Research on *Stemphylium* spp. the causal agent of the yellow leaf spot disease in sugar beet in 2012

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CONTENT

1. Introduction

In the summer of 2007 yellow spots were observed for the first time in sugar beet in the Netherlands. Since then, every year infestation of fields is reported and samples were sent to the diagnostic service of the IRS. In the beginning (2007) yellow spots were only reported from the North Eastern sandy soils. In the following year they were also reported from all other regions in the Netherlands (figure 1).
The above mentioned infestation appears in July-August on the leaves of sugar beet. The first infestation is characterised by small, irregular, yellow spots on the leaves. Subsequently the yellow spots necrotise from inside out into a brownish tissue. The spots spread over the leaves and infest the whole plant (figure 2). Heavily infested leaves die and on the newly formed leaves new yellow spots appear. Due to the loss of leaves the canopy opens and the soil becomes visible in August-September, in case of a severe infestation. Often, the infestation starts in patches on a field and spreads over the whole field (figures 3 and 4).
As described in a previous report the spots are not caused by nutrient deficiency, but there is a fungal cause, since some fungicides had a good efficacy [1]. From the spots *Stemphylium* spp. and *Alternaria alternata* were isolated. A climate room trial with isolates of both stemphylium and alternaria, isolated from the yellow spots, revealed that the stemphylium isolates were capable of infecting sugar beet [2].
The results of the independent replicate of the climate room trial, the results of two field trials and a survey of Suiker Unie on the spread of stemphylium, all conducted in 2012, are described in this report.

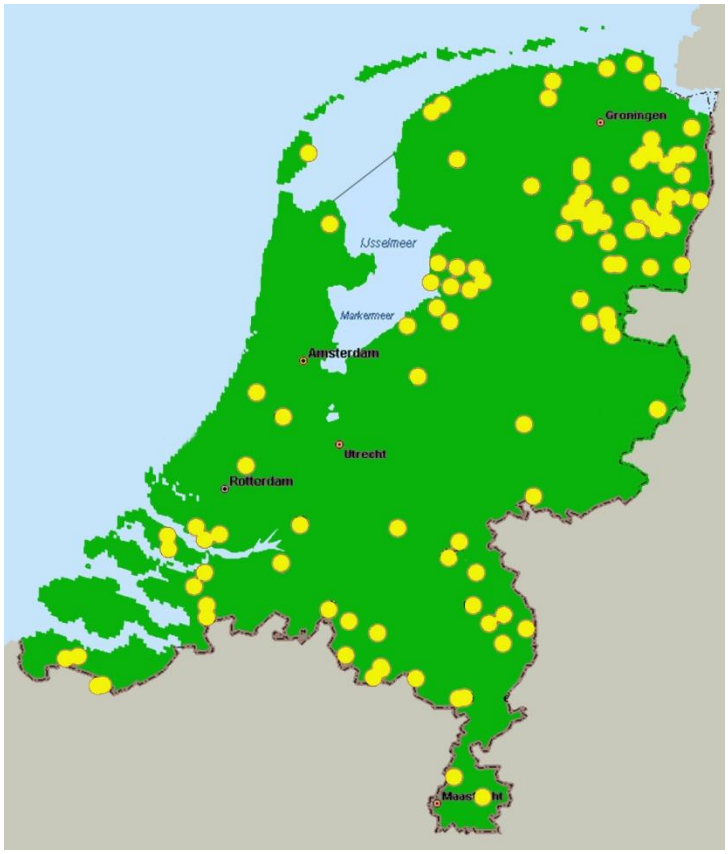

Figure 1. Spread of stemphylium in the Netherlands. Spots indicate infested fields on which the occurrence of stemphylium was confirmed by the Diagnostic Service of the IRS. Samples received in the period 2007-2012.

Figure 2. Heavily infested sugar beet leaves by stemphylium. The yellow spots are small and irregular in shape. Spots necrotise from inside out and form large (1-3 cm) brown necrotic spots. In a later stage, parts of and whole leaves necrotise.

Figure 3. Often an infestation of stemphylium in a field starts patchwise.

Figure 4. By stemphylium infested leaves start to necrotise, while new leaves are formed by the sugar beet plants. Those get infested too by stemphylium. Subsequently, the canopy falls open and the soil becomes visible (Photo: 21 September 2007).

2. Materials and methods

2.1 Climate room trial

In a climate room (23°C at day (16 hours; 20.000 lux) and 16°C at night) a trial with artificial inoculation was conducted. Sugar beet plants (cultivar 'Coyote'; SESVanderHave) were grown in a peat 10% (v/v) - sand mixture. Ten weeks after sowing plants were sprayed with 5 ml water or a spore suspension of alternaria or stemphylium. Fungal isolates were grown on WACM (Water Agar Chloramphenicol Metalaxyl) and transferred to PDA (Potato Dextrose Agar) for spore production. Spores were produced at 18^{o}C, twelve hours in dark and twelve hours with UV-light. Spores were harvested after two weeks in sterile demineralised water and counted.
Per object ten plants were inoculated. Two stemphylium isolates (GV 10-140a1 and GV 11-265a) and two alternaria isolates (GV 10-187 and GV 10-234b1) were used. Isolates were derived from different fields infested with yellow spots. Next to healthy growing plants (pH-KCl = 6.2), plants were infected with *Heterodera schachtii* (1,860 larvae per plant) or were grown on a low pH (pH-KCl = 4.2). Of all those factors described above, there were two objects: one had damaged leaves and the other one undamaged (Table 1). Damaging of the leaves was done by rubbing them lightly with a scourer, three times prior to inoculation. Directly after inoculation plants were covered with a plastic bag and transferred to the climate room. Four days after inoculation the plants were scored on symptom development.

Table 1. Objects in the climate room trial.

object	foliage	*Heterodera schachtii* (larvae/plant)	pH-KCl	fungus	isolate	spores (*10^4/plant)
1	undamaged	0	6.2	water	control (water)	0.0
2	undamaged	0	6.2	stemphylium	GV 10-140a1	2.8
3	undamaged	0	6.2	stemphylium	GV 11-265a	2.8
4	undamaged	0	6.2	alternaria	GV 10-187 1	3.3
5	undamaged	0	6.2	alternaria	GV 10-234b1	3.5
6	undamaged	1860	6.2	stemphylium	GV 10-140a1	2.8
7	undamaged	1860	6.2	stemphylium	GV 11-265a	2.8
8	undamaged	1860	6.2	alternaria	GV 10-187 1	3.3
9	undamaged	1860	6.2	alternaria	GV 10-234b1	3.5
10	undamaged	0	4.2	stemphylium	GV 10-140a1	2.8
11	undamaged	0	4.2	stemphylium	GV 11-265a	2.8
12	undamaged	0	4.2	alternaria	GV 10-187 1	3.3
13	undamaged	0	4.2	alternaria	GV 10-234b1	3.5
14	damaged	0	6.2	water	control (water)	0.0
15	damaged	0	6.2	stemphylium	GV 10-140a1	2.8
16	damaged	0	6.2	stemphylium	GV11-265a	2.8
17	damaged	0	6.2	alternaria	GV 10-187 1	3.3
18	damaged	0	6.2	alternaria	GV 10-234b1	3.5
19	damaged	1860	6.2	stemphylium	GV 10-140a1	2.8
20	damaged	1860	6.2	stemphylium	GV 11-265a	2.8
21	damaged	1860	6.2	alternaria	GV 10-187 1	3.3
22	damaged	1860	6.2	alternaria	GV 10-234b1	3.5
23	damaged	0	4.2	stemphylium	GV 10-140a1	2.8
24	damaged	0	4.2	stemphylium	GV 11-265a	2.8
25	damaged	0	4.2	alternaria	GV 10-187 1	3.3
26	damaged	0	4.2	alternaria	GV 10-234b1	3.5

2.2 Field trial for the efficacy of fungicides

In 2012 two field trials were conducted under the GEP Certificate (annex A) to test the efficacy of different fungicides against stemphylium. Field trials were located in Eerste Exloërmond and Nieuw Buinen and were conducted on fields naturally infested with stemphylium. Infection was prior to start of the field trials confirmed by the Diagnostic Service of the IRS. Trials were started at the moment the first leaf spots appeared in the fields. On both fields the cultivar 'Rhino' (SESvanderHave) was grown. The location and layout of the field trials can be found in annexes B1 and C1. On both field trials the objects were the same: untreated (control), Opus Team (1.0 l/ha), Sphere SC (0.25 l/ha), Spyrale EC (1.0 l/ha), Spyrale EC (1.0 l/ha) + Trips-Flo (0.1 l/ha), IRS 694 (1.33 l/ha), IRS 700 (1.0 l/ha), IRS 704 (0.7 l/ha), IRS 704 (1.0 l/ha), IRS 705 (0.8 l/ha), IRS 706 (1.2 l/ha) and IRS 707 (1.0 l/ha). All products used were fungicides. Fungicides not registered for Dutch sugar beet growing are named under IRS-code.
The field trials were sprayed for the first time on 23 July 2012. The second and third application were conducted on 15 August and 10 September 2012. Gross plot size was 14.5 meter × 3 meter (six rows of sugar beet) and nett size was 12.5 meter × 3 meter. On each of the field trials, the infestation per plot was assessed for four times (15 August, 7 September, 28 September and 2 November 2012).
Field trials were mechanically harvested on 8 November 2012. Gross weight was determined and 3 subsamples of circa 20 kg were taken from each plot. Subsamples were analysed for sugar beet quality in the tare house of the IRS.
The field trials had four replicates in a random design. The field trial design is shown in the annexes B2 and C2. The assessments and yields are analysed with ANOVA using the statistical package Genstat (15th Edition).

2.3 Spread throughout the Netherlands

The employees of the Agricultural Department of Suiker Unie located in the different sugar beet growing areas have estimated the amount of fields infested with stemphylium leaf spot, and the percentage of the acreage where yield loss by stemphylium occurred.

3. Results and discussion

3.1 Climate room trial

The results of the climate room trial are the same as those from the climate room trial in 2011 [2,3]. Both isolates of stemphylium were able to cause uncountable spots on the leaves of all objects with stemphylium (figure 5). Three days after inoculation the spots were already present on the leaves. One week after the first symptoms heavily infested, yellow leaves started to die (figure 6).
Both alternaria-isolates were not able to produce symptoms on undamaged leaves. Only on damaged leaves, alternaria isolates were able to infect, but did not cause spots, but rather black edges around the cuts of the scourer. The control treatment (water) was free of leaf spots for both undamaged and damaged leaves (figure 7).
Stemphylium was able to cause the 'yellow spot' symptoms on healthy plants as well as on plants with the additional stress levels (low pH, beet cyst nematodes and damaged leaves). The fact that the results are the same as in the initial trial in 2011, proves that the 'yellow leaf spot disease' in Dutch sugar beet growing is caused by stemphylium. A more detailed identification of the specie(s) is in progress. From the spots in the climate room trial, stemphylium was re-isolated.

Figure 5. Leaves inoculated with stemphylium isolates showed leaf spots.

Figure 6. Leaves inoculated with stemphylium isolates. One week after the first symptoms heavily infested, yellow leaves started to die.

Figure 7. Leaves inoculated with water or alternaria showed no leaf spots.

3.2 Fungicide field trials 2012

Both trial fields were homogeneous infested with stemphylium. The disease pressure on both field trials was high. Therefore, a third application with the fungicides was carried out. From the start of the field trials onwards, the infestation on the field trial in Eerste Exloërmond was higher compared to the field trial in Nieuw Buinen. The data of the infestation assessments is shown in the annexes B3, B4, C3 and C4. The infestation of other foliar fungi was very low on both field trials. In the untreated control of Eerste Exloërmond, a few spots of *Cercospora beticola* and *Ramularia beticola* were found and no infestation of other fungi than stemphylium in the plots of the other objects. In the untreated control of Nieuw Buinen, spots of *Cercospora beticola* and *Ramularia beticola* were found. Also in the plots A4, D4, A10 and D10 a few spots of *Cercospora beticola* and *Ramularia beticola* were found, but not in the other plots of the field trial. So, the infestation of *Cercospora beticola* and *Ramularia beticola* was too low for a reliable assessment of the efficacy against cercospora and ramularia of the fungicides used. Thus both field trials provide clear information on the efficacy against stemphylium of the fungicides tested.
The results of the efficacy of the different fungicides used, assessed on 2 November 2012, are shown in figure 8. The results on both field trials were in line with each other. No interaction of fungicide with location was found (data not shown). Based on the results, the fungicides could be classified in three groups: 1) no efficacy, equal to the untreated control (Opus Team and IRS 704 1.0 l/ha in Nieuw Buinen); 2) little or some efficacy (Sphere SC, Spyrale EC, Spyrale EC + Trips-Flo, IRS 700 and IRS 704 (both dosages in Eerste Exloërmond and 0.7 l/ha in Nieuw Buinen)) and 3) good efficacy (IRS 705, IRS 706, IRS 707 and IRS 694). Within these classes the fungicides did not differ from each other.
Because no interaction between location of the trial field and fungicide efficacy was found, the data of both trial fields can be averaged. This data is shown in figure 9. From this averaged data can be concluded that the separation of fungicides into groups becomes more distinct: 1) no efficacy, equal to the untreated control (Opus Team); 2) little or some efficacy (Sphere SC, Spyrale EC, Spyrale EC + Trips-Flo, IRS 700 and IRS 704 (both dosages)) and 3) good efficacy (IRS 705, IRS 706, IRS 707 and IRS 694). The fungicide IRS 694 had a significantly better efficacy compared to IRS 707 in the last group.

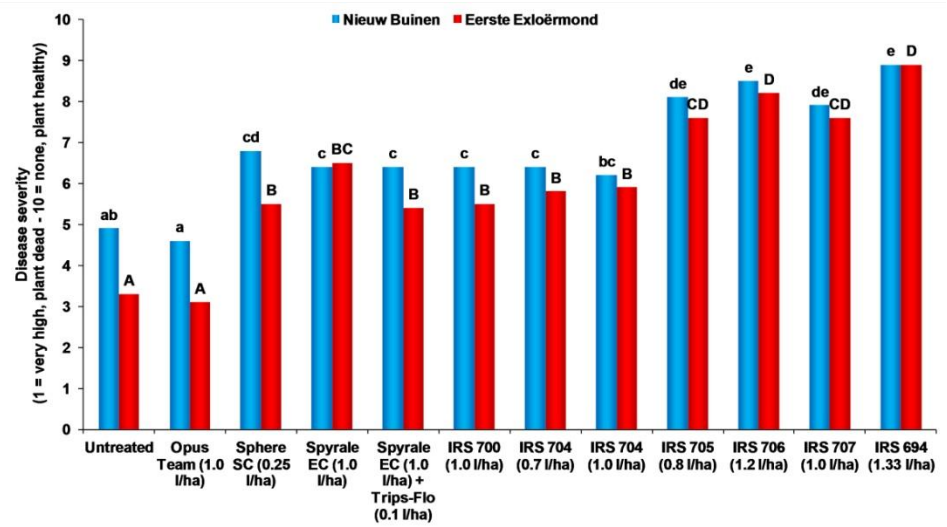

Figure 8. Disease severity (1 = very high, plant dead - 10 = none, plant healthy) on 2 November 2012. Different letters (Nieuw Buinen lower case; Eerste Exloërmond capitals) indicate significant differences. Data from the field trials in Nieuw Buinen (p^1<0.001; LSD^2 5% = 1.43) and Eerste Exloërmond (p^1<0.001; LSD^2 5% = 1.32).

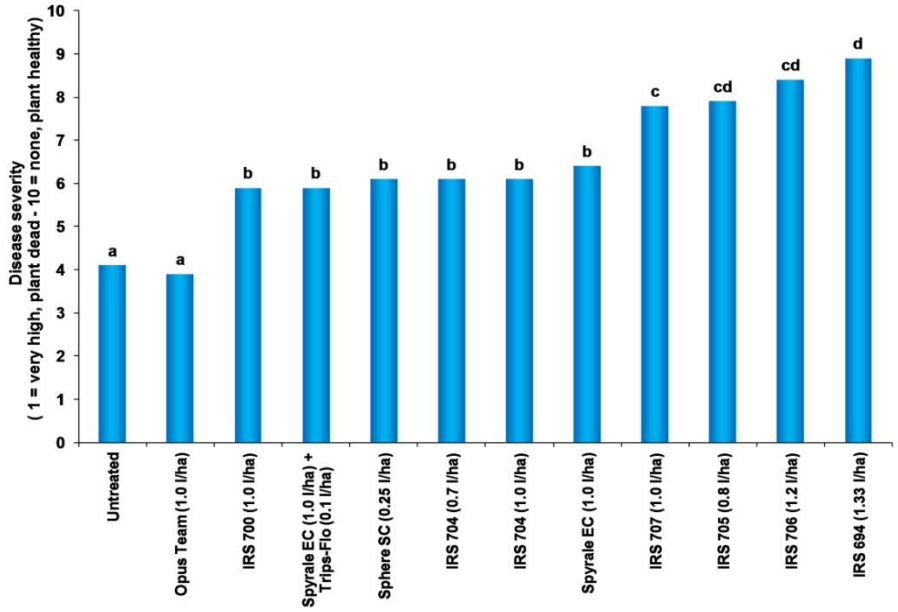

Figure 9. Average disease severity (1 = very high, plant dead - 10 = none, plant healthy) on 2 November 2012 from both field trials in 2012, Nieuw Buinen and Eerste Exloërmond. Different letters indicate significant differences (p^1 <0.001; LSD^2 5% = 1.02).

[1] p = probability >0.05 = not significant, <0.05 and >0.001 = significant, <0.001 = very significant.
[2] LSD = least significant difference.

Sugar yields for the untreated control were on the field trials in Eerste Exloërmond and Nieuw Buinen respectively 11.2 and 14.5 ton per sugar hectare (annex B5, B6, C5 and C6). The financial yields of both field trials are shown in figure 10. The classification into three groups (like for the assessment of fungicide efficacy) can also be applied to the financial yields, with only minor differences. In Nieuw Buinen the fungicide IRS 705, which had a good efficacy

based on symptoms, does not have a significant higher yield compared to Sphere SC, IRS 700 and IRS 704 (both dosages), which are in the group with little or some efficacy and does not differ from IRS 707 (1.0 l/ha) either, which had a good efficacy based on symptoms. In Eerste Exloërmond the financial yield of fungicide IRS 705 did not differ significantly from the financial yields of the fungicides IRS 706 and IRS 707, which both had a good efficacy. In Eerste Exloërmond the treatment with Spyrale EC + Trips-Flo did not give a significantly higher yield compared to the untreated control and Opus Team. On both field trials the highest financial yield was obtained by the fungicide IRS 694. On the field trial in Nieuw Buinen the fungicide IRS 706 was statistically equal to IRS 694 concerning the financial yield. On average for both field trials, this fungicide had a 32% higher sugar yield compared to the untreated control (figure 11). Due to the higher infestation on the field trial in Eerste Exloërmond, the damage of stemphylium to sugar yield was bigger (4.7 t/ha; 42%) compared to the field trial in Nieuw Buinen (3.2 t/ha; 22%). The financial yield under stemphylium infestation of the fungicide with the best efficacy was in Eerste Exloërmond 1,319 Euro (51%) and in Nieuw Buinen 920 Euro per hectare (26%) higher. The registered fungicides Spyrale EC en Sphere SC did not differ significantly from each other and gave a 14% higher sugar yield and a 17% higher financial yield compared to untreated.
These results clearly show that the in sugar beet registered fungicide Opus Team has no efficacy against stemphylium and that the two registered fungicides Spyrale EC and Sphere SC have some efficacy against stemphylium. Despite some efficacy the (currently) only permitted fungicides to control stemphylium still impose financial losses, due to incomplete control. On average the difference between Spyrale EC and Sphere SC towards, the best fungicide tested is 618 Euro per hectare. This underlines the urgent need for the registration in sugar beets of fungicides with good efficacy.
One object was the addition of Trips-Flo to Spyrale EC. Trips-Flo is a formulation that should cause a better distribution and attachment of the sprayed solution to the leaves. On both individual trial fields (and average data thereof) the addition of Trips-Flo did not cause an improvement of the efficacy of the fungicide.

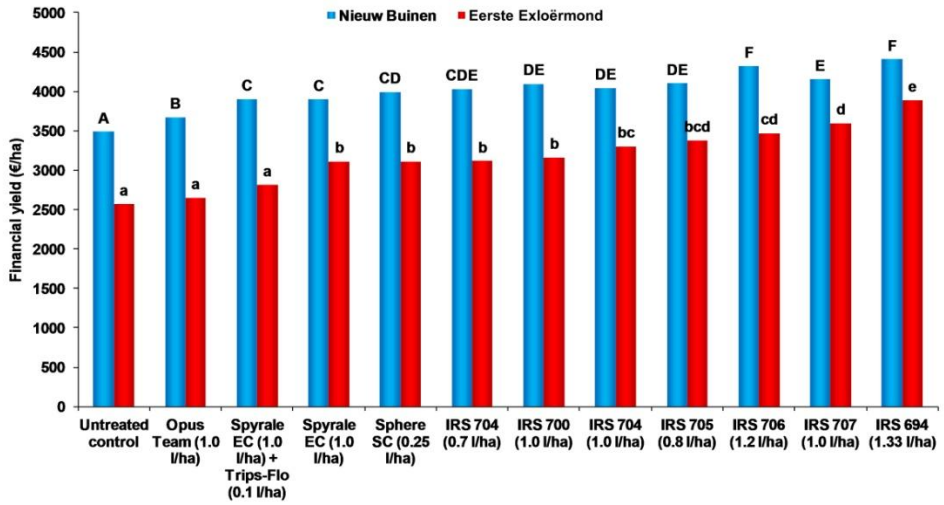

Figure 10. Financial yield as the result of the efficacy of different fungicides. Different letters (Nieuw Buinen capitals; Eerste Exloërmond lower case) indicate significant differences. Data from the field trials in Nieuw Buinen (p^1<0.001; LSD^2 5% = 141) and Eerste Exloërmond (p^1<0.001; $LSD^2$5% = 288).

[1] p = probability > 0.05 = not significant, < 0.05 and >0.001 = significant, <0.001 = very significant.
[2] LSD = least significant difference.

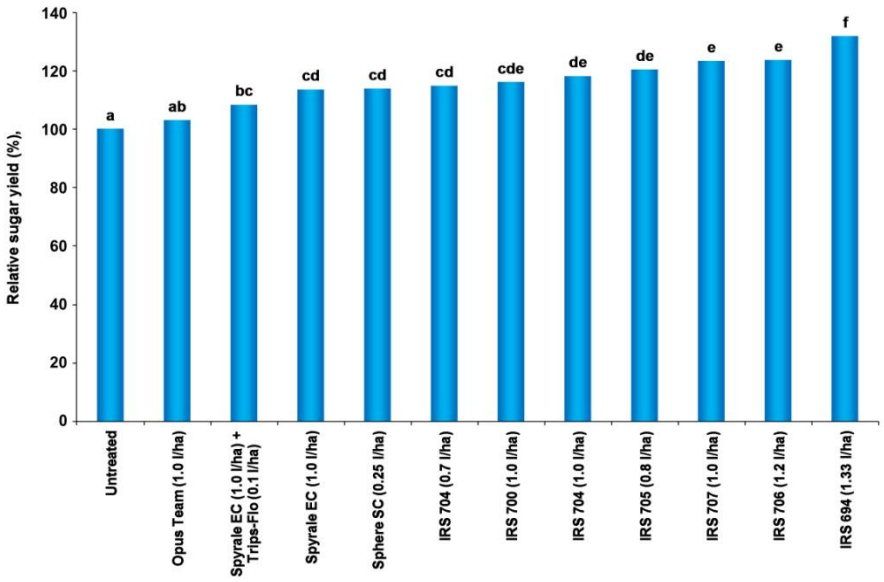

Figure 11. Relative sugar yield as the result of the efficacy of different fungicides, average date from two trial fields (Nieuw Buinen and Eerste Exloërmond) in 2012. Different letters indicate significant differences. Data from the field trials in Nieuw Buinen (p^1<0.001; LSD^2 5% = 7.8).

[1] p = probability > 0.05 = not significant, < 0.05 and >0.001 = significant, <0.001 = very significant.
[2] LSD = least significant difference.

3.3 Spread throughout the Netherlands

The results of the inventarisation of the Agricultural Department of Suiker Unie are shown in figures 12 and 13. On 32% (23,286 ha) of the sugar beet fields symptoms of a stemphylium infestation were found in 2012. This figure shows that stemphylium is wide spread, especially in the Central, North, North Eastern and Eastern part of the Netherlands. In these regions most of the acreage with yield loss due to stemphylium infestation could be found. On average, yield loss due to stemphylium infestation occurred on 20% (14,390 ha) of the Dutch sugar beet fields.

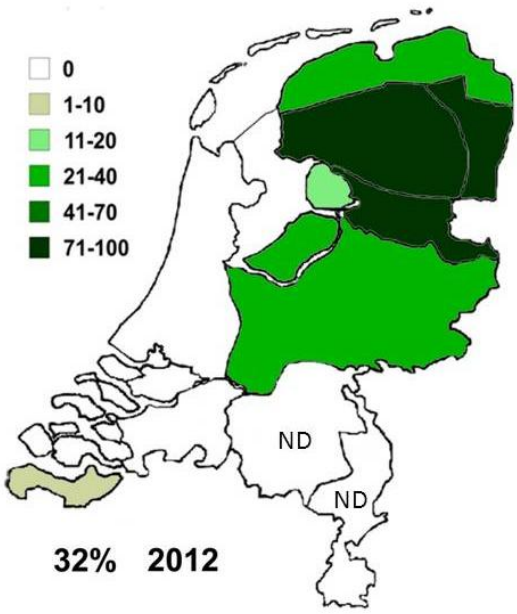

Figure 12. Spread of stemphylium (yellow leaf spot disease) in the Netherlands in 2012. Colours on the map show the relative amount of fields infested with stemphylium (32% = 23,286 ha). Data from the inventarisation of the Agricultural Department of Suiker Unie. From Oost-Brabant and Limburg no data was received (ND).

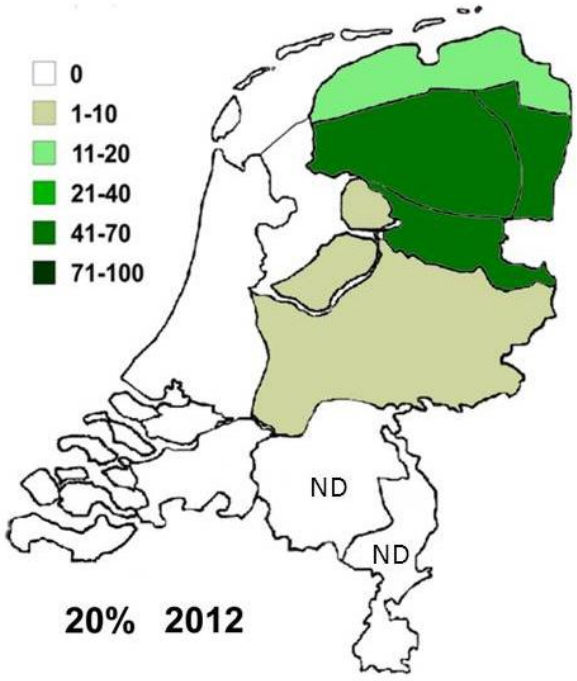

Figure 13. Acreage (20% = 14,390 ha) with yield loss by stemphylium (yellow leaf spot disease) infestation in the Netherlands in 2012. Colours on the map show the relative amount of fields infested with stemphylium where yield loss due to this infestation occurred. Data from the inventarisation of the Agricultural Department of Suiker Unie. From Oost-Brabant and Limburg no data was received (ND).

4. Summary and conclusions

The yellow leaf spot disease in Dutch sugar beet growing is caused by *Stemphylium* spp. Alternaria-isolates were not able to cause spots on undamaged leaves in the climate room trials, while both stemphylium isolates did.
On two field trials the efficacy of different fungicides was tested. The addition of Trips-Flo did not cause an improvement of the fungicide's efficacy.
There were clear differences in efficacy found between the different fungicides. There was no interaction between fungicide efficacy and location. Based on the efficacy assessment on two trial fields' average, the fungicides could be classified in three groups: 1) no efficacy, equal to the untreated control (Opus Team); 2) little or some efficacy (Sphere SC, Spyrale EC, Spyrale EC + Trips-Flo, IRS 700 and IRS 704 (both dosages tested)) and 3) good efficacy (IRS 694, IRS 705, IRS 706 and IRS 707). Within the last class the fungicide IRS 694 was significantly better compared to IRS 707.
The fungicide with the highest efficacy resulted in a 32% higher sugar yield.
The financial loss due to stemphylium infestation was in Eerste Exloërmond 1.319 Euro per hectare (51%) and in Nieuw Buinen 920 Euro per hectare (26%). The registered fungicides Spyrale EC and Sphere SC did not differ significantly from each other and gave a 14% higher sugar yield and a 17% higher financial yield compared to untreated.
The results clearly show that the in sugar beet registered fungicide Opus Team has no efficacy against stemphylium leaf spot and that the two registered fungicides Spyrale EC and Sphere SC have some efficacy against stemphylium leaf spot in sugar beet. The difference of Spyrale EC and Sphere SC with the best fungicide tested was 618 Euro per hectare. This underlines in sugar beets the urgent need for the registration of fungicides with good efficacy.
In 2012 stemphylium infestation could be found on 32% of the total acreage of Dutch sugar beet growing. On 20% (14,390 ha) yield loss due to this infestation occurred.

5. Samenvatting en conclusies

De gele vlekjes in de Nederlandse suikerbietenteelt worden veroorzaakt door *Stemphylium* spp. Alternaria-isolaten waren niet in staat om bladvlekken te veroorzaken op onbeschadigd blad. Dit konden beide stemphyliumisolaten wel.
Op twee veldproeven is de effectiviteit van verschillende fungiciden getest. Toevoeging van Trips-Flo (hechter uitvloeier) had geen effect op de effectiviteit van de fungicide.
Tussen de verschillende fungiciden was een duidelijk verschil in effectiviteit. Er was geen interactie tussen fungicide-effectiviteit en locatie. Op basis van het resultaat van de gemiddelde effectiviteitsbeoordeling op twee proefvelden kunnen de fungiciden in drie groepen worden onderverdeeld: 1) geen werking, effectiviteit gelijk aan onbehandeld (Opus Team); 2) weinig tot enige werking (Sphere SC, Spyrale EC, Spyrale EC + Trips-Flo, IRS 700 en IRS 704 (beide geteste doseringen)) en 3) goede werking (IRS 694, IRS 705, IRS 706 en IRS 707). Binnen deze laatste klasse was het fungicide IRS 694 significant beter in vergelijking met IRS 707. Het fungicide met de beste effectiviteit, had een 32% hogere suikeropbrengst.
De financiële schade door de stemphylium-aantasting was in Eerste Exloërmond 1.319 euro per hectare (51%) en in Nieuw Buinen 920 euro per hectare (26%). De in de suikerbietenteelt toegelaten fungiciden Spyrale EC en Sphere SC verschilden niet significant van elkaar en gaven respectievelijk 14% hogere suikeropbrengsten en 17% hogere financiële opbrengsten ten opzichte van onbehandeld. De resultaten laten duidelijk zien dat het voor bladschimmels toegelaten fungicide Opus Team geen werking heeft tegen stemphyliumbladvlekken in suikerbieten. Het verschil van 618 euro per hectare tussen het best werkende fungicide (IRS 694) en het gemiddelde van Spyrale EC en Sphere SC onderstreept de noodzaak voor toelating in suikerbieten van fungiciden met een goede werking tegen stemphylium.
In 2012 is een aantasting door stemphylium gevonden op 32% van de Nederlandse suikerbieten percelen. Op 20% van het suikerbietenareaal (14.390 ha) is schade opgetreden door infectie met stemphylium.

6. Literature

1. Hanse, A.C. en Raaijmakers, E.E.M. (2011)
   Verslag onderzoeken aan 'gele vlekjes' van 2007-2010.
   IRS-rapport 11R04. IRS, Bergen op Zoom.

2. Hanse, A.C. (2012)
   Stemphylium: de veroorzaker van de gele vlekjes. Resultaten klimaatkamer en veldproeven in 2011.
   IRS-rapport 12R01. IRS, Bergen op Zoom.

3. IRS Jaarverslag 2011 (2012)
   Project No. 12-14: Onderzoek naar gele vlekjes in suikerbieten. IRS, Bergen op Zoom.

Annex A GEP CERTIFICATE

Ministerie van Landbouw, Natuur en Voedselkwaliteit

landbouw, natuur en voedselkwaliteit

This is to declare that, in conformity with the request of March 4, 2008

Stichting IRS

Residing Van Konijnenburgweg 24, Bergen op Zoom, the Netherlands

HAS OFFICIALLY BEEN RECOGNISED AS AN ORGANISATION FOR EFFICACY TESTING

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 will commence on June 19, 2008 and expire on June 19, 2014

Wageningen, June 9, 2008

For the Minister of Agriculture, Nature and Food Quality,

Mr. ing. H.A. Harmsma

Acting Director Plant Protection Service

Annex B Fungicide field trial Eerste Exloërmond 2012

Annex B1 Field trial location

Field trial number and name: 12-12-14.01 Fungicidenbespuiting tegen gele vlekjes Eerste Exloërmond

Annex B2 Field trial design and objects Eerste Exloërmond

Field trial:	12-12-14.01	Fungicidenbespuiting tegen gele vlekjes Eerste Exlöermond
Replicates: 4		Plots per replicate: 12
Plot nett size:12.5×3 meter		Plot gross size:14.5×3 meter

OBJECT NUMBERS

D

10	**11**	**1**	**7**	**8**	**9**
2	**5**	**12**	**3**	**6**	**4**
7	**2**	**5**	**9**	**11**	**8**
1	**6**	**3**	**10**	**4**	**12**
9	**1**	**11**	**8**	**7**	**5**
3	**10**	**4**	**12**	**2**	**6**
12	**4**	**2**	**6**	**10**	**1**
8	**3**	**7**	**5**	**9**	**11**

A

object	description
1	untreated control
2	Opus Team (1.0 l/ha)
3	Sphere SC (0.25 l/ha)
4	IRS 694 (1.33 l/ha)
5	Spyrale EC (1.0 l/ha)
6	IRS 700 (1.0 l/ha)
7	IRS 704 (0.7 l/ha)
8	IRS 704 (1.0 l/ha)
9	IRS 705 (0.8 l/ha)
10	IRS 706 (1.2 l/ha)
11	IRS 707 (1.0 l/ha)
12	Spyrale EC (1.0 l/ha) + Trips-Flo (0.1 l/ha)

Annex B3 Stemphylium assessments Eerste Exloërmond

nr	object	replicate	stemphylium infestation (1 = very high, plant dead - 10 = none, plant healthy)			
			15-8-2012	7-9-2012	28-9-2012	2-11-2012
1	untreated control	A	5.5	5.0	4.0	4.0
1	untreated control	B	4.0	4.5	3.0	3.0
1	untreated control	C	4.5	4.0	3.0	2.0
1	untreated control	D	6.0	5.0	5.0	4.0
2	Opus Team	A	5.5	5.0	4.0	4.5
2	Opus Team	B	3.5	4.0	3.0	2.0
2	Opus Team	C	6.0	4.5	3.5	3.0
2	Opus Team	D	6.0	5.0	4.0	3.0
3	Sphere SC	A	7.0	6.5	5.0	6.0
3	Sphere SC	B	5.0	4.5	4.5	4.0
3	Sphere SC	C	4.0	6.0	5.0	7.0
3	Sphere SC	D	5.0	5.5	7.0	5.0
4	IRS 694	A	7.5	9.0	9.5	9.0
4	IRS 694	B	7.5	8.5	8.5	9.0
4	IRS 694	C	7.0	8.5	8.0	8.5
4	IRS 694	D	7.5	8.5	9.0	9.0
5	Spyrale EC	A	7.0	7.0	7.0	7.0
5	Spyrale EC	B	7.5	7.0	6.0	7.0
5	Spyrale EC	C	6.5	6.5	7.0	6.0
5	Spyrale EC	D	6.5	7.0	6.0	6.0
6	IRS 700	A	6.5	6.0	4.5	5.0
6	IRS 700	B	7.5	7.0	5.0	6.0
6	IRS 700	C	6.0	5.0	5.0	6.0
6	IRS 700	D	6.0	6.5	5.0	5.0
7	IRS 704	A	7.0	7.0	6.0	7.0
7	IRS 704	B	6.5	5.5	5.0	5.0
7	IRS 704	C	5.5	5.0	4.5	5.0
7	IRS 704	D	5.0	4.5	6.0	6.0
8	IRS 704	A	7.5	7.5	6.5	7.0
8	IRS 704	B	6.0	6.0	5.0	4.0
8	IRS 704	C	7.5	6.5	6.0	6.5
8	IRS 704	D	7.0	5.5	5.0	6.0
9	IRS 705	A	7.0	7.5	6.5	8.0
9	IRS 705	B	6.5	7.5	6.5	6.5
9	IRS 705	C	7.5	6.5	8.5	8.0
9	IRS 705	D	8.0	7.5	8.5	8.0
10	IRS 706	A	7.0	7.5	7.5	8.5
10	IRS 706	B	7.0	7.5	7.0	7.5
10	IRS 706	C	7.5	8.5	8.5	9.0
10	IRS 706	D	8.0	8.5	8.0	8.0
11	IRS 707	A	7.5	8.0	6.5	7.5
11	IRS 707	B	7.0	7.0	6.5	7.5
11	IRS 707	C	7.0	6.0	7.5	7.5
11	IRS 707	D	8.0	8.0	8.0	8.0
12	Spyrale EC + Trips-Flo	A	7.5	7.5	6.5	7.5
12	Spyrale EC + Trips-Flo	B	4.0	4.5	3.0	2.0
12	Spyrale EC + Trips-Flo	C	7.5	7.0	6.0	6.0
12	Spyrale EC + Trips-Flo	D	6.0	6.0	5.5	6.0

Annex B4 Summarised assessments of stemphylium infestation Eerste Exloërmond

object	description	15-8-2012[1]	7-9-2012[1]	28-9-2012[1]	2-11-2012[1]
1	untreated control	5.0 a	4.6 a	3.8 a	3.3 a
2	Opus Team (1.0 l/ha)	5.3 ab	4.6 a	3.6 a	3.1 a
3	Sphere SC (0.25 l/ha)	5.3 ab	5.6 ab	5.4 b	5.5 b
4	IRS 694 (1.33 l/ha)	7.4 d	8.6 f	8.8 f	8.9 d
5	Spyrale EC (1.0 l/ha)	6.9 cd	6.9 cd	6.5 cd	6.5 bc
6	IRS 700 (1.0 l/ha)	6.5 cd	6.1 bc	4.9 b	5.5 b
7	IRS 704 (0.7 l/ha)	6.0 abc	5.5 ab	5.4 b	5.8 b
8	IRS 704 (1.0 l/ha)	7.0 cd	6.4 bcd	5.6 bc	5.9 b
9	IRS 705 (0.8 l/ha)	7.3 d	7.2 de	7.5 de	7.6 cd
10	IRS 706 (1.2 l/ha)	7.4 d	8.0 ef	7.8 ef	8.2 d
11	IRS 707 (1.0 l/ha)	7.4 d	7.2 de	7.1 de	7.6 cd
12	Spyrale EC (1.0 l/ha) + Trips-Flo (0.1 l/ha)	6.3 bcd	6.2 bcd	5.2 b	5.4 b
probability[2]		<0.001	<0.001	<0.001	<0.001
LSD[3] 5%		1.22	1.01	1.07	1.32

[1] Date of assessment of stemphylium infestation (1 = very high, plant dead - 10 = none, plant healthy).
[2] probability: >0.05 = not significant, < 0.05 and >0.001 = significant, <0.001 = very significant.
[3] LSD = least significant difference.

Annex B5 Yield and sugar beet quality Eerste Exloërmond

object	description	replicate	root yield (t/ha)	sugar-content (%)	sugar yield (t/ha)	soil tare (%)	K	Na	AmN	glucose	WIN
							(mmol/kg)				
1	untreated	A	63.0	16.29	10.3	4.3	33.9	7.1	21.3	1.9	89.5
1	untreated	B	67.0	16.46	11.0	3.6	31.6	5.2	12.5	2.2	91.1
1	untreated	C	68.6	16.41	11.2	4.0	36.0	5.0	15.9	1.9	90.2
1	untreated	D	72.7	17.01	12.4	4.5	34.7	4.7	18.5	2.1	90.4
2	Opus Team	A	71.3	16.71	11.9	3.3	33.6	4.2	13.2	2.0	91.0
2	Opus Team	B	61.6	15.75	9.7	2.7	29.8	4.8	14.7	1.7	90.6
2	Opus Team	C	72.9	16.77	12.2	3.3	35.3	4.7	16.1	1.9	90.5
2	Opus Team	D	72.8	16.74	12.2	3.6	38.5	4.8	17.5	2.0	90.0
3	Sphere SC	A	77.2	18.04	13.9	3.0	35.1	4.1	9.5	2.1	92.0
3	Sphere SC	B	66.4	17.52	11.6	3.2	32.2	3.7	9.6	2.2	92.0
3	Sphere SC	C	74.9	17.68	13.2	4.8	33.8	3.6	11.7	2.4	91.7
3	Sphere SC	D	75.9	17.39	13.2	3.2	33.5	3.3	13.9	2.0	91.4
4	IRS 694	A	85.0	18.22	15.5	3.3	37.5	3.5	11.0	2.1	91.8
4	IRS 694	B	82.7	18.09	15.0	3.4	32.4	3.1	7.3	2.7	92.5
4	IRS 694	C	87.7	18.48	16.2	2.0	35.8	3.2	8.9	2.2	92.3
4	IRS 694	D	94.0	18.22	17.1	3.5	35.7	4.3	10.7	1.9	91.9
5	Spyrale EC	A	74.5	17.01	12.7	4.5	31.4	3.4	12.7	2.2	91.5
5	Spyrale EC	B	75.1	17.11	12.8	5.8	33.5	6.5	18.5	2.0	90.4
5	Spyrale EC	C	79.0	17.38	13.7	5.0	33.8	4.0	13.6	2.2	91.3
5	Spyrale EC	D	78.4	17.59	13.8	3.8	36.5	4.4	13.1	2.1	91.2
6	IRS 700	A	66.3	17.51	11.6	4.2	30.0	3.2	11.3	2.0	92.0
6	IRS 700	B	72.1	17.68	12.8	3.9	32.8	4.8	14.5	1.9	91.4
6	IRS 700	C	77.3	17.67	13.7	2.4	36.0	4.2	10.8	2.5	91.6
6	IRS 700	D	82.7	17.89	14.8	4.2	34.5	3.6	11.4	2.1	91.8
7	IRS 704	A	80.2	17.46	14.0	3.8	35.8	4.1	11.6	2.0	91.4
7	IRS 704	B	73.9	17.18	12.7	4.2	33.0	4.2	13.5	1.9	91.3
7	IRS 704	C	76.8	17.53	13.5	3.8	37.3	4.4	11.6	2.1	91.3
7	IRS 704	D	74.9	16.82	12.6	4.1	31.5	3.7	13.8	2.1	91.2
8	IRS 704	A	81.8	17.76	14.5	3.2	36.2	4.1	10.5	1.8	91.7
8	IRS 704	B	74.5	17.11	12.7	4.7	31.6	3.2	13.3	2.0	91.5
8	IRS 704	C	80.0	17.94	14.3	3.8	35.6	4.3	13.4	2.1	91.4
8	IRS 704	D	80.6	17.23	13.9	3.1	33.4	3.8	12.3	2.0	91.4
9	IRS 705	A	78.2	17.45	13.6	3.6	31.2	4.5	11.5	2.3	91.8
9	IRS 705	B	73.7	17.82	13.1	3.9	32.2	4.1	9.2	2.2	92.1
9	IRS 705	C	79.5	17.82	14.2	4.8	33.5	2.9	13.3	2.1	91.7
9	IRS 705	D	87.5	17.65	15.4	2.8	34.9	4.8	13.6	1.9	91.3
10	IRS 706	A	72.3	17.85	12.9	3.4	30.9	3.5	10.0	2.1	92.2
10	IRS 706	B	77.3	18.31	14.2	3.1	32.0	3.4	7.2	2.4	92.6
10	IRS 706	C	81.1	18.09	14.7	5.1	34.3	2.5	11.9	2.2	91.9
10	IRS 706	D	84.3	18.25	15.4	2.1	37.9	3.7	10.7	2.2	91.8
11	IRS 707	A	81.0	18.22	14.8	3.4	32.3	4.1	10.3	1.9	92.2
11	IRS 707	B	77.8	17.62	13.7	4.3	30.9	3.4	9.7	2.3	92.2
11	IRS 707	C	82.7	18.25	15.1	2.3	33.2	3.0	9.2	2.4	92.3
11	IRS 707	D	85.3	18.23	15.5	2.4	35.5	4.3	10.7	2.2	91.9
12	Spyrale EC + Trips-Flo	A	72.9	17.17	12.5	4.7	35.3	4.5	13.3	2.0	91.1
12	Spyrale EC + Trips-Flo	B	57.5	16.13	9.3	3.6	29.5	3.9	13.4	2.1	91.1
12	Spyrale EC + Trips-Flo	C	77.1	17.49	13.5	4.5	36.3	4.9	13.9	1.9	91.1
12	Spyrale EC + Trips-Flo	D	77.0	16.90	13.0	4.9	35.8	4.1	16.5	2.1	90.6

Annex B6 Summarised yield parameters Eerste Exloërmond

object	root yield (t/ha)	sugar content (%)	sugar yield (t/ha)	soil tare (%)	K (mmol/kg)	Na (mmol/kg)	AmN (mmol/kg)	glucose (mmol/kg)	WIN	financial yield (€/ha)
1	67.8	16.54	11.2	4.1	34.1	5.5	17.1	2.0	90.3	2570
2	69.7	16.49	11.5	3.2	34.3	4.7	15.3	1.9	90.5	2649
3	73.6	17.66	13.0	3.6	33.7	3.6	11.2	2.2	91.8	3114
4	87.3	18.25	15.9	3.0	35.3	3.5	9.5	2.2	92.1	3888
5	76.7	17.27	13.3	4.8	33.8	4.6	14.5	2.1	91.1	3113
6	74.6	17.69	13.2	3.7	33.3	3.9	12.0	2.1	91.7	3164
7	76.5	17.25	13.2	4.0	34.4	4.1	12.6	2.0	91.3	3115
8	79.2	17.51	13.9	3.7	34.2	3.8	12.4	2.0	91.5	3305
9	79.7	17.68	14.1	3.8	32.9	4.1	11.9	2.1	91.7	3377
10	78.7	18.13	14.3	3.4	33.8	3.3	9.9	2.2	92.1	3471
11	81.7	18.08	14.8	3.1	33.0	3.7	10.0	2.2	92.1	3598
12	71.1	16.92	12.1	4.4	34.2	4.3	14.3	2.0	90.9	2813
probability[1]	<0.001	<0.001	<0.001	0.10	0.89	0.01	<0.001	0.07	<0.001	<0.001
LSD[2] 5%	5.3	0.43	1.1	1.1	2.8	1.0	2.8	0.2	0.5	288

[1] probability: >0.05 = not significant, <0.05 and >0.001 = significant, <0.001 = very significant.
[2] LSD = least significant difference.

Annex C Fungicide field trial Nieuw Buinen 2012

Annex C1 Field trial location

Field trial number and name: 12-12-14.02 Fungicidenbespuiting tegen gele vlekjes Nieuw Buinen

Bijlage C2 Field trial design and objects Nieuw Buinen

Field trial: 12-12-14.02	Fungicidenbespuiting tegen gele vlekjes Nieuw Buinen
Replicates: 4	Plots per replicate: 12
Plot nett size:12.5×3 meter	Plot gross size:14.5×3 meter

OBJECT NUMBERS

D

11	**2**	**5**	**8**	**6**	**4**
3	**9**	**12**	**7**	**1**	**10**
12	**10**	**1**	**3**	**8**	**7**
9	**11**	**6**	**4**	**2**	**5**
2	**4**	**11**	**12**	**7**	**3**
8	**1**	**9**	**10**	**5**	**6**
6	**7**	**3**	**11**	**4**	**1**
10	**8**	**2**	**5**	**12**	**9**

A

object	description
1	untreated control
2	Opus Team (1.0 l/ha)
3	Sphere SC (0.25 l/ha)
4	IRS 694 (1.33 l/ha)
5	Spyrale EC (1.0 l/ha)
6	IRS 700 (1.0 l/ha)
7	IRS 704 (0.7 l/ha)
8	IRS 704 (1.0 l/ha)
9	IRS 705 (0.8 l/ha)
10	IRS 706 (1.2 l/ha)
11	IRS 707 (1.0 l/ha)
12	Spyrale EC (1.0 l/ha) + Trips-Flo (0.1 l/ha)

Bijlage C3 Stemphylium assessment Nieuw Buinen

nr	object	replicate	stemphylium infestation (1 = very high, plant dead - 10 = none, plant healthy)			
			15-8-2012	7-9-2012	28-9-2012	2-11-2012
1	untreated control	A	7.5	6.0	7.0	7.0
1	untreated control	B	7.0	6.5	5.0	5.5
1	untreated control	C	6.5	6.0	5.0	4.0
1	untreated control	D	6.5	5.0	4.0	3.0
2	Opus Team	A	7.0	6.5	6.0	5.0
2	Opus Team	B	7.5	6.5	5.5	5.0
2	Opus Team	C	6.5	5.5	4.0	3.5
2	Opus Team	D	7.0	6.0	5.0	5.0
3	Sphere SC	A	7.5	7.0	6.5	6.0
3	Sphere SC	B	8.0	7.5	7.0	8.0
3	Sphere SC	C	7.5	7.0	6.0	6.0
3	Sphere SC	D	6.5	7.5	6.5	7.0
4	IRS 694	A	8.0	9.0	9.0	8.5
4	IRS 694	B	8.5	9.0	9.5	9.5
4	IRS 694	C	7.5	8.0	9.0	8.5
4	IRS 694	D	8.5	9.0	9.0	9.0
5	Spyrale EC	A	7.0	7.0	7.0	5.5
5	Spyrale EC	B	6.0	7.0	6.0	5.0
5	Spyrale EC	C	7.5	7.5	8.0	8.0
5	Spyrale EC	D	7.5	7.0	7.0	7.0
6	IRS 700	A	7.8	8.5	7.0	6.0
6	IRS 700	B	8.0	8.0	7.0	7.0
6	IRS 700	C	8.0	8.0	7.5	7.0
6	IRS 700	D	7.5	7.5	5.5	5.5
7	IRS 704	A	7.5	7.5	6.5	6.0
7	IRS 704	B	7.5	7.0	5.5	5.5
7	IRS 704	C	7.5	7.5	7.5	8.0
7	IRS 704	D	7.5	7.5	7.0	6.0
8	IRS 704	A	7.5	7.5	7.5	7.0
8	IRS 704	B	7.5	7.5	7.0	6.0
8	IRS 704	C	7.0	6.5	6.0	5.5
8	IRS 704	D	7.5	7.0	6.0	6.5
9	IRS 705	A	8.0	8.5	8.5	8.5
9	IRS 705	B	8.0	9.0	8.0	8.0
9	IRS 705	C	8.0	8.5	8.5	7.0
9	IRS 705	D	8.5	9.0	9.0	9.0
10	IRS 706	A	8.0	9.0	9.0	8.5
10	IRS 706	B	7.5	8.0	8.5	7.5
10	IRS 706	C	8.5	9.0	9.0	9.0
10	IRS 706	D	8.0	9.0	9.0	9.0
11	IRS 707	A	8.5	8.5	8.0	8.0
11	IRS 707	B	8.0	8.5	8.5	8.0
11	IRS 707	C	8.0	8.5	9.0	8.0
11	IRS 707	D	8.0	8.0	8.0	7.5
12	Spyrale EC + Trips-Flo	A	6.5	6.5	6.5	5.5
12	Spyrale EC + Trips-Flo	B	7.5	7.0	6.5	6.0
12	Spyrale EC + Trips-Flo	C	8.0	7.5	6.0	6.5
12	Spyrale EC + Trips-Flo	D	8.0	7.5	7.0	7.5

Annex C4 Summarised assessments of stemphylium infestation Nieuw Buinen

object	description	15-8-2012[1]	7-9-2012[1]	28-9-2012[1]	2-11-2012[1]
1	untreated control	6.9 a	5.9 a	5.2 a	4.9 ab
2	Opus Team (1.0 l/ha)	7.0 a	6.1 a	5.1 a	4.6 a
3	Sphere SC (0.25 l/ha)	7.4 ab	7.2 b	6.5 b	6.8 cd
4	IRS 694 (1.33 l/ha)	8.1 b	8.8 d	9.1 c	8.9 e
5	Spyrale EC (1.0 l/ha)	7.0 a	7.1 b	7.0 b	6.4 c
6	IRS 700 (1.0 l/ha)	7.8 b	8.0 c	6.8 b	6.4 c
7	IRS 704 (0.7 l/ha)	7.5 ab	7.4 bc	6.6 b	6.4 c
8	IRS 704 (1.0 l/ha)	7.4 ab	7.1 b	6.6 b	6.2 bc
9	IRS 705 (0.8 l/ha)	8.1 b	8.8 d	8.5 c	8.1 de
10	IRS 706 (1.2 l/ha)	8.0 b	8.8 d	8.9 c	8.5 e
11	IRS 707 (1.0 l/ha)	8.1 b	8.4 cd	8.4 c	7.9 de
12	Spyrale EC (1.0 l/ha) + Trips-Flo (0.1 l/ha)	7.5 ab	7.1 b	6.5 b	6.4 c
probability[2]		0.001	<0.001	<0.001	<0.001
LSD[3] 5%		0.68	0.62	1.01	1.43

[1] Date of assessment of stemphylium infestation (1 = very high, plant dead - 10 = none, plant healthy).
[2] probability: >0.05 = not significant, <0.05 and >0.001 = significant, <0.001 = very significant.
[3] LSD = least significant difference.

Annex C5 Yield and sugar beet quality Nieuw Buinen

object	description	replicate	root yield (t/ha)	sugar-content (%)	sugar yield (t/ha)	soil tare (%)	K (mmol/kg)	Na (mmol/kg)	AmN (mmol/kg)	glucose (mmol/kg)	WIN
1	untreated control	A	87.1	17.65	15.4	4.8	31.1	2.8	13.0	2.2	91.8
1	untreated control	B	80.4	17.89	14.4	2.8	36.1	3.7	13.2	2.0	91.5
1	untreated control	C	80.6	17.76	14.3	3.4	32.1	3.6	12.8	2.0	91.8
1	untreated control	D	78.9	17.70	14.0	3.1	30.8	3.3	11.2	2.5	92.0
2	Opus Team	A	85.5	18.08	15.5	2.6	33.5	2.9	11.1	2.2	92.0
2	Opus Team	B	81.9	17.96	14.7	2.7	36.6	3.3	14.0	2.0	91.4
2	Opus Team	C	84.1	18.35	15.4	2.8	30.7	2.7	8.6	2.2	92.7
2	Opus Team	D	79.9	18.23	14.6	2.2	30.5	3.2	9.4	2.3	92.5
3	Sphere SC	A	90.8	18.51	16.8	2.7	34.7	3.0	9.1	2.2	92.3
3	Sphere SC	B	87.4	18.16	15.9	2.6	31.2	2.7	11.3	2.2	92.2
3	Sphere SC	C	88.1	18.70	16.5	2.3	32.1	3.0	10.2	2.3	92.5
3	Sphere SC	D	86.3	18.37	15.9	1.9	37.1	3.1	10.8	2.0	91.9
4	IRS 694	A	91.2	19.19	17.5	2.1	31.8	2.4	7.3	2.6	93.1
4	IRS 694	B	93.6	18.61	17.4	1.9	35.4	2.8	8.8	2.1	92.4
4	IRS 694	C	93.4	19.06	17.8	2.4	31.2	2.7	6.9	2.4	93.1
4	IRS 694	D	96.8	18.55	18.0	3.5	33.4	2.3	9.1	2.2	92.5
5	Spyrale EC	A	86.2	18.73	16.2	1.8	30.9	2.9	9.0	2.3	92.7
5	Spyrale EC	B	84.1	18.56	15.6	3.8	30.7	2.8	7.9	2.4	92.8
5	Spyrale EC	C	90.4	17.74	16.0	4.3	32.8	2.9	12.0	2.5	91.8
5	Spyrale EC	D	83.7	18.59	15.6	2.6	30.1	2.9	7.5	2.5	92.9
6	IRS 700	A	89.1	18.70	16.7	2.2	34.1	2.7	9.5	2.4	92.4
6	IRS 700	B	92.3	17.90	16.5	3.8	30.8	2.4	12.7	2.2	92.0
6	IRS 700	C	89.8	18.66	16.8	3.0	31.8	2.9	10.8	2.0	92.5
6	IRS 700	D	87.9	18.82	16.5	2.1	31.6	2.7	7.4	2.5	92.9
7	IRS 704	A	85.9	18.63	16.0	2.1	35.1	2.9	9.2	2.2	92.4
7	IRS 704	B	84.7	18.53	15.7	2.3	29.4	2.9	7.6	2.4	92.9
7	IRS 704	C	93.4	18.19	17.0	2.6	32.6	2.5	13.1	2.3	92.0
7	IRS 704	D	86.6	18.98	16.4	2.2	30.5	2.7	7.8	2.4	93.0
8	IRS 704	A	88.0	18.78	16.5	2.7	35.5	2.9	9.7	2.2	92.3
8	IRS 704	B	87.8	18.66	16.4	3.7	35.1	2.9	11.7	2.0	92.1
8	IRS 704	C	88.0	18.60	16.4	2.9	32.2	2.9	8.6	2.3	92.6
8	IRS 704	D	86.1	18.78	16.2	2.5	31.2	3.2	8.9	2.6	92.7
9	IRS 705	A	97.9	18.27	17.9	4.1	31.6	2.4	11.6	2.4	92.3
9	IRS 705	B	90.1	18.28	16.5	2.4	34.9	3.4	10.6	2.2	92.0
9	IRS 705	C	89.1	18.32	16.3	2.6	35.1	3.5	11.2	2.3	92.0
9	IRS 705	D	87.3	18.63	16.3	2.2	32.4	3.2	8.9	2.1	92.6
10	IRS 706	A	93.2	18.98	17.7	2.1	34.1	2.8	8.5	2.3	92.7
10	IRS 706	B	90.4	18.85	17.0	2.0	31.7	2.6	8.1	2.2	92.8
10	IRS 706	C	94.8	18.85	17.9	2.3	34.3	2.8	8.1	2.3	92.6
10	IRS 706	D	94.1	18.26	17.2	5.6	32.5	2.3	11.1	2.2	92.2
11	IRS 707	A	90.5	18.75	17.0	2.5	31.4	2.8	8.0	2.2	92.8
11	IRS 707	B	89.6	18.76	16.8	2.4	32.3	2.8	9.7	2.0	92.6
11	IRS 707	C	87.4	18.88	16.5	2.7	33.2	2.8	10.2	2.1	92.5
11	IRS 707	D	87.1	18.94	16.5	2.2	32.1	2.7	7.8	2.5	92.9
12	Spyrale EC + Trips-Flo	A	90.5	18.58	16.8	2.9	31.8	2.9	8.1	2.4	92.7
12	Spyrale EC + Trips-Flo	B	85.5	18.47	15.8	3.2	29.9	3.0	9.6	2.2	92.6
12	Spyrale EC + Trips-Flo	C	83.9	18.15	15.2	2.3	34.3	3.1	11.3	2.1	92.0
12	Spyrale EC + Trips-Flo	D	84.1	18.55	15.6	3.2	31.0	2.9	11.0	2.3	92.4

Annex C6 Summarised yield parameters Nieuw Buinen

object	root yield (t/ha)	sugar content (%)	sugar yield (t/ha)	soil tare (%)	K (mmol/kg)	Na (mmol/kg)	AmN (mmol/kg)	Glu (mmol/kg)	WIN	financial yield (€/ha)
1	81.7	17.75	14.5	3.5	32.5	3.3	12.6	2.2	91.8	3,485
2	82.8	18.15	15.0	2.6	32.8	3.0	10.8	2.2	92.2	3,672
3	88.1	18.43	16.3	2.4	33.8	3.0	10.4	2.2	92.2	3,993
4	93.7	18.85	17.7	2.5	32.9	2.5	8.0	2.3	92.8	4,405
5	86.1	18.40	15.8	3.1	31.1	2.9	9.1	2.4	92.6	3,896
6	89.8	18.52	16.6	2.8	32.1	2.7	10.1	2.3	92.5	4,098
7	87.7	18.58	16.3	2.3	31.9	2.8	9.4	2.3	92.6	4,028
8	87.5	18.71	16.4	2.9	33.5	2.9	9.7	2.2	92.5	4,044
9	91.1	18.38	16.7	2.9	33.5	3.1	10.6	2.3	92.2	4,100
10	93.1	18.74	17.4	3.0	33.2	2.6	8.9	2.2	92.6	4,319
11	88.7	18.83	16.7	2.5	32.3	2.8	8.9	2.2	92.7	4,151
12	86.0	18.44	15.9	2.9	31.8	3.0	10.0	2.2	92.4	3,901
LSD[1] 5%	3.7	0.38	0.6	1.2	2.9	0.4	2.3	0.2	0.5	141
probability[2]	<0.001	<0.001	<0.001	0.76	0.78	<0.001	0.05	0.57	0.02	<0.001

[1] LSD = least significant difference.
[2] probability: >0.05 = not significant, <0.05 and >0.001 = significant, <0.001 = very significant.