be rejected.

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

The valid percentage of $higher$ yield (29.1 %) exceeds the 10 % threshold. The resulting p-value is greater than the level of significance $\alpha = 0.01$ (Table 61) and therefore, the corresponding null hypothesis $p_{higher\ yield} \geq 0.1$ could not be rejected.

An effect on yield of MON 810 is indicated.

Table 61: Test results as well as 99 % confidence intervals for $p_{As\ usual}$, p_{Minus} and p_{Plus} probabilities of yield in MON 810 compared to conventional maize in 2021

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	178 (70.9%)	1.0	0 (0.0%)	< 0.01	73 (29.1%)	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
70.9%	63.5%	78.3%	0.0%	0.0%	0.0%	29.1%	21.7%	36.5%

3.4.2.8 Occurrence of volunteers

The occurrence of volunteers was assessed to be *less* frequent for MON 810 than for conventional maize in 2.0 % (5/251) and *as usual* in 98.0 % (246/251) of all cases (Table 62, Figure 30). Individual explanations for these observations are given in Appendix A, Table A 7.

Table 62: Occurrence of MON 810 volunteers compared to conventional maize in 2021

		Frequency	**Percent**	**Valid percentages**	**Accumulated percentages**
Valid	less often	5	2.0	2.0	2.0
	as usual	246	98.0	98.0	100.0
	more often	0	0.0	0.0	100.0
Total		**251**	**100.0**	**100.0**	

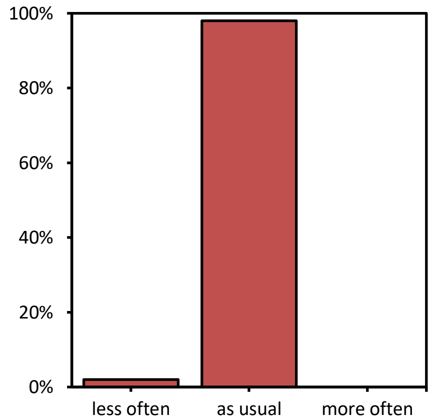

Figure 30: Occurrence of MON 810 volunteers compared to conventional maize in 2021

(1) The valid percentage of *as usual* occurrence of volunteers (98.0 %) is significantly greater than 90 %. The resulting p-value is smaller than the level of significance $\alpha = 0.01$ (Table 63). The null hypothesis $p_{as\ usual} \leq 0.9$ is rejected with a power of 100 %.

No effect on occurrence of MON 810 volunteers is indicated.

Table 63: Test results as well as 99 % confidence intervals for $p_{As\ usual}$, p_{Minus} and p_{Plus} probabilities of occurrence of volunteers in MON 810 compared to conventional maize in 2021

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%

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

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

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

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

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

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

Table A 8.

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

All farmers assessed the disease susceptibility of MON 810 to be as usual (Table 64).

Table 64: Disease susceptibility in MON 810 compared to conventional maize in 2021

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	less susceptible	0	0.0	0.0	0.0
	as usual	251	100.0	100.0	100.0
	more susceptible	0	0.0	0.0	100.0
Total		251	100.0	100.0	

No effect on disease susceptibility is indicated.

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

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

No farmer reported less or more disease susceptibility to fungal species.

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 65, Figure 31).

Table 65: Insect pest control of *O. nubilalis* in MON 810 in 2021

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	weak	0	0.0	0.0	0.0
	good	28	11.2	11.2	11.2
	very good	223	88.8	88.8	100.0
Total		251	100.0	100.0	

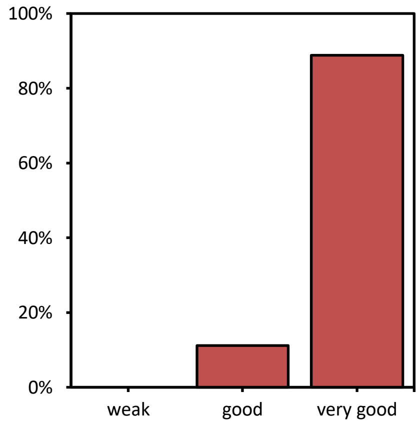

Figure 31: Insect pest control of *Ostrinia nubilalis* in MON 810 in 2021

100.0 % (251/251) of the farmers attested a $good$ or $very\ good$ control of *Sesamia* spp. (Pink Borer) (Table 66, Figure 32).

Table 66: Insect pest control of *Sesamia* spp. in MON 810 in 2021

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	weak	0	0.0	0.0	0.0
	good	28	11.2	11.2	11.2
	very good	223	88.8	88.8	100.0
Total		**251**	**100.0**	**100.0**	

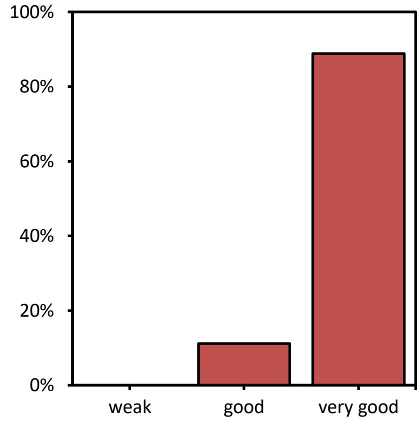

Figure 32: Insect pest control of *Sesa mia* spp. in MON 810 in 2021

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

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

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

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

Farmers assessed MON 810 to be less susceptible to pests in 6.0 % (15/251) of all cases (Table 67, Figure 33).

Table 67: Pest susceptibility of MON 810 compared to conventional maize in 2021

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	less susceptible	15	6.0	6.0	6.0
	as usual	236	94.0	94.0	100.0
	more susceptible	0	0.0	0.0	100.0
Total		**251**	**100.0**	**100.0**	

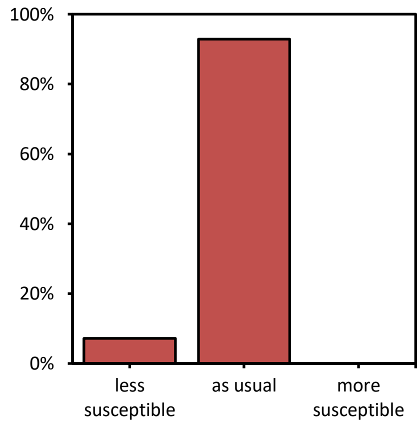

Figure 33: Pest susceptibility of MON 810 compared to conventional maize in 2021

(1) The valid percentage of $as\ usual$ susceptibility (94.0 %) is greater than 90 %. However, the resulting p-value is larger than the level of significance $\alpha = 0.01$ (Table 68) and therefore, the corresponding null hypothesis $p_{as\ usual} \leq 0.9$ could not be rejected.

(2) The valid percentage of $lower$ susceptibility (6.0 %) is smaller than 10 %. However, the resulting p-value is larger than the level of significance $\alpha = 0.01$ (Table 68) 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 68). 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 68: 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 2021

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	236 (94.0%)	< 0.01	15 (6.0%)	0.017	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
94.0%	90.2%	97.9%	6.0%	2.1%	9.8%	0.0%	0.0%	0.0%

The 15 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 69 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 69: Specification of differences in pest susceptibility in MON 810 compared to conventional maize in 2021

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	251	240 (95.6%)	< 0.01	11 (4.4%)	< 0.01	0 (0.0%)	< 0.01
	Spodoptera Frugiperda	251	245 (97.6%)	< 0.01	6 (2.4%)	< 0.01	0 (0.0%)	< 0.01
	Helicoverpa zea	251	250 (99.6%)	< 0.01	1 (0.4%)	< 0.01	0 (0.0%)	< 0.01
	Agrotis spp.	251	250 (99.6%)	< 0.01	1 (0.4%)	< 0.01	0 (0.0%)	< 0.01
Coleoptera	Diabrotica / Agriotes	251	248 (98.8%)	< 0.01	3 (1.2%)	< 0.01	0 (0.0%)	< 0.01
	Agriotes spp.	251	250 (99.6%)	< 0.01	1 (0.4%)	< 0.01	0 (0.0%)	< 0.01
Hemiptera	Cicadella sp.	251	250 (99.6%)	< 0.01	1 (0.4%)	< 0.01	0 (0.0%)	< 0.01
	Aphids	251	250 (99.6%)	< 0.01	1 (0.4%)	< 0.01	0 (0.0%)	< 0.01

What becomes clear in Table 69 is that for all listed pests

(1) the valid percentages of $as\ usual$ pest susceptibility in MON 810 compared to conventional maize in 2021 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 91 % for *Agrotis ipsilon* and 100 % for all other pests.

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 (but not significantly) reduced.

A 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 (251/251) found the weed pressure to be *as usual* in MON 810 fields compared to conventional fields (Table 70).

Table 70: Weed pressure in MON 810 compared to conventional maize in 2021

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	less weeds	0	0.0	0.0	0.0
	as usual	251	100.0	100.0	100.0
	more weeds	0	0.0	0.0	100.0
Total		**251**	**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:

- *Sorghum halepense*
- *Chenopodium album*
- *Abutilon theophrasti*
- *Xanthium strumarium*
- *Datura stramonium*
- *Cyperus spp.*

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

Except for three farmers who did not know, all farmers (248/248) assessed the occurrence of non target insects in MON 810 fields to be *as usual* (Table 71).

Table 71: Occurrence of non target insects in MON 810 compared to conventional maize in 2021

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	less	0	0.0	0.0	0.0
	as usual	248	98.8	100.0	100.0
	more	0	0.0	0.0	100.0
	Total	248	98.8	100.0	
Missing	Do not know	3	1.2		
	No statement	0	0.0		
Total		**251**	**100.0**		

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

3.4.7.2 Occurrence of birds

Except for four farmers who did not know, all farmers (248/248) assessed the occurrence of birds in MON 810 fields to be *as usual* (Table 72).

Table 72: Occurrence of birds in MON 810 compared to conventional maize in 2021

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	less	0	0.0	0.0	0.0
	as usual	247	98.4	100.0	100.0
	more	0	0.0	0.0	100.0
	Total	247	98.4	100.0	
Missing	Do not know	4	1.6		
	No statement	0	0.0		
Total		**251**	**100.0**		

No effect on occurrence of birds is indicated.

3.4.7.3 Occurrence of mammals

Except for four farmers who did not know, all farmers (248/248) assessed the occurrence of mammals in MON 810 fields to be *as usual* (Table 73).

Table 73: Occurrence of mammals in MON 810 compared to conventional maize in 2021

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	less	0	0.0	0.0	0.0
	as usual	247	98.4	100.0	100.0
	more	0	0.0	0.0	100.0
	Total	247	98.4	100.0	
Missing	Do not know	4	1.6		
	No statement	0	0.0		
Total		**251**	**100.0**		

No effect on the occurrence of mammals is indicated.

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

The occurrence of wildlife in MON 810 is reported to be mostly unchanged for non target insects, birds and mammals. Only 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 % (6/251) of the farmers used the harvest of MON 810 to feed their animals (Table 74, Figure 34). 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 74: Use of MON 810 harvest for animal feed in 2021

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	yes	6	2.4	2.4	2.4
	no	245	97.6	97.6	100.0
Total		**251**	**100.0**	**100.0**	

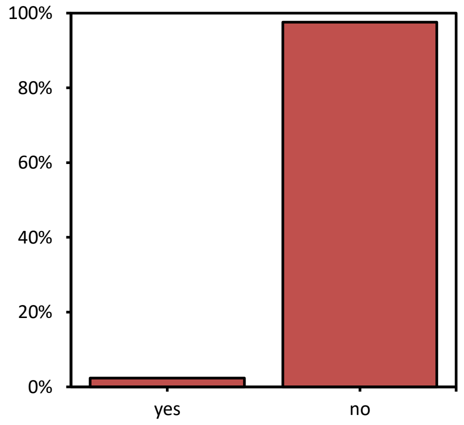

Figure 34: Use of MON 810 harvest for animal feed in 2021

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 75).

Table 75: Performance of animals fed MON 810 compared to animals fed conventional maize in 2021

		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 2021 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 but one farmer (250/251) reported to have been informed about the good agricultural practices applicable to MON 810 (Table 76).

96.4 % (240/249) of the farmers considered the training sessions to be either *useful* or *very useful* (Table 77 and Figure 35). This information indicates that the great majority of the farmers had been exposed to a valuable training concerning MON 810.

Table 76: Information on good agricultural practices in 2021

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	yes	250	99.6	99.6	99.6
	no	1	0.4	0.4	100.0
Total		**251**	**100.0**	**100.0**	

Table 77: Evaluation of training sessions in 2021

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	very useful	47	18.7	18.9	18.9
	useful	193	76.9	77.5	96.4
	not useful	9	3.6	3.6	100.0
	Total	249	99.2	100.0	
	No statement	2	0.8		
Total		**251**	**100.0**		

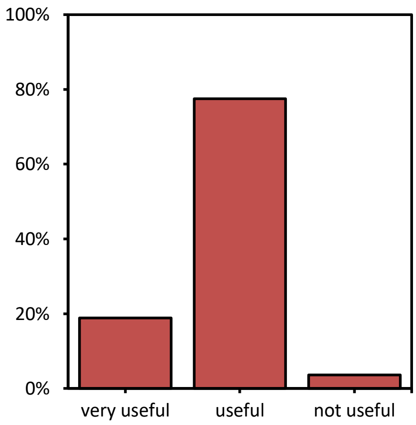

Figure 35: Evaluation of training sessions in 2021

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 98.8 % (249/250) of the given responses. This indicates in all cases the bags were labeled appropriately and that the label and the accompanying documentation were clear to the farmers.

Table 78: Perception of seed bag label recommendations in 2021

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	yes	249	98.8	99.6	99.6
	no	1	0.4	0.4	100.0
	Total	250	99.2	100.0	
	No statement	1	0.4		
Total		**251**	**100.0**		

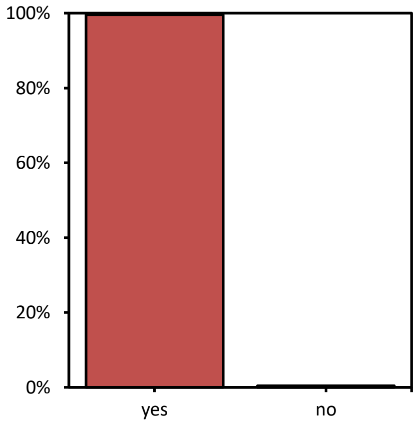

Figure 36: Perception of seed bag label recommendations in 2021

The great majority of the farmers (97.6 %; 245/251) reported that they are following the label recommendations on the seed bags (Table 79 and Figure 37). 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 79: Compliance with label recommendations in 2021

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	yes	245	97.6	97.6	97.6
	no	6	2.4	2.4	100.0
Total		**251**	**100.0**	**100.0**	

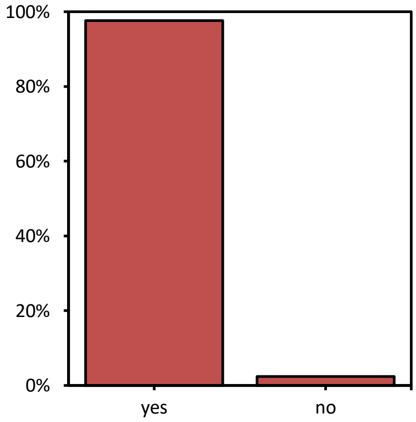

Figure 37: Compliance with label recommendations in 2021

3.5.3 Prevention of insect resistance

89.2 % (224/251) of the farmers planted a refuge within their farms (Table 80, Figure 38). 8.4 % (21/251) 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 % (6/251) of the farmers reported that they did not plant a refuge although having more than 5 ha of maize planted on their farm.

Table 80: Planting of a refuge in 2021

		Frequency	Percent	Valid percentages	Accumulated percentages
Valid	yes	224	89.2	89.2	89.2
	no, because the area of Bt maize is < 5 ha	21	8.4	8.4	97.6
	no	6	2.4	2.4	100.0
Total		**251**	**100.0**	**100.0**	

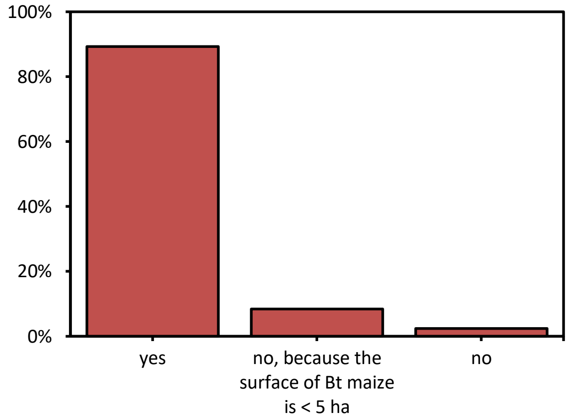

Figure 38: Planting of a refuge in 2021

Therefore, 97.6 % (245/251) 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 81).

Table 81: Refuge implementation per country in 2021

		Refuge implementation			
	Country	**Yes**	**No, because the area of *Bt* maize is < 5 ha**	**No**	**Total**
Valid	Spain	212	21	6	239
	Portugal	12	0	0	12
Total		224	21	6	251

As a result of the continuous and intensive training of farmers with regards to implementing a refuge, the overall compliance is again high this year. In Spain, 2.8 % (6/218) of the farmers who were required to did not plant a refuge, for which three reasons were given. The first reason was that they feared the yield losses in conventional maize (4/6; 66.7 %), the second reason was that they had conventional maize as neighbouring plots (1/6, 16.7 %) and one farmer stated that he/she did not know about the technical rules (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: Lérida (3 farmers), Huesca (2 farmer) and Albacete (1 farmer). Further information cannot be provided due to personal data protection obligations (privacy regulations).

4 Conclusions

The analysis of 251 questionnaires from a survey of farmers cultivating MON 810 in 2021 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 2021 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 2021 growing seasons. Currently, the database contains data of 4,130 valid questionnaires. As shown in Table 82 and Table 83 the frequency patterns of farmers' answers in 2021 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 82 and Table 83 had been going down more or less continuously over the last years, so that this is not an unexpected outcome.

After sixteen 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 82: Overview on the frequency of $Minus$[5] answers of the monitoring characters in 2006 – 2021 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	2021
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	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	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	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	0.4
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	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	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	15.9
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	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	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	2.0
Disease susceptibility	36.1	21.7	34.7	29.3	25.6	19.7	17.3	12.5	5.4	4.2	6.8	2.4	0.8	2.0	2.0	0.0
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	6.0
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	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	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	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	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 83: Overview on the frequency of $Plus^6$ answers of the monitoring characters in 2006 – 2021 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	2021
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	2.0
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	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	2.0
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	4.4
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	4.0
Weed control practices	0.4	0.3	0.3	0.0	0.4	0.0	0.0	0.0	1.9	0.0	0.0	0.0	0.0	0.4	0.4	0.0
Fungal control practices	0.0	1.1	0.3	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4	0.0	0.0	0.0
Fertilizer Application	0.8	0.3	0.0	0.4	0.4	0.0	0.0	2.3	0.4	0.0	0.0	0.0	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	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	2.0
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	5.2
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	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	0.0
Plant growth and development	1.6	4.8	2.7	2.1	3.7	0.8	2.0	0.8	0.0	0.4	0.4	1.6	1.2	0.4	1.6	1.2
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	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	4.4
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	29.1
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	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	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	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	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	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	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	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	0.0

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

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List of abbreviations

GM	genetically modified
GMO	genetically modified organism
GMP	genetically modified plant
GS	general surveillance

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6 Annex A Tables of free entries

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

Country	Quest. Nr.	Crop rotation	Comments
Spain	5991	changed	I plant conventional after maize and I plant YieldGard after barley
Spain	5994		I plant YieldGard after barley and I plant conventional after peas and vecht
Spain	6046		I plant YieldGard after barley and I plant conventional after maize
Spain	6068		I plant YieldGard after radish and I plant conventional after maize
Spain	6094		I plant YieldGard after barley 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	5991	later	short cycle	YieldGard is shorter cycle than conventional
Spain	5994			I plant YieldGard later because is shorter cycle than conventional
Spain	6046			I plant YieldGard later because is short cycle
Spain	6068			YieldGard is shorter cycle than conventional
Spain	6094			Because 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				
Prothioconazole	LumiGEN	0	12	12
Teflutrin	Force 20 CS	4	0	4
Sprayed				
Abamectin	Abamectin, Agrimec Pro, Apache, Asteria, Safran	108	0	108
Acetamiprid	Epik	1	0	1
Betaciflutrin	Bulldock 25 EC	1	0	1
Clorantraniliprol	Ampligo	0	1	1
Deltamethrin	Decis, Decis Evo, Decis Expert	4	1	5
Hexitiazox	Jalisco	1	0	0
Lambda-cyhalothrin	Ampligo, Atlas, Atrapa, Judo, Karate King, Karate Zeon	21	15	35
Granulated				
Chlorpyrifos	Piritec 5 GR	1	0	1
Cypermethrin	Belem	47	0	47
Lambda-cyhalothrin	Pointer Geo, Kenotrin Geo	27	0	27
Teflutrin	Force 1.5 G, Lebron	2	0	2

Table A 4: Explanations for *changed* insect and corn borer control practice in MON 810 (Section 3.4.1.4)

Country	Quest. Nr.	Insecticides in conv. maize	Insect control practice in MON 810	Explanation for differences in insect control practice	Explanation for differences in corn borer control practice
Portugal	5884	yes	changed	1 less insecticide treatment applied in YG field. Seed treatment (Lumigen) was equally applied in YG and Conv fields	The farmer didn´t apply any treatment in the Yieldgard maize for the control of maize borer
Portugal	5889			1 less insecticide treatment applied in YG fields. Seed treatment (Lumigen) was equally applied in YG and Conv fields	The farmer didn´t realize any treatments in the Yieldgard maize fields for the control of maize borer.
Portugal	5890			1 less insecticide treatment in the YG fields. Seed treatment (Lumigen) was equally applied in YG and Conv fields	The farmer didn´t apply any treatments in the Yieldgard maize fields for the control of maize borer.
Spain	5901			I treat conventional against ECB but no YieldGard	I treat conventional maize against ECB, YieldGard maize is resistant to ECB and I don´t treat it
Spain	5904			I treat conventional maize against ECB but no YieldGard	I treat conventional maize against ECB but no YieldGard maize
Spain	5910			I treat conventional maize against ECB but no YieldGard maize	I treat conventional maize against ECB but no YieldGard because is resistant
Spain	5979			I treat conventional maize against ECB with Coragen 20 SC but no YieldGard	I treat conventional maize against ECB, in the case of YieldGard is not necessary because is resistant
Spain	5994			I treat conventional against ECB with Coragen 20 SC but no YieldGard	I treat conventional maize against ECB but no YieldGard because is resistant
Spain	6034			I treat conventional against ECB with Coragen 20 SC but no YieldGard maize	I treat conventional maize against ECB but no YieldGard maize because is resistant
Spain	6094			I treat conventional against ECB with Coragen 20 SC but no YieldGard	I treat conventional against ECB but no YieldGard maize because is resistant
Spain	6104			I treat conventional against ECB but no YieldGard	I treat conventional maize against ECB but no YieldGard

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	97	0	97
Isoxaflutol 22,5% + Tiencarbazona-Metil 9%	Adengo	68	1	69
Nicosulfuron 4%	Elite M	62	0	62
Mesotrione 4% + (S)-Metolachlor 40%	Camix	34	0	34
Mesotrione 3,75% + Terbutilazina 18,75% + (S)-Metolachlor 31,25%	Lumax	20	11	31
Isoxaflutol 24%	Spade Flexx	30	0	30
Tembotriona 4,4%	Laudis OD	20	0	20
Dicamba 48%	Banvel D	18	0	18
Foramsulfuron 3% + Tiencarbazona Metil 1%	Monsoon Active	18	0	18
Mesotrione 7,73%, Nicosulfuron 3%	Elumis	17	0	17
Fluroxipir 33,3%	Starane HL	9	0	9
Fluroxypyr	Hurler	8	0	8
Isoxadifen-ethyl, Tembotrione	Laudis	7	1	8
Glifosato 36%	Roundup Ultra Plus	8	0	8
Nicosulfuron	Nicosulfuron 4%	7	0	7
2,4-D 30% + Florasulam 0,62%	Mustang	3	3	6
Sulcotrione	Sudoku	0	6	6
Dicamba 50%, Prosulfuron 5%	Casper	5	0	5
Nicosulfuron	Sajon	5	0	5
Sulcotrione	Zeus	0	5	5
Dicamba 48%	Dimbo 480 SL	4	0	4
Glyphosate 36%	Glyphosate 36%	4	0	4
Dicamba	Penteo	4	0	4
Bromoxinil 23,5%	Bromoxinil 24 EC	3	0	3
Mesotrione 10%	Callisto 100 SC	3	0	3
Dicamba	Inka 70	3	0	3
Nicosulfuron 4%	Nic-Sar	3	0	3
Nicosulfuron	Winner	0	3	3
Foramsulfuron, Isoxadifen-ethyl	Cubix	2	0	2
Fluroxipir	Flurostar 200	2	0	2
Nicosulfuron, Terbuthylazine	Nicoter	0	2	2
Dicamba 55% + Nicosulfuron 9,2% + Rimsulfuron 2,3%	Principal Plus	2	0	2
Fluroxipir	Tidex	2	0	2
Fluroxipir 20%	Arbiter	1	0	1
Flufenacet, Terbuthylazine	Aspect	0	1	1
Trifluralin	Bonanza	0	1	1
Bromoxinil	Bromotril	1	0	1
Bromoxynil	Bromotril 24 EC	1	0	1
Bromoxynil	Buctril	1	0	1
Mesotrione	Callisto	0	1	1
Nicosulfuron 6%	Elite Plus 6 OD	1	0	1
Mesotriona 7,5% + Nicosulfuron 3%	Elumis	1	0	1
Fluroxipir 20%	Fluroxipir 20%	1	0	1
S-Metolacloro 31,25% + Terbutilazina 18,75%	Gardoprim Gold	1	0	1
Dicamba 48%	Kalimba	1	0	1
Fluroxipir 20%	Leto	1	0	1
Isoxaflutol 24%	Memphis Avance	1	0	1
Imazamox 1,67% + Pendimetalina 25%	Mutual	1	0	1
Nicosulfuron 4%	Nic-Sar	1	0	1
Nicosulfuron 4%	Nycos	1	0	1
Foramsulfuron, Isoxadifen-ethyl	Option	0	1	1
Nicosulfuron	PANTANI	1	0	1
Nicosulfuron 42,9% + Rimsulfuron 10,7%	Principal	1	0	1
Pendimetalina 33%	Teseo	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	5991	later	Later planting and harvesting	I planted YieldGard later than conventional and I also harvested it later
Spain	5994	later		I plant YieldGard later and I harvest it later than conventional
Spain	6046	later		I plant YieldGard later than conventional and I harvest it later
Spain	6068	later		I plant YieldGard later than conventional maize and I harvest it later
Spain	6094	later		I plant YieldGard maize later than conventional and I harvest it later

Table A 7: Explanations for characteristics of MON 810 different from *as usual* (Section 3.4.2).
Grey-colored fields highlight 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
Portugal	5880	more vigourous	as usual	as usual	as usual	as usual	as usual	as usual	as usual	The quality, strength, strong vigour, robustness and sanity of the YG Maize were notorious an evident characteristics in the YG dry maize, were similar compared with CV maize.
Portugal	5881	more vigourous	as usual	as usual	as usual	as usual	as usual	as usual	as usual	The huge sanity of plants, larger vigour of the YG Maize were visible in the fields like the fact that the maize is more (adverse weather conditions). The average yields of 13 200 kg/ha in the YG dry maize, were similar compared with CV maize.
Portugal	5882	more vigourous	as usual	as usual	as usual	as usual	as usual	as usual	as usual	YG maize plants had higher vigorous, resistant, sanity checked in the fields by the farmer. The average yields of 13 100 kg/ha in the YG dry maize, were similar compared with CV maize.
Portugal	5883	more vigourous	as usual	as usual	as usual	as usual	as usual	as usual	as usual	The YG maize caracheristics well visible in the fieds were the sublime vigour, good quality of maizecob and large sanity of the plant. This last campaign the average yields of 14 600 kg/ha in the YG dry maize and the average yields of 54 000 kg/ha in the YG forage maize were similar compared with CV forage maize.
Portugal	5884	more vigourous	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	The quality, sanity and higher vigour and strength of the YG maize were importants and notorious in the fields. The average yields of 16 340 kg/ha in the YG dry maize, an average of 1000 kg/ha higher compared with CV maize.
Portugal	5885	more vigourous	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	The higher vigour, the notorious sanity of YG plants and the goods maize productivities were the mains agronomical characteristics of the YG maize mentioned by the farmer.The average yields of 15 300 kg/ha in the YG dry maize, an average of 500 kg/ha higher compared with CV maize.
Portugal	5886	more vigourous	as usual	as usual	as usual	as usual	as usual	as usual	as usual	The major vigour, main consistence and quality plants and safety production notorious in the fields were the advantages characteristics of the YG maize mentioned by the farmer. The average yields of 14 800 kg/ha in the YG dry maize, were similar compared with CV maize.
Portugal	5887	more vigourous	as usual	as usual	as usual	as usual	as usual	as usual	as usual	The maize grain quality, high sanity and consistent plant vigour were the advantages characteristics of the YG maize mentioned and visibled by the farmer. The average yields of 14 500 kg/ha in the YG dry maize, were similar compared with CV maize.
Portugal	5888	more vigourous	as usual	as usual	as usual	as usual	as usual	as usual	as usual	The enormous sanity and higher vigour of the YG plants were visible in the fields ans confered good production safety. The average yields of 14 000 kg/ha in the YG dry maize, were similar compared with CV maize.
Portugal	5889	more vigourous	as usual	as usual	as usual	as usual	as usual	as usual	as usual	The main consistence vigour, strength, quality and the fact that the maize was more resistant to adverse weather climate conditions were the advantages characteristics notorious of the YG maize fields. The average yields of 12 800 kg/ha in the YG dry maize, were similar compared with CV maize.

Portugal	5890	more vigourous	as usual	as usual	as usual	as usual	as usual	as usual	as usual	The advantages characteristics of the YG maize mentioned by the farmer were the strength (vigour), sanity and also the safety resistant to adverse weather climate conditions. The average yields of 14 100 kg/ha in the YG dry maize, were similar compared with CV maize.
Portugal	5891	more vigourous	as usual	as usual	as usual	as usual	as usual	as usual	as usual	The quality of grain maize, vigour and strength and high sanity were the main agronomical characteristics verified in the fields by the producer. The average yields of 12 250 kg/ha in the YG dry maize, were similar compared with CV maize. The average yields of 42 250 kg/ha in the YG forage maize were similar compared with CV forage maize
Spain	5894	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YG does not have ECB's damages and it produces more than CV
Spain	5905	more vigourous	accelerated	as usual	delayed	less often	delayed	higher yield	less often	YG is more vigorous and emerges before, it grows slower, it is healthier, it maturates some days later, it does not fall and there are not volunteers the following year and it gives more kilos than CV
Spain	5907	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YG does not have ECB's damages, it does not fall and it produces more than CV
Spain	5908	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YG produces more than CV because is healthier, without ECB's damages
Spain	5909	as usual	as usual	as usual	as usual	less often	delayed	higher yield	less often	YG is resistant to ECB, it does not fall and there are less volunteers the following year, it maturates some days later and it gives more production than CV
Spain	5910	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YG gives more kilos than CV because is healthier, without ECB's damages
Spain	5917	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YG is more productive than CV because is resistant to ECB
Spain	5918	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YG produces 500 kg/ha more than CV because does not have ECB's damages
Spain	5928	as usual	as usual	as usual	as usual	as usual	delayed	as usual	as usual	YG is more green, with more moisture and it maturates some days later than CV
Spain	5929	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YG is resistant to ECB, it is healthier and it produces more than CV
Spain	5930	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YG does not fall because does not have ECB's damages, everything is harvested and it gives more kilos than CV
Spain	5932	as usual	as usual	as usual	delayed	less often	delayed	higher yield	as usual	YG grows slower, it is healthier, without ECB's damages, it does not fall, it maturates some days later and it produces more than CV
Spain	5935	as usual	as usual	as usual	as usual	less often	delayed	higher yield	as usual	YG is healthier because is resistant to ECB , it does not fall, it maturates somewhat later and it is more productive than CV
Spain	5937	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YG does not have ECB's damages and it gives more production than CV
Spain	5938	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YG gives more kilos than CV because is resistant to ECB
Spain	5947	as usual	as usual	as usual	delayed	less often	delayed	higher yield	as usual	YG is healthier, whithout ECB's damages, it grows slower and it maturates somewhat later, it does not fall and it produces more than CV
Spain	5949	as usual	as usual	as usual	as usual	less often	as usual	higher yield	less often	YG does not fall because does not have ECB's damages, there are less volunteers the following year, everything is harvested and it gives more kilos than CV
Spain	5950	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YG is resistant to ECB and does not fall, evrything is harvested and it gives more kilos than CV

Spain	5957	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YG produces more than CV because does not have ECB's damages
Spain	5958	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YG is healthier, without ECB's damages and it gives more kilos than CV
Spain	5959	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YG is resistant to ECB and it is more productive than CV
Spain	5960	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YG does not fall because does not have ECB's damages and it produces more than CV
Spain	5970	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YG does not have ECB's damages, it does not fall and it produces more than CV
Spain	5973	as usual	as usual	as usual	as usual	less often	as usual	higher yield	less often	YG does not fall and there are less volunteers the following year, it does not have ECB's damages and it produces more than CV
Spain	5979	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YG does not fall because does not have ECB's damages and it gives more production than CV
Spain	5981	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YG is resistant to ECB, it does not fall, everything is harvested and it gives more kilos than CV
Spain	5982	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YG does not fall and produces more than CV because is resistant to ECB
Spain	5989	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YG does not fall because is healthier, without ECB's damages and it produces more than CV
Spain	5990	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YG does not have ECB's damages, it does not fall and it gives more kilos than CV
Spain	5992	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YG does not have ECB's damages, it does not fall and it is more peroductive than CV
Spain	5994	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YG does not fall and produces more than CV because is resistant to ECB
Spain	5999	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YG produces more than CV because does not have ECB's damages
Spain	6000	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YG does not have ECB's damages, it does not fall and it produces more than CV
Spain	6011	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YG is healthier, without ECB's damages and produces more than CV
Spain	6019	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YG produces more than CV because does not have ECB's damages
Spain	6022	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YG does not fall and produces more than CV because does not have ECB's damages
Spain	6023	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YG gives more kilos than CV because does not have ECB's damages
Spain	6025	as usual	as usual	as usual	as usual	less often	delayed	higher yield	less often	YG is more green, with more humidity and maturates some days later, it does not fall and there are not volunteers the following year and it gives more kilos than CV because does not have ECB's damages
Spain	6027	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YG produces more than CV because does not have ECB's damages
Spain	6034	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YG is resistant to ECB, it does not fall, everything is harvested and it gives more kilos than CV
Spain	6037	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YG does not fall and it is more more productive than CV because is resistant to ECB
Spain	6038	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YG is healthier, without ECB's damages and produces more than CV

Spain	6040	as usual	as usual	as usual	as usual	less often	delayed	higher yield	as usual	YG is more green, with more humidity, it maturates somewhat later, it does not fall and it gives more kilos than CV because does not have ECB's damages
Spain	6041	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YG does not fall and produces more than CV because is resistant to ECB
Spain	6043	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YG produces more than CV because is healthier, without ECB's damages
Spain	6046	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YG does not have ECB's damages and it produces more than CV
Spain	6051	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YG is resistant to ECB and it produces more than CV
Spain	6053	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YG does not have ECB's damages and it produces more than CV
Spain	6054	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YG gives more kilos than CV because is resistant to ECB
Spain	6055	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YG does not fall, it is healthier, without ECB's damages, everything is harvested and it produces more than CV
Spain	6056	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YG gives more kilos than CV because does not have ECB's damages
Spain	6057	as usual	as usual	as usual	as usual	less often	delayed	higher yield	as usual	YG has more humidity and maturates somewhat later, it does not have ECB's damages and it does not fall and it produces more than CV
Spain	6066	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YG does not fall and produces more than CV because does not have ECB's damages
Spain	6067	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YG is healthier because is resistant to ECB, it does not fall and it produces more than CV
Spain	6069	as usual	as usual	as usual	as usual	less often	delayed	higher yield	as usual	YG is more green and maturates some days later, it does not fall and it gives more kilos than CV because does not fall and it gives more kilos than CV because does not have ECB's damages
Spain	6074	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YG does not have ECB's damages, it does not fall and gives more kilos than CV
Spain	6078	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YG is more productive than CV because does not have ECB's damages
Spain	6080	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YG does not fall and produces more than CV because is resistant to ECB
Spain	6083	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YG gives more kilos than CV because does not have ECB's damages
Spain	6084	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YG is resistant to ECB and does not fall, it is healthier and it produces more than CV
Spain	6091	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YG does not fall, everything is harvested and it gives more kilos than CV because is resistant to ECB
Spain	6093	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YG is healthier, without ECB's damages and it produces more than CV
Spain	6094	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YG does not have ECB's damages, it does not fall and it produces more than CV
Spain	6097	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YG does not fall and gives more kilos than CV because does not have ECB's damages
Spain	6102	as usual	as usual	as usual	as usual	less often	delayed	higher yield	as usual	YG is healthier, it does not fall, it maturates somewhat later and it gives more kilos than CV because does not have ECB's damages
Spain	6103	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YG does not have ECB's damages and it produces more than CV

Spain	6104	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YG is resistant to ECB, it is healthier, it does not fall and it gives more kilos than CV
Spain	6105	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YG does not have ECB's damages and it produces more than CV
Spain	6106	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YG is more productive than CV because does not have ECB's damages
Spain	6113	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YG gives more kilos than CV because does not have ECB's damages
Spain	6116	as usual	as usual	as usual	as usual	less often	as usual	higher yield	as usual	YG does not fall, everything is harvested, it does not have ECB's damages and it gives more kilos than CV
Spain	6130	as usual	as usual	as usual	as usual	as usual	as usual	higher yield	as usual	YG does not have ECB's damages and it produces more than CV

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

Country	Quest. Nr.	Comments aggregate	Comments
Spain	5900	no corn borer in 2021	There were not differences between YieldGard and conventional because there was not ECB's attack
Spain	5922		When there is not ECB´s attack there are not differences between YieldGard and conventional
Spain	5955		When there is not ECB´s attack there are not differences between YieldGard and conventional
Spain	5967		YieldGard and conventional behaved in a similar way because there was not ECB's attack
Spain	6003		There was not ECB's attack therefore there were not differences between YieldGard and conventional
Spain	6004		YieldGard and conventional behaved in a similar way because there was not ECB's attack
Spain	6021		When there is not ECB´s attack there are not differences between YieldGard and conventional
Spain	6029		YieldGard and conventional behaved in a similar way because there was not ECB's attack
Spain	6032		There were not differences between YieldGard and conventional because there was not ECB's attack
Spain	6063		There was not ECB's attack therefore there were not differences between YieldGard and conventional
Spain	6064		YieldGard and conventional behaved in a similar way because there was not ECB's attack
Spain	6082		There was not ECB's attack therefore there were not differences between YieldGard and conventional
Spain	6086		There was not ECB's attack therefore there were not differences between YieldGard and conventional
Spain	6087		YieldGard and conventional behaved in a similar way because there was not ECB's attack
Spain	6089		When there is not ECB´s attack there are not differences between YieldGard and conventional
Spain	6098		There was not ECB's attack therefore there were not differences between YieldGard and conventional
Spain	6120		When there is not ECB´s attack there are not differences between YieldGard and conventional
Spain	6121		There were not differences between YieldGard and conventional because there was not ECB's attack
Spain	6125		YieldGard and conventional behaved in a similar way because there was not ECB's attack
Spain	6136		When there is not ECB´s attack there are not differences between YieldGard and conventional
Spain	6157		When there is not ECB´s attack there are not differences between YieldGard and conventional
Spain	6163		When there is not ECB´s attack YieldGard and conventional behave the same
Spain	5905	YG more vigorous than CV	YieldGard is greener and it has more moisture than the conventional
Spain	5928		YieldGard has some degrees more moisture´s degrees than the conventional
Spain	5932		YieldGard is greener and it has one or two more moisture's degrees than the conventional
Spain	5935		YieldGard is greener and it has more moisture than the conventional
Spain	5947		YieldGard is greener and it has one or two more moisture's degrees than the conventional
Spain	6069		YieldGard has one or two more moisture's degrees than the conventional

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

Country	Quest. Nr.	Disease susceptibility	Comments aggregate	Comments
Portugal	5880	as usual	no significant diseases to report in the region	One more campaign that didn´t verify any relevant about the diseases to report in the agricultural maize production area.
Portugal	5881	as usual		Diseases were not verify in their production area, nothing in the region of production about diseases.
Portugal	5882	as usual		Nothing checked and visible in the fields about diseases in the maize region of production. Didn´t verify to anything about diseases in the maize region of production. Didn´t verify to anything about diseases susceptibility.
Portugal	5884	as usual		The region of production had a lower incidence of diseases in the total maize area. It was difficult to analyse difference about diseases susceptibility. Nothing to report.
Portugal	5885	as usual		Without any meaning in the productive region of maize. Nothing relevant to report in differences of susceptibilities between the various types of maize (yieldgard and conventional).
Portugal	5889	as usual		The farmer did not verify nothing significant about diseases susceptibility in the maize fields and diferent types of maize.
Spain	6152	less susceptible	YieldGard has less fungal attack	YieldGard does not have ECB´s injuries which would facilitate the fungal entry such as Fusarium, Ustilago, etc. YieldGard has less fungal attack such as Fusarium, Ustilago, Giberella, … and the virus than conventional
Portugal	5883	as usual	Only minor presence of "Cephalosporium Maydis"	The producer verified a short presence in general in the region of maize production of the disease "Cephalosporium Maydis" but without any difference in susceptibility between the different types of maize.
Portugal	5886	as usual		Didn´t verify any difference in susceptibility visibled in the fields. The producer verified a short presence in general in the region of maize production of the disease "Cephalosporium Maydis and Fusarium spp"
Portugal	5887	as usual		The producer verified a presence in general in the region of maize production of the disease "Cephalosporium Maydis" but didn´t verify any difference in susceptibility visibled in the fields between the diferent types of maize.
Portugal	5888	as usual		Without any difference in susceptibility in the fields despite the farmer verified a presence in general in the region of maize production of the disease "Cephalosporium Maydis".
Portugal	5890	as usual		The farmer verified a presence in general in the region of maize production of the diseases "Cephalosporium Maydis and Fusarium spp" but without any difference in susceptibility visibled in the fields.
Portugal	5891	as usual		The producer checked a presence in the region of maize production of the diseases "Fusarium spp and Cephalosporium Maydis" but without any difference in susceptibility between the yieldgard and the conventional maize.

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

Country	Quest. Nr.	Ostrinia nubilalis	Sesamia spp.	Comments
Portugal	5880	very good	very good	The strong combat and efficient control of maize borers were higher despite the geral lower presence of pests.
Portugal	5881	very good	very good	The control of maize borers was efficient and safety in the Yieldgard plants.
Portugal	5882	very good	very good	Total control of the maize borers in the fields checked and visible characteristic in the Yieldgard maize fields
Portugal	5883	very good	very good	Exemplary and effective control in the maize borers in the yieldgard maize notorious in the fields by the farmer.
Portugal	5884	very good	very good	The total control was notorious and visible of the maize borers in the yieldgard maize.
Portugal	5885	very good	very good	The quality of the control was huge and completely efficiency of the maize borers and checked in the fields by the farmer.
Portugal	5886	very good	very good	Higher quality control notorious in the maize borers. It was an evident characteristic in the maize fields.
Portugal	5887	very good	very good	Enormous quality control and higher efficiency in the combat of the maize borers. It was an evident and visible characteristic
Portugal	5888	very good	very good	Efficiency combat of the maize borers. Higher sanity of the yieldgard plants were visible.
Portugal	5889	very good	very good	It was an evident characteristic in the maize fields checked by the farmer the good control of the maize borers.
Portugal	5890	very good	very good	Strong control and efficiency in the combat of the maize borers allowed a higher safety production for the farmer. It was an
Portugal	5891	very good	very good	Very efficient production control of the maize borers in the yieldgard maize fields. The sanity of the yieldgard maize plants

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	5880	less susceptible	Agrotis Ipsilon; Diabrotica / Agriotes; Spodoptera Frugiperda	good sanity of YieldGard improved its resistance	The sanity and quality of YG maize were higher and was notorious that the YG plants were less susceptible from the attacks of other pests. Despite that this campaign of maize production had a lower incidence of pests in the area of maize.
Portugal	5881	less susceptible	Agrotis Ipsilon; Spodoptera Frugiperda; Diabrotica / Agriotes		Despite the very lower incidence of pests in the area of maize fields, the larger sanity and quality of YG maize made those plants less susceptible from the attacks of other pests.
Portugal	5882	less susceptible	Diabrotica / Agriotes; Spodoptera Frugiperda; Agrotis Ipsilon		The sanity was notorious in the YG maize fields and the resistance to other pests was better and less susceptible to the attack to other pests. Remember that the maize production area had a lower incidence of pests in general.
Portugal	5884	less susceptible	Agrotis Ipsilon; Spodoptera Frugiperda		The enormous sanity of YG plants and their large production safety were always evident and higher and so less susceptible to the attack by other pests.
Portugal	5885	less susceptible	Agrotis Ipsilon		The farmer always verified a less susceptible to the attack by other pests like Agrotis Ipsilon in the YG maize. The sanity of the YG maize made the diference and was important.
Portugal	5886	less susceptible	Agrotis Ipsilon; Spodoptera Frugiperda		The enormous health and sanity of the YG plant confers high production safety and, consequently, less susceptible from the attacks of other pests.
Portugal	5887	less susceptible	Agrotis Ipsilon		The sanity of the YG maize was evident in the maize fields and made YG plants less susceptible from the attacks of other pests. This campaign the region of production had a lower incidence of pests in the total area.
Portugal	5888	less susceptible	Agrotis Ipsilon		The producer always verified in the fields a little less susceptible to the attack to other pests. The sanity of the YG maize was important and evident in the maize fields.
Portugal	5889	less susceptible	Helicoverpa zea; Agrotis Ipsilon		Despite this campaign had a lower incidence of pests in the area of maize fields, the larger sanity of YG maize allowed less susceptible from the attacks of other pests.
Portugal	5890	less susceptible	Agrotis Ipsilon; Spodoptera Frugiperda		The production safety is also reflected and made the YG plants less susceptible from the attacks of other pests. The sanity of the YG maize was evident in the maize fields despite this campaign had a lower incidence of pests in general.
Portugal	5891	less susceptible	Agrotis Ipsilon		The sanity and quality of the YG maize made YG plants less susceptible from the attacks of other pests. The fact that were resistant to the attack of the maize borer pest, made YG plants less susceptible from the attacks of other pests.
Portugal	5883	as usual	-	low incidence makes it hard to judge	Very difficult to ascertain and visualize differences in susceptibility. This campaign, like in others years, the region of production had a very lower incidence of pests in the total area.
Spain	5909	less susceptible	Aphids	YieldGard had fewer attacks/damages	YG has less aphid attack than CV
Spain	5913	less susceptible	Agriotes spp.		YG has less Agriotes attack than CV
Spain	5920	less susceptible	Agrotis spp.		There is less Agrotis attack in the YG maize than in the CV
Spain	5932	less susceptible	Cicadella sp.		YG is healthier and it has less Cicedella attack than the CV

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

Name of weed	Frequency
Sorghum halepense	166
Amaranthus retroflexus	120
Chenopodium album	108
Abutilon theophrasti	96
Xanthium strumarium	48
Datura stramonium	38
Cyperus spp.	27
Echinochloa spp.	25
Setaria spp.	23
Solanum nigrum	20
Echinochloa crus-galli	19
Malva spp.	18
Digitaria sanguinalis	14
Hordeum sp.	11
Medicago sativa	7
Diplotaxis erucoides	2
Helianthus annuus	2
Triticum aestivum	2
Anchusa azurea	1
Cirsium arvense	1
Galium spp.	1
Kali turgida	1
Lolium ssp.	1
Papaver sp.	1
Phragmites australis	1

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

Country	Quest. Nr.	Bird occurence	Mammal occurence	Comments
Portugal	5880	as usual	as usual	Without any problems of wild boars in the maize fields of the region.
Portugal	5883	as usual	as usual	Presence of wild boar in the maize production region but with no difference in susceptibility between the different types of maize.
Portugal	5884	as usual	as usual	It is an increasingly and serious problem for farmers the large presence of wild boars in the maize fields. Without any difference of susceptibility between diferent types of maize (yieldgard and conventional).
Portugal	5886	as usual	as usual	Higher presence of wild boar in the maize production region of the farmer but without difference in susceptibility between the the different types of maize.
Portugal	5887	as usual	as usual	Presence of wild boar in the maize production region in general but without any difference in susceptibility between the different types of maize.
Portugal	5888	as usual	as usual	The region of maize production with higher presence of wild boar but with no difference in susceptibility between the different types of maize.
Portugal	5890	as usual	as usual	Higher presence of wild boar in the maize general production region of the farmer but without difference in susceptibility between the different types of maize.

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

Country	Quest. Nr.	Compliance	Comment
Spain	5898	no	I did not plant refuge
Spain	6016		I did not plant refuge in the second planting of YieldGard maize
Spain	6046		I did not plant refuge in the second planting of YieldGard maize
Spain	6071		I did not read the recommendations of the label
Spain	6082		I did not plant refuge
Spain	6098		I did not plant refuge in the second planting of YieldGard maize

Table A 15: Motivations for not planting a refuge

Country	Quest. Nr.	Plant refuge	Reasons
Spain	5898	no	ECB produces higher yield losses in the conventional maize
Spain	6016		There is conventional maize of second planting in the neighboring fields
Spain	6046		ECB produces higher yield losses
Spain	6071		I did not know the technical rules about refuges
Spain	6082		Because ECB produces yield losses in the conventional maize
Spain	6098		Because ECB produces large yield losses in the conventional maize

7 Annex B Questionnaire

2	0	2	1	-	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	1	-	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

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2	0	2	1	-	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)

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: ________________________________

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 2021, 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 2021, did you change maize borer control practices in YieldGard® maize when compared to conventional maize?

O Similar O Changed, because:____________________

In 2021, how were the fertilizer application practices in YieldGard® maize when compared to conventional maize?

O Similar O Changed, because:____________________

In 2021, 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 ____
____
____
____