BioMath

APPLIED STATISTICS AND INFORMATICS
IN LIFE SCIENCES

Post Market Environmental Monitoring of MON 810[1] maize cultivation in Europe

Biometrical Annual Report on the Farmer Questionnaires conducted on the 2022 growing season

Responsibilities:

Data management and statistical analysis:

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

Sponsor:

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

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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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Summary

Monitoring of a genetically modified organism that has been placed on the market is regulated in line with Annex VII of Directive 2001/18/EC (European Commission 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 e.r.a. (Environmental Risk Assessment) Bayer has implemented monitoring of MON 810 maize (YieldGard maize; YG) through different tools, the main one being a farmer questionnaire (FQ) implemented since 2006.

This biometrical report presents the 2022 outcomes of the statistical analysis of the FQ collected in Spain - Europe's country with the most YG cultivation. The interviews for the FQ were completed between July 2022 and February 2023. In this 2022 growing season, 250 farmers have been surveyed.

The methodology section outlines the significant revision of the FQ after 16 years, detailing the previous and updated versions. The revised FQ, employed from the 2022 growing season, features a new set of questions, two-wave interview structure, improved comparison between YG and conventional (CV) maize, and a transition to digital data collection, while maintaining the original goal of monitoring YG cultivation's influence on safeguarding objectives.

The 2022 data suggests that, when compared to CV maize,

- YG maize does not exhibit increased weed pressure, nor are they cultivated in differing crop rotations or sown/harvested at different timings.

- They do not display heightened susceptibility to pests excluding ECB and MCB.

- The majority of farmers' observations indicate either no relevant differences between YG and CV maize or emphasize the advantageous traits of the former.

Overall, these findings are consistent with and reinforce the conclusions drawn from previous scientific research, and they also align with the insights obtained from the past 16 years of Post Market Environmental Monitoring. Thus, this new set of data confirms another year of successful monitoring, maintaining the long-established trend: no adverse effects have been identified by farmers cultivating YG .

Details are found in the respective chapters of this report, while a summary figure and table are shown at the end of the document (Figure 20; Table 57).

1. Introduction

Upon approval of YG through Commission Decision 98/294/EC (European Commission 1998), Bayer established a management strategy to minimize the development of insect resistance and offered to inform the Commission and/or Competent Authorities about the results. The results of insect resistance monitoring are provided in a separate report on a yearly basis.

This FQ survey was conducted on a voluntary basis considering the requirements in Annex VII of Directive 2001/18/EC (European Commission 2001) of the European Parliament and of the Council on the deliberate release into the environment of genetically modified plants. Annex VII of Directive 2001/18/EC states that the objective of a monitoring plan is to identify any adverse effects of the genetically modified organism or its use on human or animal health or the environment that were not anticipated in the e.r.a. The risk assessment for YG showed that its placement on the market poses a negligible risk to human and animal health and the environment. Potential adverse effects that were not anticipated in the e.r.a. can be addressed through General Surveillance. An important element in the general surveillance, applied by Bayer on a voluntary basis, is the FQ survey.

This report aims to present the rationale behind the FQ approach and the analysis of the FQ results from the 2022 planting season. The questionnaire approach was first implemented in 2006, and its format is reviewed annually based on the outcome of the latest survey. It is important to note that the biggest change in the FQ was made for this year's version, which is further explained in the following sections.

2. Methodology

2.1 The farmer questionnaire (FQ)

2.1.1 The structure of the farmer questionnaire

A FQ was developed to gather information on monitoring characteristics and influential factors. The primary objective of the FQ is to identify potential adverse effects that may be associated with the cultivation of YG plants.

The FQ is organized into four specific areas for collecting data.

- Part 1 records general information on maize cultivation, cultivation area, and local insect pest and weed pressure independent of YG or CV cultivation background and possible influencing factors.
- Part 2 establishes differences between YG and CV maize in the usual practices of maize cultivation, including crop rotation, sowing time, harvest time, and corn borer management practices.
- Part 3 focuses on observations regarding susceptibility of YG to non-target insect pests, growth and development, yield, and any other unusual benefits or harms associated with YG and CV maize.
- Part 4 evaluates compliance with the recommendations for good YG cultivation practices.

It should be noted that the initial FQ has undergone a significant revision after 16 years (2006-2021 growing seasons), resulting in a new version of the FQ that will be used from the 2022 growing season onwards.

2.1.2 Previous version

The initial FQ was developed by the German Federal Biological Research Centre for Agriculture and Forestry (BBA, now JKI), in collaboration with maize breeders and statisticians in Germany (Wilhelm et al. 2004). This development was based on the identification of relevant monitoring characteristics and influencing factors. To test the validity of the FQ, a pilot survey was conducted in 2005. Based on the results of this survey, an adapted version of the FQ was created and was first applied in 2006.

The format of the FQ was reviewed annually to ensure the relevance and statistical significance of the collected data. If necessary, adjustments were made to improve the quality of the FQ. In 2009, the FQ was modified in response to feedback from the DG Environment (13 March 2009) and discussions within EuropaBio. In all cases, interviews happened following the harvesting period.

2.1.3 Revised version of the FQ (2022 onwards)

The fundamental goal of the updated FQ is consistent with its prior version, which is to monitor the possible influence of YG general surveillance cultivation on safeguarding objectives such as sustainable agriculture, plant health, and soil function. The revised version of the FQ contains a new set of questions considering the lifetime since the YG technology has been on the market and a summary of questions for which no new information was reported by the farmers in the 16 years (2006-2021 growing seasons). Based on the observation that no new information was obtained from questions on particularized monitoring characteristics, they were condensed to fewer questions summarizing the monitoring observations.

In addition, the revised FQ was designed for interviews in two waves. Interviews for the first wave occur after sowing (July 2022), while those for the second wave happen after harvesting (January 2023). This strategy was employed to minimize the duration between the pertinent activity (such as sowing) and the corresponding inquiry. Therefore, based on their relevance for the time of the growing season, some questions were exclusively included in one of the two waves, while others were present in both.

In the revised FQ, a further strategy was introduced to enable farmers to make a more accurate comparison between YG and CV maize. At the outset of the FQ, farmers are requested to provide details of up to five of their fields each for YG and CV maize. Subsequently, the interviewer manually selected one of the five YG and one of the five CV fields at random, which then serve as the reference fields for the farmers to compare when answering questions that involve a direct comparison between YG and CV maize.

Also beginning this year with the revised FQ, data collection has transitioned to a digital format, in contrast to previous years when data was first collected on paper and then digitized.

All questions of the revised FQ can be found in the Appendix.

2.1.3 Interviewer

All interviews were conducted by trained interviewers working at bithA[2]. A 'user's manual' was developed in advance to assist interviewers in filling out questionnaires with farmers. bithA was also involved during the development of the revised FQ. Interviewers are trained to understand the questions and background in order to address any uncertainties.

2.2 Sample size and selection

The sample size for this survey was initially determined to ensure accuracy requirements for an exact binomial test, with a threshold of $p = 0.9$ for adverse effects to be tested. To meet this requirement, 90% of As usual-answers, $\alpha = 0.01$ (type I error), $\beta = 0.01$ (type II error), and $d = 3\%$ (minimum difference of practical interest) were necessary. As a result, a sample size of 2500 farmers was established and distributed across 10 years (i.e. 2006-2015 growing seasons). After 17 years (2006-2022 growing seasons) since the first FQ in 2006, the initial goal has been surpassed for some time. Nevertheless, despite the initial intention for the sample size of 250 per year no longer being relevant, the decision was made to maintain this number for consistency.

Regarding sample selection, proportional sampling based on the YG cultivation area in each country within the European Union has traditionally been employed. However, in recent years, only Spain and Portugal have cultivated YG. Furthermore, there has been a significant disparity in sample sizes between Spain and Portugal, with approximately 240 farmers from Spain and only 10 from Portugal. As a result, and in conjunction with the revised FQ, it was decided in 2022 to exclusively focus on Spain for the purpose of sample selection[3]. Within Spain, the 250[4] farmers were sampled according to the relative total cultivation area per autonomous community. bithA selected farmers from customer lists, previous survey experience, or through region-specific search. During the seed purchasing process, farmers were notified of the possibility of being contacted for a survey. Any refusals from farmers were duly recorded.

2.3 Collection of monitoring characteristics

The monitoring characteristics in the revised FQ were developed based on the same protection goals as those used in the initial FQ (such as animal health, plant health, soil function, sustainable agriculture and biodiversity). The monitoring characteristics that are addressed in the revised FQ, are summarized in the table below:

Table 1: Monitoring characteristics and corresponding protection goals

Monitoring characteristics	Category	Protection goals
Crop rotation	Integrated pest management practices	Plant health, Sustainable agriculture
Sowing time		
Harvest time		
Corn borer control practices		
Susceptibility to non-target insect pests	Maize development and performance in- and off-field	Plant health, Animal health, Soil function, Sustainable agriculture, Biodiversity
Maize characteristics in- and off-field		
Good agricultural practices		Sustainable agriculture

[2] bithA - Bio_Investigation to Health for Animal and Agriculture - https://www.bitha.org/

[3] The annual FQ survey conducted by the Portuguese authorities is considered sufficient due to the limited MON810 cultivation area in Portugal.

[4] Note that due to the fact that the questionnaire was administered in two waves, and as a precautionary measure for potential dropouts in the second wave, a small number of additional farmers were interviewed in the first wave. As a result, responses from 253 farmers are available for questions asked in the first wave, while only 250 of those farmers provided answers for questions that were asked in the second wave.

Monitoring characteristics	Category	Protection goals
Seed labelling	Sustainability of YG technology use	
Refuge compliance		
Frequency of YG cultivation		

2.4 Collection of environmental/agricultural characteristics

In order to comprehensively assess local conditions and identify the causes of potential effects on monitoring parameters, it is essential to investigate potentially influencing factors in addition to named monitoring characteristics. Therefore, in the revised FQ, influencing such as pest or weed pressure as well as agricultural practices such as variety choice, crop rotation or sowing and harvesting time are addressed.

2.5 Data management and quality control

A database was created by bithA to manage and store data. Each question was assigned a variable name, and a label and its type (qualitative, quantitative, date) were defined for each variable. In addition, for variables from multiple-choice questions, all possible answers were defined and labelled. After completing the interviews for each wave, bithA exported the data from the database to BioMath[5]. All data were then checked for quality and plausibility. The quality control process initially verified the completeness of the data. Some data fields were made mandatory, so missing values were not accepted. Furthermore, the values were checked for correctness, such as ensuring that quantitative values were within a plausible min-max range and that qualitative values met acceptable criteria. A plausibility control process validated the variable values for their contents, identifying incorrect answers and ensuring logical connections between different questions. It also checked for consistency between answers and specifications. In case of any failed checks, BioMath contacted bithA to resolve the issue and resend the data. Finally, BioMath conducted the statistical analysis.

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[5] BioMath GmbH - Applied statistics and informatics in life sciences - https://biomath.de/

3 Results

3.1 Maize growing area

3.1.1 Sampling, quality and plausibility control

A total of 517 farmers were contacted to obtain the 250 farmers as respondents to the FQ in the 2022 season (see Table 2 for details).

Table 2: Information on how many farmers were contacted to obtain 250 respondents and reasons for those that were contacted, but did not participate in the 2022 season

	Frequency	Percentage
Total farmers contacted [=(1)+(2)]	517	100.00%
(1) Total respondents	250	48.36%
(2) Total contacted but not participated	267	51.64%
Reasons for those contacted but not participated		
They did not grow YG in 2022 (only CV maize planted)	86	16.63%
They did not grow maize in 2022	68	13.15%
They grew YG in 2022 but refused to answer the interview	76	14.70%
Absents / not localized	20	3.87%
They were retired	17	3.29%

Farmers were sampled according to the relative total planting area per autonomous community. Therefore, the relative distribution between autonomous communities shown in in Table 3 and Figure 1 represents both, the number of interviewed farmers and the total planting area in the 2022 season.

Table 3: Number of farmers interviewed per autonomous community in the 2022 season

	Frequency	Valid percentages	Accumulated percentages
Aragón	105	42.0%	42.0%
Cataluña	84	33.6%	75.6%
Comunidad Foral de Navarra	24	9.6%	85.2%
Extremadura	23	9.2%	94.4%
Castilla-La Mancha	8	3.2%	97.6%
Andalucía	5	2.0%	99.6%
Castilla y León	1	0.4%	100.0%
Total	**250**	**100.0%**	
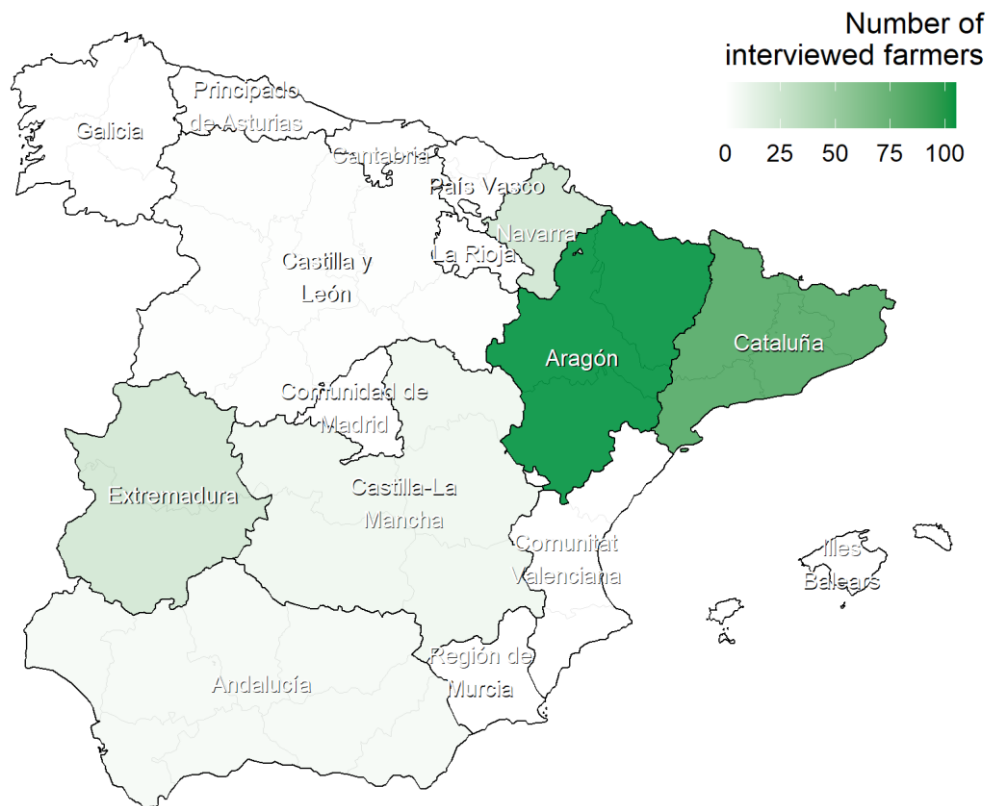
Figure 1: Number of farmers interviewed per autonomous community in the 2022 season

3.1.2 Size and number of maize fields

On average, the interviewed farmers have planted 3.7 and 5.7 fields of YG and CV maize in the 2022 season, respectively. In terms of total planted area, the respective mean values were 18.2 ha and 18.6 ha (Table 4).

Table 4: Number and area of maize fields in the 2022 season

	N	Miss	Mean	StdDev	Min	Median	Max
Number YG	250	0	3.7	7.6	1	2	100
Number CV	212	38	5.7	13.3	1	2	100
Number Total	250	0	8.6	18.1	1	4	200
Area YG [ha]	250	0	18.2	30.2	1	8	320
Area CV [ha]	212	38	18.6	43.8	1	5	480
Area Total [ha]	250	0	33.9	66.3	1	15	800

Note that respondents to this FQ must have sowed at least one YG field, but are not obligated to have a CV field. However, as certain questions in the FQ require a comparison between YG and CV fields, farmers who do not have CV fields are requested to specify the CV reference they will use for the forthcoming questions. Of the 38 farmers who did not plant any CV field in the 2022 season, 35 (92.1%) farmers compared their YG reference field to a CV field from other farmers (e.g. on a neighboring farm) and 3 (7.9%) farmers compared their YG reference field to a CV field they had planted the previous year.

3.1.3 Varieties

The farmers were asked to list the YG and CV varieties they cultivated on up to five of their fields in the 2022 season. Across all fields, 39 YG varieties and 79 CV varieties were listed. The most frequently listed varieties with their respective frequencies can be found in Table 5 and Table 6. Per YG and CV, respectively, the top varieties that constitute approximately 66% of all listed varieties are shown.

Table 5: Frequency of most commonly listed YG varieties in the 2022 season

Type	Variety	Frequency	Valid percentages	Accumulated percentages
YG	DKC5032YG	119	21.3%	21.3%
YG	DKC6351YG	57	10.2%	31.5%
YG	DKC6729YG	55	9.9%	41.4%
YG	DKC6631YG	42	7.5%	48.9%
YG	P0937Y	40	7.2%	56.1%
YG	PORTBOU YG	31	5.6%	61.6%

Table 6: Frequency of most commonly listed CV varieties in the 2022 season

Type	Variety	Frequency	Valid percentages	Accumulated percentages
CV	P0937	62	10.9%	10.9%
CV	DKC6980	49	8.6%	19.5%
CV	DKC6402	40	7.0%	26.5%
CV	DKC4974	27	4.7%	31.3%
CV	DKC5031	23	4.0%	35.3%
CV	P 1524	20	3.5%	38.8%
CV	DKC5741	19	3.3%	42.2%
CV	DKC6351	19	3.3%	45.5%
CV	P 1570	19	3.3%	48.9%
CV	POURTBOU	19	3.3%	52.2%
CV	P 0937	17	3.0%	55.2%
CV	DKC6728	16	2.8%	58.0%
CV	KWS KEFIEROS	15	2.6%	60.6%
CV	P1570	15	2.6%	63.3%
CV	DKC5685	12	2.1%	65.4%

3.1.4 Pest pressure

Farmers were asked about the pest pressure in all their fields in the in the 2022 season. Furthermore, this was done separately for (i) the general pest pressure and subsequently (ii) specifically for corn borer pressure.

3.1.4.1 General pest pressure

Farmers were asked about the general pest pressure in all their fields in the 2022 season. In the first wave (Jul 2022), 113 (45.2%) of the farmers found it to be "As Usual", 92 (36.8%) farmers stated it was "Low" and 45 (18.0%) farmers stated it was "High". In the second wave (Jan 2023), 98 (39.2%) of the farmers found it to be "As Usual", 40 (16.0%) farmers stated it was "Low" and 112 (44.8%) farmers stated it was "High" (Table 7, Table 8, Figure 2).

Table 7: Farmers' assessment of about the general pest pressure in all their fields in the 2022 season in the first wave (Jul 2022).

	Frequency	Valid percentages	Accumulated percentages
Low	92	36.8%	36.8%
As Usual	113	45.2%	82.0%
High	45	18.0%	100.0%
Total	**250**	**100.0%**	

Table 8: Farmers' assessment of about the general pest pressure in all their fields in the 2022 season in the second wave (Jan 2023).

	Frequency	Valid percentages	Accumulated percentages
Low	40	16.0%	16.0%
As Usual	98	39.2%	55.2%
High	112	44.8%	100.0%
Total	**250**	**100.0%**	
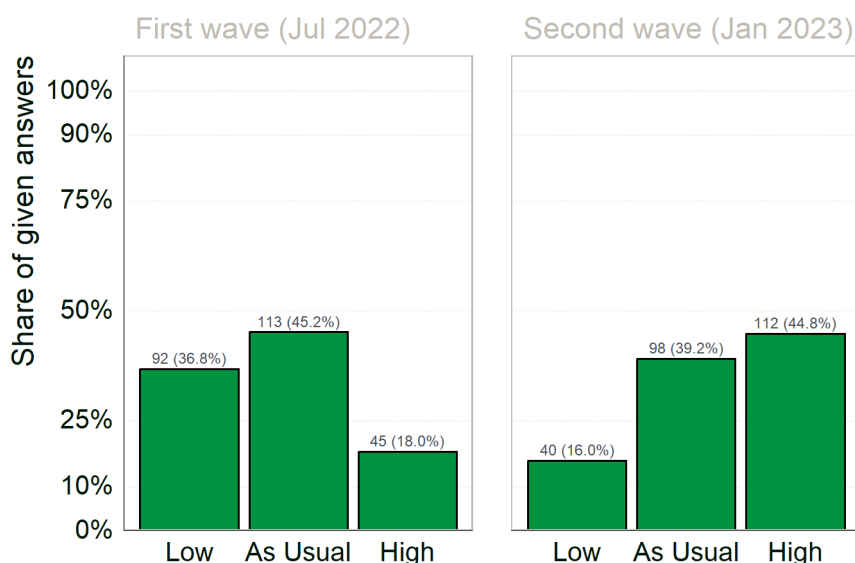
Figure 2: Farmers' assessment of about the general pest pressure in all their fields in the 2022 season.

All farmers who found the general pest pressure to be high in all their fields were then asked to list up to five of the pests they had observed. The three most common species were *Agriotes sp.*, *Tetranychus-oligunychus* and *Agrotis segetum*. All listed pests are shown in Table 9.

Table 9: Frequency of pests listed by farmers who found pest pressure to be high in the 2022 season. Per wave, each farmer who found pest pressure to be high could list up to five pests.

Pest	Wave 1	Wave 2
Agriotes sp.	32	82
Tetranychus-oligunychus	5	94
Agrotis segetum	19	39
Zyginidia scutellaris	1	19
Rhopalosiphum maidis	0	17
Phorbia platura	0	12
Corn borer	8	0
Heliotis	0	8
Heliothis	4	0
Laodelphax striatellus	2	2
Mythimna unipuncta	0	3
Cicadella viridis	0	2
Diloboderus abderus	0	2
Diabrotica virgifera	1	0
Mythinma unipuncta	1	0
Mosquito	1	0
Rhophalosiphum maidis	1	0
Helyomorpha halys	0	1
Spodoptera exigua	0	1
Spodoptera frugiperda	0	1

3.1.4.2 Corn borer pressure

Farmers were asked about the corn borer pressure in all their fields in the 2022 season. In the first wave (Jul 2022), 144 (57.6%) of the farmers found it to be "As Usual", 87 (34.8%) farmers stated it was "Low" and 19 (7.6%) farmers stated it was "High". In the second wave (Jan 2023), 132 (52.8%) of the farmers found it to be "As Usual", 81 (32.4%) farmers stated it was "Low" and 37 (14.8%) farmers stated it was "High" (Table 10, Table 11, Figure 3).

Table 10: Farmers' assessment of about the corn borer pressure in all their fields in the 2022 season in the first wave (Jul 2022).

	Frequency	Valid percentages	Accumulated percentages
Low	87	34.8%	34.8%
As Usual	144	57.6%	92.4%
High	19	7.6%	100.0%
Total	**250**	**100.0%**	

Table 11: Farmers' assessment of about the corn borer pressure in all their fields in the 2022 season in the second wave (Jan 2023).

	Frequency	Valid percentages	Accumulated percentages
Low	81	32.4%	32.4%
As Usual	132	52.8%	85.2%
High	37	14.8%	100.0%
Total	**250**	**100.0%**	
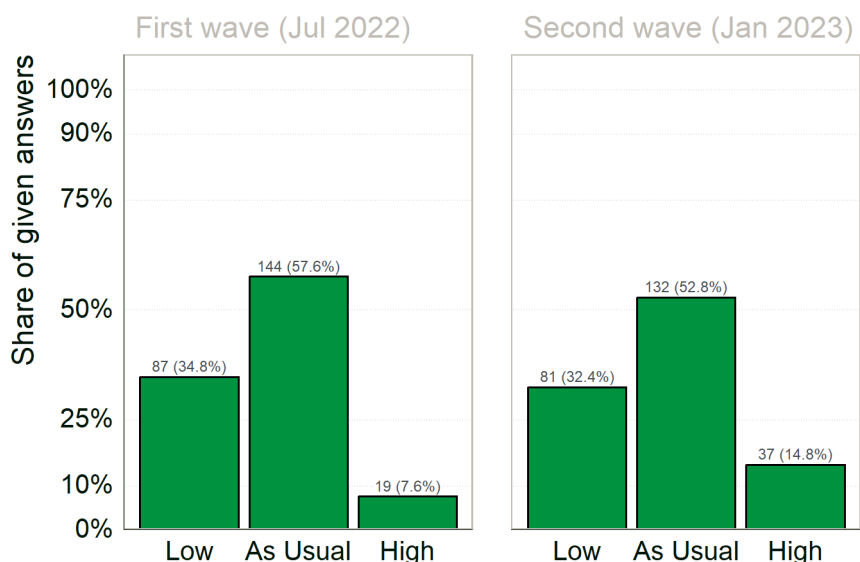
Figure 3: Farmers' assessment of about the corn borer pressure in all their fields in the 2022 season.

The two most common corn borer species are *Ostrinia nubilalis* (ECB; European corn borer) and *Sesamia spp* (MCB; Mediterranean corn borer).

Those farmers who had found the corn borer pressure to be high were asked which corn borer species they had found to be of high pressure in all their fields in the 2022 season. In the first wave (Jul 2022), all the farmers (19/19) could not differentiate between them. In the second wave (Jan 2023), 6 (16.2%) of the farmers found it to be "ECB", 29 (78.4%) farmers could not differentiate between them and 2 (5.4%) farmers stated it was "MCB".

3.1.5 Weed pressure

The farmers were asked to list up to five of the most common weeds on their fields. The three most common species were *Sorghum halepense*, *Chenopodium album* and *Echinochloa crus-galli*. All listed weeds are shown in Table 12.

Table 12: Weed frequencies. Each farmer could list up to five common weeds on their fields in the 2022 season

Weed	Wave 1	Wave 2
Sorghum halepense	176	180
Chenopodium album	123	121
Echinochloa crus-galli	82	117
Amaranthus retroflexus	91	83
Xanthium echinatum	74	77
Datura stramonium	70	69
Malva sp.	34	102
Abutilon theophrasti	134	0
Abutilon theophrasti medik	0	115
Cyperus rotundus	46	51
Setaria sp.	41	48
Malva sylvestris	75	4
Digitaria sanguinalis	30	39
Galium sp.	28	8
Lolium sp.	18	14
Abutillon theophrasti medik	0	25
Portulaca oleracea	10	15
Xanthium spinosum	13	10
Cyperus sp.	22	0
Amaranthus palmeri	2	18
Solanum nigrum	11	8
Portulaca olaracea	0	9
Polygonum convolvulus	5	0
Panicum	0	5
Cynodon dactylon	1	4
Diplotaxis erucoides	4	0
Avena fatua	3	1
Convolvulus arvensis	3	1
Cirsium arvense	1	3
Veronica arvensis	3	0
Convulvulus arvensis	0	3
Sorgum halepense	2	0
Salsola kali	1	1
Bromus tectorum	1	0
Malvas silvestre	1	0
Sonchus oleraceus	1	0
Salsola cali	0	1

Farmers were asked whether there was a difference between their YG and CV fields regarding weed pressure in the 2022 season. In the first wave (Jul 2022), 244 (97.6%) of the farmers found it to be "No", 3 (1.2%) farmers stated it was "Yes" and 3 (1.2%) farmers stated it was "Don't know". In the second wave (Jan 2023), 248 (99.2%) of the farmers found it to be "No", 2 (0.8%) farmers stated it was "Yes" (Table 13, Table 14, Figure 4).

Table 13: Farmers' assessment of whether there was a difference between their YG and CV fields regarding weed pressure in the 2022 season in the first wave (Jul 2022).

	Frequency	Valid percentages	Accumulated percentages
Yes	3	1.2%	1.2%
No	244	97.6%	98.8%
Don't know	3	1.2%	100.0%

	Frequency	Valid percentages	Accumulated percentages
Total	**250**	**100.0%**	

Table 14: Farmers' assessment of whether there was a difference between their YG and CV fields regarding weed pressure in the 2022 season in the second wave (Jan 2023).

	Frequency	Valid percentages	Accumulated percentages
Yes	2	0.8%	0.8%
No	248	99.2%	100.0%
Don't know	0	0.0%	100.0%
Total	**250**	**100.0%**	
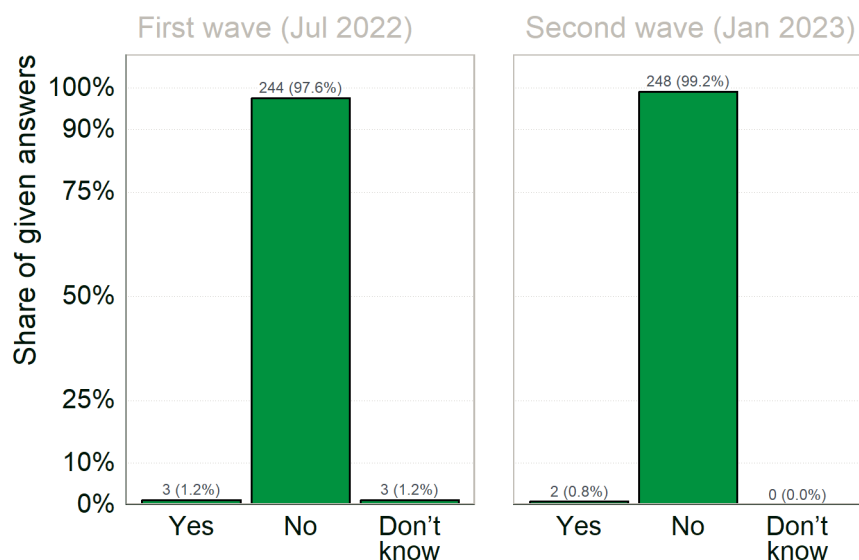
Figure 4: Farmers' assessment of whether there was a difference between their YG and CV fields regarding weed pressure in the 2022 season.

The 5 farmers that answered "Yes", were asked to comment further. All comments were translated into English, aggregated into groups of similar meaning if possible and are provided in Table 15.

Table 15: Farmers' comments on why they answered "Yes" to the question whether there was a difference between their YG and CV fields regarding weed pressure in the 2022 season.

Farmer(s)	Freq	Answer wave 1	Comment wave 1	Answer wave 2	Comment wave 2	Comment aggregate
1124	1	No		Yes	In the area of CV maize, when it is affected by the corn borer, there is more lost hollow of fallen maize, the sun enters more and the soil produces more weeds, the maize YG, being all standing, gives shade, the ground is more covered and does not produce weeds.	Difference due to better vigor of YG maize
1088	1	Yes	In YG farms, less presence of weeds due to rotation.	No		Difference due to different crop rotation between YG & CV
1163	1		In the YG farm I have more cereal ryegrass, having had worst weather conditions on the previous barley crop. A lot of barley seed fell to the ground and then in the late maize sowings I had a lot of barley ryegrass resprouting, I even had to treat with herbicides in several passes.			
1052	1		Where I sow CV there are always more weeds due to rotation.			
1240	1	No		Yes	I have had more barley ryegrass in a YG maize field because I stoned over winter barley crop and a lot of barley seed was left on the soil, and I had more barley ryegrass in a YG maize field than in a CV maize field.	Difference due to different soil treatment between YG & CV

3.2 Integrated pest management practices

3.2.1 Crop rotation

The farmers were asked what crops they had planted on their YG and CV reference fields over the last two years. If the answer was "Maize" they were further asked to specify whether it was YG or CV maize and to provide the variety name. Note that some Spanish farmers conduct two plantings in a single year. These are referred to as "early" and "late" planting here. Table 16 shows - with respect to the YG reference field in the 2022 season - the frequencies of crops that had been planted there in the preceding two years.

Table 16: Frequency of crops planted in the preceding two years on the YG reference field in the 2022 season. Note that some farmers conduct two plantings in a single year, which are referred to as "early" and "late" planting here. Also, in case of 'overall frequency', the sum per year may exceed 250, since some farmers conduct two plantings in a single year.

Crop	Overall frequency		Frequency of early planting		Frequency of late planting	
	2020	2021	2020	2021	2020	2021
YG Maize	181	134	154	103	27	31
Barley	27	53	27	53		
CV Maize	25	35	25	34		1
Wheat	16	23	15	23	1	
Alfalfa	8	8	8	8		
Peas	1	7	1	7		
Vetch		4		4		
Cauliflower	3		3			
Legumes	3	1	3	1		
Potato	2	3	2	3		
Asparagus	2	2	2	2		
Broccoli	2	2	2	2		
Trigo	2		2			
Beans	1	2	1	1		
Sunflower		2	1			
Endive	1	1	1			
Fallow	1		1			
Oats	1			1	1	1
Tomato	1			1		
Garlic		1		1		
Grassland		1		1		1
Onion		1				1
Tobacco		1				1
Total	**277**	**280**	**248**	**245**	**29**	**35**

A summary of the crop rotations is given in Table 17 and Figure 5 with a focus on YG maize rotation with CV maize or other crops.

Table 17: Crop rotation summary with respect to YG maize in the 2022 season. Note that 'YG: 2 years' refers to YG planting in each of the preceding two years and 'YG: 1 year, rotation with CV maize' refers to rotation between YG and CV planting in the preceding two years. In both cases, combinations with other crops (early/late) may happen within a year.

Reference field	Crop rotation in the preceding 2 years	Frequency	Percent
YG	YG: 2 years	115	46.0%
	YG: 1 year, rotation with CV maize	23	9.2%
	YG: 1 year, rotation with other crops	61	24.4%
	YG: Not planted	51	20.4%
	Total	**250**	**100%**
CV	YG: 2 years	19	7.6%
	YG: 1 year, rotation with CV maize	34	13.6%
	YG: 1 year, rotation with other crops	23	9.2%
	YG: Not planted	174	69.6%
	Total	**250**	**100%**
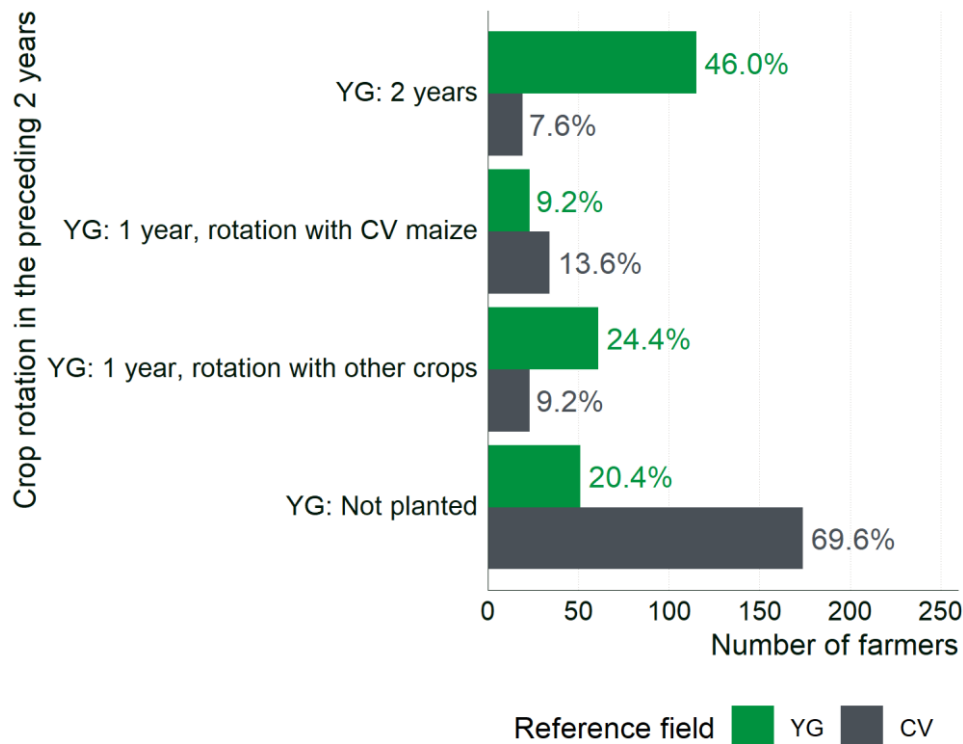
Figure 5: Crop rotation summary with respect to frequencies of YG maize in the 2022 season. Crop rotation summary with respect to YG maize in the 2022 season. Note that 'YG: 2 years' refers to YG planting in each of the preceding two years and 'YG: 1 year, rotation with CV maize' refers to rotation between YG and CV planting in the preceding two years. In both cases, combinations with other crops (early/late) may happen within a year.

Farmers were asked regarding their crop rotation in YG fields compared to that in CV fields in the 2022 season. While 236 (94.4%) of the farmers found it to be "As usual", 14 (5.6%) farmers stated it was "Changed" (

Table 18, Figure 6).

Table 18: Farmers' assessment of regarding their crop rotation in YG fields compared to that in CV fields in the 2022 season.

	Frequency	Valid percentages	Accumulated percentages
As usual	236	94.4%	94.4%
Changed	14	5.6%	100.0%
Total	**250**	**100.0%**	
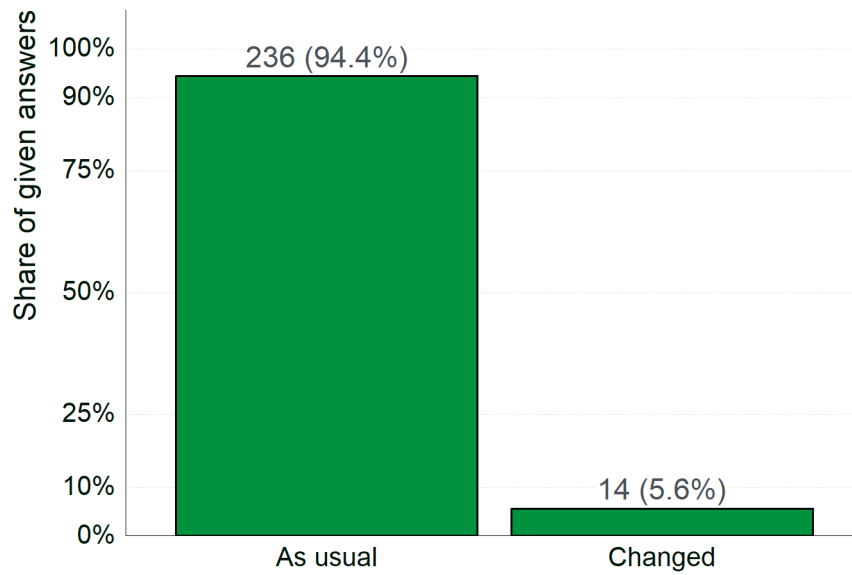
Figure 6: Farmers' assessment of regarding their crop rotation in YG fields compared to that in CV fields in the 2022 season.

The 14 farmers that answered "Changed", were asked to comment further. All comments were translated into English, aggregated into groups of similar meaning if possible and are provided in Table 19.

Table 19: Farmers' comments on why they answered "Changed" to the question regarding their crop rotation in YG fields compared to that in CV fields in the 2022 season.

Farmer(s)	Freq	Answer	Comment	Comment aggregate
1112	1	Changed	Because before I did not plant maize after a short cycle barley, I planted maize after year and so on and so forth, now with the short cycle with maize I can make a second crop of YG after producing a first crop of barley, the CV I plant as a single crop in the field, longer cycles, more productive.	YG allows for second planting
1180	1		Before I only sowed CV first crop corn, now I can make a second crop with YG without being affected by the corn borer, except for the areas of refuge of CV maize that is where the worm can damage the CV corn, the rotation changes by the fact of being able to make two harvests in the year.	
1213	1		Before, I only sowed CV in the first harvest, now I can do a second harvest with short cycle YG without being affected by the corn borer except the refuge. The rotation, changes are that I can make two harvests in the year, with CV I could not do it because it would be damaged by the corn borer.	
1088	1		I can make a second crop (bean for example) after the short cycle.	
1185	1		I can make two harvest and full harvest without damages.	
1187, 1193, 1219	3		I can make two harvests.	
1179	1		Not only for having two harvests, also sow YG allows me make changes in sow times if I have bad weather conditions.	
1111	1		I have YG sown after barley, in direct seeding for late seeding to avoid corn borer affection in YG, in farms after crop sowing plus CV, same YG and CV cycles and same/similar seeding dates. I want to harvest the CV earlier.	YG is less affected by corn borer and thus allows for other crop rotations
1203	1		In the fields where I plant more YG I do less rotation with other crops, because YG is not affected with cornborer and I can rotate less.	
1052	1		Since I sow YG corn, the farms that go to YG corn are those that I have dedicated several years to CV corn, for example three years of CV corn and then change to YG corn to avoid the pest, because it is more prone to the drill in farms that go year after year of maize.	
1048	1		The fact that YG maize is not affected by corn borer allows us to make rotations different from what we are used to in some farms.	
1212	1		With YG I sow shorts cycles and I can make rotation with other crops. I couldn't do it before for corn borer damages.	

3.2.2 Sowing time

The farmers were asked about their sowing time for maize. More specifically, they provided a start and end date for maize sowing for both their YG reference field and CV reference field. Sowing time is mostly similar for CV and YG fields. In fact, 227 (90.8%) of the farmers provided identical sowing time spans for CV and YG fields. Additional summary statistics are provided in Table 20.

Table 20: Summary statistics for YG and CV sowing time spans in the 2022 season

		Minimum	Mean	Maximum
CV	Sowing start	2022-03-15	2022-04-30	2022-06-24
YG	Sowing start	2022-03-15	2022-05-01	2022-07-01
CV	Sowing end	2022-03-23	2022-05-04	2022-06-30
YG	Sowing end	2022-03-23	2022-05-04	2022-07-05

Farmers were asked whether they sowed YG maize earlier, later or at the same time as CV maize in the 2022 season. While 233 (93.2%) of the farmers found it to be "No difference", 8 (3.2%) farmers stated it was "Earlier" and 9 (3.6%) farmers stated it was "Later" (Table 21, Figure 7).

Table 21: Farmers' assessment of whether they sowed YG maize earlier, later or at the same time as CV maize in the 2022 season.

	Frequency	Valid percentages	Accumulated percentages
Earlier	8	3.2%	3.2%
No difference	233	93.2%	96.4%
Later	9	3.6%	100.0%
Total	**250**	**100.0%**	
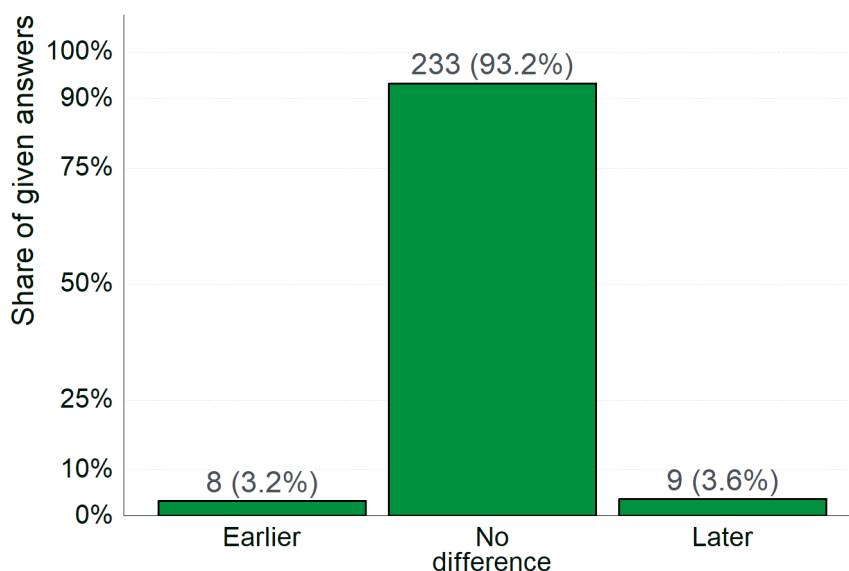
Figure 7: Farmers' assessment of whether they sowed YG maize earlier, later or at the same time as CV maize in the 2022 season.

The 14 farmers that answered "Earlier" or "Later", were asked to comment further. All comments were translated into English, aggregated into groups of similar meaning if possible and are provided in Table 22.

Table 22: Farmers' comments on why they answered "Earlier" or "Later" to the question whether they sowed YG maize earlier, later or at the same time as CV maize in the 2022 season.

Farmer(s)	Freq	Answer	Comment	Comment aggregate
1062	1	Earlier	I sow a few days before the CV, because the corn borer affects more to late sowings, and although they are few days I adjust to sow the CV of refuge days before the corn YG to better avoid the corn borer.	Avoid corn borer
1024	1		As it is a longer cycle, I sowed it earlier than the CV.	Different cycles, crop management
1123, 1183, 1246	3		Different cycles.	
1009	1		I had the soil better.	Environmental conditions
1021	1		I sowed later CV because of the weather, not for any other reason.	
1112	1		I have sowed later for my first cycle.	No reason
1204	1	Later	Combine sowing allows me to schedule the harvest.	
1118, 1184	2		Different cycles.	
1111	1		Only a few days to harvest before.	
1090	1		Adapt my harvest and rotation if I can sow another crops in rotations.	To allow for second planting
1088	1		I can make a seconde maize harvest.	

3.2.3 Harvest time

The farmers were asked about their harvest time for maize. More specifically, they provided a start and end date for maize harvest for both their YG reference field and CV reference field.

Table 23: Summary statistics for YG and CV harvest time spans in the 2022 season

		Minimum	Mean	Maximum
CV	harvest start	2022-09-01	2022-10-11	2022-12-20
YG	harvest start	2022-09-01	2022-10-12	2022-12-20
CV	harvest end	2022-09-10	2022-10-23	2023-01-20
YG	harvest end	2022-09-10	2022-10-24	2023-01-20

Farmers were asked whether they harvested YG maize earlier, later or at the same time as CV maize in the 2022 season. While 236 (94.4%) of the farmers found it to be "No difference", 1 (0.4%) farmers stated it was "Earlier" and 13 (5.2%) farmers stated it was "Later" (Table 24, Figure 8).

Table 24: Farmers' assessment of whether they harvested YG maize earlier, later or at the same time as CV maize in the 2022 season.

	Frequency	Valid percentages	Accumulated percentages
Earlier	1	0.4%	0.4%
No difference	236	94.4%	94.8%
Later	13	5.2%	100.0%
Total	**250**	**100.0%**	
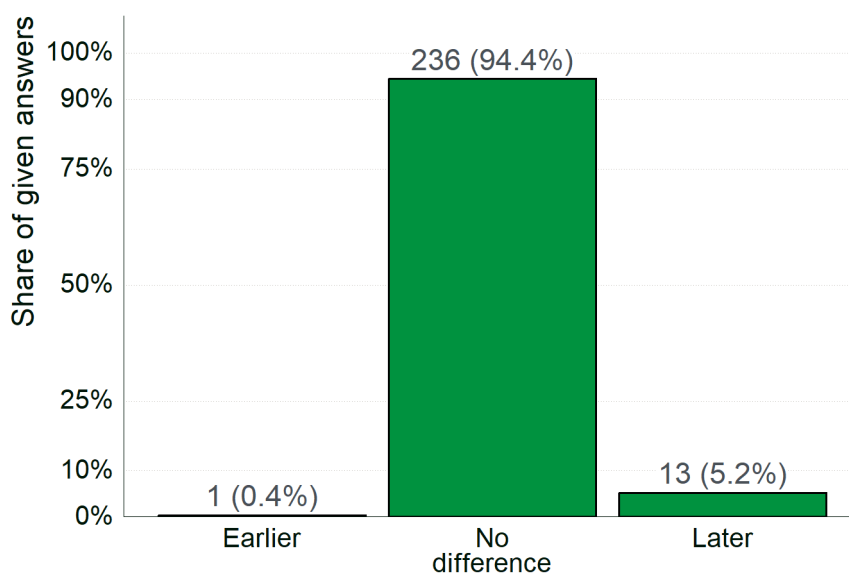
Figure 8: Farmers' assessment of whether they harvested YG maize earlier, later or at the same time as CV maize in the 2022 season.

The 14 farmers that answered "Later" or "Earlier", were asked to comment further. All comments were translated into English, aggregated into groups of similar meaning if possible and are provided in Table 25.

Table 25: Farmers' comments on why they answered "Later" or "Earlier" to the question whether they harvested YG maize earlier, later or at the same time as CV maize in the 2022 season.

Farmer(s)	Freq	Answer	Comment	Comment aggregate
1184	1	Later	I harvest later, as the CV maize is drier at maturity, I start harvesting with the CV maize and continue with the YG maize. The YG maize is healthier at maturity, it dries a little later and when harvested it gives a few degrees, one or two degrees more humidity than the CV maize.	CV maize is drier at maturity
1109	1		I harvest the CV corn earlier because it is drier at maturity due to its longer cycle than the YG maize and sow it earlier, the YG corn was sown later and/or second harvest after the peas and I have to harvest it later to finish its cycle and be dry at maturity.	
1233	1		I harvest the CV corn earlier because it is drier at maturity due to its longer cycle than the YG maize and sow it earlier, the YG corn was sown later, and/or second harvest after beans and I have to harvest it later to finish its cycle and be dry at maturity.	
1012	1		I harvest the CV maize earlier because it is drier at maturity, at the same cycle, the YG maize has a little more humidity and holds more because it is not affected by the corn borer, the CV maize can be affected by the corn borer and I harvest earlier to avoid the maize falling due to the pest, but it is only a few days before harvesting the CV maize.	
1039	1		I harvest the CV maize earlier because it is drier at maturity, at the same cycle, the YG maize has a little more humidity and holds more because it is not affected by the corn borer, the CV maize can be affected by the corn borer and I harvest earlier to avoid the maize falling due to the pest.	
1243	1	Earlier	Because I sowed the YG maize earlier than CV maize.	In accordance with changed sowing
1202	1	Later	Because YG maize is planted a month later than CV maize and the cycle is similar, so I harvest CV maize first.	
1027, 1235	2		CV maize is sown two months earlier, and harvested earlier because of the drying process. And YG maize I sow late and second crop after harvesting barley and it is harvested later at the end of its cycle, one month after CV maize, all because of different sowings and cycles.	
1069	1		Controlled harvest of transgenic and CV maize.	
1151	1		I harvest the CV maize earlier because it is sown a month earlier than the YG maize, it finishes the cycle earlier, the CV maize dries earlier and I harvest earlier than the YG.	
1206	1		I sow the CV corn first, and the harvest is because the cycle is finished, before the YG maize.	

Farmer(s)	Freq	Answer	Comment	Comment aggregate
1107	1		Because YG maize is more resistant to the weather and can withstand harvesting longer because it is more standing in case the harvesting machine can not enter the fields and also it can be harvested later.	YG benefits in harvesting
1218	1		YG maize is more resistant to corn borer, so I harvest the CV maize a few days before and then the YG maize, so that in the event of rain and/or wind, there is no loss due to maize that has fallen and cannot be harvested, so I harvest the CV maize first.	

3.2.4 Corn borer management practices

Insecticides

Farmers were asked whether they applied insecticides as a corn borer management practice in the 2022 season in their YG and CV field, respectively. For YG, all of the farmers (250/250) answered "No". For CV, 7 (2.8%) of the farmers answered "Yes", 243 (97.2%) farmers answered "No" (Table 26, Table 27).

Table 26: Applied insecticides as a corn borer management practice in YG field in the 2022 season.

	Frequency	**Valid percentages**	**Accumulated percentages**
Yes	0	0.0%	0.0%
No	250	100.0%	100.0%
Total	**250**	**100.0%**	

Table 27: Applied insecticides as a corn borer management practice in CV field in the 2022 season.

	Frequency	**Valid percentages**	**Accumulated percentages**
Yes	7	2.8%	2.8%
No	243	97.2%	100.0%
Total	**250**	**100.0%**	

The 7 farmers who did apply insecticides on their CV fields in the 2022 season were asked to list up to five products: 5 of the farmers listed Coragen 20SC, while the other two listed Decis Expert and Deltametrin.

Biocontrol treatments

Farmers were asked whether they applied biocontrol treatments as a corn borer management practice in the 2022 season in their YG and CV field, respectively. For YG, all of the farmers (250/250) answered "No". For CV, all of the farmers (250/250) answered "No" (Table 28, Table 29).

Table 28: Applied biocontrol treatments as a corn borer management practice in YG field in the 2022 season.

	Frequency	**Valid percentages**	**Accumulated percentages**
Yes	0	0.0%	0.0%
No	250	100.0%	100.0%
Total	**250**	**100.0%**	

Table 29: Applied biocontrol treatments as a corn borer management practice in CV field in the 2022 season.

	Frequency	**Valid percentages**	**Accumulated percentages**
Yes	0	0.0%	0.0%
No	250	100.0%	100.0%
Total	**250**	**100.0%**	

Other treatments

Farmers were asked whether they applied other treatments as a corn borer management practice in the 2022 season in their YG and CV field, respectively. For YG, all of the farmers (250/250) answered "No". For CV, all of the farmers (250/250) answered "No" (Table 30, Table 31).

Table 30: Applied other treatments as a corn borer management practice in YG field in the 2022 season.

	Frequency	Valid percentages	Accumulated percentages
Yes	0	0.0%	0.0%
No	250	100.0%	100.0%
Total	**250**	**100.0%**	

Table 31: Applied other treatments as a corn borer management practice in CV field in the 2022 season.

	Frequency	Valid percentages	Accumulated percentages
Yes	0	0.0%	0.0%
No	250	100.0%	100.0%
Total	**250**	**100.0%**	

No treatments

Farmers were asked whether they applied no treatment at all as a corn borer management practice in the 2022 season in their YG and CV field, respectively. For YG, all of the farmers (250/250) answered "Yes". For CV, 243 (97.2%) of the farmers answered "Yes", 7 (2.8%) farmers answered "No" (Table 32, Table 33).

Table 32: Applied no treatment at all as a corn borer management practice in YG field in the 2022 season.

	Frequency	Valid percentages	Accumulated percentages
Yes	250	100.0%	100.0%
No	0	0.0%	100.0%
Total	**250**	**100.0%**	

Table 33: Applied no treatment at all as a corn borer management practice in CV field in the 2022 season.

	Frequency	Valid percentages	Accumulated percentages
Yes	243	97.2%	97.2%
No	7	2.8%	100.0%
Total	**250**	**100.0%**	

It should be noted that the responses to this inquiry are somewhat repetitive as they can be inferred from the answers provided to the previous three questions related to insecticides, biocontrol treatments and other treatments.

Overall efficacy

Farmers were asked about the overall efficacy of the GM varieties in terms of their protection against corn borer in the 2022 season. For ECB, 229 (91.6%) of the farmers found it to be "Very good", 21 (8.4%) farmers stated it was "Good". For MCB, 229 (91.6%) of the farmers found it to be "Very good", 21 (8.4%) farmers stated it was "Good" (Table 34, Table 35, Figure 9).

Table 34: Farmers' assessment of about the overall efficacy of the GM varieties in terms of their protection against corn borer in the 2022 season for ECB

	Frequency	Valid percentages	Accumulated percentages
Very good	229	91.6%	91.6%
Good	21	8.4%	100.0%
Weak	0	0.0%	100.0%
Don't know	0	0.0%	100.0%
Total	**250**	**100.0%**	

Table 35: Farmers' assessment of about the overall efficacy of the GM varieties in terms of their protection against corn borer in the 2022 season for MCB.

	Frequency	Valid percentages	Accumulated percentages
Very good	229	91.6%	91.6%
Good	21	8.4%	100.0%
Weak	0	0.0%	100.0%
Don't know	0	0.0%	100.0%
Total	**250**	**100.0%**	
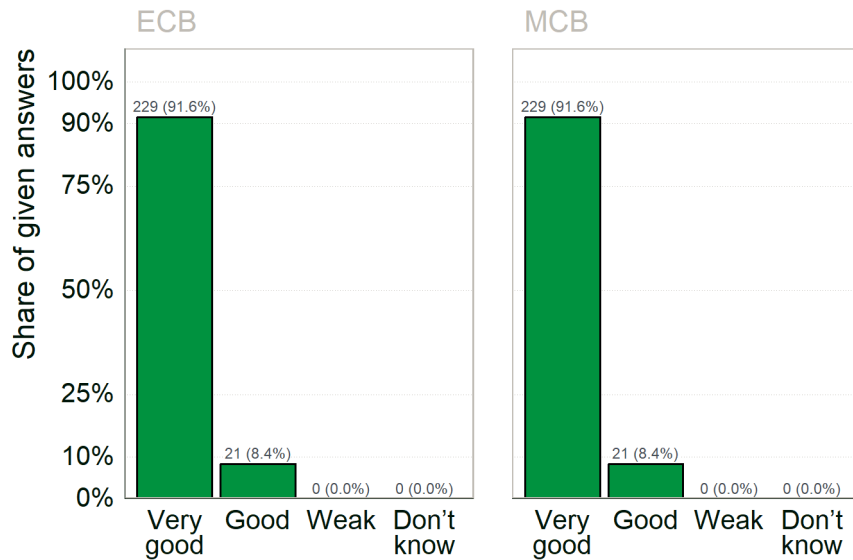
Figure 9: Farmers' assessment of about the overall efficacy of the GM varieties in terms of their protection against corn borer in the 2022 season.

One farmer that answered "Very good" efficacy of the GM varieties in terms of their protection against ECB, commented further. The comment was translated into English and is provided in Table 36.

Table 36: Farmers' comments on why they answered "Very good" to the question about the overall efficacy of the GM varieties in terms of their protection against ECB in the 2022 season.

Farmer(s)	Freq	Answer	General Comment	Comment why weak	Comment aggregate
1109	1	Very good	Total efficacy, in CV maize I have lost 35% of my crop to the corn borer.		No loss in YG, 35% loss in CV

One farmer that answered "Very good" regarding efficacy of the GM varieties in terms of their protection against MCB, commented further. The comment was translated into English and is provided in Table 37.

Table 37: Farmers' comments on why they answered "Very good" to the question about the overall efficacy of the GM varieties in terms of their protection against MCB in the 2022 season.

Farmer(s)	Freq	Answer	General Comment	Comment why weak	Comment aggregate
1109	1	Very good	Total efficacy, in CV maize I have lost 35% of my crop to the corn borer.		No loss in YG, 35% loss in CV

3.3 Development and yield observations

3.3.1 Susceptibility

Farmers were asked about the overall susceptibility - excluding ECB and MCB - of maize on their YG reference field compared to their CV reference field in the 2022 season. While 238 (95.2%) of the farmers found it to be "As usual", 1 (0.4%) farmers stated it was "More Susceptible" and 11 (4.4%) farmers stated it was "Less Susceptible" (Table 38, Figure 10).

Table 38: Farmers' assessment of about the overall susceptibility - excluding ECB and MCB - of maize on their YG reference field compared to their CV reference field in the 2022 season.

	Frequency	Valid percentages	Accumulated percentages
More Susceptible	1	0.4%	0.4%
As usual	238	95.2%	95.6%
Less Susceptible	11	4.4%	100.0%
Total	**250**	**100.0%**	
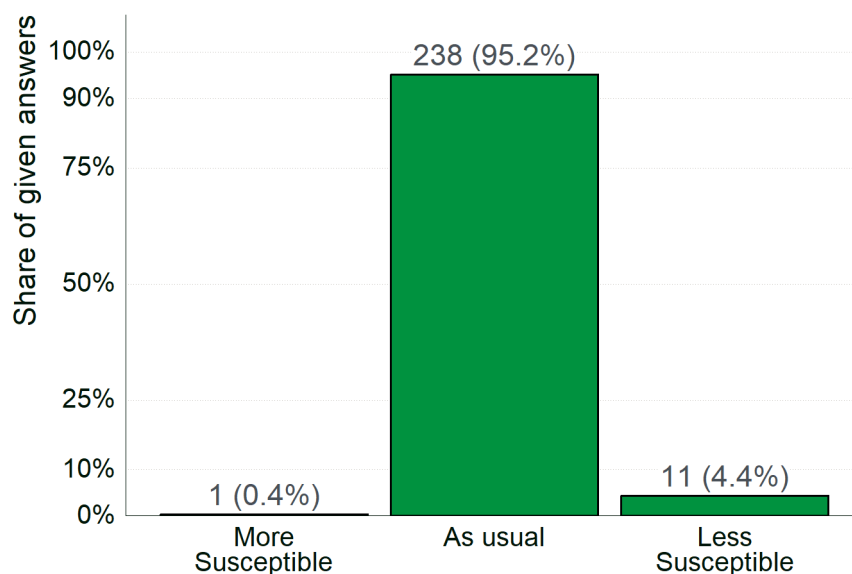
Figure 10: Farmers' assessment of about the overall susceptibility - excluding ECB and MCB - of maize on their YG reference field compared to their CV reference field in the 2022 season.

The farmers were further asked to list up to five insect pests and compare the susceptibility of YG to CV maize in the 2022 season. Results for pests that were mentioned by at least three farmers are shown in Figure 11.
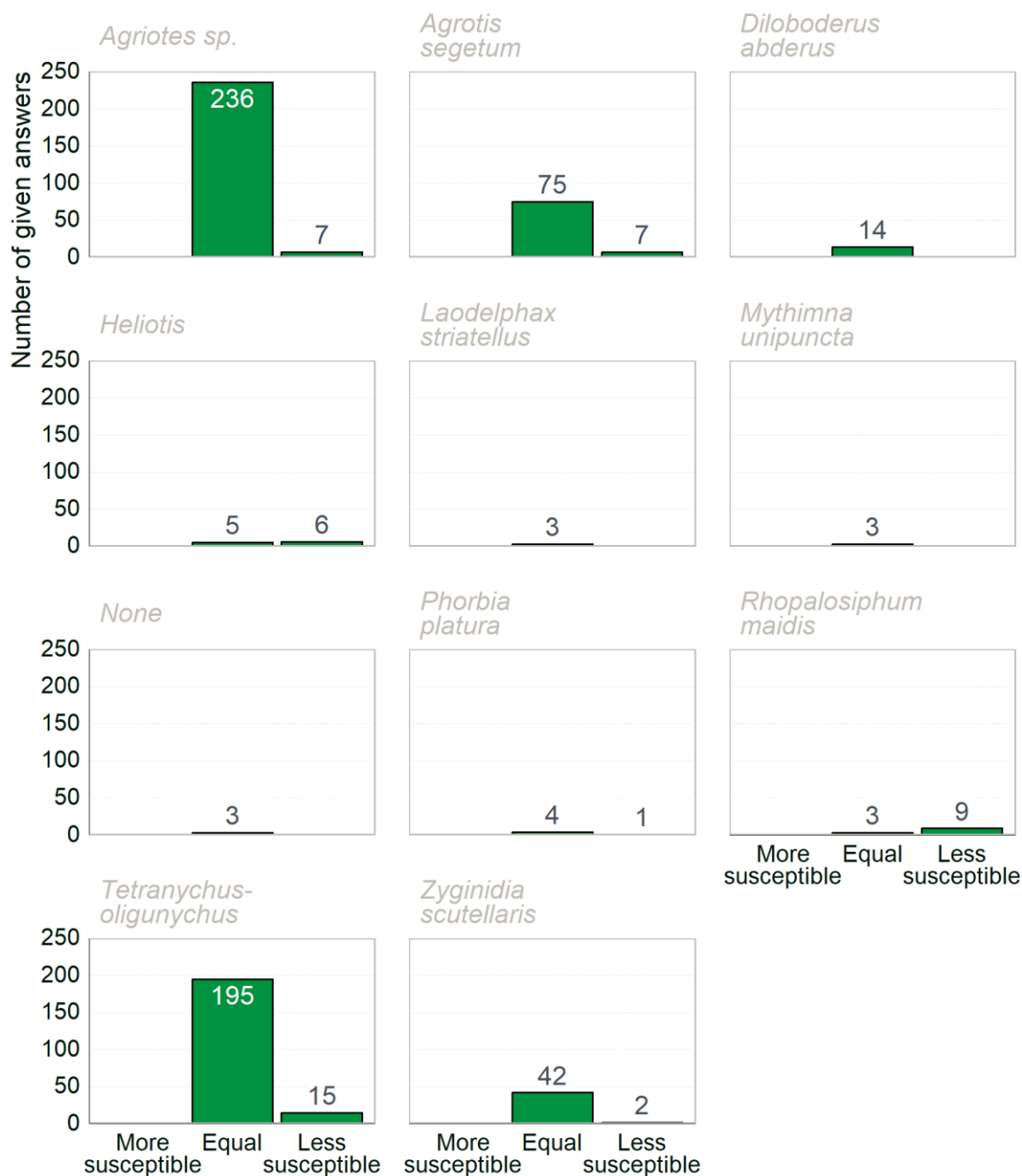
Figure 11: Farmers' assessment of the susceptibility of YG compared to CV maize to insect pests in the 2022 season. Each farmer could list up to five pests. Only pests that were mentioned by at least three farmers are shown.

All replies saying YG was more susceptible in the 2022 season are shown with the respective farmer's comment in Table 39.

Table 39: Comments by farmers who stated that there was a higher susceptibility to a certain pest on their YG reference field compared to their CV reference field in the 2022 season.

Farmer(s)	Pest	Susceptibility	Comment
1058	*Rhopalosiphum maidis fitch*	More susceptible	Most affected YG maize, maybe because of the growing area, carries out multi-purpose treatments (not specified).

Finally, farmers were asked about the total number of insecticides, biological treatments and other treatments they applied in the 2022 season on their YG and CV reference field, respectively. The comments of those farmers, who responded different numbers for their YG and CV reference field are shown in Table 40.

Table 40: Comments by farmers who stated that in the 2022 season they applied a different number of insecticides, biological treatments or other treatments to their YG reference field compared to their CV reference field.

Farmer	Treatment	Total farmers		Comment
		YG	CV	
1035	Biological	1	0	Only in YG maize plots, product: laying bags spikak plus de open nature (contains neoseiulus californicus which are predators of adults, larvae y eggs of tetranychus-oligunychus) in bags placed, located in the area-plot where tetranychus-oligunychus affects in order to eradicate the pest in a localised manner.
	Insecticide	1	2	For YG maize and CV maize one application for agriotes sp.: belem 0,8 mg granulated in pre-sowing, incorporates localised furrow in the sowing line next to the seed, apply with seed corn borer. And only in CV maize for tetranychus-oligunychus: abamectin generic,(ca-lex) for tetranychus-oligunychus: abamectin generic, late post-emergence pass, foliar spray with spraying machinery.

3.3.2 Unusual growth, performance and observations

Farmers were asked whether there were unusual growth and yield observations in their YG reference field compared to their CV reference field in the 2022 season. In the first wave (Jul 2022), 221 (88.4%) of the farmers found it to be "No", 26 (10.4%) farmers stated it was "Yes" and 3 (1.2%) farmers stated it was "Don't know". In the second wave (Jan 2023), 180 (72.0%) of the farmers found it to be "No", 68 (27.2%) farmers stated it was "Yes" and 2 (0.8%) farmers stated it was "Don't know" (Table 41, Table 42, Figure 12).

Table 41: Farmers' assessment of whether there were unusual growth and yield observations in their YG reference field compared to their CV reference field in the 2022 season in the first wave (Jul 2022).

	Frequency	Valid percentages	Accumulated percentages
Yes	26	10.4%	10.4%
No	221	88.4%	98.8%
Don't know	3	1.2%	100.0%
Total	**250**	**100.0%**	

Table 42: Farmers' assessment of whether there were unusual growth and yield observations in their YG reference field compared to their CV reference field in the 2022 season in the second wave (Jan 2023).

	Frequency	Valid percentages	Accumulated percentages
Yes	68	27.2%	27.2%
No	180	72.0%	99.2%
Don't know	2	0.8%	100.0%

	Frequency	Valid percentages	Accumulated percentages
Total	**250**	**100.0%**	
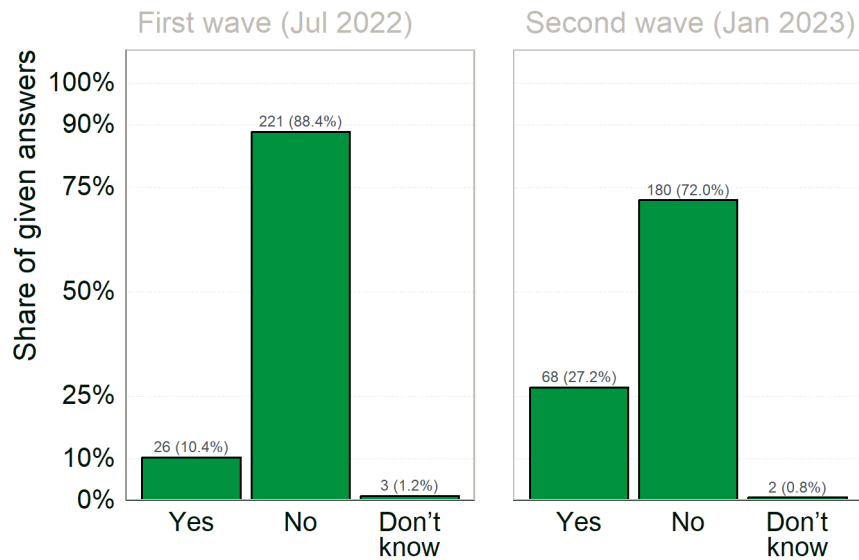
Figure 12: Farmers' assessment of whether there were unusual growth and yield observations in their YG reference field compared to their CV reference field in the 2022 season.

The 85 farmers that answered "Yes", were asked to comment further. All comments were translated into English, aggregated into groups of similar meaning if possible and are provided in Table 43.

Table 43: Farmers' comments on why they answered "Yes" to the question whether there were unusual growth and yield observations in their YG reference field compared to their CV reference field in the 2022 season.

Farmer(s)	Freq	Answer wave 1	Comment wave 1	Answer wave 2	Comment wave 2	Comment aggregate
1166	1	No		Yes	Some blackening affected the YG variety, as well as CV varieties in other areas.	Blackening of YG and CV varieties
1017	1	Yes	P1570 has a better emergence than mas69 and its because they are different varieties, no because are transgenic or not, also p1570 has a larger size.	No		Different varieties
1115, 1118, 1123, ...	10		Two different varieties and there is a difference between them. I think that is not for being CV and / or YG. They are planted at the same time and have been born the same but show visual differences.			
1117, 1140, 1146	3			Yes	YG is healthier, borns and growths better.	
1101	1	No			YG maize is healthier at maturity, dries later, and gives more production at harvest than CV maize.	YG grows better
1015, 1046, 1061, ...	15				YG is healthier, borns and growths better.	
1086, 1099, 1103, ...	4				YG is healthier.	
1204	1	Yes	Better growth in YG.			
1063	1		Better production in YG.	No		
1179	1		The growing of YG is much better than CV.			
1132	1		YG corn grows and develops better than CV corn from the aforementioned plots, even though they are different varieties of the same cycle but different.			
1203	1		YG is healthier that CV all the time till harvest.	Yes	YG is healthier, borns and growths better.	
1236, 1242, 1249	3		YG is healthier that CV all the time till harvest. Also YG resist worst wind conditions.	No		
1244	1			Yes	Corn borer doesn't affect to YG, so more production and healthier.	

Farmer(s)	Freq	Answer wave 1	Comment wave 1	Answer wave 2	Comment wave 2	Comment aggregate
1215, 1225	2				YG is healthier, borns and growths better.	
1139	1	Don't know			Corn borer doesn't affect to YG, so more production.	YG grows better, unaffected by corn borer
1057, 1189	2	No			At maturity, YG maize gives slightly more humidity than CV maize, for being a maize healther than the CV maize because it does not affect any corn borer.	
1004, 1027, 1031, ...	10				Corn borer doesn't affect to YG, so more production and healthier.	
1002, 1055, 1102	3				Corn borer doesn't affect to YG, so more production.	
1025, 1051, 1085, ...	12				YG maize gives slightly more humidity than CV maize, as it does not affect the corn borer.	
1006, 1013, 1036, ...	7				YG maize gives slightly more humidity than CV maize, for being a maize healther than the CV maize because it does not affect any corn borer.	
1007	1				YG maize is not affected by the corn borer, which does affect CV maize, even if there are few pests in the maize. Higher yield yields in YG maize by not affecting the corn borer, there is always some borer in the conventional even if it is a low level of pest. Everything else: birth, emergence, development and flowering are the same between YG and isogenic maize And there is no unusual observation.	
1143	1	Yes	Yes, YG resist corn borer and is a huge difference.		YG is healthier, borns and growths better.	
1095	1	No			If we have corn borer, I prefer YG becouse maize is doesn't affected, but if not we should prefer CV.	YG is unaffected by corn borer

Farmer(s)	Freq	Answer wave 1	Comment wave 1	Answer wave 2	Comment wave 2	Comment aggregate
1075	1				YG maize dries a little later, so as not to affect the corn borer.	

3.3.3 Other additional remarks

Farmers were additionally given the chance to list any unusual benefit or harm (e.g. to animals or the environment) they observed on their YG reference field compared to their CV reference field. All comments were translated into English, aggregated into groups of similar meaning if possible and are provided in Table 44.

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Table 44: All answers given farmer regarding any unusual benefit or harm (e.g. to animals or the environment) they observed on their YG reference field compared to their CV reference field in the 2022 season

Farmer(s)	Freq	Comment wave 1	Comment wave 2	Comment aggregate
1235	1	No difference between YG and CV.	At harvest it has a few degrees of humidity more than CV maize.	CV maize is drier at maturity
1012	1		YG maize is healthier and at harvest it has a few degrees of humidity more than CV maize. The maize cob looks healthier and fully developed.	
1202	1		YG maize is healthier and more productive at the end of the cycle, the maize cob looks healthier and fully developed. The cycle ends first.	
1035	1		YG maize is healthier and more productive, resistant to corn borer, although it is affected by other pests.	
1163	1		YG maize is healthier and more productive, resistant to corn borer, and gives more moisture at harvest than CV maize.	
1128	1		YG maize is healthier at maturity, and is more resistant to corn borer.	
1109	1		YG maize is healthier at maturity, dries later, and gives more moisture at harvest than CV maize,the plant keeps longer, are resistants to wind and lack of humidity that CV maize, YG maize delays maturity and is more resistant to corn borer.	
1131	1		YG maize is healthier at maturity, dries later, and gives more moisture at harvest than CV maize.	
1039	1		YG maize is healthier that CV maize, is more resistant to wind and at harvest it has a few degrees of humidity more than CV maize. The visual appreciation is better in YG maize.	
1069	1		YG maize produces more moisture and apparently more growth at harvest than CV maize, at the same cycles, varieties, planting and harvesting.	
1043, 1098, 1168	3		YG maize produces more moisture at harvest than CV maize, at the same cycles, varieties, planting and harvesting.	

Farmer(s)	Freq	Comment wave 1	Comment wave 2	Comment aggregate
1194	1		YG maize yields more moisture at harvest than CV maize.	
1212	1		Apparently there is nothing unusual in comparisons except the degree of humidity, at harvest, and gives more moisture at harvest than CV maize.	
1236	1		YG maize is healthier and more productive, resistant to corn borer, healthier at maturity, dries later, and gives more moisture at harvest than CV maize.	
1132	1	I have left the refuge in the inside part of the YG field inside and I have not had any wild boar attacks. Before, I did the opposite and I had attacks.	No observations.	No differences between YG and CV
1004, 1137, 1151, ...	11	No difference between YG and CV.	He does not observe any difference between the YG maize field and CV maize, nor unusual damage for the animals and the environment, YG maize is not affected by the corn borer, which does affect CV maize, even if there is little pest in the maize.	
1108	1		He does not observe any difference between the YG maize field and CV maize, nor unusual damage for the animals and the environment, as it is not affected by the corn borer, it is very healthy at maturity, the bush is preserved more, it withstands wind, fall and lying down well. YG maize is not affected by the corn borer, which does affect CV maize, even if there is little pest in the corn.	
1006, 1102, 1195	3		He does not observe any difference between the YG maize field and CV maize, nor unusual damage for the animals and the environment.	
1001, 1002, 1003, ...	180		No observations.	
1152	1		Not observed any difference between the YG maize field and CV maize, nor unusual damage for the animals and the environment, YG maize is not affected by the corn borer, which does affect CV maize, even if there is little pest in the maize.	
1061	1		There is a lot of plague of rabbits, and they go to both YG maize and CV maize, there is no difference between the YG maize field and CV maize field, nor	

Farmer(s)	Freq	Comment wave 1	Comment wave 2	Comment aggregate
			unusual damage to animals and the environment, YG maize is not affected by the corn borer, which does affect CV maize, even if there is little pest in the maize.	
1222	1		There is no difference between the YG maize field and CV maize field, nor unusual damage for the animals and the environment, the YG maize is not affected by the corn borer, which does affect the CV maize, even if there is little pest in the maize.	
1032	1		Virosis affects both YG and CV maizes.	
1251, 1252, 1253	3			
1025	1	With YG, I don't have corn borer, lower harvest losses with YG.	He does not observe any difference between the YG maize field and CV maize, nor unusual damage for the animals and the environment, YG maize is not affected by the corn borer, which does affect CV maize, even if there is little pest in the maize.	
1021	1		No observations.	
1007	1	With YG, I don't have corn borer.	He does not observe any difference between the YG maize field and CV maize, nor unusual damage for the animals and the environment, YG maize is not affected by the corn borer, which does affect CV maize, even if there is little pest in the maize.	
1015	1		He does not observe, the damage of wild boars and birds is the same in both crops of maize and he does not see any difference with respect to the circulation of bees or in the environment.	
1023	1		No observations, wild boar affects everything.	
1143	1		He does not observe any difference between the YG maize field and CV maize, nor unusual damage for the animals and the environment, YG maize is not affected by the corn borer, which does affect CV maize, even if there is little pest in the maize.	
1017, 1063, 1115, ...	20		No observations.	
1221	1	No difference between YG and CV.	There are wild boars in my zone because they are refugees in the nearby mountain: I leave CV maize refuge outside YG maize, the wild boars eat from the	Wild boar accessed the border of the plot/field

Farmer(s)	Freq	Comment wave 1	Comment wave 2	Comment aggregate
			border of the CV maize and do not eat the YG maize inside, they do not touch the YG, they do not want it (CV maize at the head of the entrance of the plot and the YG maize is inside after three lines of conventithere are wild boars in my zone because they are refugees in the nearby mountain: I leave CV maize refuge outside YG maize, the wild boars eat from the border of the CV maize and do not eat the YG maize inside, they do not touch the YG, they do not want it (CV maize at the head of the entrance of the plot and the YG maize is inside after three lines of CV maize).	
1078	1		I visualize wild boars in the neighbor's CV maize fields and not in his YG maize crops, but he thinks it is more because of the humidity conditions of the neighbor's land than because of the variety of maize.	Wild boars tend to favor drier field
1089	1		Most affected YG maize (by maize fungus).	YG maize more affected by fungus
1028	1	With YG, I don't have corn borer.	YG maize is healthier and more productive, resistant to corn borer, healthier at maturity, dries later, and gives more moisture at harvest than CV maize.	YG maize performs better
1225	1		YG maize is more productive than CV maize.	
1058	1	No difference between YG and CV.	YG maize is more resistant to pests.	YG more resistant to pests
1087	1		YG maize is more resistant to the mythimna unipuncta.	
1243	1		YG maize is more resistant to the mythimna unipuncta, and tetranychus-oligunychus.	

3.4 Implementation of Bt maize specific measures

3.4.1 Good agricultural practice

Farmers were asked whether they had been briefed on good agricultural practices for YG in the 2022 season. While 235 (94.0%) of the farmers found it to be "Yes", 15 (6.0%) farmers stated it was "No" (Table 45, Figure 13).

Table 45: Farmers' assessment of whether they had been briefed on good agricultural practices for YG in the 2022 season.

	Frequency	Valid percentages	Accumulated percentages
Yes	235	94.0%	94.0%
No	15	6.0%	100.0%
Total	**250**	**100.0%**	
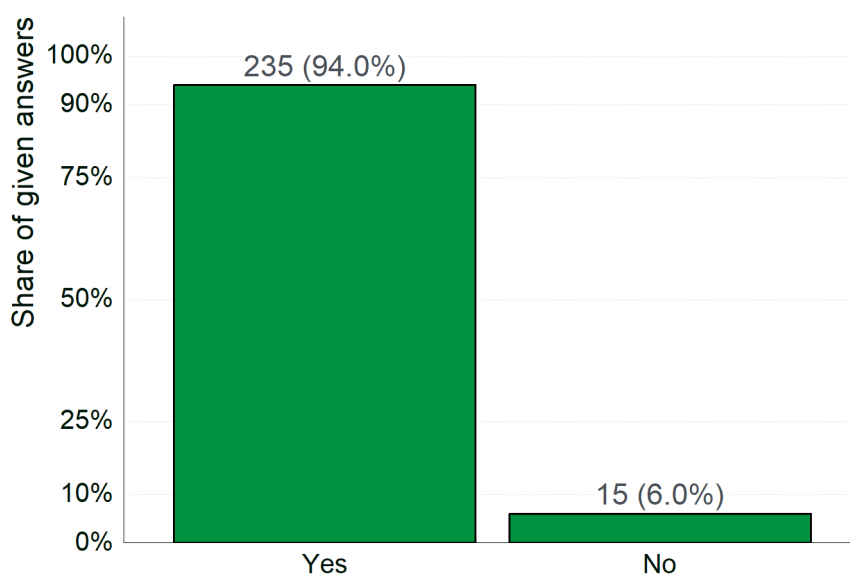
Figure 13: Farmers' assessment of whether they had been briefed on good agricultural practices for YG in the 2022 season.

Farmers were asked whether they found the information on YG good agricultural practices useful (given they had been briefed) in the 2022 season. While 123 (52.3%) of the farmers found it to be "Useful", 104 (44.3%) farmers stated it was "Very useful" and 8 (3.4%) farmers stated it was "Not useful" (Table 46, Figure 14).

Table 46: Farmers' assessment of whether they found the information on YG good agricultural practices useful (given they had been briefed) in the 2022 season.

	Frequency	Valid percentages	Accumulated percentages
Very useful	104	44.3%	44.3%
Useful	123	52.3%	96.6%
Not useful	8	3.4%	100.0%
Total	**235**	**100.0%**	
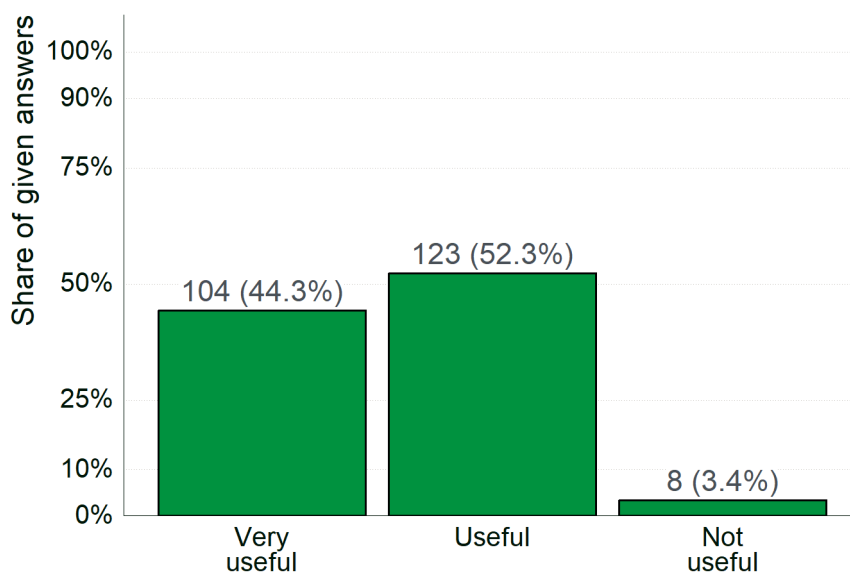
Figure 14: Farmers' assessment of whether they found the information on YG good agricultural practices useful (given they had been briefed) in the 2022 season.

3.4.2 Seed bag labels

Farmers were asked whether the seed bags were labeled with information that the seed is genetically modified YG maize in the 2022 season. While 0 (0.0%) of the farmers answered "No", 246 (98.4%) farmers answered "Yes" (Table 47, Figure 15).

Table 47: Farmers' assessment of whether the seed bags were labeled with information that the seed is genetically modified YG maize in the 2022 season.

	Frequency	Valid percentages	Accumulated percentages
Yes	246	98.4%	98.4%
No	0	0.0%	98.4%
Don't know	4	1.6%	100.0%
Total	**250**	**100.0%**	
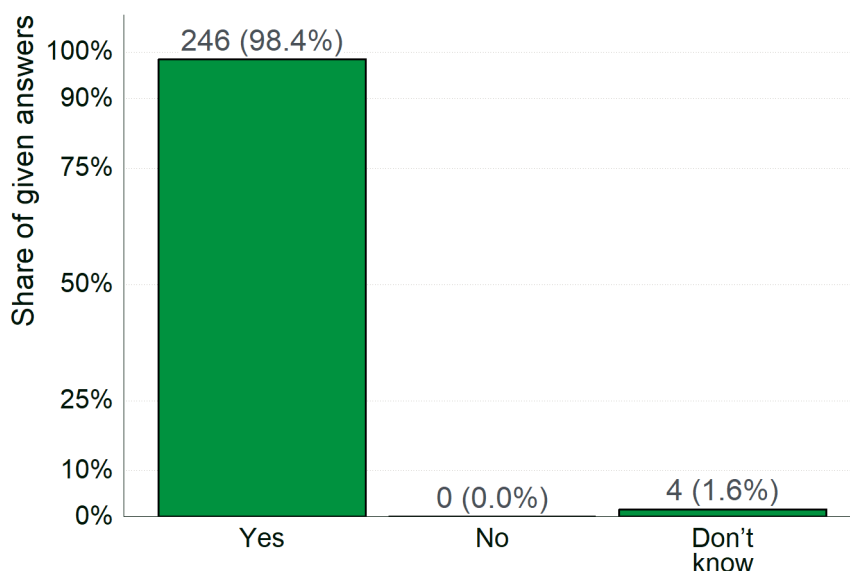
Figure 15: Farmers' assessment of whether the seed bags were labeled with information that the seed is genetically modified YG maize in the 2022 season.

Farmers were asked whether the seed bags were labeled with recommendations on how to grow genetically modified YG maize in the 2022 season. While 0 (0.0%) of the farmers answered "No", 247 (98.8%) farmers answered "Yes" (Table 48, Figure 16).

Table 48: Farmers' assessment of whether the seed bags were labeled with recommendations on how to grow genetically modified YG maize in the 2022 season.

	Frequency	Valid percentages	Accumulated percentages
Yes	247	98.8%	98.8%
No	0	0.0%	98.8%
Don't know	3	1.2%	100.0%
Total	**250**	**100.0%**	
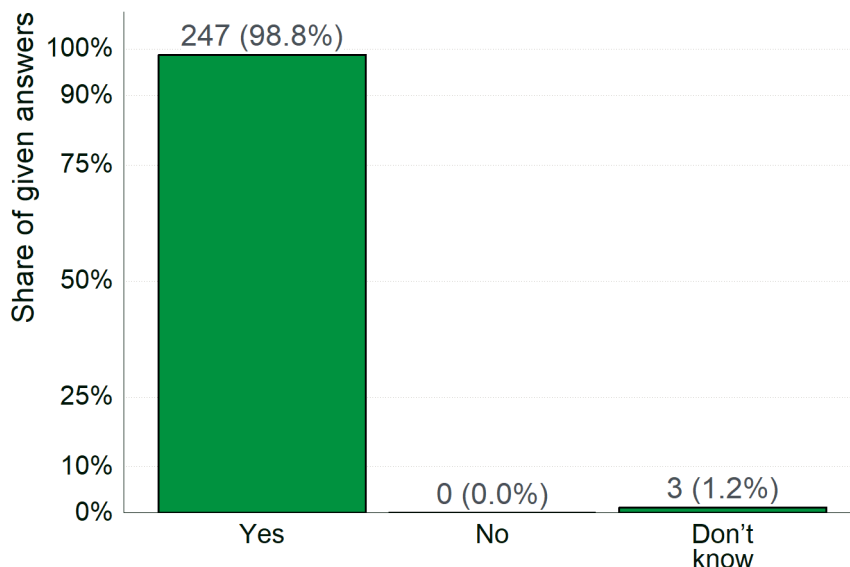
Figure 16: Farmers' assessment of whether the seed bags were labeled with recommendations on how to grow genetically modified YG maize in the 2022 season.

Farmers were asked whether they followed the recommendations on the seed bag labels in the 2022 season. All of the farmers (250/250) answered "Yes" (Table 49, Figure 17).

Table 49: Farmers' assessment of whether they followed the recommendations on the seed bag labels in the 2022 season.

	Frequency	Valid percentages	Accumulated percentages
Yes	250	100.0%	100.0%
No	0	0.0%	100.0%
Total	**250**	**100.0%**	
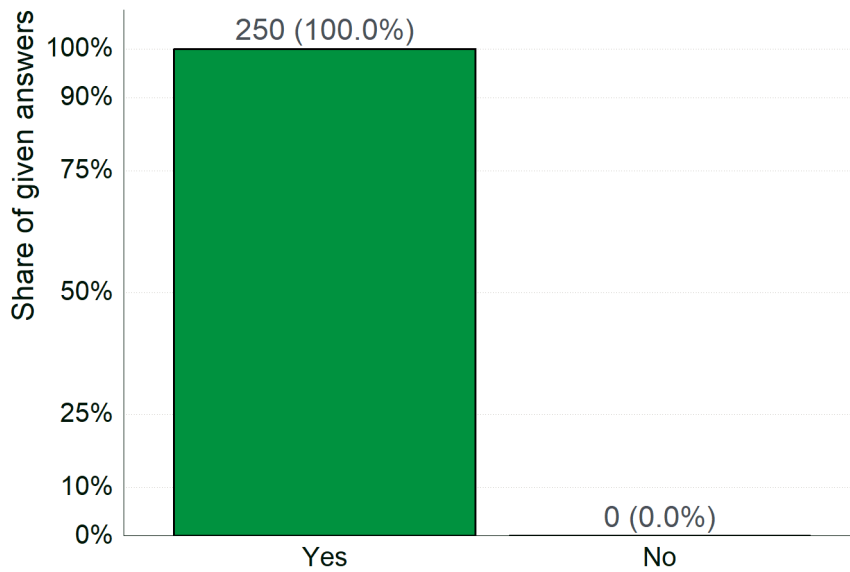
Figure 17: Farmers' assessment of whether they followed the recommendations on the seed bag labels in the 2022 season.

3.4.3 Prevention of insect resistance

Farmers were asked whether they had planted a refuge according to the technical guidelines in the 2022 season. While 67 (26.8%) of the farmers answered "No, <5ha", 183 (73.2%) farmers answered "Yes" (Table 50, Figure 18).

Table 50: Farmers' assessment of whether they had planted a refuge according to the technical guidelines in the 2022 season.

	Frequency	Valid percentages	Accumulated percentages
Yes	183	73.2%	73.2%
No, <5ha	67	26.8%	100.0%
No	0	0.0%	100.0%
Total	**250**	**100.0%**	
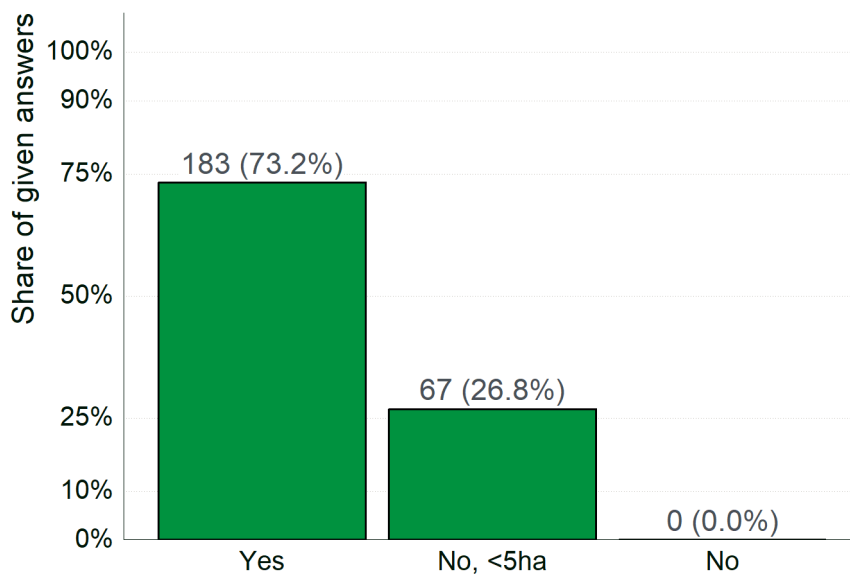
Figure 18: Farmers' assessment of whether they had planted a refuge according to the technical guidelines in the 2022 season.

3.4.4 Sustainability

Farmers were asked questions regarding the sustainability of YG maize technology to gain insights into their motivations and practices. This section explores various aspects related to the long-term viability and adoption of this technology among the farming community.

On average, the interviewed farmers have grown YG maize for 14.9 years, with individual numbers ranging from 1 to 25 years (Table 53).

Table 51: Number of years cultivating YG maize

	N	Miss	Mean	StdDev	IQR	Min	Median	Max
Number of years cultivating YG maize	250	0	14.9	5.06	10	1	15	25

All farmers were given the opportunity to comment on why they cultivate YG maize. All comments were translated into English, aggregated into groups of similar meaning if possible and are provided in Table 52.

Table 52: Farmers' comments on why they cultivate YG.

Farmer(s)	Freq	Comment	Comment aggregate
1224	1	It can make a second late sowing crop.	YG allows for second planting
1226	1	Higher productivity.	YG has better quality
1002	1	Higher YG maize crop health Higher grain quality, free of microtoxins.	YG has good harvest
1008, 1011, 1015, ...	51	Corn borer doesn't affect, more production.	YG has higher yield / YG is resistant to corn borer
1001, 1003, 1005, ...	128	Corn borer doesn't affect.	
1051, 1134	2	Good harvest.	
1004, 1014, 1026, ...	30	Is more resistant to corn borer and has higher productivity.	
1165, 1171	2	Secure production.	YG has stable yield
1058, 1087	2	YG maizes are more resistant to the maize mythimna unipuncta.	YG is more resistant to mythimna unipuncta
1230	1	YG maizes are more resistant to pests.	YG is more resistant to pests
1179	1	It is more resistant to corn borer.	YG is resistant to corn borer
1073	1	YG maizes are more resistant to corn borer and to avoid late sowing.	
1018, 1042, 1043, ...	24	YG maizes are more resistant to corn borer.	
1045, 1089	2	It is more resistant to corn borer, it can make a second late sowing crop.	YG is resistant to corn borer / YG allows for second planting
1020, 1033, 1147	3	It is more resistant to corn borer, it can make a second sowing crop.	

All farmers were given the opportunity to comment on their balance of the use of the GM maize regarding e.g. insecticide application, grain or silage production and quality. All comments were translated into English, aggregated into groups of similar meaning if possible and are provided in Table 54.

Table 53: Farmers' comments on their balance of the use of GM maize regarding e.g. insecticide application, grain or silage production and quality.

Farmer(s)	Freq	Comment	Comment aggregate
1020	1	It can make a second late sowing crop and repeat crop plots.	YG allows for second planting
1032	1	YG maizes are more resistant to corn borer, no difference has been observed between YG maize and CV maize and both types of maize are susceptible to viruses.	YG and CV have similar susceptibility to viruses
1004, 1031, 1051, ...	26	More production.	YG has higher yield
1001, 1003, 1005, ...	157	More revenues, better and healthier maize and more harvest.	
1047, 1058, 1068, ...	9	Is more resistant to corn borer and has higher production.	YG has higher yield / YG is resistant to corn borer
1018, 1043, 1049, ...	8	Is more resistant to corn borer, better quality and higher production of maize.	
1062, 1117, 1119, ...	4	YG maizes are more resistant to corn borer and has higher production.	
1033, 1198	2	YG maizes are more resistant to corn borer and higher profitability.	
1076	1	YG maizes are more resistant to corn borer, better crop health and has higher production.	
1087, 1132, 1211, ...	5	Is more resistant to corn borer, better quality, higher production of maize and less use of insecticides.	YG has higher yield / YG is resistant to corn borer / YG needs less insecticides
1042, 1098, 1206, ...	5	Is more resistant to corn borer, higher production of maize and less use of insecticides.	
1002, 1006, 1010, ...	21	Harvest secure.	YG has stable yield
1172	1	Is used where CV maize has pests and corn borer problems.	YG is resistant to corn borer
1073, 1162, 1231	3	YG maizes are more resistant to corn borer.	
1089	1	It is more resistant to corn borer, it can make late sowing crop.	YG is resistant to corn borer / YG allows for second planting
1045, 1159	2	Is more resistant to corn borer and less use of insecticides.	YG is resistant to corn borer / YG needs less insecticides
1185, 1224	2	YG maizes are more resistant to corn borer and less use of insecticides.	
1084	1	YG maizes are more resistant to corn borer and less workers.	YG is resistant to corn borer / YG needs less workers

All farmers were given the opportunity to comment on their economic balance of the use of the GM maize is, i.e. which factor most affected the increase/decrease in income and expenses. All comments were translated into English, aggregated into groups of similar meaning if possible and are provided in Table 54.

Table 54: Farmers' comments on their economic balance of the use of GM maize is, i.e. which factor most affected the increase/decrease in income and expenses.

Farmer(s)	Freq	Comment	Comment aggregate
1020	1	It can make a second late sowing crop and repeat crop plots.	YG allows for second planting
1032	1	YG maizes are more resistant to corn borer, no difference has been observed between YG maize and CV maize and both types of maize are susceptible to viruses.	YG and CV have similar susceptibility to viruses
1004, 1031, 1051, ...	26	More production.	YG has higher yield
1001, 1003, 1005, ...	157	More revenues, better and healthier maize and more harvest.	
1047, 1058, 1068, ...	9	Is more resistant to corn borer and has higher production.	YG has higher yield / YG is resistant to corn borer
1018, 1043, 1049, ...	8	Is more resistant to corn borer, better quality and higher production of maize.	
1062, 1117, 1119, ...	4	YG maizes are more resistant to corn borer and has higher production.	
1033, 1198	2	YG maizes are more resistant to corn borer and higher profitability.	
1076	1	YG maizes are more resistant to corn borer, better crop health and has higher production.	
1087, 1132, 1211, ...	5	Is more resistant to corn borer, better quality, higher production of maize and less use of insecticides.	YG has higher yield / YG is resistant to corn borer / YG needs less insecticides
1042, 1098, 1206, ...	5	Is more resistant to corn borer, higher production of maize and less use of insecticides.	
1002, 1006, 1010, ...	21	Harvest secure.	YG has stable yield
1172	1	Is used where CV maize has pests and corn borer problems.	YG is resistant to corn borer
1073, 1162, 1231	3	YG maizes are more resistant to corn borer.	
1089	1	It is more resistant to corn borer, it can make late sowing crop.	YG is resistant to corn borer / YG allows for second planting
1045, 1159	2	Is more resistant to corn borer and less use of insecticides.	YG is resistant to corn borer / YG needs less insecticides
1185, 1224	2	YG maizes are more resistant to corn borer and less use of insecticides.	

Farmer(s)	Freq	Comment	Comment aggregate
1084	1	YG maizes are more resistant to corn borer and less workers.	YG is resistant to corn borer / YG needs less workers

Farmers were asked whether they will use GM maize again in the future. All of the farmers (250/250) answered "Yes" (Table 55, Figure 19).

Table 55: Farmers' assessment of whether they will use GM maize again in the future.

	Frequency	Valid percentages	Accumulated percentages
Yes	250	100.0%	100.0%
No	0	0.0%	100.0%
Total	**250**	**100.0%**	
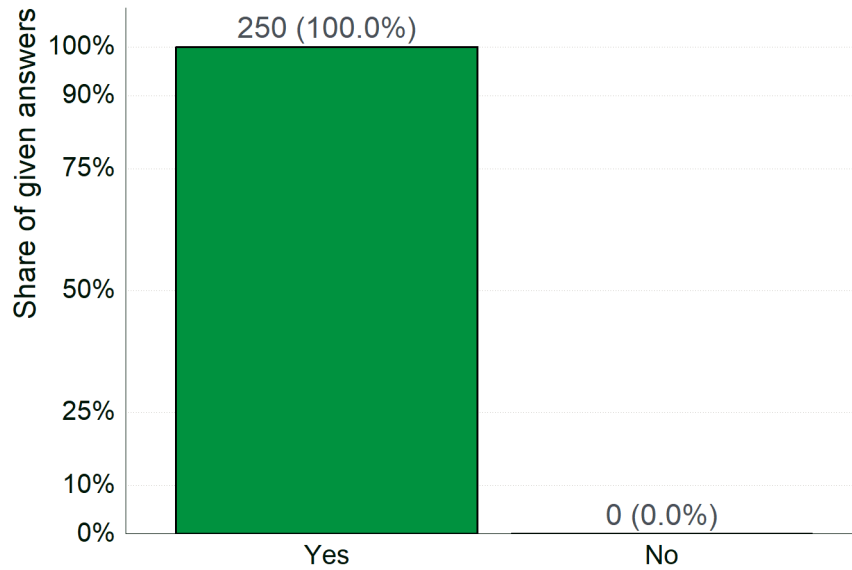
Figure 19: Farmers' assessment of whether they will use GM maize again in the future.

The 250 farmers that answered "Yes", were asked to comment further. All comments were translated into English, aggregated into groups of similar meaning if possible and are provided in Table 56.

Table 56: Farmers' comments on why they answered "Yes" to the question whether they will use GM maize again in the future.

Farmer(s)	Freq	Answer	Comment	Comment aggregate
1073, 1159, 1168	3	Yes	Higher production.	YG has higher yield
1047	1		Better quality and higher production of maize.	YG has higher yield / YG has better quality
1003, 1004, 1005, ...	89		Avoid corn borer infestation and higher production.	YG has higher yield / YG is resistant to corn borer
1217	1		Avoid corn borer infestation, higher production and greater profitability.	
1101	1		Higher in YG maize by not affecting the corn borer, always some pressure in CV.	
1176, 1220	2		Is more resistant to corn borer and higher production.	
1248	1		It is more resistant to corn borer and higher production.	
1243	1		It is more resistant to corn borer, less attack from other pests, greater health and higher production.	
1087	1		YG maizes are more resistant to corn borer and better profitability.	
1241	1		Secure harvest.	YG has stable yield
1009, 1030, 1048, ...	11		No pests during maize development with maize YG.	YG is more resistant to pests
1001, 1002, 1006, ...	123		Avoid corn borer infestation.	YG is resistant to corn borer
1191	1		YG maize is not affected by the corn borer, which does affect CV maize, even if there are few pests in the maize.	
1045, 1062, 1147, ...	4		It is more resistant to corn borer, it can make a second late sowing crop.	YG is resistant to corn borer / YG allows for second planting
1119, 1211, 1231	3		YG maizes are more resistant to corn borer and greater health.	YG maizes are more resistant to corn borer and greater health.
1033, 1089, 1172, ...	4		YG maizes are more resistant to corn borer and higher profitability.	YG maizes are more resistant to corn borer and higher profitability.
1032, 1058, 1238	3		YG maizes are more resistant to corn borer, higher production and higher profitability.	YG maizes are more resistant to corn borer, higher production and higher profitability.

3.5 Overview YG vs. CV comparison

The following section provides an overview of all results concerning the direct comparisons between YG and CV maize, focusing on monitored characteristics during the 2022 season (Figure 20; Table 57). The data from 2022 suggest that in comparison to CV maize varieties,

- YG fields do not exhibit increased weed pressure, nor are they cultivated in differing crop rotations or sown/harvested at different timings.

- They do not display heightened susceptibility to pests excluding ECB and MCB.

- The majority of farmers' observations indicate either no relevant differences between YG and CV maize or emphasize the advantageous traits of the former.

Overall, these findings are consistent with and reinforce the conclusions drawn from previous scientific research, and they also align with the insights obtained from 16 years of Post Market Environmental Monitoring. Thus, this new set of data confirms another year of successful monitoring, maintaining the long-established trend: no adverse effects have been identified by YG cultivating farmers.In this year of data collection, no adverse effects have been identified by YG cultivating farmers.
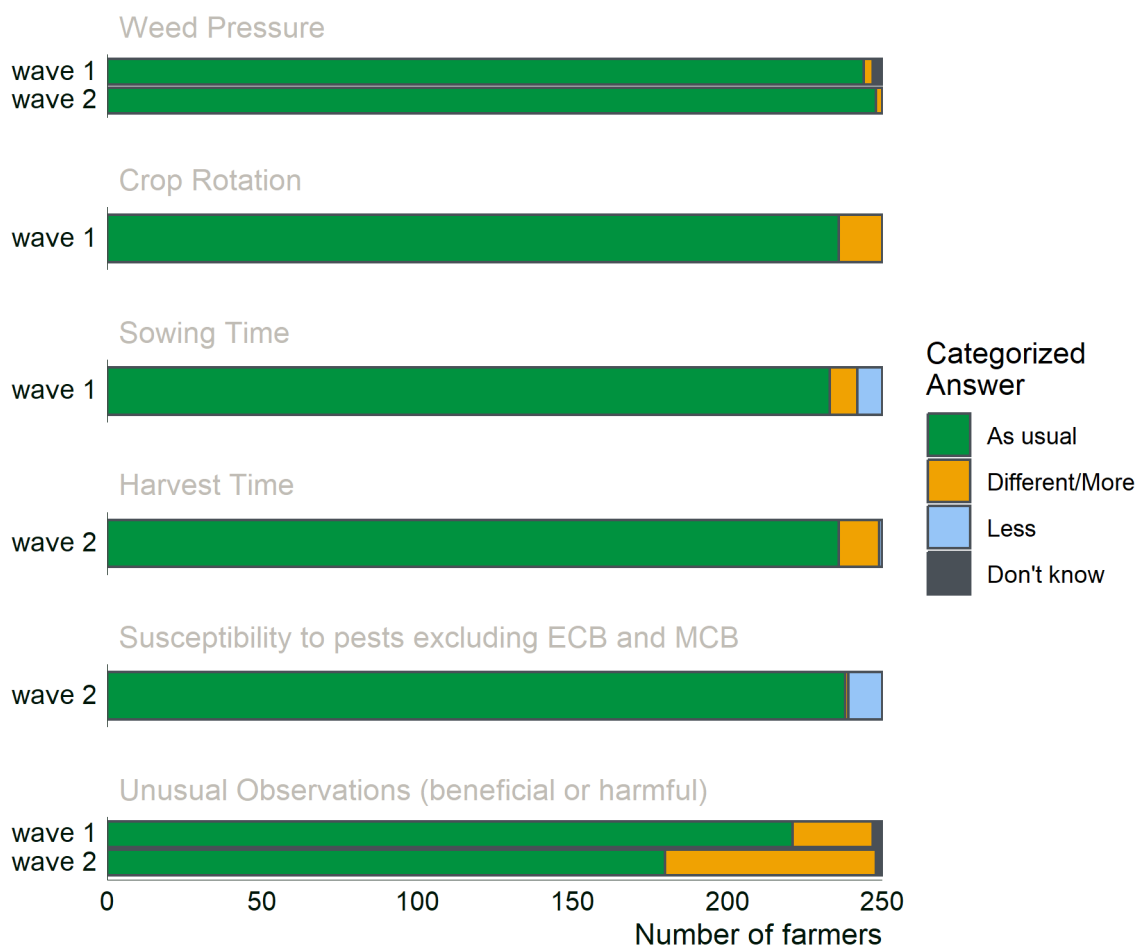
Figure 20: Overview for all results regarding direct comparisons YG vs. CV maize of monitoring characters in the 2022 season

Table 57: Overview for all results regarding direct comparisons YG vs. CV maize of monitoring characters in the 2022 season

Monitoring character	Wave	Answer	Categorized Answer	Frequency	Percentage
Weed Pressure	1	Yes	Different/More	3	1.2%
		No	As usual	244	97.6%
		Don't know	Don't know	3	1.2%
	2	Yes	Different/More	2	0.8%
		No	As usual	248	99.2%
		Don't know	Don't know	0	0.0%
Crop Rotation	1	As usual	As usual	236	94.4%
		Changed	Different/More	14	5.6%
Sowing Time	1	Earlier	Less	8	3.2%
		No difference	As usual	233	93.2%
		Later	Different/More	9	3.6%
Harvest Time	2	Earlier	Less	1	0.4%
		No difference	As usual	236	94.4%
		Later	Different/More	13	5.2%
Susceptibility	2	More Susceptible	Different/More	1	0.4%
		As usual	As usual	238	95.2%
		Less Susceptible	Less	11	4.4%
Unusual Observations (beneficial or harmful)	1	Yes	Different/More	26	10.4%
		No	As usual	221	88.4%
		Don't know	Don't know	3	1.2%
	2	Yes	Different/More	68	27.2%
		No	As usual	180	72.0%
		Don't know	Don't know	2	0.8%

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Appendix

Farmer Questionnaire

Product: insect protected YieldGard® maize

Farmer personal and confidential data

Farmer's name:	[free text]
Farmer's address:	[free text]
City:	[harmonised text]
Postal code:	[harmonised text]
Interviewer's name:	[harmonised text]
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.

Metadata

	Metadata
Year	[Choose from list]
Event	[Choose from list]
Partner*	[Choose from list]
Country	[Choose from list]
Interviewer**	[Choose from list]
Farmer (unique ID for each farmer)	[Number]

* Partner is the organization that implements the survey.

** Interviewer is the employee from the Partner that is contacting the farmers.

1 Maize growing area

1.1 Location:

Province: [Choose from List]

1.2 Size and number of maize fields:

Provide the number of fields and total area of fields planted with YieldGard® maize, conventional maize and overall, in the following table:

	YieldGard® maize	Conventional maize	Total
Number of fields	[number]	[number]	[number]
Total area of fields	[number]	[number]	[number]

1.3 Details for up to five fields:

Randomly choose
- up to five of the fields where YieldGard® maize was planted this season and
- up to five of the fields where conventional maize was planted this season

and provide the following details:

	Name or ID/ Location/ Municipality	YieldGard® maize variety planted this season
YG Field #1	[free text]	[harmonised text]
YG Field #2	[free text]	[harmonised text]
YG Field #3	[free text]	[harmonised text]
YG Field #4	[free text]	[harmonised text]
YG Field #5	[free text]	[harmonised text]

	Name/ Location/ Identifier	Conventional maize variety planted this season
Conv Field #1	[free text]	[harmonised text]
Conv Field #2	[free text]	[harmonised text]
Conv Field #3	[free text]	[harmonised text]
Conv Field #4	[free text]	[harmonised text]
Conv Field #5	[free text]	[harmonised text]

If no conventional maize field was planted:
You did not plant conventional maize this season. However, throughout this questionnaire you will be asked to compare different aspects of your YieldGard® maize to that of conventional maize. Tell us what conventional maize you will use for the comparisons:
[Choose: „Conventional maize planted by neighbouring farmers"/„Conventional maize planted on my farm last year"/"other"]

If „other" was chosen as an answer:
Specify what is meant by „other": [free text]

At this point in the questionnaire a step must be taken in the background: One of the YG Fields and one of the Conv Fields should be picked randomly. These randomly chosen fields should then replace the YG Field #X and Conv Field #X for all questions below. This guarantees that for those questions which should specifically be answered regarding a single field, this single field is drawn (somewhat) randomly for each farmer.

Chosen YieldGard field: [Choose: YG Field #1/ YG Field #2/ YG Field #3/ YG Field #4/ YG Field #5]

Chosen Conv field: [Choose: Conv Field #1/ Conv Field #2/ Conv Field #3/ Conv Field #4/ Conv Field #5/ Neighbour / Last Year / Other]

1.4 Local insect pest pressure in maize fields:

How is the general insect pest pressure in all maize fields in the current season?
[Choose: Low/As Usual/High]

If "High" is chosen as an answer:
List up to five insect pests prevalent in the maize fields

1. [harmonised text]
2. [harmonised text]
3. [harmonised text]
4. [harmonised text]
5. [harmonised text]

How is the corn borer pressure in all maize fields in the current season?
[Choose: Low/As Usual/High]

If "High" is chosen as an answer:
Indicate the corn borer species prevalent in the maize fields
[Choose: European corn borer (*Ostrinia nubilalis*) / Mediterranean corn borer (*Sesamia spp*)/ Cannot differentiate]

1.5   Local weed pressure in maize fields:

List up to five of the most typical weeds in all maize fields:

1. [harmonised text]
2. [harmonised text]
3. [harmonised text]
4. [harmonised text]
5. [harmonised text]

Where there any unusual observations regarding weeds in YieldGard® maize compared to conventional maize?
[Choose: Yes/No/Don't know]

If „Yes" was chosen as an answer:
Specify the unusual observations: [free text]

2 Observations on integrated pest management practices in YieldGard® maize (compared to conventional maize)

2.1 Crop rotation:

For YG Field #X (as listed in 1.3), list the crops planted during the last two years (with one or two plantings per year, respectively):

Indicate year and planting period [Early season (Feb-Apr)/ Late season (May-Jul)]	Crop planted on YG Field #X	If Crop was maize, was it YieldGard® or conventional?	If Crop was maize, name the variety
YYYY/Planting period	[harmonised text]	[Choose: YieldGard/ Conventional]	[harmonised text]
YYYY/Planting period	[harmonised text]	[Choose: YieldGard/ Conventional]	[harmonised text]
YYYY/Planting period	[harmonised text]	[Choose: YieldGard/ Conventional]	[harmonised text]
YYYY/Planting period	[harmonised text]	[Choose: YieldGard/ Conventional]	[harmonised text]

For Conv Field #X (as listed in 1.3), list the crops planted during the last two years (with one or two plantings per year, respectively):

Indicate year and planting period [Early season (Feb-Apr)/ Late season (May-Jul)]	Crop planted on Conv Field #X	If Crop was maize, was it YieldGard® or conventional?	If Crop was maize, name the variety
YYYY/Planting period	[harmonised text]	[Choose: YieldGard/ Conventional]	[harmonised text]
YYYY/Planting period	[harmonised text]	[Choose: YieldGard/ Conventional]	[harmonised text]
YYYY/Planting period	[harmonised text]	[Choose: YieldGard/ Conventional]	[harmonised text]
YYYY/Planting period	[harmonised text]	[Choose: YieldGard/ Conventional]	[harmonised text]

How was your crop rotation for YieldGard® maize compared with conventional maize?
[Choose: As usual/Changed]

If „Changed" was chosen as an answer:
Specify why the crop rotation was changed: [free text]

2.2 Time of maize sowing

For YG Field #X (as listed in 1.3), when did you sow?
[Date-start – Date-end]

For Conv Field #X (as listed in 1.3), when did you sow?
[Date-start – Date-end]

Did you sow YieldGard® maize earlier or later than conventional maize?
[Choose: Earlier/Later/No difference]

If „Earlier" or „Later" was chosen as an answer:
Why did you sow YieldGard® maize earlier or later than conventional:

[free text]

2.3 Time of maize harvest

For YG Field #X (as listed in 1.3), when did you harvest?
[Date-start – Date-end]

For Conv Field #X (as listed in 1.3), when did you harvest?
[Date-start – Date-end]

Did you harvest YieldGard® maize earlier or later than conventional maize?
[Choose: Earlier/Later/No difference]

If „Earlier" or „Later" was chosen as an answer:
Why did you harvest YieldGard® maize earlier or later than conventional:
[free text]

2.4 Corn borer control practices

For YG Field #X (as listed in 1.3), name the corn borer control practices you applied:

	Was applied	If „Yes", name up to five	If „Yes", comment
Insecticides	[Choose: Yes/No]	1. [harmonised text] 2. [harmonised text] 3. [harmonised text] 4. [harmonised text] 5. [harmonised text]	1. [free text] 2. [free text] 3. [free text] 4. [free text] 5. [free text]
Biocontrol treatments	[Choose: Yes/No]	1. [harmonised text] 2. [harmonised text] 3. [harmonised text] 4. [harmonised text] 5. [harmonised text]	1. [free text] 2. [free text] 3. [free text] 4. [free text] 5. [free text]
Other	[Choose: Yes/No]	1. [harmonised text] 2. [harmonised text] 3. [harmonised text] 4. [harmonised text] 5. [harmonised text]	1. [free text] 2. [free text] 3. [free text] 4. [free text] 5. [free text]
None	[Choose: Yes/No]	-	[free text]

For Conv Field #X (as listed in 1.3), name the corn borer control practices you applied:

	Was applied	If „Yes", name up to five	If „Yes", comment
Insecticides	[Choose: Yes/No]	1. [harmonised text] 2. [harmonised text] 3. [harmonised text] 4. [harmonised text] 5. [harmonised text]	1. [free text] 2. [free text] 3. [free text] 4. [free text] 5. [free text]
Biocontrol treatments	[Choose: Yes/No]	1. [harmonised text] 2. [harmonised text] 3. [harmonised text] 4. [harmonised text] 5. [harmonised text]	1. [free text] 2. [free text] 3. [free text] 4. [free text] 5. [free text]
Other	[Choose: Yes/No]	1. [harmonised text] 2. [harmonised text] 3. [harmonised text] 4. [harmonised text] 5. [harmonised text]	1. [free text] 2. [free text] 3. [free text] 4. [free text] 5. [free text]
None	[Choose: Yes/No]	-	[free text]

What is the overall efficacy of the GM varieties on the two insects controlled by YieldGard® maize?

	Overall efficacy	Additional Comment
European corn borer (Ostrinia nubilalis)	[Choose: Very good/ Good/ Weak/ Don't know]	[free text]
Mediterranean corn borer (Sesamia spp)	[Choose: Very good/ Good/ Weak/ Don't know]	[free text]

If „Weak" was chosen as an answer:
Specify the reasons for the overall weak efficacy of the YieldGard® varieties:
[free text]

3 Observations on development and performance of YieldGard® maize (compared to conventional maize)

3.1 Susceptibility of YieldGard® maize to OTHER insect pests

Excluding European corn borer (Ostrinia nubilalis) and Mediterranean borer (Sesamia spp), what was the overall susceptibility of YieldGard® maize on YG Field #X compared to conventional maize on Conv Field #X?
[Choose: As usual/More susceptible/Less susceptible]

If „More susceptible/Less susceptible" was chosen as an answer:
List up to five insect pests and compare the susceptibility of YieldGard® maize to that of conventional maize:

	Insect pest	Compared to conventional maize on Conv Field #X, YieldGard® maize on YG Field #X was	Additional comment
Insect pest #1	[harmonized text]	[Choose: More Susceptible/ Less susceptible]	[free text]
Insect pest #2	[harmonized text]	[Choose: More Susceptible/ Less susceptible]	[free text]
Insect pest #3	[harmonized text]	[Choose: More Susceptible/ Less susceptible]	[free text]
Insect pest #4	[harmonized text]	[Choose: More Susceptible/ Less susceptible]	[free text]
Insect pest #5	[harmonized text]	[Choose: More Susceptible/ Less susceptible]	[free text]

To control the above insect pests, indicate the number of treatments applied to YieldGard® maize on YG Field #X and to conventional maize on Conv Field #X

	Number of treatments applied to		
	YieldGard® maize on YG Field #X	conventional maize on Conv Field #X	Additional comment
Insecticide	[number]	[number]	[free text]
Biocontrol	[number]	[number]	[free text]
Other	[number]	[number]	[free text]

3.2 Characteristics of YieldGard® maize in the field

Are there any unusual observations on the growth and performance of the YieldGard® maize on YG Field #X compared to conventional maize on Conv Field #X (e.g. emergence, incidence of stalk/root lodging, maturity, yield)?
[Choose: Yes/No/Don't Know]

If „Yes" was chosen as an answer:
Specify unusual observations on the growth and performance of the YieldGard® maize compared to conventional maize: [free text]

3.3 Any additional remarks or observations due to YieldGard® maize

List any unusual observations due to YieldGard® maize on YG Field #X compared to conventional maize on Conv Field #X (e.g. benefits / unusual harms to animals and the environment)
[free text]

4 Implementation of Bt-maize specific measures

4.1 Good agricultural practices for YieldGard® maize

Have you been informed on good agricultural practices for YieldGard® maize?
[Choose: Yes/No]

If „Yes" was chosen as an answer:
Would you evaluate these technical sessions as:
[Choose: Very useful/Useful/Not useful]

4.2 Seed

Was the seed bag labelled with information that the seed is genetically modified YieldGard® maize?
[Choose: Yes/No/I did not pay attention]

Did the seed bag labelling include recommendations on how to cultivate genetically modified YieldGard® maize?
[Choose: Yes/No/I did not pay attention]

Did you comply with the label recommendations on seed bags?
[Choose: Yes/No]

If „No" was chosen as an answer:
Specify why you did not comply with the label recommendations
[free text]

4.3 Prevention of insect resistance

Did you plant a refuge in accordance with the technical guidelines?
[Choose: Yes/No because the total area of YieldGard® is ≤ 5 ha/No]

If „No" was chosen as an answer:
Specify why you did not plant a refuge although having planted > 5 ha YieldGard® maize on your farm
[free text]

4.4 Questions related to sustainability of YieldGard® maize technology

How many years have you cultivated YieldGard® maize varieties? [number]

What are the reasons for you to cultivate YieldGard varieties? [free text]

What is your balance of the use of GM maize? (Regarding insecticide application, production and quality of grain or silage, etc.) [free text]

What is the economic balance of using GM maize? (Indicate which factor most affected the increase/decrease of revenue and expenses) [free text]

Are you going to plant GM maize again?
[Choose: Yes/No]

Please explain the decision reason(s) [free text]