ANNEX 7

GENERAL SURVEILLANCE OF AMFLORA POTATOES USING A FARM QUESTIONNAIRE

BioMath

APPLIED STATISTICS AND INFORMATICS
IN LIFE SCIENCES

General surveillance of Amflora potatoes using a farm questionnaire

Biometrical report for the 2010 planting season

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Summary

EH92-527-1 potato (variety Amflora) is a starch potato with increased amylopectin content in the tuber starch for which BASF Plant Science had submitted a notification for placing on the market according to Directive 2001/18/EC [4]. In March 2010, following Commission Decision 2010/135/EU [8], the Swedish Board of Agriculture issued the consent for cultivating amylopectin potato EH92-527-1 in the European Union. The consent requires the implementation of the Amflora monitoring plan comprising General Surveillance (GS), Case-Specific Monitoring and the Identity Preservation (IP) system.

In the 2010 growing season, Amflora potato was cultivated commercially at locations in the Czech Republic, Germany and Sweden for seed and starch potato production. To meet the requirements of GS, as part of the IP system general observations were made throughout the vegetation period on cultivation practices, general characteristics of Amflora, its susceptibility to pests and diseases, its growth and development as well as the occurrence of wildlife, and captured in the format of a farm questionnaire. A total of 26 farm questionnaires addressing the different monitoring characters were collected from all growers participating in the IP system for cultivation of Amflora potato, and analysed.

An evaluation of the monitoring characters that were rated $as\ usual$ or were deviating from what is in general observed for potato cultivation by the growers allowed the following conclusions. For most characters Amflora performed as any conventional potato variety (e.g. presence of wildlife, success of pest or disease control, phenotype). Other deviations (e.g. earlier maturity, later harvest, slower development, lower yield) were clearly a consequence of adverse weather conditions and other influencing factors, and none of them were considered as adverse effects.

Chapter 1

Introduction

Post-market monitoring of genetically modified plants under cultivation is mandatory in the EU. According to Annex VII of Directive 2001/18/EC [4] of the European Parliament and of the Council on the deliberate release into the environment of genetically modified plants, the objective of the monitoring is to:

- confirm that any assumption regarding the occurrence and impact of potential adverse effects of the GMO or its use in the environmental risk assessment are correct, and
- identify the occurrence of adverse effects of the GMO or its use on human health or the environment, which were not anticipated in the environmental risk assessment.

For EH92-527-1 potato (variety Amflora) the consent issued by the Swedish Board of Agriculture following Commission Decision 2010/135/EU [8] requires the implementation of the Amflora monitoring plan comprising General Surveillance (GS), Case-Specific Monitoring and the Identity Preservation (IP) system.

The objective of this biometrical report is to present the results of the analysis of the monitoring data on GS that were collected for the 2010 Amflora growing season via the Amflora field-plot card-indices and the Amflora farm questionnaire..

Chapter 2

Methodology

The aim of General Surveillance (GS) is to identify potential adverse effects of cultivating Amflora potatoes that were not identified during the pre-market risk assessment. The risk assessment and GS relate to the conservation of protection goals such as biodiversity, sustainable agriculture, plant, human and animal health as well as soil function.

From the protection goals and the outcome of the pre-market risk assessment several monitoring characters that might be influenced by the cultivation of Amflora were derived. In GS data on these monitoring characters are collected. Additionally data on several other influencing factors like environmental conditions, agronomic measures or field specific characteristics are collected to separate their influence from the possible effect of genetic modification.

2.1 Definition of monitoring characters

The main focus of the tools for GS is the survey of several monitoring characters that were derived from protection goals. Table 2.1 provides an overview on the monitored characters and the protection goals that are addressed.

The data for the monitoring characters were surveyed on a qualitative scale by asking farmers for their assessment of the Amflora potato cultivation compared to the cultivation of conventional starch potatoes. For most questions, three possible categories of answers were given: $As\ usual$, $Plus$ (e.g. delayed, better, more) or $Minus$ (e.g. accelerated, poorer or less) (see Table 2.2). Mention of $Minus$ or $Plus$ implies no valuation, it is used to define the direction of the difference.

Table 2.1: Monitoring characters and corresponding protection goals

Monitoring characters	**Protection goals**
Sprouting	Plant health
Time to emergence	Plant health
Plant growth	Plant health, soil function
Phenotype	Plant health, soil function
Weed pressure	Sustainable agriculture, soil function, biodiversity
Success of weed control	Sustainable agriculture, soil function
Occurrence of pests	Plant health, biodiversity
Pest susceptibility	Plant health
Success of pest control	Sustainable agriculture
Occurrence of disease	Plant health
Disease susceptibility	Plant health
Late blight pressure	Sustainable agriculture, soil function, biodiversity
Success of late blight control	Sustainable agriculture
Success of disease control	Sustainable agriculture
Maturity	Sustainable agriculture, plant health
Date of harvest	Sustainable agriculture, plant health
Yield	Sustainable agriculture, soil function
Presence of wild animals	Biodiversity
Additional observations	All

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

Table 2.2: Monitoring characters and their categories

Monitoring characters - observations of Amflora	*Minus*	*As usual*	*Plus*
Sprouting	Poorer	As usual	Better
Time to emergence	Accelerated	As usual	Delayed
Plant growth	Accelerated	As usual	Delayed
Phenotype		As usual	Different
Weed pressure	Less	As usual	More
Success of weed control	Poorer	As usual	Better
Occurrence of pests	Fewer	As usual	More
Pest susceptibility	Less	As usual	More
Success of pest control	Poorer	As usual	Better
Occurrence of disease	Fewer	As usual	More
Disease susceptibility	Less	As usual	More
Late blight pressure	Less	As usual	More
Success of late blight control	Poorer	As usual	Better
Success of disease control	Poorer	As usual	Better
Maturity	Accelerated	As usual	Delayed
Date of harvest	Accelerated	As usual	Delayed
Yield	Less	As usual	More
Presence of wild animals	Less	As usual	More

2.2 Definition of influencing factors

Additionally, several possible influencing factors were surveyed to assess the local cultivation and environmental conditions and to determine causes of potential effects relating to the monitoring characters other than genetic modification (Table 2.3).

Table 2.3: Monitored influencing factors

Type	Factor
Site	Soil quality rating, humus content, soil type, results of soil test, soil fertility, rainfall, temperature, soil temperature during planting
Cultivation	Crop rotation (inter crop), tillage, seed category, quality and quantity, planting method, date of planting and forming ridges, irrigation, fertilization, use of herbicides, insecticides and fungicides, pest, disease and weed control measures, haulm killing and harvest

2.3 Tools for General Surveillance

As written in article 4.1(d) of the Commission Decision concerning the placing on the market of Amflora [8] BASF Plant Science extended the existing monitoring networks to include all growers of Amflora by two tools: the field-plot card-index and the farm questionnaire.

2.3.1 Field-plot card-index

BASF Plant Science introduced an Identity Preservation (IP) system to assure the quality of the Amflora potato through a system of tracking and records. Farmers are asked to complete field-plot card-indices (Form 5) in order to collect and document all information relevant to the cultivation of Amflora potato. The field-plot card-index also contains a section on GS where the farmer should describe his general observations during the vegetation period. The questions asked here mainly concentrated on assessments of environmental and agronomic factors to obtain data on influencing factors possibly having an effect on Amflora cultivation independent from the genetic modification.

Farmers were asked to assess weather conditions (to be $on\ average$ or $different$) and environmental conditions as well as agronomic characters ($as\ usual$ or $different$). Observed differences

should be further specified. Responses describing unusual observation could be further viewed to identify the cause for thr differences.

2.3.2 Farm questionnaire

The farm questionnaire as a tool for GS was first developed in a pilot study by the German Federal Biological Research Center for Agriculture and Forestry (BBA, now JKI), maize breeders and statisticians (Schmidt *et al.* 2008 [10]). A revised version of the original farm questionnaire is used for GS of GM maize cultivation in Europe. The farm questionnaire for maize was adapted for the purpose of GS relating to the cultivation of of Amflora potatoes under an IP system, tested and improved in a three-year period prior to the first commercial cultivation of Amflora potatoes in 2010.

The questionnaire consists of five parts for collecting monitoring characters, influencing factors and other background data. The sections of the questionnaire are:

0 Personal details
1 Farm
2 Location
  2.1 Soil
  2.2 Weather
3 Cultivation measures
  3.1 Cultivation, beginning after harvest of preceding crop
  3.2 Data relating to seed potatoes
  3.3 Planting / Cultivation / Development
  3.4 Fertilization
  3.5 Chemical weed control
  3.6 Occurrence of pests / treatment
  3.7 Occurrence of disease / treatment
  3.8 Use of herbicides for haulm killing
  3.9 Harvest
4 Presence of wild animals
5 Additional comments

Section 1 records general, basic data of the field as size of the farm, cultivation area and which potato varieties were cultivated. Section 2 summarises data about location, the soil and weather in the region of cultivation. Section 3 collects data on Amflora cultivation practices and observations. In 9 subsections the farmer is asked about crop rotation, planting, growth and development of Amflora, irrigation, fertilization, weed, disease and pest occurrence and control, harvest and yield. In Section 4 the farmer is asked to answer a question on the occurence of wildlife. In section 5 the farmer can provide comments on additional observations.

In Section 3 and 4 monitoring characters (see table 2.1) as well as influencing factors (see table 2.3) are collected. Questions on monitoring characters are formulated in such a way that farmers give their assessment on the behavior of the GM potato compared to conventional (starch) potatoes, and therefore with three possible answers ($Plus$/ $As\ usual$/ $Minus$). The $Plus$ and $Minus$ answers

indicate a deviation from experiences in cultivation of conventional (starch) potatoes. Each $Plus$ or $Minus$ assessment must be provided with an explanation for this assessment. High frequencies ($> 10\%$ of answers from all farmers for respective question) of $Plus$ or $Minus$ answers would indicate possible effects.

2.3.3 Coding of personal data

In each questionnaire the personal details were coded according to the following format:

1	9	-	S	T	-	A	M	-	2	0	1	0	-	C	Z	-	0	1	-	0	1
Event Code			Crop Code			Variety Code			Year Code					Country Code			Farmer code			Area Code	

Codes:

Event: 19 BPS-25271-9

Crop: ST *Solanum tuberosum*

Variety: AM Amflora

Country: SE Sweden
CZ Czech Republic
DE Germany

Farmer: ascending counter for farmers within the country

Area: ascending counter within the farmer

(e.g. 19-ST-AM-2010-CZ-01-01).

The data were stored and handled in accordance with the Data Protection Directive 95/46/EC [3].

2.3.4 Interviews

The field-plot card-indices were completed by the farmers throughout the growing season whereas for completing the farm questionnaires individual face-to-face interviews were performed. The quality of the interviewers' work determines the data quality of the questionnaires. Therefore only well trained staff should perform the interviews with the farmers. In 2010, the total number of locations where Amflora was cultivated in the Czech Republic, Germany and Sweden was 26. In order to avoid misinterpretations of the questions posed in the farm questionnaire, BioMath representatives with experience and background in using farm questionnaires for GS interviewed all participating farmers in the three member states.

2.4 Sample size determination

As written in article 4.1(d) of the Commission Decision concerning the placing on the market of Amflora [8] **all** growers of Amflora should be included into GS on the basis of the questionnaires and the IP system. That means that for the survey no sample will be drawn but a total survey (census) will be performed. Therefore no sample size determination is required.

2.5 Definition of baselines, effects and statistical test procedure

Normally - if there is no effect of Amflora cultivation or other influencing factors, and the question in the farm questionnaire being well formulated and unambiguous - one would expect a predominant part of the farmers assessing the situation to be $As\ usual$ for a certain monitoring character and only few answers $Minus$ or $Plus$ which are expected to be balanced in both $Minus$ and $Plus$ direction. Therefore the 'no effect' or 'baseline' situation may be characterised by assigning low probabilities - e.g. 5% - to the answers $Minus$ and $Plus$ and high probability - 90% - to the answer $As\ usual$ (Figure 2.1).

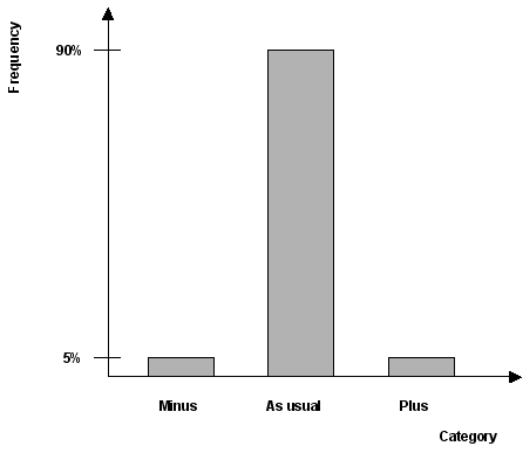

Figure 2.1: Balanced (expected) baseline distribution of the farmers´ answers (no effect)

An effect of the cultivation of Amflora or any other influencing factor would arise in a greater percentage of $Plus$ or $Minus$ answers, indicating an increase of the corresponding probability. An increase of the probability for $Plus$ or $Minus$ answers for 5% or more above the baseline level of 5% is considered as relevant. Consequently, a threshold of 10% for the probabilities of $Plus$ or $Minus$ answers is determined for identifying an effect (Figure 2.2). Graphically, an effect would be expressed by an unbalanced distribution (Figure 2.3 a and b).

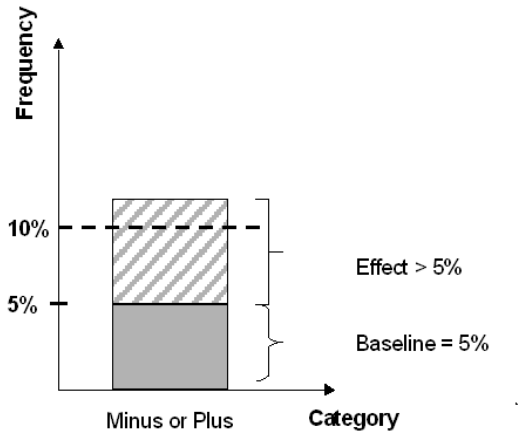

Figure 2.2: Definition of baseline distribution

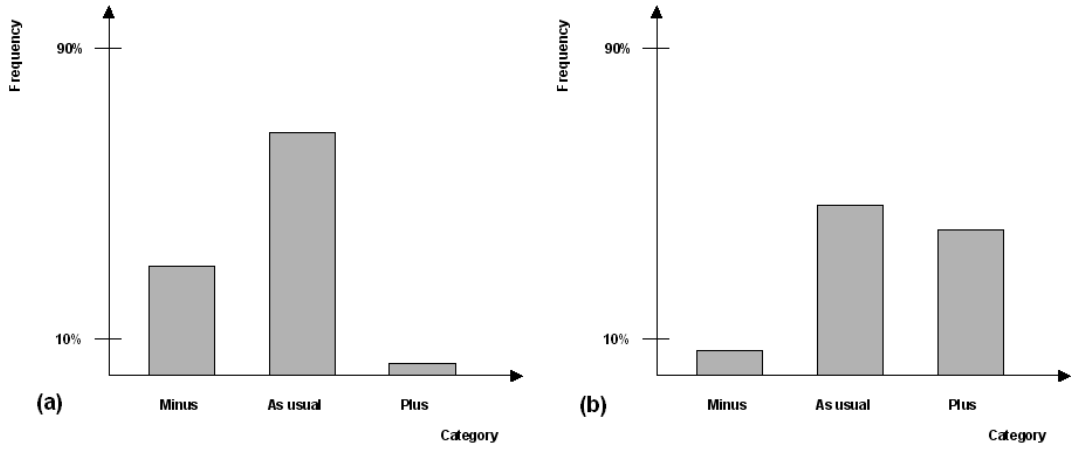

Figure 2.3: Examples for distributions of farmers' answers indicating an effect (a) $> 10\%$ in category $Minus \rightarrow$ effect, (b) $> 10\%$ in category $Plus \rightarrow$ effect

In case of Amflora monitoring where all farmers are included (census) the statistical procedures concentrate on descriptive statistics. This is contrary to the sampling approach, where test procedures to infer from the sample to the whole population are applied.

To decide whether the observed frequencies of $Plus$ or $Minus$ answers indicate an effect (i.e. an increase of the corresponding probability to 10% or more), the 99% upper confidence bound for the probability is calculated with the observed frequencies (Figure 2.4)[9]. Observed frequencies are expected to be higher than this bound only with error probability 1% or less. That means that in case this bound is lower than the threshold of 10% no indication for an effect is given. The assumption that the true probability equals or is less than the confidence bound will be correct with error probability 99%.

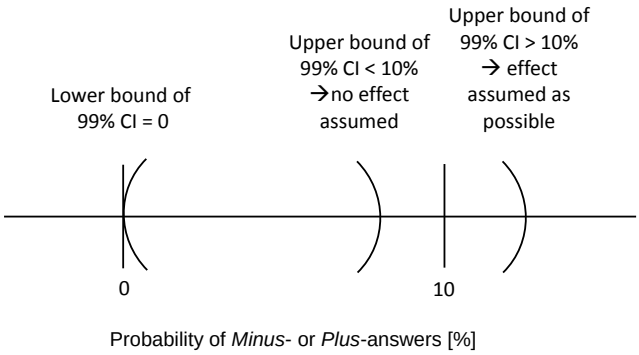

Figure 2.4: Confidence interval for the probability of $Plus$- or $Minus$-anwers

In case of sample sizes smaller than 45 the confidence bound exceeds the threshold of 10%, even if no answer was $Plus$ or $Minus$. In 2010, with 26 questionnaires, the 99% upper confidence bound for such probability of a $Plus$ (or $Minus$, resp.) answer will be 16%. Obviously it is not justified to assume in this case an indication for an effect and one can only decide with a higher error probability level (e.g. 10%).

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

1. The frequencies of the farmers‘ answers for the three categories and the corresponding confidence intervals (CI) are calculated. The calculation of absolute and relative frequencies is done both on the basis of all and on the basis of valid answers. When farmers gave no statement, these answers are accounted as missing values and therefore not considered valid. As a consequence, the "valid percentages" state the proportions of the several categories of an answer that are really known, whereas the "percentages" only specify the proportions of the categories within the whole answer spectrum, including no answers.

2. The frequencies of $Plus$ and/or $Minus$ answers and their corresponding 99% upper confidence bound are compared with the threshold of 10%. If the confidence bound does not

exceed 10%, no effect is assumed, otherwise an effect is assumed as possible.

3. Where an effect is indicated, the effect must be interpreted (adverse/ beneficial).
4. Where an adverse effect is identified, the cause of the effect has to be ascertained (Amflora cultivation, other influencing factors).
5. Identification of adverse effects potentially caused by Amflora cultivation requires further examinations.

2.6 Data management and quality control

The data from field-plot card-indices and farm questionnaires were stored in two separate SPSS[1]-files. For each question a variable was defined by a variable name and a variable label (short description of the question). The variables were specified according to their type (qualitative or quantitative), format etc. Missing values were defined (0: no statement, -1: not readable). For not readable entries in the questionnaires, queries were formulated and the field representatives or farmers were asked for explanation. These entries in the file were corrected. For quantitative variables (e.g. total potato area in ha) the real values from the questionnaire were taken for the file, for qualitative variables the possible parameter values (e.g. $Plus/As\ usual/Minus$) were defined and coded (and only the code values were taken).

The file for the field-plot card-indices contains 180 variables for 24 cases (in two cases one farmer in Sweden completed one field-plot card-index to cover two neighbouring fields) and the file for the farm questionnaire contains ca 280 variables for 26 cases for the 2010 field season.

A quality control check of all cases for the 2010 field season looked at each variable for completeness (unacceptable missing values like -1: unreadable) and correctness (quantitative values within a plausible min-max range, qualitative values only with acceptable parameter values). Plausibility control checked the variable values for their contents, both to find incorrect answers and to prove the logical connections between different questions. It also looked for the consistency between $Plus/Minus$ answers and specifications, i.e. whether all these answers were provided with a specification and whether the specifications really substantiated the $Plus/Minus$ answers.

[1] SPSS [11] is a computer program used for statistical analysis.

Chapter 3

Results

3.1 Field-plot card-index

The 24 Field-plot card-indices were completed by the Amflora cultivating farmers during Oktober 2010.

The information collected in the field-plot card-index relating to general observations throughout the vegetation period was evaluated and is presented in the following section.

3.1.1 General observations during the vegetation period

The farmers should characterise their general observations on rain fall, temperature, soil fertility, weed management, treatment against *Phytophthora infestans*, parasites and plant growth and development (e.g. emergence, flower development).

The farmers were asked to give information about the level of the annual rainfall. In 29.2% (7/24) of the cases the farmers announced that the average annual rainfall varied between 600 and 700 mm in mean 657.14 mm per year. Another question asked the farmers to characterise the rain fall during the vegetation period. All farmers did answer this question. In 83.3% (20/24) of the cases it was $above\ or\ below\ average$ (Table 3.1). The differences were specified in 2 cases as 600 mm rain during the vegetation period, in 5 cases as 650 mm rain during the vegetation period and in one case the farmer stated that the rain fall was "*during vegetation period below average*".

Table 3.1: Rain fall in 2010

		Frequency	Percent	Valid percent
Valid	average	4	16.7	16.7
	above or below average	20	83.3	83.3
Total		24	100.0	100.0

In all cases the farmers stated the temperature to be $as\ usual$ during the vegetation period. The soil fertility was characterised in 95.8% (23/24) of all cases to be $as\ usual$. In one case the farmer gave no statement on the soil fertility.

In all cases the farmers characterised the weed management. In 87.5% (21/24) of the cases it was $as\ usual$, in 12.5% (3/24) of the cases the farmers stated it to be $different$ (Table 3.2). In these 3 cases the farmers described that there occured "*more weeds in general this year*".

Table 3.2: Weed management in 2010

		Frequency	**Percent**	**Valid percent**
Valid	as usual	21	87.5	87.5
	different	3	12.5	12.5
Total		24	100.0	100.0

The treatment against *Phytophthora infestans* was also characterised for all cases. In 87.5% (21/24) of them the farmers stated it to be $as\ usual$, in 12.5% (3/24) the farmers marked it to be $different$ (Table 3.3). The differences was describes in these 3 cases by the farmers with the comment: "*more Phytophthora in general this year, we controled it via spraying*".

Table 3.3: Treatment against *Phytophthora infestans* in 2010

		Frequency	**Percent**	**Valid percent**
Valid	as usual	21	87.5	87.5
	different	3	12.5	12.5
Total		24	100.0	100.0

Statements on parasites were given in 95.8% (23/24) of the cases. In 82.6% (19/23) of them the farmer declared it to be $as\ usual$, in 17.4% (4/23) of the cases parasites were $different$ (Table 3.4). The specifications for the differences were: "*more parasites in general this year*" (3 cases) and "*very low pressure of aphids*" (one case).

Table 3.4: Parasites in 2010

		Frequency	Percent	Valid percent
Valid	as usual	19	79.2	82.6
	different	4	16.7	17.4
	Total	23	95.8	100.0
Missing	no statement	1	4.2	
Total		24	100.0	

The plant growth and development (e.g. emergence, flower development) was characterised in all cases. In 91.7% (21/24) of them the farmers marked it to be $as\ usual$, in 8.3% (2/24) the farmers stated it to be $different$ (Table 3.5). In those two cases the farmers descibed that there occured "*Rhizoctonia solani*".

Table 3.5: Plant growth and development in 2010

		Frequency	Percent	Valid percent	Upper bound of 99% CI
Valid	as usual	22	91.7	91.7	
	different	2	8.3	8.3	30.67
Total		24	100.0	100.0	

3.2 Farm questionnaire

The general observations as decribed by the farmers in the field-plot card index was captured in the extended format of the Amflora farm questionnaire. For this purpose a series of interviews was conducted with all farmers in February 2011. Quality and plausibility control confirmed that all 26 questionnaires could be considered for analysis.A detailed analysis of the parameters surveyed with the farm questionnaire in 2010 is given in the following sections.

3.2.1 Farm

In 2010, 26 questionnaires were surveyed in the 3 member states of the EU where cultivation of Amflora for starch production or seed multiplication took place. These comprised 18 questionnaires (69.2%) for locations in Sweden, 7 (26.9%) for locations in the Czech Republic and one (3.8%) for Germany.

The size of farm varied between 105.0 and 2550.0 ha. The farmers used between 6.94 and 260.0 ha of their farm for cultivating potatoes at all and between 6.94 and 50.0 ha of their farm for cultivating Amflora potatoes (Table 3.6). The sizes of the individual fields used for Amflora cultivation ranged between 0.59 and 46.02 ha.

Table 3.6: Farm data of surveyed fields in 2010

	N	mean	minimum	maximum
Size of farm [ha]	26	843.5769	105.00	2550.00
Total area of all potatoes [ha]	26	68.6919	6.94	260.00
Total area of Amflora potatoes [ha]	26	24.6150	6.94	50.00
Size of surveyed field [ha]	26	9.0192	0.59	46.02

Farmers specified to cultivate conventional potato varieties: Fontane (13), Early Puritan (7), King Edward (7), Mandel (7), Maritema (4), Lady Claire (3), Adela (2) and Saturna (2). At 3 farms where 6 of the surveyed fields were situated no conventional potato variety was planted.

At one farm, with two of the surveyed fields (7.7%) other starch potatoes were cultivated, but representing only one single variety.

During this survey the Amflora potato cultivation was compared with conventional cultivation of potatoes in gereral, but not explicitly with specific starch potato varieties.

3.2.2 Location

3.2.2.1 Soil

The predominant soil type was specified for all fields (Table 3.7).

Table 3.7: Predominant soil type of surveyed fields in 2010

		Frequency	Percent	Valid percent
Valid	Heavy loam	4	15.4	15.4
	Loam	4	15.4	15.4
	Loamy sand	2	7.7	7.7
	Slightly loamy sand	7	26.9	26.9
	Sand	6	23.1	23.1
	Clay and Sand	2	7.7	7.7
	Slightly loamy sand and Sand	1	3.8	3.8
	Total	26	100.0	100.0

Only for one field (3.8%) the soil quality rating (Ackerzahl) was specified (value 32). This field was situated in Germany. In Sweden and Czech Republic no rating system for soil quality exists. Not for all fields information on humus content and soil test data as pH-, P-, K-, Mg- and Mn-value were given (Table 3.8). The year of the soil test was specified for 65.4% (17/26) of the fields. For 5 fields the soil test was made in 2004, for 9 fields in 2009 and for 3 fields in 2010.

Table 3.8: Soil data of surveyed areas in 2010

	N	mean	minimum	maximum
Humus content [%]	9	3.3333	2.00	4.00
pH-Value	17	5.7353	4.90	6.40
P [mg]	17	58.2294	5.10	206.00
K [mg]	17	63.7176	2.50	223.00
Mg [mg]	17	69.4882	2.80	202.00
Mn [μg]	3	1876.67	1300.00	2196.00

At 84.6% (22/26) of all fields a test for nematodes was performed. 68.2% (15/22) of the tests were $negative$, for 31.8% (7/22) of the fields the results of the tests were not available. (In Sweden those tests are performed by the authorities and farmers are only informed in case of positive tests results.)

The soil fertility was characterised qualitatively for all fields. It was described to be $average - normal$ for 84.6% (22/26) and $above\ average - good$ for 15.4% (4/26) of the fields (Table 3.9, Figure 3.1).

Table 3.9: Soil fertility of surveyed areas in 2010

		Frequency	Percent	Valid percent
Valid	below average - poor	0	0.0	0.0
	average - normal	22	84.6	84.6
	above average - good	4	15.4	15.4
	Total	26	100.0	100.0

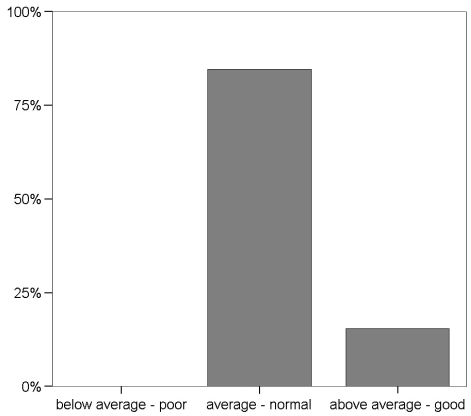

Figure 3.1: Soil fertility of surveyed areas in 2010

3.2.2.2 Weather

The farmers were asked to give information about the annual rainfall and temperature and to characterise the rainfall and the temperature during the growing season.

For 96.2% (25/26) of the fields a statement about the average annual rainfall was given. It varied between 500 and 700 mm per year in mean 574 mm. For the growing period the rainfall was specified for 42.3% (11/26) of the fields, it varied between 248 and 650 mm in mean 494.73 mm. Only for 15.4% (4/26) of the fields the averaged annual temperature was specified, it varied between 6.7 and 7.0°C in mean 6.85°C. Information on average temperature for the growing period was given only for 11.5% (3/26) of the fields to be 14°C.

The rainfall and the temperature during the growing season were characterised for all farms (Table 3.10, Figure 3.2). The overall assessment of these characterisations is that 2010 was a very wet and cold year.

Table 3.10: Characterisation of rainfall and temperature of surveyed areas in 2010

		Frequency	Percent	Valid percent
Rainfall				
Valid	below average - dry	1	3.8	3.8
	average - normal	0	0.0	0.0
	above average - damp	25	96.2	96.2
	Total	26	100.0	100.0
Temperature				
Valid	below average - cold	7	29.6	29.6
	average - normal	19	73.1	73.1
	above average - warm	0	0.0	0.0
	Total	26	100.0	100.0

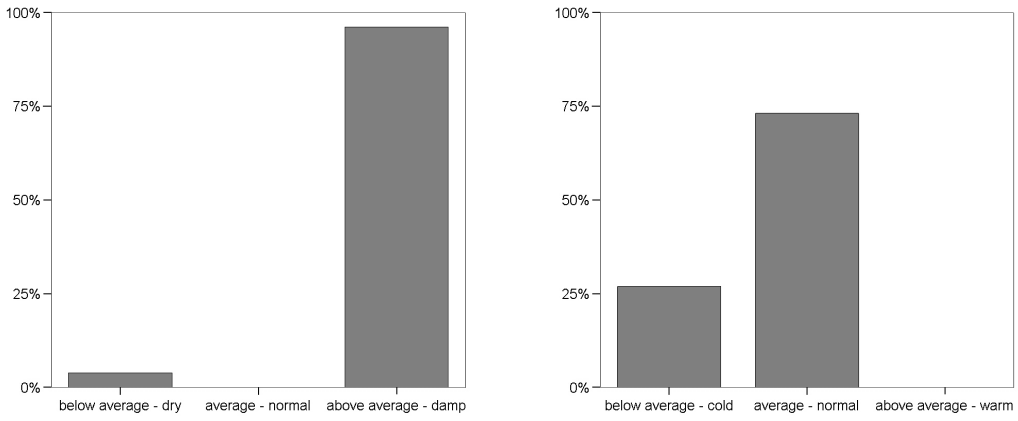

Figure 3.2: Characterisation of rainfall (left) and temperature (right) during the growing season

3.2.3 Cultivation measures

3.2.3.1 Cultivation, beginning after harvest of preceding crop

All of the interviewed farmers specified their preceding crops of the two previous years (Table 3.11). Fallow land - fallow land (42.3%) and trifolium - wheat (19.2%) were mentioned the most as preceding crops.

Table 3.11: Preceding crops in 2010

Pre-crop 2 years ago	Pre-crop last year	Frequency	Percent	Valid percent
fallow land	fallow land	11	42.3	43.3
trifolium	wheat	5	19.2	19.2
oat	wheat	2	7.7	7.7
barley	wheat	1	3.8	3.8
maize	maize	1	3.8	3.8
oat	barley	1	3.8	3.8
oil seed rape	wheat	1	3.8	3.8
oil seed rape	rye	1	3.8	3.8
rye	rye	1	3.8	3.8
wheat	triticale	1	3.8	3.8
wheat/rye	barley/oat	1	3.8	3.8
Total		26	100.0	100.0

The soil was tilled at all fields. 38.5% of the fields (10/26) were tilled in $fall$, 61.5% (16/22) in $spring$ (Table 3.12).

Table 3.12: Time of tillage in 2010

		Frequency	Percent	Valid percent
Valid	Fall	10	38.5	38.5
	Spring	16	61.5	61.5
	Total	26	100.0	100.0

96.1% (25/26) of the fields were tilled with a $turning$ method. Only one field (3.8%) was tilled with a $non - turning$ method (Table 3.13).

Table 3.13: Tillage method in 2010

		Frequency	Percent	Valid percent
Valid	Turning	25	96.1	96.1
	Non-turning	1	3.8	3.8
	Separating	0	0.0	0.0
	Total	26	100.0	100.0

At two of all fields (7.7%) an inter crop was planted, rye at one field and Phazelia at the other.

At 88.5% of the fields (23/26) another tillage prior planting was performed. The used methods were:

- rotary tilling (6 fields),
- ploughing, loosening, destoning, making rows (5 fields),
- loosening and milling (4 fields),
- making ridges (3 fields),
- harrowing and crumbeling (2 fields),
- dragging, separation of stones (2 fields) and
- milling (1 field).

3.2.3.2 Data relating to seed potatoes

The category of the used seed potatoes was specified for all fields. The farmers stated to have used seeds of the categories: A, E, SE 1, S 2, SS (Minituber) and Z.

For all fields the question on sprouting was answered. The answers were: "*yes*", "*no*", "*very low (5%)*", "*50%*" and "*100%*".

Also the tuber size (calibration) was described for all fields. It ranged between 15 and 60 mm. The quantity of seed potatoes was specified for 96.2% (25/26) of the fields between 2.2 and 3.5 t/ha in mean 2.699 t/ha. For one of the fields the quantity of seed potatoes was not described in t/ha but it was stated to be 58000 tubers/ha.

For all fields the question on treatment/coating was answered. The seed potatoes for 69.2% (18/26) of the fields were treated with Monceren, for 30.8% (8/26) of the fields the seed potatoes were not treated (Table 3.14). One of the not treated fields was situated in Sweden (planted with mini tubers), the other 7 not treated fields were situated in Czech Republic (starch production).

Table 3.14: Treatment of seed potatoes in 2010

		Frequency	Percent	Valid percent
Valid	Monceren	18	69.23	69.23
	no	8	30.77	30.77
	Total	26	100.00	100.00

3.2.3.3 Planting / Cultivation / Development

The Amflora potatoes were planted between April 19 and June 24. Ridges were formed between May 5 and June 28. The date of emergence was between May 25 and July 16 (Table 3.15). The soil temperature during planting between 7.5°C and 16°C. Amflora potatoes were planted in rows with a distance that varied between 75 and 85 cm and with a plant distance that varied between 17 and 33 cm.

Table 3.15: Data of planting, forming ridges and emergence in 2010

	N	mean	minimum	maximum
Planting date	26	31.05.2010	19.04.2010	24.06.2010
Date of forming ridges	26	02.06.2010	05.05.2010	28.06.2010
Date of emergence	26	22.06.2010	25.05.2010	16.07.2010

All farmers used the standard planting method (with plowed furrows).

The farmers stated dates for up to 4 checks for offtypes from June 27 to August 17, but all farmers said that they checked all their fields at least every second week during the growing season in general.

For all fields a statement on irrigation was given but, only one of them (3.8%) was irrigated (Table 3.16). This field was located in Germany and was irrigated partly.

Table 3.16: Irrigation in 2010

		Frequency	Percent	Valid percent
Valid	yes	1	3.8	3.8
	no	25	96.2	96.2
	Total	26	100.0	100.0

The farmers were asked to characterise the sprouting, the time to emergence, the plant growth and the phenotype of the Amflora plants in comparison to the Amflora variety description and similar varieties.

At 88.5% (23/26) of the fields the sprouting compared to the Amflora variety description and similar varieties was $as\ usual$, at 11.5% (3/26) of the fields it was $poorer$ (Table 3.17, Figure 3.3). The

farmers gave specifications for the $poorer$ sprouting. One stated that it was "*because of Rhizoctonia* ", one stated that "*due to paperworks the delivery of the seeds was very late*" and one stated that there was "*too high temperature for more than one week*" and the seed potatoes had "*long sprouts*".

Table 3.17: Characterisation of sprouting in 2010 compared to the Amflora variety description and similar varieties

		Frequency	**Percent**	**Valid percent**	**Upper bound of 99% CI**
Valid	poorer	3	11.5	11.5	33.72
	as usual	23	88.5	88.5	
	better	0	0.0	0.0	16.23
	Total	26	100.0	100.0	

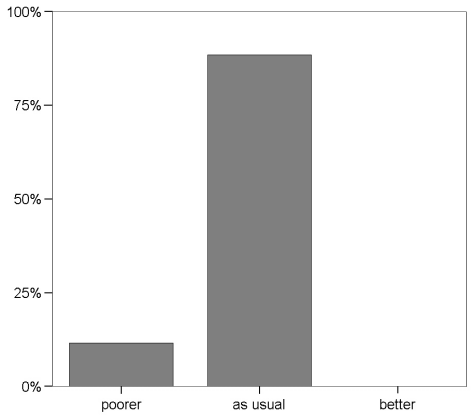

Figure 3.3: Characterisation of sprouting in 2010 compared to the Amflora variety description and similar varieties

The time to emergence compared to the Amflora variety description and similar varieties was characterised for 88.5% (23/26) of the fields to be $as\ usual$, for 11.5% (3/26) of the fields it was $delayed$ (Table 3.18, Figure 3.4). The difference from $as\ usual$ were explained by the farmers with: "*because of Rhizoctonia*", "*seed was old, when it came*" and "*no full dormancy, emerged very uneven*".

Table 3.18: Characterisation of time to emergence in 2010 compared to the Amflora variety description and similar varieties

		Frequency	Percent	Valid percent	Upper bound of 99% CI
Valid	accelerated	0	0.0	0.0	16.23
	as usual	23	88.5	88.5	
	delayed	3	11.5	11.5	33.72
	Total	26	100.0	100.0	

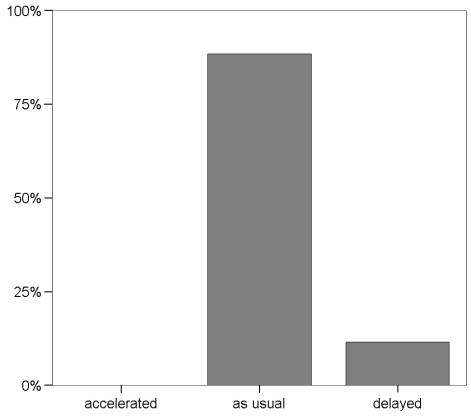

Figure 3.4: Characterisation of time to emergence in 2010 compared to the Amflora variety description and similar varieties

The plant growth compared to the Amflora variety description and similar varieties was characterised to be $as\ usual$ in 88.5% (23/26) of the cases. At 3 fields (11.5%) the plant growth was characterised to be $delayed$ (Table 3.19, Figure 3.5). The explanation for the differences in plant growth were: "*because of Rhizoctonia*", "*very late delivery of seed, it was old when it came*" and "*because of the weather*". An additional comment for plant growth characterised as $as\ usual$ was: "*late, uneven in one seed lot*".

Table 3.19: Characterisation of plant growth in 2010 compared to the Amflora variety description and similar varieties

		Frequency	Percent	Valid percent	Upper bound of 99% CI
Valid	accelerated	0	0.0	0.0	16.23
	as usual	23	88.5	88.5	
	delayed	3	11.5	11.5	33.72
	Total	26	100.0	100.0	

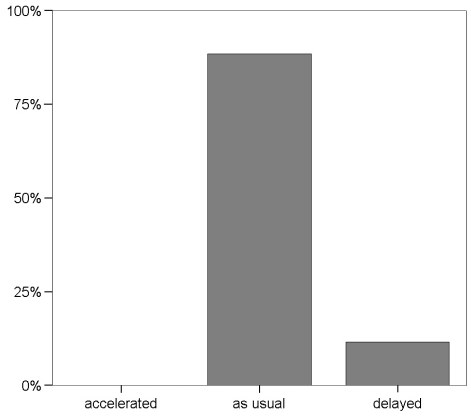

Figure 3.5: Characterisation of plant growth in 2010 compared to the Amflora variety description and similar varieties

The phenotype of the plants compared to the Amflora variety description and similar varieties was characterised to be $as\ usual$ at all fields.

3.2.3.4 Fertilisation

At 15.4% (4/26) of the fields organic fertilisers were used between 29.09.2009 and 11.05.2010 once. The used organic fertilisers and the corresponding contents are:

- pig manure (2.5 - 3 t/ha, content: N 50 - 60 kg, P 20 - 25 kg, K 40 - 130 kg) and
- cow dung (26.89 t/ha, content: N 53 kg, P 82 kg, K 190 kg).

At all fields mineral fertilisers was applied between April 20 and August 21, at some fields up to 8 times. The most used mineral fertiliser, NPK 8-5-19, was used at 20 fields (76.9%) in a quantity between 500 and 850 kg/ha (content of this fertiliser: N 14.5 - 68 kg, P 25 - 43 kg, K 43 - 160 kg, Mg 10 - 20 kg).

Other specified mineral fertilisers with described applied amount and content are:

- Dumag (at each of 3 fields 3 times: 20 kg/ha, content: N 3.5 kg, Mg 2.5 kg),
- K 20 (at 7 fields once: 230 kg/ha, content: K 46 kg),
- P 9 (at 7 fields once: 230 kg/ha, content: P 21 kg),
- Urea (at 2 fields once and at 2 fields twice: 5 - 120 kg/ha, content: N 2.3 - 120 kg),
- DAM (at 5 fields once: content: K 30 - 31.5 kg),
- Kalimagnesta (at 5 fields once: 150 - 250 kg/ha, content: K 40 - 62 kg),
- Patentkali (at each of 2 fields twice: 200 kg/ha, content: K 60 kg, Mg 20 kg),
- Fortesim Beta (at 3 fields once: 7.6 kg/ha),
- K-gel (at 3 fields once: 2 kg/ha, content: K 0.35 kg),
- Magnitra (at 2 fields once: 4 l/ha, content: N 0.28 kg, Mg 0.4 kg),
- Unika (at 2 fields once: 250 kg/ha, content: K 35 kg, K 97 kg) and
- KAS (at 1 fields once: 420 kg/ha, content: N 113 kg).

3.2.3.5 Chemical weed control

The weed pressure compared to comparator variety or similar varieties was characterised for all fields. At four of them (15.4%) there were fewer weeds, at all other fields (22/26, 84.6%) the weed pressure was $as\ usual$ (Table 3.20, Figure 3.6).

Table 3.20: Weed pressure on Amflora in 2010 compared to comparator variety or similar varieties

		Frequency	Percent	Valid percent	Upper bound of 99% CI
Valid	fewer weeds	4	15.4	15.4	38.49
	as usual	22	84.6	84.6	
	more weeds	0	0.0	0.0	16.23
	Total	26	100.0	100.0	

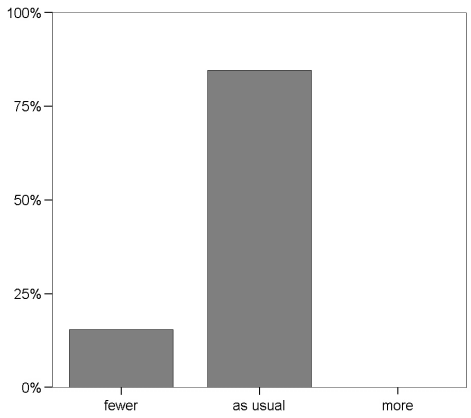

Figure 3.6: Weed pressure on Amflora in 2010 compared to comparator variety or similar varieties

The weeds that occurred in Amflora fields with their frequencies of nomination are listed in Table 3.21. The applied herbicides with frequency and used quantity are listed in Table 3.22. The application date of herbicides was between May 27 and July 29.

Table 3.21: Weeds in 2010

Weed	Frequency
Elytrigia repens	12
Persicaria lapathifolia	8
Dicotyledonous weeds	7
Fallopia convolvulus	7
Chenopodium album	5
Rye volunteers	2
Stellaria media	2
Tripleurospermum	2
Tussilago farfara	2
Atriplex	1
Sonchus arvensis	1

Table 3.22: Used herbicides in 2010

Herbicide	Frequency	Quantity[kg/ha]
Sencor	24	0.25 - 0.7
Titus	20	0.02 - 0.05
Command	5	0.2 - 0.25
Spotlight 24 EC	4	0.05 - 0.07
Afalon	2	1
Boxer	2	4
Glyfomax	2	4
Roundup	2	1

Note: Additionally the wetting agent Sunoco was used by some farmers.

The success of the weed control on Amflora potatoes in relation to comparator varieties or similar varieties was characterised to be $as\ usual$ at 80.8% (21/26) of the fields or to be $better$ at 19.2% (5/26) (Table 3.23, Figure 3.7). The explanation for better weed control were, that it was "*the right time for application*" (3 fields) and that there was "*good soil condition*" (1 field). Additional comments on this question were: "*considering the situation of no preparation of the soil it was ok*" (4 fields).

Table 3.23: Success of weed control in Amflora in 2010 compared to comparator variety or similar varieties

		Frequency	Percent	Valid percent	Upper bound of 99% CI
Valid	poorer	0	0.0	0.0	16.23
	as usual	21	80.8	80.8	
	better	5	19.2	19.2	43.00
	Total	26	100.0	100.0	

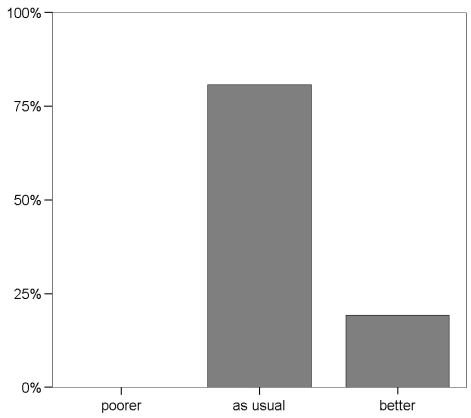

Figure 3.7: Success of weed control in Amflora in 2010 compared to comparator variety or similar varieties

3.2.3.6 Occurrence of pests / treatment

Information about the general pest occurrence in Amflora and the susceptibility to pests of Amflora in relation to the comparator variety was given for all fields. At one field (3.8%) the occurrence of pests was $fewer$, at 96.2% of them (25/26) it was $as\ usual$. The susceptibility of Amflora potatoes to pests in relation to comparator varieties was $as\ usual$ in 92.3% (24/26) of the cases. At 2 fields (7.7%) Amflora was $more\ susceptible$ to pests (Table 3.24, Figure 3.8).

Table 3.24: Pest occurrence in Amflora and susceptibility to pests of Amflora in 2010 compared to comparator variety or similar varieties

		Frequency	Percent	Valid percent	Upper bound of 99% CI
Pests occurrence					
Valid	fewer pests	1	3.8	3.8	22.93
	as usual	25	96.2	96.2	
	more pests	0	0.0	0.0	16.23
	Total	26	100.0	100.0	
Susceptibility to pests					
Valid	less susceptible	0	0.0	0.0	16.23
	as usual	24	92.3	92.3	
	more susceptible	2	7.7	7.7	28.59
	Total	10	100.0	100.0	

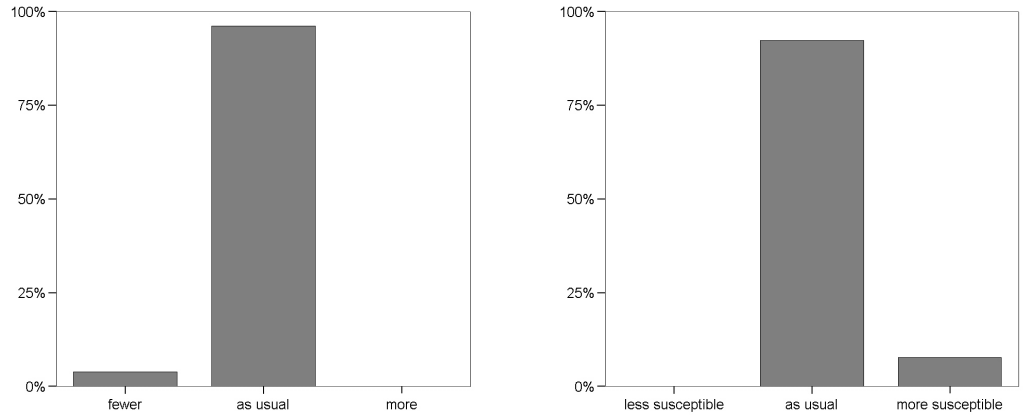

Figure 3.8: Pest occurrence in Amflora (left) and susceptibility to pests of Amflora (right) in 2010 compared to comparator variety or similar varieties

The pests that occurred on the Amflora potato fields are potato beetle and aphids. Potato beetles were controlled at 30.8% (8/26) of all fields, which were situated in Germany and Czech Republic. In Sweden potato beetles do not occur. Aphids were controlled at 80.8% (21/26) of the fields. The used insecticides are listed in Table 3.25 (including the frequency and quantity of using). The pest control was performed between June 2 and August 16.

Table 3.25: Used insecticides in 2010

Insecticide	Frequency	Quantity[kg/ha]
Oil (Repellent)	70	0.75 - 7
Sumi-Alpha	30	0.2 - 0.4
Beta Baytroid	28	0.4
Decis	14	0.2 - 0.3
Rustica	12	4.5 - 6
Biscaya	4	0.2 - 0.3
Cyperb	4	0.3
Dantop	4	0.1
Calypso	3	0.1
Actara	2	0.08
Mospilan	2	0.06

The success of the pest control in Amflora potatoes in relation to comparator variety or similar varieties was characterised to be $as\ usual$ at all fields.

3.2.3.7 Occurrence of disease / treatment

The farmers were asked to evaluate the occurrence of diseases on Amflora potato fields and the susceptibility of Amflora potatoes to diseases in relation to the comparator variety or similar varieties in general. At 84.6% (22/26) of the fields the occurrence of diseases was $as\ usual$, at 15.4% (4/26) of them there were $more\ diseases$ in Amflora potatoes. At 80.8% (21/26) of the fields the susceptibility to diseases was $as\ usual$, at 19.2% (5/26) of them the Amflora potatoes were $more\ susceptible$ to diseases (Table 3.26, Figure 3.9).

Table 3.26: Disease occurrence in Amflora and susceptibility to diseases of Amflora in 2010 compared to comparator variety or similar varieties

		Frequency	Percent	Valid percent	Upper bound of 99% CI
Disease occurrence					
Valid	fewer diseases	0	0.0	0.0	16.23
	as usual	22	84.6	84.6	
	more diseases	4	15.4	15.4	38.49
	Total	26	100.0	100.0	
Susceptibility to diseases					
Valid	less susceptible	0	0.0	0.0	16.23
	as usual	21	80.8	80.8	
	more susceptible	5	19.2	19.2	43.00
	Total	26	100.0	100.0	

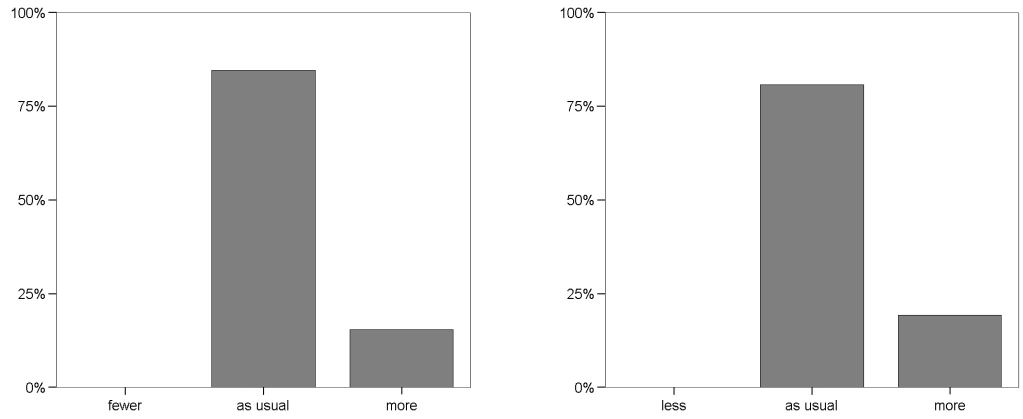

Figure 3.9: Disease occurrence in Amflora (left) and susceptibility to diseases of Amflora (right) in 2010 compared to comparator variety and similar varieties

Late blight

The farmers were asked to evaluate the pressure caused by late blight (*Phytophthora infestans*) in Amflora potatoes in relation to the comparator variety or similar varieties. Here at 92.2% (24/26) of the fields the pressure was $as\ usual$, at 7.7% (2/26) of them the pressure was $less$ (Table 3.27, Figure 3.10).

Table 3.27: Occurrence of late blight in Amflora in 2010 compared to comparator variety or similar varieties

		Frequency	Percent	Valid percent	Upper bound of 99% CI
Valid	less	2	7.7	7.7	28.59
	as usual	24	92.3	92.3	
	more	0	0.0	0.0	16.23
	Total	26	100.0	100.0	

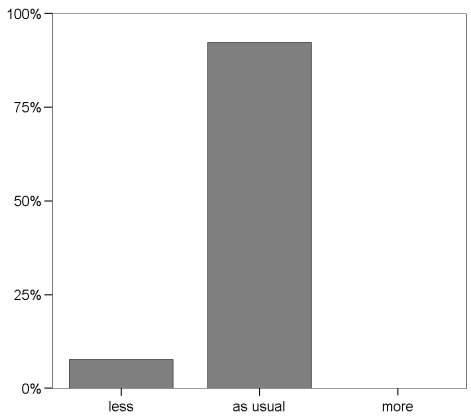

Figure 3.10: Occurrence of late blight in Amflora in 2010 compared to comparator variety or similar varieties

The applied fungicides with frequency and quantity of using are listed in Table 3.28. Fungicides were applied between June 23 and September 20.

Table 3.28: Used fungicides in 2010

Fungicide	Frequency	Quantity[kg/ha]
Ranman	39	0.18 - 0.60
Revus	33	0.40 - 0.60
Altima	10	0.40
Tattoo	9	2.00 - 2.30
Criterium	8	2.50
Ridomil gold	7	2.00
Consento	6	2.00
Infinito	3	1.60
Curzate	2	1.00 - 2.00
Vondac	1	1.00

The success of control measures for late blight in Amflora potatoes in relation to comparator variety or similar varieties was $as\ usual$ at all fields. Additional comments on this questions were that there was "*no late blight*" (at 4 fields) and "*no problem with late blight in general.*" (at 2 fields).

Other diseases

Other diseases than late blight occurred at 69.2% (18/26) of the Amflora potato fields. The diseases that occurred and the frequency of occurrence and the description of control measures are listed in Table 3.29. All measures were performed between May 15 and August 3. In 4 cases was added that there were "*no single diseases in other potatoes, but in Amflora quite a lot*".

Table 3.29: Other diseases in Amflora potatoes in 2010

Disease	treatment	frequency
Blackleg, stem canker	picking by hand (13)	13
Potato virus Y (PVY)	picking by hand (13)	13
	not treated (2)	
Rhizoctonia solani (black scurf)	Monceren (6)	6
Potato leaf roll virus (PLRV)	not treated (2)	2

At the 16 fields where control measures were performed the farmers characterised the success of control measures for other diseases in Amflora potatoes in relation to comparator variety or similar varieties. At 93.8% (15/16) fields the success was $as\ usual$. At one field (6.3%) the farmer descibed the success to be $poorer$ and explained that there was "*no symptom expression because of heat and dryness, thats why no efficient selection was possible*" (Table 3.30, Figure 3.11).

Table 3.30: Success of control measures for other diseases in Amflora potatoes in 2010 in relation to comparator variety or similar varieties

		Frequency	Percent	Valid percent	Upper bound of 99% CI
Valid	poorer	1	3.8	6.3	34.88
	as usual	15	57.7	93.8	
	better	0	0.0	0.0	25.01
	Total	16	61.5	100.0	
Missing		10	38.5		
Total		26	100.0		

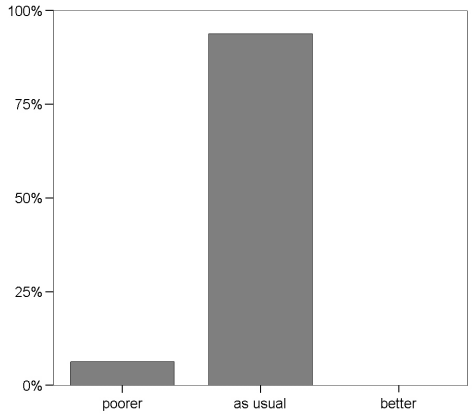

Figure 3.11: Success of control measures for other diseases in Amflora potatoes in 2010 in relation to comparator variety or similar varieties

3.2.3.8 Use of herbicides for haulm killing

The common methods that are used for haulm killing are chemical (use of herbicides) and mechanical measures. At 46.2% (12/26) of the fields $only\ chemical\ measures$, at 42.3% (11/26) of them $only\ mecanically\ measures$ and at 11.5% (3/26) of them $both\ methods$ were used (Table 3.31).

The herbicides used for haulm killing were:

Reglone, at 14 fields
Spotlight, at 11 fields
Shirlan, at 3 fields and
Shark at 1 field.

Table 3.31: Haulm killing methods in 2010

		Frequency	Percent	Valid percent
Valid	chemical measures only	12	46.2	46.2
	mechanically only	11	42.3	42.3
	both methods	3	11.5	11.5
	Total	26	100.0	100.0

3.2.4 Harvest

The farmers harvested the Amflora potatoes between August 31 and October 27. The yield was between 3.0 (from mini tubers) and 28.74 t/ha.

The farmers were asked to characterise the maturity, the date of harvest and the yield in comparison to the Amflora variety description and similar varieties. The maturity was described to be $accelerated$ at 23.1% (6/26), $as\ usual$ at 61.5% (16/26) and $delayed$ at 15.3% (4/26) of the fields. The date of harvest was $accelerated$ at 3.8% (1/26), $as\ usual$ at 38.5% (10/26) and $delayed$ at 57.7% (15/26) of the fields. The yield was $less$ in 69.2% (18/26) and $as\ usual$ in 30.8% (8/26) of the cases (Table 3.32, Figures 3.12 and 3.13).

Table 3.32: Characterisations of maturity, date of harvest and yield in 2010 compared to the Amflora variety description and similar varieties

		Frequency	Percent	Valid percent	Upper bound of 99% CI
Maturity					
Valid	accelerated	6	23.1	23.1	47.29
	as usual	16	61.5	61.5	
	delayed	4	15.4	15.4	38.49
	Total	26	100.0	100.0	
Date of harvest					
Valid	accelerated	1	3.8	3.8	22.93
	as usual	10	38.5	38.5	
	delayed	15	57.7	57.7	79.38
	Total	26	100.0	100.0	
Yield					
Valid	less	18	69.2	69.2	87.80
	as usual	8	30.8	30.8	
	more	0	0.0	0.0	16.23
	Total	26	100.0	100.0	

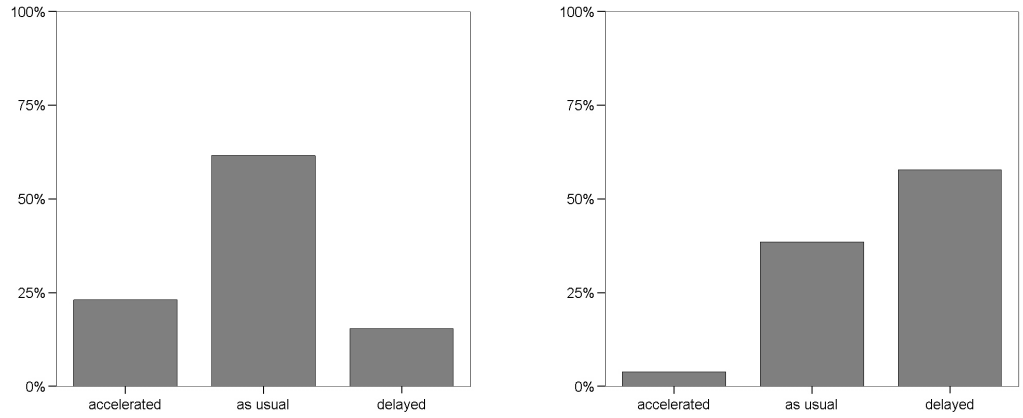

Figure 3.12: Characterisations of maturity (left) and date of Harvest (right) in 2010 compared to the Amflora variety description and similar varieties

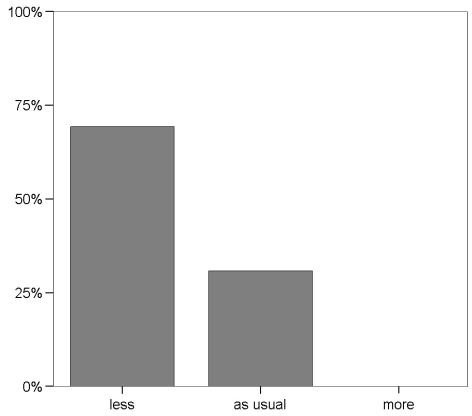

Figure 3.13: Characterisations of yield in 2010 compared to the Amflora variety description and similar varieties

All farmers that detected differences from $as\ usual$ did explain it. The explanations are listed in Table 3.33.

Table 3.33: Specification of differences in maturity, date of harvest and yield in 2010 compared to the Amflora variety description and similar varieties

Answer	Count of Nomination	Explaination
Maturity		
accelerated	3	because of late planting and weather
accelerated	3	too short dormancy period, harvested too late last year, planted too late
delayed	2	shorter time of growing season
delayed	1	one seed lot bad
delayed	1	seeds planted too late
Date of harvest		
accelerated	1	because of the weather
delayed	7	technical reasons
delayed	5	due to late planting
delayed	3	because of much rain
Yield		
less	8	weather and late planting
less	3	due to late planting
less	2	because of weather and short vegetation period
less	2	because of weather conditons
less	1	because of weather, differences between irrigated and not irrigated fieldparts
less	1	very low, some 8-9 tubers/potato
less	1	attacked heavily by Rhizoctonia

3.2.5 Presence of wild animals

All farmers answered the question on their general impression regarding presence of wild animals in their Amflora potato fields in relation to the comparator variety or similar varieties. At 73.1% (19/26) of the fields it was $as\ usual$, at 7 fields (26.9%) the farmers did not observe wild animals.

3.2.6 Additional comments

One farmer with 3 fields stated that "*it was very rainy in the late summer before harvest*". One farmer said that his Amflora potatoes had "*drought and heat stress and burnings on the leafs*". A farmer with 2 fields declared that "*2010 was no good year for potatoes in comparison to other years*" and one farmer with 2 fields "*didn't see any big differences between Amflora and other potatoes*".

3.3 Summary of results - Discussion

The results of the descriptive analysis of monitoring characters surveyed with the farm questionnaire during the 2010 growing season are summarised in Table 3.34.

Table 3.34: Overview on the results of the descriptive analysis of the monitoring characters in 2010

Monitoring characters	$Valid$	$Minus$	$As\ usual$	$Plus$
Sprouting	26	11.5%	88.5%	0.0%
Time to emergence	26	0.0%	88.5%	11.5%
Plant growth	26	0.0%	88.5%	11.5%
Phenotype	26		100.0%	0.0%
Weed pressure	26	15.4%	84.6%	0.0%
Success of weed control	26	0.0%	80.8%	19.2%
Occurrence of pests	26	3.8%	96.2%	0.0%
Pest susceptibility	26	0.0%	92.3%	7.7%
Success of pest control	26	0.0%	100.0%	0.0%
Occurrence of disease	26	0.0%	84.6 %	15.4 %
Disease susceptibility	26	0.0 %	80.8%	19.2%
Late blight pressure	26	7.7%	92.3%	0.0%
Success of late blight control	26	0.0%	100.0%	0.0%
Success of control of disease	16	6.3%	93.8%	0.0%
Maturity	26	23.1 %	61.5 %	15.4%
Date of harvest	26	3.8%	38.5%	57.7%
Yield	26	69.2%	30.8%	0.0%
Presence of wild animals	19	0.0%	100.0 %	0.0%

For all monitoring character values $Plus$ and $Minus$ additionally the corresponding 99% upper confidence bounds were calculated (see tables in the text). Due to small number of questionnaires, no upper confidence bound was lower than the threshold of 10%.

The summary shows - considering the small sample size of 26 - mainly balanced distributions with a predominant part of the farmers assessing the situation to be $as\ usual$ for most monitoring characters. Evident deviations from this baseline pattern are observable for the characters maturity, date of harvest and yield. This clearly can be explained by weather conditions, as it was specified in the farmers' explanations or in the influencing factors (rain fall, temperature). Also other slight deviations (time to emergence, plant growth) must be explained by these environmental influences.

Other deviations like success of weed control indicate a positive effect contrary to an adverse one.

The occurrence of diseases and pest and disease susceptibility show increased frequencies of $Plus$ answers. This can be explained by variety characteristics, which do not exceed conventional varieties' variation and do not indicate an adverse effect of the genetic modification.

Chapter 4

Conclusions

A total of 26 farm questionnaires addressing the different monitoring characters were collected from all growers participating in the IP system for cultivation of Amflora potato, and analysed. An evaluation of the monitoring characters that were rated $as\ usual$ or were deviating from what is in general observed for potato cultivation by the growers allowed the following conclusions. For most characters Amflora performed as any conventional potato variety (e.g. presence of wildlife, success of pest or disease control, phenotype). Other deviations (e.g. earlier maturity, later harvest, slower development, lower yield) were clearly a consequence of adverse weather conditions and other influencing factors, and none of them were considered as adverse effects.

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