Efficacy to control potato late blight by applying biological crop protection products

EuroBlight field experiment AGV8005

A. Evenhuis

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Contents

1 Introduction

1.1 EuroBlight Table

Late blight caused by *Phytophthora infestans* is the most important foliar disease in the cultivation of potatoes. The crop needs to be protected from *P. infestans* by spraying fungicides regularly during the growing season. It is important to use fungicides that effectively protect leaves against this disease. A whole range of fungicides was or became registered in the last years. Each fungicide has its own mode of action and efficacies and therefore has specific characteristics. To evaluate each characteristic a EuroBlight table was set up to get an overview of the value of each characteristic. Up until the Bologna meeting in 2007, the ratings are based upon expert judgement, from both agrochemical companies and independent researchers. To evaluate the effectiveness of fungicides harmonised protocols were discussed at Tallinn. It was proposed that ratings of fungicides for the EU-table are calculated when field experiments are carried out over 2 years in 3 European countries. Each year from 2006 to 2021 at least three experiments were carried out. In fact 49 field experiments were set up to compare the effectiveness against leaf late blight by measuring the protection of leaves from application of a fungicide in a standard 7-day spray schedule (this standard spray schedule is not necessarily related to the label recommendations). This protection originates from the protectant and/or curative properties of the active ingredients and in the rapid growth phase of the crop also protection of new growth can contribute to the effectiveness of the fungicide for leaf blight control. Dose rates were the highest preventative doses registered in Europe. The results of the trials were used to re-evaluate the effectiveness of fungicides to control potato late blight.

1.2 EuroBlight table set-up for low risk products

Nowadays a growing public concern on using synthetic crop protection products has led to the search for new and biological crop protection products (BCPP) with low risk to the environment. In literature products from bacterial origin, plant extracts, salts etc are described and claim to control *P. infestans*. Within the EuroBlight network, an initiative was taken to set up an experiment to rate the biological crop protection products similarly to the EuroBlight table for fungicides. Since it is expected that these products will be less effective than synthetic fungicides the set-up of the experiment was adjusted. Major adjustments in comparison to the EuroBlight experiment are:

- The cultivar is medium susceptible to potato late blight
- The potato crop is not inoculated. Infection relies on natural sources
- Spreader rows are set-up in the experiment in case potato late blight does not occur naturally
- No sprinkler irrigation to facilitate the late blight epidemic is used. Irrigation for the purpose of supplying water in case of drought is allowed.
- The untreated control is allotted randomly to the block design
- Spray application is carried out as much as possible based on infection risk by use of a decision support model

This report describes the efficacy of biological plant protection products to control potato late blight during the whole season of the 2021 experiment at Lelystad (NL).

2 Methods and materials

2.1 Experimental set up.

The cultivated potato plants (cv. Agria) were grown at Wageningen University and Research location Lelystad. The experiment was treated conform local good agricultural practice, only the fungicide sprayings against *P. infestans* were carried out as mentioned in Table 1. A plot consisted of 3 meters (4 rows) of 11 meters. The trial was carried out in four replications. The experiment was carried out in accordance with GEP (NVWA-recognition; Appendix 2; details Appendix 1).

Conducted Under GLP: No Official Trial ID: -
Conducted Under GEP: Yes Other Trial ID: AGV8005

No.	Guideline	Description
1.	PP 1/135(4)	phytotoxicity assessment
2.	PP 1/152(4)	Design and analysis of efficacy evaluation trials
3.	PP 1/181(4)	Conduct and reporting of efficacy evaluation trials including GEP
4.	PP 1/2(4)	Phytophthora infestans on potato

2.2 Treatments

In Table 1 the biological crop protection products used, and dose rates are presented. Applications were carried out using a CHD-sprayer with Airmix XR110.04 nozzles approximately 50 cm above the foliage. Sprayings were carried out with 300 l/ha and 2.5 bar.

Table 1 Treatments and biological crop protection products applied according to the BlightApp

Code	Treatment	Active ingredient	Dose rate l or kg per ha
A	Untreated control	-	-
B			
C			
D			
E			
F			
G			
H			
J			
K	Copper reference	copper	
L			

The spray application were timed to protect the crop before an infection period. For that the BlightApp developed by WUR was used. On 26 June 2021, the potato plants were sprayed with the different treatments for the first time (Table 2). Spray interval varied from 4 to 8 days. Weather conditions at the time of spraying are given in Table 2.

Table 2 Weather conditions during spray applications (NOT YET AVAILABLE)

Date	Time	BBCH	Temp.	RH	wind speed	wind direction	hours dry[1]	Precipitation [6][2]
			(°C)	(%)	(m/s)		(h)	(mm)
28-6-2021	9:00							
6-7-2021	9:00	40						
12-7-2021	11:00	51						
19-7-2021	9:00	57						
23-7-2021	13:00	61						
29-7-2021	11:00	67						
4-8-2021	9:00	70						
9-8-2021	16:00	73						

[1]: Number of hours without precipitation after the spray application
[2]: Cumulative precipitation (mm) in the first six hours after the spray application.

2.3 Inoculation *P. infestans*

The experiment was not inoculated with *Phytophthora infestans*. Spreader rows were present in the field alongside the plots. No sprinkler irrigation facilitated the potato late blight epidemic. Irrigation was not necessary due to wet conditions.

2.4 Disease observations and Yield

Disease observations were carried out once or twice a week. The number of infected leaves was counted, and percentage infected foliage was calculated or percentage necrotic foliage per plot was estimated.
The Standard Area under Disease Progress Curve (StAUDPC) was calculated (indication for disease development during the growing season).
The crop was not harvested.

2.5 Statistics

Analysis of variance on the parameters was made using GENSTAT 19th Edition. The experiment was carried out with four replications in a randomised block design. Each replication consisted of a plot. Transformation of data was carried out when necessary.

3 Results

Due to a lot of precipitation in May the potatoes were planted a month later than planned in the first week of June. At the first half of July weather conditions were conducive for potato late blight which coincided with emergence of the plants. The weather conditions in the second half of July and the first half of August were less conducive for potato late blight but still several infection periods occurred. In general summer was cool with regular rain showers.

Until 7 July no significant differences of potato late blight severity between treatments were observed. Data are given in Appendix 3. Based on the StAUDPC treatments B, E, F, G, H and K, significantly controlled potato late blight. Percentage control of treatments B, E, F, G, H and K was 10%, 9%, 45%, 35%, 36% and 33% respectively. The results are presented in Table 4, Figure 1 and Figure 2.

Table 3 Arithmetical means of potato late blight severity (%) and back transformed logit means for the different treatments.

label[1]	7-jul	14-jul	17-jul	20-jul	23-jul	27-jul	30-jul	3-aug	9-aug	StAUDPC
A	0.002 a[3]	5.1	48.8	62.5	82.5 e	89.3 c	96.5	98.3	99.0	63.2 e
B	0.001 a	1.8	25.0	38.8	72.5 cd	89.3 c	94.3	97.5	99.0	57.0 c
C	0.008 a	3.0	40.0	53.8	78.8 cde	91.3 c	96.5	98.0	98.8	61.1 e
D	0.001 a	5.0	45.0	63.8	81.3 de	92.8 c	97.0	98.5	99.0	63.3 e
E	0.001 a	4.3	31.3	37.5	71.3 c	88.8 c	92.3	96.5	99.0	57.3 cd
F	0.008 a	0.4	2.1	6.9	26.3 a	50.0 a	63.8	75.0	81.3	34.5 a
G	0.001 a	0.6	2.9	9.0	40.0 b	62.5 b	72.5	85.0	96.8	41.4 b
H	0.000 a	1.3	8.8	10.0	41.3 b	58.8 b	71.3	81.3	88.0	40.4 b
J	0.003 a	3.6	40.0	53.8	72.5 cd	88.0 c	93.8	97.0	98.8	59.7 cde
K	0.001 a	0.8	3.1	6.9	42.5 b	62.5 b	76.3	86.8	96.0	42.1 b
L	0.001 a	3.1	41.3	56.3	76.3 cde	90.0 c	94.8	97.5	99.0	60.8 de
Lsd	0.009	2.2	14.2	16.5	9.0	7.1	7.4	5.0	2.6	3.7
F pr.	n.s.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

label[2]	7-jul	14-jul	17-jul	20-jul	23-jul	27-jul	30-jul	3-aug	9-aug	StAUDPC
A	0.001	5.6 d	48.6 d	61.7 c	83.1	89.8	97.5 c	99.3 c	100.0 d	64.1
B	0.001	2.7 bc	25.0 c	37.5 b	73.0	90.1	95.2 c	98.5 c	100.0 d	57.9
C	0.007	3.9 cd	34.5 cd	53.2 bc	79.4	92.0	97.5 c	99.0 c	99.7 cd	61.9
D	0.001	5.5 d	44.9 d	63.6 c	82.1	93.7	98.0 c	99.5 c	100.0 d	64.3
E	0.001	5.0 d	30.8 cd	37.8 b	72.1	89.5	93.1 c	97.5 c	100.0 d	58.2
F	0.007	1.4 a	3.0 a	7.8 a	26.1	50.7	64.5 a	75.8 a	82.2 a	35.5
G	0.001	1.5 a	3.8 a	9.1 a	39.4	62.4	72.5 b	85.8 b	97.7 cd	42.1
H	0.000	2.1 ab	9.5 b	10.4 a	41.3	59.6	72.1 b	82.2 b	88.9 b	41.3
J	0.003	4.5 d	40.2 cd	50.9 bc	72.5	88.6	94.7 c	98.0 c	99.7 cd	60.5
K	0.001	1.6 ab	4.0 a	7.8 a	41.8	61.8	76.1 b	87.5 b	97.0 c	42.8
L	0.000	3.9 cd	39.7 cd	53.9 bc	77.1	90.8	95.7 c	98.5 c	100.0 d	61.7
F pr.	n.s.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

[1]) The upper table gives the arithmetical means, when followed by a character the values are normally distributed allowing ANOVA without transformation

[2]) The lower table gives the back-transformed logit values to meet the requirements for a normal distribution.

[3]) Values in columns followed by the same character are not significantly different (P=0.05).

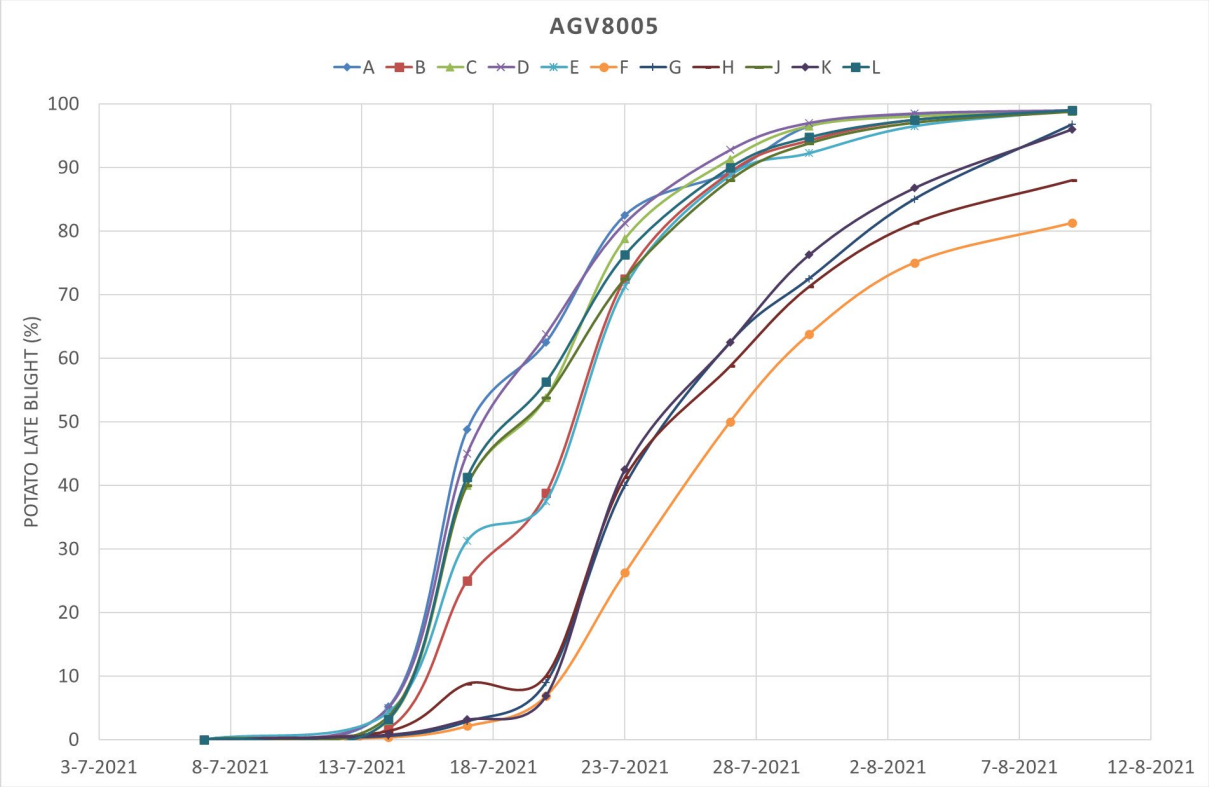


Figure 1 Potato late blight epidemic as a result of various spray schedules

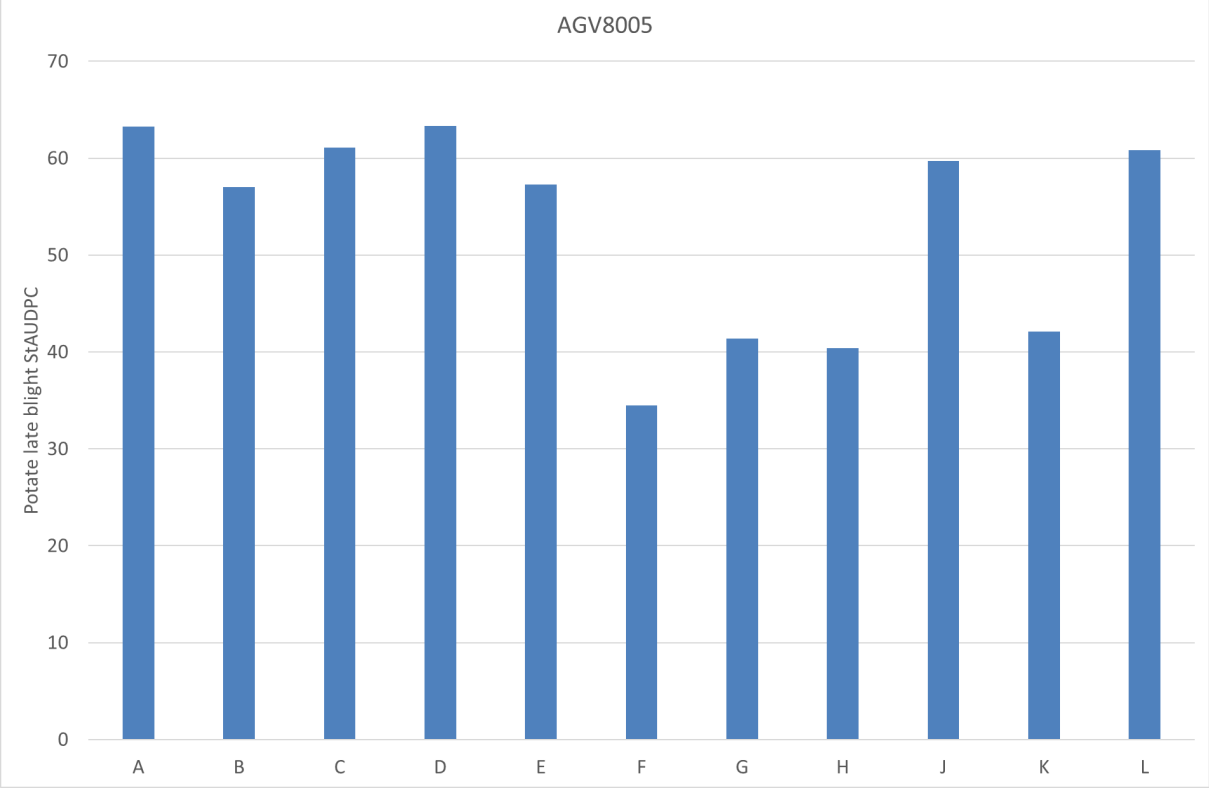


Figure 2 Potato late blight StAUDPC as a result of various spray schedules

4 Discussion and conclusions

The experiment aimed at showing the efficacy of biological crop protection products to control potato late blight.

4.1 Potato late blight

The season was characterised by heavy infection periods in the first half of July followed by several infection period until desiccation of the crop half august. Disease pressure was not enhanced by misting of the crop and relied on natural weather circumstances. Furthermore no artificial inoculation was carried out. In the neighbourhood fields infected with *P. infestans* were present ensuring some disease pressure. Disease severity increased rapidly from until half July onward. Basically, treatments C, D, J and L were not able to control *P. infestans* under heavy disease pressure. In this experiment the products were sprayed taking into account periods of infection risk. Unfortunately the second spray application had to be postponed due to the weather circumstances which might have affected the performance of the products. Pin point application of the biological crop protection products might have improved the efficacy, but it remains the question if this would be sufficient.
Based on the StAUDPC treatments B, E, F, G, H and K, significantly controlled potato late blight. Percentage control of treatments B, E, F, G, H and K was 10%, 9%, 45%, 35%, 36% and 33% respectively. Given the fact of an exceptional disease pressure and a spray interval of eight days at the beginning of the season under more normal circumstances the results might have been significantly better. At least for these treatments efficacy has been shown.

4.2 Tuber blight

Tuber blight incidence was not assessed.

4.3 Yield

Yield was not assessed.

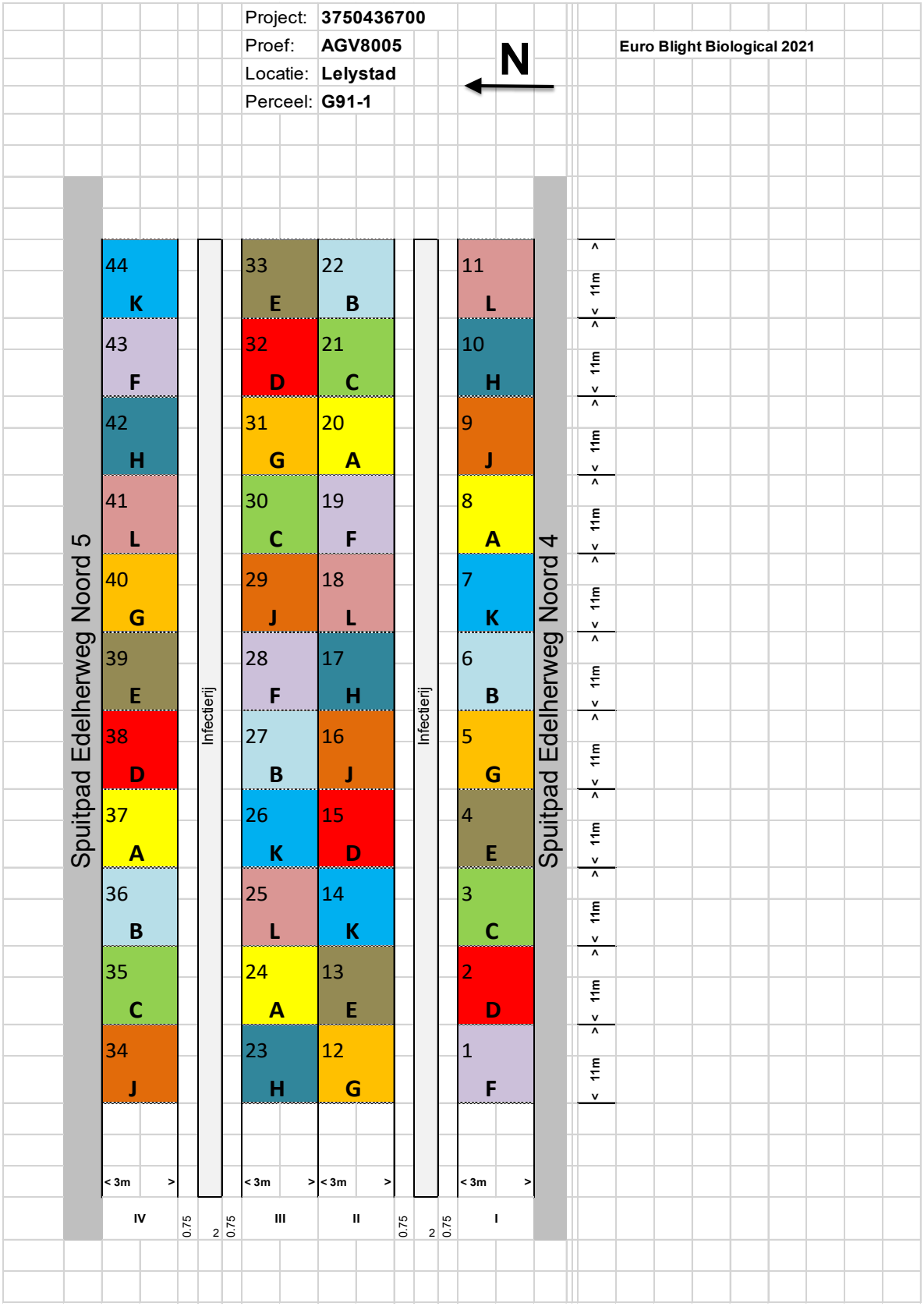
4.4 Conclusions

- No phytotoxicity was observed, in this experiment the crop protection products used were crop safe.
- Based on the StAUDPC, treatments C, D, J and L were not able to control *P. infestans*, disease severity was comparable to the untreated control (A).
- Based on the StAUDPC treatments B, E, F, G, H and K, significantly controlled potato late blight.
- The efficacy of treatment F to control potato late blight was significantly better than the copper reference (K).
- The efficacy of treatments G and H to control potato late blight was comparable to the copper reference (K).
- The efficacy of treatments B and E to control potato late blight was significantly less than the copper reference (K).

Annex 1 Trial lay-out

Site	Lelystad, The Netherlands 52.53 N; 5.56 E

Soil texture:	Clay sandy loam
Previous crop:	sugar beet
Tillage:	Conventional till
Fertilization:	
Variety:	Agria
Planting date:	1 June 2021
Seed Rate:	2.500 kg/ha
Herbicide treatment:	according to good agricultural practice
Fungicide application:	see paragraph 2.2
Alternaria treatments:	-
Crop desiccation:	11 & 26 August
Harvest:	-
Tuber assessments:	-
Gross plot dimensions:	Six rows (0.75 m) of 11 m length
Net plot dimensions:	Two rows (0.75) of 11 m length
Demo design:	Four replications in a randomized block design


Project: 3750436700
Proef: AGV8005
Locatie: Lelystad
Perceel: G91-1
N
Euro Blight Biological 2021
Spuitpad Edelherweg Noord 5
Spuitpad Edelherweg Noord 4
Infectierij
Infectierij
44 K
43 F
42 H
41 L
40 G
39 E
38 D
37 A
36 B
35 C
34 J
33 E
32 D
31 G
30 C
29 J
28 F
27 B
26 K
25 L
24 A
23 H
22 B
21 C
20 A
19 F
18 L
17 H
16 J
15 D
14 K
13 E
12 G
11 L
10 H
9 J
8 A
7 K
6 B
5 G
4 E
3 C
2 D
1 F
< 3m >
11m
IV
III
II
I
0.75
2
0.75

Annex 2 NVWA certificate

Netherlands Food and Consumer
Product Safety Authority
Ministry of Economic Affairs

Certificate

of Official Recognition of Efficacy Testing Organisations in the Netherlands
This certifies that, in conformity with the request of March 9, 2017

STICHTING WAGENINGEN RESEARCH
BUSINESS UNIT PRAKTIJKONDERZOEK AGV

Residing: Edelhertweg 1 Lelystad, the Netherlands

has officially been recognised as an organisation for efficacy testing in the Netherlands.

As has been laid down in the 'Regeling gewasbeschermingsmiddelen en biociden' (Regulation Crop Protection Products and Biocides) of September 26, 2007 (Staatscourant 2007, 386).

This recognition commences on: March 1, 2017
and expires on: February 12, 2022

The above organisation is competent to carry out efficacy trials/tests in the categories mentioned in the annex of this certificate.

Utrecht, March 14, 2017

For the Minister of Economic Affairs,

Ir. W.J.H. van der Sande
Deputy Director
Netherlands Plant Protection Organization

CERTIFICATE NUMBER: NL_GEP_13160822

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Annex 3 Disease observations PLB

Date:			7-7	14-7	17-7	20-7	23-7	27-7	30-7	3-8	9-8	
Crop stage (BBCH):			40	51	53	57	61	65	67	70	73	
Crop height (cm):			35	55	55	50	55	55	55	55	55	
ny, half cloudy, cloudy):			B	B	Z	B	B	HB	HB	HB	HB	
et (disease/pest/weed):			P. infestans	P. infestans	P. infestans	P. infestans	P. infestans	P. infestans	P. infestans	P. infestans	P. infestans	
t level(Field/Leaf/Stem):			Veld	Veld	Veld	Veld	Veld	Veld	Veld	Veld	Veld	
Assessment:			Loof	Loof	Loof	Loof	Loof	Loof	Loof	Loof	Loof	
Unit:			%	%	%	%	%	%	%	%	%	
nner (estimate, count):			Schatten	Schatten	Schatten	Schatten	Schatten	Schatten	Schatten	Schatten	Schatten	
			PHYTIN%0707	PHYTIN%1407	PHYTIN%1707	'HYTIN%200	HYTIN%230	HYTIN%270	HYTIN%300	HYTIN%003	HYTIN%0908	
	Treatment!	Repl!	0	7	10	13	16	20	23	27	33	
Field!	**Object!**	**Blok!**	Phy0707	Phy1407	Phy1707	Phy2007	Phy2307	Phy2707	Phy3007	Phy0308	Phy0908	StAUDPC33
1	F	**1**	0.03	0.003	1	5	15	60	65	85	85	36.0
2	D	**1**	0	2.5	35	65	80	97	97	99	99	62.5
3	**C**	**1**	0.03	2.5	45	45	80	95	97	98	99	61.3
4	E	**1**	0.001	3.5	25	35	75	95	95	98	99	57.9
5	G	**1**	0.001	1.5	3.5	15	55	75	80	90	98	46.7
6	B	**1**	0.003	2.5	35	50	80	95	97	99	99	61.0
7	K	**1**	0.002	2	5	7.5	55	75	80	92	98	46.6
8	A	**1**	0.002	7.5	65	80	90	95	97	99	99	68.2
9	J	**1**	0	3.5	50	70	85	95	95	98	99	64.5
10	H	**1**	0	2.5	10	10	50	60	70	85	90	42.3
11	L	**1**	0	3.5	45	80	85	95	95	98	99	64.9
12	G	**2**	0.001	0.1	2	7.5	35	60	70	85	97	40.1
13	E	**2**	0.001	3.5	35	50	70	85	92	95	99	57.8
14	K	**2**	0.002	0.1	2	5	40	65	85	90	97	43.3
15	D	**2**	0.004	7.5	55	75	85	92	97	99	99	66.0
16	J	**2**	0.01	3.5	35	50	70	90	95	97	99	59.0
17	H	**2**	0	1	5	5	30	55	75	80	92	38.5
18	L	**2**	0	5	55	65	75	95	97	98	99	63.8
19	F	**2**	0	0.5	3.5	7.5	30	45	70	70	80	34.3
20	A	**2**	0.003	7.5	50	65	85	95	97	98	99	64.8
21	C	**2**	0	2	45	55	75	95	97	98	99	61.6
22	**B**	**2**	0	1	25	35	70	92	95	98	99	56.7
23	H	**3**	0	1.5	10	15	50	65	75	80	90	43.0
24	A	**3**	0	3.5	45	65	85	92	97	98	99	63.4
25	**L**	**3**	0	2.5	20	30	75	90	95	97	99	56.2
26	K	**3**	0	0.3	3.5	7.5	50	70	85	90	97	45.2
27	B	**3**	0	2	25	50	80	90	95	98	99	59.1
28	F	**3**	0	0.7	2.5	7.5	35	50	65	70	80	34.8
29	J	**3**	0.002	5	45	70	80	92	95	98	99	63.4
30	C	**3**	0	5	60	75	90	95	97	99	99	66.9
31	G	**3**	0	0.3	3.5	10	45	70	85	90	97	44.9
32	D	**3**	0	7.5	55	70	85	92	97	98	99	65.4
33	E	**3**	0	7.5	45	35	75	95	97	98	99	60.6
34	J	**4**	0	2.5	30	25	55	75	90	95	98	52.0
35	C	**4**	0	2.5	10	40	70	80	95	97	98	54.5
36	B	**4**	0.002	1.5	15	20	60	80	90	95	99	51.2
37	A	**4**	0.001	2	35	40	70	75	95	98	99	56.4
38	D	**4**	0	2.5	35	45	75	90	97	98	99	59.3
39	E	**4**	0.001	2.5	20	30	65	80	85	95	99	52.7
40	G	**4**	0.002	0.5	2.5	3.5	25	45	55	75	95	33.9
41	L	**4**	0.002	1.5	45	50	70	80	92	97	99	58.2
42	H	**4**	0.001	0.2	10	10	35	55	65	80	80	37.7
43	F	**4**	0	0.3	1.5	7.5	25	45	55	75	80	32.8
44	K	**4**	0	0.7	2	7.5	25	40	55	75	92	33.4

Annex 4 Yield and tuber blight

Not assessed in this experiment

Annex 5 Weather data Lelystad

Datum	T-avg °C	Tmin °C	Tmax °C	RVmin %	Rain. mm/d	Wind m/s	Wind °
1-5-2021	8.4	6.6	11.2	72	0.4	2.8	W
2-5-2021	7.7	5.6	10.4	63	0.6	3.8	NW
3-5-2021	9.3	5.2	13.6	53	0	2.8	ZZW
4-5-2021	9	7.5	11.5	57	11.1	6.2	ZW
5-5-2021	7.7	6.3	9.9	64	2.6	5.2	W
6-5-2021	7.2	3.4	11.4	55	0.2	2	ZW
7-5-2021	8	4.5	11.6	55	0	2.7	W
8-5-2021	8.9	2.8	14.8	59	5	2.4	ZZO
9-5-2021	18.2	12.4	25.1	55	2	2.3	Z
10-5-2021	15.7	12.5	19.1	63	3.2	2.2	Z
11-5-2021	13.8	11.7	17.7	75	0.8	1.6	NNO
12-5-2021	13	9.5	16.4	52	0	2.1	WNW
13-5-2021	13.6	8.7	19.3	54	0	1.7	NNO
14-5-2021	9.6	7.5	12.3	77	0	1.8	N
15-5-2021	10.3	8.1	14.1	73	2.6	1.1	ZO
16-5-2021	10.8	8.7	15.4	73	12	1.7	ZZW
17-5-2021	11.2	8.7	14.6	80	5.6	2	ZW
18-5-2021	11.5	8.8	14.9	71	4.8	1.8	W
19-5-2021	10.9	7.8	14.4	72	0.2	1.6	ZW
20-5-2021	12.3	7.7	16.6	59	0.2	2.1	ZZW
21-5-2021	12.9	9.8	16	48	0.8	5	ZZW
22-5-2021	10.8	9.2	12.6	66	7	4.1	ZW
23-5-2021	11	7.3	14.6	56	0.4	2.3	ZZW
24-5-2021	11.9	9.6	15.4	72	10	2.5	Z
25-5-2021	10.5	7.8	13.9	72	1.8	3	WZW
26-5-2021	10.8	8	13.7	70	5.6	3.3	WZW
27-5-2021	11	9.8	13.1	82	6.6	4.5	NW
28-5-2021	12.6	7.5	17.1	55	0	1.8	N
29-5-2021	12	7.8	15.2	74	0	2.4	N
30-5-2021	14.2	9.3	19.7	60	0	2.3	NNO
31-5-2021	15.5	8.5	23.9	35	0	1.5	NO
1-6-2021	19.8	11.5	26.4	27	0	1.6	ONO
2-6-2021	20.8	13.2	28.3	32	0	1.6	NO
3-6-2021	20.9	16.9	26.8	50	0	1.9	WZW
4-6-2021	19.4	14.8	23.4	63	0	1.9	NW
5-6-2021	16	14	17.7	89	6.2	2.6	NW
6-6-2021	16.2	13.9	19.5	59	0	3.3	NW
7-6-2021	16.7	10.5	20.3	55	0	2.6	N
8-6-2021	18.5	11.9	23.7	43	0	1.5	NNO
9-6-2021	19.7	13.9	24.5	52	0	1.4	WNW
10-6-2021	19.9	12.4	26	40	0	1.5	WZW
11-6-2021	19.2	15	24.1	73	0	1.9	WZW
12-6-2021	17.3	13.9	20.7	57	0	3.2	WNW

13-6-2021	17	11.1	22.3	47	0	1.4	NW
14-6-2021	20	13.6	26.5	46	0	2.2	WZW
15-6-2021	17.8	14.3	21	54	0	2.4	N
16-6-2021	21.9	12.1	29.9	41	0	1.1	O
17-6-2021	24.3	17.7	32.1	42	0	1.9	W
18-6-2021	22.1	18.8	30.2	55	10.4	1.8	NO
19-6-2021	18.4	16	19.7	83	0.4	2.3	ZW
20-6-2021	18.1	15.1	20.8	77	14	2.4	NNW
21-6-2021	13.8	12.2	15.6	84	11.4	3.8	NNO
22-6-2021	14.6	11.7	17.5	62	0	3.3	NNO
23-6-2021	14.5	12.3	16.8	68	0	2.3	NNO
24-6-2021	14.9	11.8	18.5	63	0	1.6	N
25-6-2021	15.3	10	20.1	75	0	1.5	Z
26-6-2021	19.2	15	24.4	60	0.2	1.8	O
27-6-2021	20.8	15.6	26.7	54	6.6	2.4	NO
28-6-2021	20.3	16.1	25.5	70	0	1.7	N
29-6-2021	17	14.8	19.4	93	13.2	2.3	N
30-6-2021	14.6	13.4	16.6	87	4	3.1	NNW
1-7-2021	15.8	14	18.3	82	0.2	2.9	WNW
2-7-2021	17	14.3	22	67	0.2	1.5	WZW
3-7-2021	19.2	12.1	25.3	55	5.6	0.8	ZO
4-7-2021	18.8	16.6	22.9	69	10.6	1.3	WZW
5-7-2021	17.2	14.4	20.6	70	3.8	1.8	Z
6-7-2021	18.2	14.6	22.3	59	1	3.1	Z
7-7-2021	17.8	13.5	22.2	64	0	2	ZZW
8-7-2021	18.1	12.2	22.8	61	0	1.2	W
9-7-2021	18.3	13.3	22.3	57	0	1.6	NW
10-7-2021	18.2	14.7	21.8	67	0	1.3	NNW
11-7-2021	18.1	14.4	23.5	70	0.2	0.9	NNW
12-7-2021	20.6	15.3	25.3	54	1	1	ONO
13-7-2021	19.4	18.1	21.3	91	0	2.7	N
14-7-2021	19.2	18.2	20.8	97	1.4	4.6	NNW
15-7-2021	18.3	17.1	19.5	89	11.4	5	N
16-7-2021	17.7	16	20.1	76	0	3.8	NNW
17-7-2021	19.3	15.4	22.7	70	0	3.2	NNW
18-7-2021	19.9	15.9	25.2	64	0	2.3	NW
19-7-2021	17.8	13.8	21	60	0	1.8	NNW
20-7-2021	18	11.7	23.8	46	0	1.1	NNO
21-7-2021	19.6	14	25.1	51	0	1.4	N
22-7-2021	18	14.8	20.9	63	0	2.2	N
23-7-2021	17.8	13.8	21.3	59	0	1.4	NO
24-7-2021	19.5	13.6	26.3	61	0.6	1.5	ONO
25-7-2021	20.3	16	24.9	65	24.1	1.4	ONO
26-7-2021	19.8	16	24.9	64	2	1.3	Z
27-7-2021	18.5	16	22.6	71	8.6	1.9	ZZW
28-7-2021	17.7	14.6	21.8	61	1.2	2.8	ZZW
29-7-2021	17.2	13	20.9	51	3.6	3.6	ZW
30-7-2021	17.1	12.9	22.4	60	4.4	2.2	ZZW
31-7-2021	17.5	15.2	20.3	75	3.2	3.7	WZW
1-8-2021	16.2	13.7	19.9	74	15.6	2.1	W

2-8-2021	16.1	13.1	20	61	0	2.1	NW
3-8-2021	15.7	11.3	18.5	68	0.4	0.8	NNO
4-8-2021	16.8	12.2	22.4	62	0	1	NNO
5-8-2021	18.7	12.8	24.6	54	0	0.9	OZO
6-8-2021	18.8	16.3	21.7	67	2	2.3	Z
7-8-2021	17.5	14	22.4	57	4.8	2.2	Z
8-8-2021	16.8	14.7	20.1	66	5.9	3.5	ZZW
9-8-2021	16.6	13.6	20.5	66	4	2.9	ZZW
10-8-2021	17.4	14.4	21.3	66	12.4	2.1	ZW
11-8-2021	18.6	12.3	24.9	49	0	1.1	ZZW
12-8-2021	19.4	14.9	24	57	0	1.3	ZZW
13-8-2021	18.4	15.1	21.7	61	0	2.2	ZW
14-8-2021	18.7	15.1	23	60	0	2.2	ZW
15-8-2021	19.9	15.6	25.8	48	0	2.1	ZW
16-8-2021	16.9	15.2	18.5	56	5.8	4.7	W
17-8-2021	15.5	14.3	17.3	76	12.6	3.5	W
18-8-2021	17.1	15.3	19.8	78	0	2.4	W
19-8-2021	16.6	15.4	18	87	5.4	1.8	WZW
20-8-2021	17.6	13.6	22.3	77	1	1.6	WZW
21-8-2021	18.6	13.2	24.3	66	0.2	0.8	ZO
22-8-2021	18	16.9	20.6	90	21.8	1.9	WNW
23-8-2021	18.4	15.8	22.6	51	0	2.9	NNO
24-8-2021	17.3	13.8	21.3	72	0	2.2	NNO
25-8-2021	15.8	11.9	19.4	73	0.8	2.1	NNW
26-8-2021	17	15	19.9	61	0.2	4.1	NNW
27-8-2021	16.4	14.3	19	75	0.6	4.6	N
28-8-2021	17.1	15.6	19.6	75	0	3.7	N
29-8-2021	16.5	16	17.6	88	0.6	3.9	N
30-8-2021	17.9	15.8	21	75	0	3.6	N
31-8-2021	16.5	14.6	19.4	80	0	3	N

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