



Research on the efficacy of different insecticides to control the green peach aphid (*Myzus persicae*) and the black bean aphid (*Aphis fabae*) in sugar beets in the Netherlands in 2021

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Samenvatting

Vergelingsziektevirus wordt overgebracht door bladluizen, waarvan de groene perzikluis (*Myzus persicae*) de meeste efficiënte vector is. De drie belangrijkste soorten vergelingsziektevirussen in suikerbieten zijn: Beet Yellows Virus (BYV), Beet Chlorotic Virus (BChV) en Beet Mild Yellowing Virus (BMYV). De virussen kunnen worden beheerst door de bladluizen te bestrijden. Doel van dit onderzoek is de effectiviteit bepalen van verschillende soorten insecticiden voor de bestrijding van groene perzikluizen. Omdat de zwarte bonenluis van nature ook voorkwam in de proef, is het effect op deze bladluissoort ook meegenomen in dit onderzoek.

Er is een proefveld aangelegd in Westmaas waarbij groene perzikluizen op 1 juni 2021 in het 8-10 bladstadium (BBCH 18-20) werden uitgezet. Drie dagen na de inoculatie (4 juni) zijn de verschillende bespuitingen uitgevoerd (T1). Bij enkele objecten is een tweede bespuiting uitgevoerd (T2; 16 juni).

Op basis van dit proefveld kunnen de volgende conclusies worden getrokken:

- Vanwege een natuurlijke afname van bladluizen in juni was er geen effect zichtbaar van de 2^e bespuiting;
- De aantallen groene perzikluizen waren te laag om significante verschillen tussen middelen aan te tonen;
- Closer (sulfoxaflor), Batavia (spirotetramat), Teppeki (flonicamid), IRS 770 en IRS 810 waren effectief in de beheersing van de zwarte bonenluis (*Aphis fabae*);
- Closer (sulfoxaflor), Batavia (spirotetramat), Teppeki (flonicamid) en IRS 810 waren effectief in de beheersing van het totaal aantal bladluizen;
- Closer (sulfoxaflor), Batavia (spirotetramat), Teppeki (flonicamid), IRS 770 and IRS 810 waren veilig voor suikerbieten. Er werd geen fytotoxiciteit waargenomen.

Summary

Virus yellows is an important disease in sugar beet. Virus yellows is caused by the viruses Beet Yellows Virus (BYV), Beet Chlorotic Virus (BChV) and Beet Mild Yellowing Virus (BMYV), which can cause up to 50%, 30% and 35% yield reduction, respectively. The green peach aphid (*Myzus persicae*) is the most important vector. The spread of the virus in a sugar beet field can be controlled by controlling aphids with insecticides. Also the black bean aphid (*Aphis fabae*) can cause problems in sugar beet. This aphid has a much higher damage threshold, since damage to sugar beets is mainly caused by feeding from the leaves and it hardly transmits viruses. Because this is a dominant species in sugar beet and it was present in the field trial, it was also taken into account in this research.

Different insecticides were compared with a treatment without insecticide.

Therefore a field trial was conducted in Westmaas. In this trial, green peach aphids were inoculated in sugar beet in the 8-10 leaf stage (BBCH 18-20) at the 1st of June, 2021. Three days after inoculation (4 June), the plots were sprayed with the different treatments (T1). On a few plots a second treatment (16 June; T2) was applied.

The aim was to study the efficacy of different insecticides on the control of aphids in sugar beet. From this trial it can be concluded that:

- Due to a natural decline in the number of aphids in the second part of June, no effect of T2 could be observed;
- The number of *Myzus persicae* was too low to observe differences between treatments.
- Closer (sulfoxaflor), Batavia (spirotetramat), Teppeki (flonicamid), IRS 770 and IRS 810 were effective in the control of black bean aphids (*Aphis fabae*);
- Closer (sulfoxaflor), Batavia (spirotetramat), Teppeki (flonicamid) and IRS 810 were effective in the control of aphids in general;
- Closer (sulfoxaflor), Batavia (spirotetramat), Teppeki (flonicamid), IRS 770 and IRS 810 were save for sugar beet, no phytotoxicity was observed in any treatment.

1. Introduction

Virus yellows is an important disease in sugar beet. Virus yellows is caused by the viruses Beet Yellows Virus (BYV), Beet Chlorotic Virus (BChV) and Beet Mild Yellowing Virus (BMYV), which can cause up to 50%, 30% and 35% yield reduction, respectively. The green peach aphid (*Myzus persicae*) is the most important vector. The spread of the virus in a sugar beet field can be controlled by controlling aphids with insecticides. Also the black bean aphid (*Aphis fabae*) can cause damage in sugar beet. This aphid has a much higher damage threshold, since damage to sugar beets is mainly caused by feeding from the leaves and it hardly transmits viruses. Because this is a dominant species in sugar beet, it is also taken into account in this research.

The study was conducted under Good Experimental Practises (GEP, Annex A).

2. Materials and methods

2.1 Trial site

The field trial was conducted in a sugar beet field in Westmaas, the Netherlands (Annex B).

2.2 List of products

Table 1 gives an overview of the treatments used in this study. Sugar beet seeds of the variety Yukon were treated and delivered by SESVanderHave (Tienen, B.). All seeds (also the untreated control) were treated with the fungicide Tachigaren (14.7 g hymexazol per 100.000 seeds) and the insecticide Force (10 g tefluthrin per 100.000 seeds) to prevent influences of fungi and soil pests on plant establishment. Tefluthrin does not have any effect on green peach or black bean aphids (Wauters & Dewar, 1995).

Table 1. Overview of treatments in the field trial in Westmaas, 2021 (trial code: 21-11-12.06).

number	treatment	
	T1 (4 June)	T2 (16 June)
1	untreated control	-
2	not inoculated control*	-
3	Teppeki (flonicamid) (0.14 kg/ha)	-
4	Closer (sulfoxaflor; 0.2 l/ha)	-
5	Batavia (spirotetramat; 0.45 l/ha) + adjuvant (Robbester; 1 l/ha)	-
6	Batavia (spirotetramat; 0.45 l/ha) + adjuvant (Robbester; 1 l/ha)	Batavia (spirotetramat; 0.45 l/ha) + adjuvant (Robbester; 1 l/ha)
7	IRS 770 (0.25 l/ha) + adjuvant (Robbester; 1 l/ha)	Batavia (spirotetramat; 0.45 l/ha) + adjuvant (Robbester; 1 l/ha)
8	Batavia (spirotetramat; 0.45 l/ha) + adjuvant (Robbester; 1 l/ha)	IRS 770 (0.25 l/ha) + adjuvant (Robbester; 1 l/ha)
9	Teppeki (flonicamid) (0.14 kg/ha)	Closer (sulfoxaflor; 0.2 l/ha)
10	IRS 810 (0.2 l/ha)	-

*this treatment was sprayed with Teppeki (0.14 kg/ha) to prevent damage by naturally occurring aphids on the 4th of June, 2021.

2.3 Drilling

Drilling was done with a precision sowing machine (Monosem Mecca 2017) adapted for sowing of field trials. Sowing distance within the rows was 18.0 cm and 50 cm between rows. The field trial was sown on 24 March, 2021. The trial was designed as randomised blocks in four replications (Annex C). Gross plot size: 3 meters wide (6 rows) and 15.5 meters long. Nett plot size: 3 meters wide (6 rows) and 12 meters long. General field data can be found in Annex D.

2.4 Inoculation with aphids

To obtain a homogenous distribution of green peach aphids, the trial was inoculated with reared green peach aphids on 1st of June, 2021 (treatments 1, 3-10). Green peach aphids (originally obtained from the Laboratory of Entomology of Wageningen University and Research (Wageningen, the Netherlands) in 2018) were reared in the climate chambers of IRS on six week old sugar beet plants (grown in 700 ml pots with the same mixture as described above; variety Kleist, Strube GmbH, Söllingen, Germany) in an aphid rearing cage.

For field inoculation, leaves with aphids from the plants in aphid rearing cages in the climate chambers were cut off and carefully transported to the field trials in small boxes. Three plants in row 2 and three plants in row 5 of each plot were inoculated with ten aphids per plant, by transferring the aphids using a small paint brush. Plant numbers 10, 20 and 30, counting from the beginning of row 2 and from the end of row 5, were inoculated.

One day before inoculation (31st of May, 2021), the field (except for the trial plots) was sprayed with Teppeki (0.14 kg/ha) to prevent spread of aphids over the field.

2.5 Application of treatments

Treatment 1 was the untreated control. Treatments 2 to 10 were sprayed on the 4th of June, 2021 (T1), three days post inoculation. Treatments 6 to 9 were sprayed for the second time on the 16th of June, 2021 (T2). Insecticides were applied with a broadcast application, where the entire area of each plot was treated. Applications of these treatments were conducted by Wageningen Plant Research (WPR; location Westmaas), using a CHD field trial sprayer (system Van der Wey, with Lechler Nozzle 120-02 at 3.0 bar and 400 liter spraying solution per hectare) to apply the different treatments. These nozzles had a 75% drift reduction at the pressure used (TCT, 2019).

Table 2. Conditions during spraying at the field trial in Westmaas, 2021.

parameter	T1 (treatment 2-10) (4 June)	T2 (treatment 6-9) (16 June)
application time	7.30 h.	11.00 h.
application duration (minutes)	10	10
temperature (°C)	17	22
relative humidity (RV)	88	54
wind speed	0 km/h	10 km/h
wind direction	-	East

2.6 Assessment of efficacy

The effect of the different treatments on inoculated green peach aphids, black bean aphids and other aphids was measured by counting the number of aphids in all plots on twelve plants per plot (plant numbers 5, 10, 15, 20, 25 and 30 starting at the beginning of row 2 and at the end of row 5 10 days before T1 (25th of May), 3 days after T1 (7th of June), 6 days after T1 (10th of June), 11 days after T1 (15th of June) and 24 days after T1 (28th of June; 12 days after T2). On the same plants, the number of other aphids and the number of beneficials (e.g. eggs, larvae and adults of ladybird beetles, soldier beetles, spiders, parasitic wasps, hoverflies, lacewings) were counted as well (data only shown in Annexes).

Based on the aphid data, percentage of plants with green peach aphids, black bean aphids and total aphids were calculated.

2.7 Trial destruction

Trial was not harvested. Sugar beets were destructed on 9th of September, 2021.

2.8 Analysis of data

Since data on number of aphids per plant were non-normal distributed, these data were log transformed ($y = \log_{10}(x+1)$) before statistical analysis.

Data for each assessment date (numbers of aphids and percentage of plants with aphids) were analysed by using a one-way ANOVA using Fisher Protected LSD. Data of 7, 10 and 15 June were also analysed as a two-way ANOVA (time of assessment x treatment). Data of 28th of June was not used for the analysis on the interaction, because of very low number of aphids in the untreated control.

Analyses were performed using Genstat Software Package 21.0.

3. Results and discussion

3.1 Effect on aphids

Due to low number of aphids in the trial on the 28th of June, including the untreated control, , there was no effect visible of a second treatment (T2) in this trial.

There was no significant difference between treatments for the number of green peach aphids (Table 3) or the percentage of plants with green peach aphids (Table 4) at any of the assessments dates.

There was a homogenous distribution of black bean aphids in the trial. All treatments, except for Teppeki (treatment 3) and IRS 770 (treatment 7), had significantly less black bean aphids than the untreated control (Table 5), when 7, 10 and 15 June were analyzed together. But there were no significant differences between the treatments 3-10.

All treatments had a significantly lower percentage of plants with black bean aphids than the untreated control (Table 6). There was no significant difference between treatments.

There was no interaction between assessment dates (7, 10 and 15 June) and treatments for the number of total aphids per plant. When analyzed together, Closer had significantly the lowest number of aphids per plant, although this was not significantly different from Batavia (treatment 6 and 7), Teppeki (treatment 9) and IRS 810 (treatment 10) (Table 7). All treatments, except for IRS 770 had significantly less aphids than the untreated control. Closer also had the lowest percentage of aphids (Table 8).

3.2 Effect on phytotoxicity

No symptoms of phytotoxicity were observed in any of the treatments at any assessment date (Annex F).

Table 3. Average number of green peach aphids (*Myzus persicae*) per twelve plants at the field trial in Westmaas (2021). *Myzus persicae* was inoculated on 1st of June.

number	treatment		Average number of <i>Myzus persicae</i> per 12 plants					
	T1 (4 June)	T2 (16 June)	25 May	7 June	10 June	15 June	28 June	7, 10 and 15 June
1	untreated control	-	0.0	1.8	0.9	2.3	0.0	1.6
2	not inoculated control	-	0.0	0.3	0.5	0.2	0.0	0.3
3	Teppeki (flonicamid) (0.14 kg/ha)	-	0.0	1.2	0.9	0.2	0.2	0.7
4	Closer (sulfoxaflor; 0.2 l/ha)	-	0.0	0.9	0.0	0.0	0.0	0.2
5	Batavia (spirotetramat; 0.45 l/ha) + adjuvant (Robbester; 1 l/ha)	-	0.0	1.3	0.0	0.4	0.0	0.5
6	Batavia (spirotetramat; 0.45 l/ha) + adjuvant (Robbester; 1 l/ha)	Batavia (spirotetramat; 0.45 l/ha) + adjuvant (Robbester; 1 l/ha)	0.0	0.6	0.2	0.3	0.0	0.3
7	IRS 770 (0.25 l/ha) + adjuvant (Robbester; 1 l/ha)	Batavia (spirotetramat; 0.45 l/ha) + adjuvant (Robbester; 1 l/ha)	0.0	0.8	0.6	2.1	0.0	1.1
8	Batavia (spirotetramat; 0.45 l/ha) + adjuvant (Robbester; 1 l/ha)	IRS 770 (0.25 l/ha) + adjuvant (Robbester; 1 l/ha)	0.0	1.1	0.2	2.3	0.0	1.0
9	Teppeki (flonicamid) (0.14 kg/ha)	Closer (sulfoxaflor; 0.2 l/ha)	0.0	0.7	0.4	0.4	0.0	0.5
10	IRS 810 (0.2 l/ha)	-	0.0	1.0	0.2	1.1	0.0	0.7
P			-	0.780	0.614	0.361	0.464	0.150 ¹

¹ P-value interaction ‘assessment date’ x ‘treatment’ = 0.786.

Table 4. Percentage of plants with green peach aphids (*Myzus persicae*) at the field trial in Westmaas (2021). *Myzus persicae* was inoculated on 1st of June.

number	treatment ¹		Percentage of plants with <i>Myzus persicae</i>					
	T1 (4 June)	T2 (16 June)	25 May	7 June	10 June	15 June	28 June	7, 10 and 15 June
1	untreated control	-	0.0	14.6	6.3	10.4	0.0	10.4
2	not inoculated control	-	0.0	2.1	2.1	2.1	0.0	2.1
3	Teppeki (flonicamid) (0.14 kg/ha)	-	0.0	10.4	6.3	2.1	4.2	6.3
4	Closer (sulfoxaflor; 0.2 l/ha)	-	0.0	8.3	0.0	0.0	0.0	2.8
5	Batavia (spirotetramat; 0.45 l/ha) + adjuvant (Robbester; 1 l/ha)	-	0.0	12.5	0.0	4.2	0.0	5.6
6	Batavia (spirotetramat; 0.45 l/ha) + adjuvant (Robbester; 1 l/ha)	Batavia (spirotetramat; 0.45 l/ha) + adjuvant (Robbester; 1 l/ha)	0.0	6.3	2.1	2.1	0.0	3.5
7	IRS 770 (0.25 l/ha) + adjuvant (Robbester; 1 l/ha)	Batavia (spirotetramat; 0.45 l/ha) + adjuvant (Robbester; 1 l/ha)	0.0	8.3	4.2	10.4	0.0	7.6
8	Batavia (spirotetramat; 0.45 l/ha) + adjuvant (Robbester; 1 l/ha)	IRS 770 (0.25 l/ha) + adjuvant (Robbester; 1 l/ha)	0.0	10.4	2.1	16.7	0.0	9.7
9	Teppeki (flonicamid) (0.14 kg/ha)	Closer (sulfoxaflor; 0.2 l/ha)	0.0	6.2	4.2	4.2	0.0	4.9
10	IRS 810 (0.2 l/ha)	-	0.0	8.3	2.1	4.2	0.0	4.9
P			-	0.646	0.609	0.589	0.464	0.224 ¹
LSD 5%			-	-	-	-	-	-

¹ P-value interaction ‘assessment date’ x ‘treatment’ = 0.890.

Table 5. Average number of black bean aphids (*Aphis fabae*) per twelve plants at the field trial in Westmaas (2021).

number	treatment ^l		Average number of <i>Aphis fabae</i> per 12 plants					
	T1 (4 June)	T2 (16 June)	25 May	7 June	10 June	15 June	28 June	7, 10 and 15 June
1	untreated control	-	4.6	1.4	0.9	2.6	0.0	1.5 a
2	not inoculated control	-	0.0	1.2	0.2	0.0	0.0	0.4 b
3	Teppeki (flicnicamid) (0.14 kg/ha)	-	0.0	0.4	0.7	0.9	0.2	0.7 ab
4	Closer (sulfoxaflor; 0.2 l/ha)	-	0.0	0.6	0.0	0.0	0.0	0.2 b
5	Batavia (spirotetramat; 0.45 l/ha) + adjuvant (Robbester; 1 l/ha)	-	0.0	1.0	0.0	0.0	0.0	0.3 b
6	Batavia (spirotetramat; 0.45 l/ha) + adjuvant (Robbester; 1 l/ha)	Batavia (spirotetramat; 0.45 l/ha) + adjuvant (Robbester; 1 l/ha)	0.0	1.5	0.0	0.0	0.0	0.4 b
7	IRS 770 (0.25 l/ha) + adjuvant (Robbester; 1 l/ha)	Batavia (spirotetramat; 0.45 l/ha) + adjuvant (Robbester; 1 l/ha)	0.0	3.4	0.0	0.3	0.0	0.8 ab
8	Batavia (spirotetramat; 0.45 l/ha) + adjuvant (Robbester; 1 l/ha)	IRS 770 (0.25 l/ha) + adjuvant (Robbester; 1 l/ha)	0.4	0.7	0.4	0.5	0.0	0.5 b
9	Teppeki (flicnicamid) (0.14 kg/ha)	Closer (sulfoxaflor; 0.2 l/ha)	0.0	1.5	0.0	0.0	0.2	0.4 b
10	IRS 810 (0.2 l/ha)	-	0.0	0.0	0.3	0.6	0.0	0.3 b
P			0.464	0.059	0.114	0.090	0.573	0.031 ¹

¹ P-value interaction ‘assessment date’ x ‘treatment’ = 0.063.

Table 6. Percentage of plants with black bean aphids (*Aphis fabae*) at the field trial in Westmaas (2021).

number	treatment ¹		percentage of plants with <i>Aphis fabae</i>					7, 10 and 15 June
	T1 (4 June)	T2 (16 June)	25 May	7 June	10 June	15 June	28 June	
1	untreated control	-	2.1	10.4	6.3	12.5 a	0.0	9.7 a
2	not inoculated control*	-	8.0	10.4	2.1	0.0 b	0.0	4.2 b
3	Teppeki (flonicamid) (0.14 kg/ha)	-	0.0	4.2	6.3	4.2 b	4.2	4.9 b
4	Closer (sulfoxaflor; 0.2 l/ha)	-	0.0	2.1	0.0	0.0 b	0.0	0.0 b
5	Batavia (spirotetramat; 0.45 l/ha) + adjuvant (Robbester; 1 l/ha)	-	0.0	6.2	0.0	0.0 b	0.0	2.1 b
6	Batavia (spirotetramat; 0.45 l/ha) + adjuvant (Robbester; 1 l/ha)	Batavia (spirotetramat; 0.45 l/ha) + adjuvant (Robbester; 1 l/ha)	0.0	12.5	0.0	0.0 b	0.0	4.2 b
7	IRS 770 (0.25 l/ha) + adjuvant (Robbester; 1 l/ha)	Batavia (spirotetramat; 0.45 l/ha) + adjuvant (Robbester; 1 l/ha)	0.0	12.5	0.0	2.1 b	0.0	4.9 b
8	Batavia (spirotetramat; 0.45 l/ha) + adjuvant (Robbester; 1 l/ha)	IRS 770 (0.25 l/ha) + adjuvant (Robbester; 1 l/ha)	2.1	6.3	4.2	4.2 b	0.0	4.9 b
9	Teppeki (flonicamid) (0.14 kg/ha)	Closer (sulfoxaflor; 0.2 l/ha)	0.0	8.3	0.0	0.0 b	4.2	2.8 b
10	IRS 810 (0.2 l/ha)	-	0.0	0.0	2.1	2.1 b	0.0	1.4 b
P			0.464	0.204	0.052	0.019	0.573	0.013 ¹
LSD 5%			-	-	-	6.78	-	4.50

¹ P-value interaction ‘assessment date’ x ‘treatment’ = 0.162.

Table 7. Average number of total aphids (*Myzus persicae*, *Aphis fabae* and all other aphids) per twelve plants at the field trial in Westmaas (2021).

number	treatment ¹		Average number of total aphids per 12 plants					
	T1 (4 June)	T2 (16 June)	25 May	7 June	10 June	15 June	28 June	7, 10 and 15 June
1	untreated control	-	4.6	3.7	2.0	8.9 a	0.0	4.2 a
2	not inoculated control*	-	0.0	1.5	0.6	0.4 b	0.0	0.8 cd
3	Teppeki (flicnicamid) (0.14 kg/ha)	-	0.0	1.5	1.8	1.1 b	0.3	1.5 bc
4	Closer (sulfoxaflor; 0.2 l/ha)	-	0.0	1.5	0.0	0.0 b	0.0	0.4 d
5	Batavia (spirotetramat; 0.45 l/ha) + adjuvant (Robbester; 1 l/ha)	-	0.0	2.1	0.0	0.4 b	0.0	0.6 cd
6	Batavia (spirotetramat; 0.45 l/ha) + adjuvant (Robbester; 1 l/ha)	Batavia (spirotetramat; 0.45 l/ha) + adjuvant (Robbester; 1 l/ha)	0.0	2.7	0.3	0.3 b	0.0	0.9 bcd
7	IRS 770 (0.25 l/ha) + adjuvant (Robbester; 1 l/ha)	Batavia (spirotetramat; 0.45 l/ha) + adjuvant (Robbester; 1 l/ha)	0.0	4.7	0.6	2.5 ab	0.0	2.1 ab
8	Batavia (spirotetramat; 0.45 l/ha) + adjuvant (Robbester; 1 l/ha)	IRS 770 (0.25 l/ha) + adjuvant (Robbester; 1 l/ha)	0.7	1.6	0.6	2.5 ab	0.0	1.4 bc
9	Teppeki (flicnicamid) (0.14 kg/ha)	Closer (sulfoxaflor; 0.2 l/ha)	4.6	2.7	0.4	0.4 b	0.2	1.0 bcd
10	IRS 810 (0.2 l/ha)	-	4.6	1.4	0.6	1.7 b	0.0	1.1 bcd
P			0.263	0.392	0.195	0.031	0.562	<0.001 ²

¹ *Myzus persicae* was inoculated on 1st of June.

² P-value interaction ‘assessment date’ x ‘treatment’ = 0.377.

Table 8. Percentage of plants with aphids at the field trial in Westmaas (2021).

number	treatment		Percentage of plants with aphids						7, 10 and 15 June
	T1 (4 June)	T2 (16 June)	25 May	7 June	10 June	15 June	28 June		
1	untreated control	-	2.1	22.9	14.6 a	22.9	0.0	20.1	a
2	not inoculated control*	-	0.0	12.5	2.1 c	4.2	0.0	6.3	bc
3	Teppeki (flonicamid) (0.14 kg/ha)	-	0.0	14.6	12.5 ab	6.3	8.3	11.1	bc
4	Closer (sulfoxaflor; 0.2 l/ha)	-	0.0	10.4	0.0 c	0.0	0.0	3.5	c
5	Batavia (spirotetramat; 0.45 l/ha) + adjuvant (Robbester; 1 l/ha)	-	0.0	18.8	0.0 c	4.2	0.0	7.6	bc
6	Batavia (spirotetramat; 0.45 l/ha) + adjuvant (Robbester; 1 l/ha)	Batavia (spirotetramat; 0.45 l/ha) + adjuvant (Robbester; 1 l/ha)	0.0	18.7	4.2 bc	2.1	0.0	8.3	bc
7	IRS 770 (0.25 l/ha) + adjuvant (Robbester; 1 l/ha)	Batavia (spirotetramat; 0.45 l/ha) + adjuvant (Robbester; 1 l/ha)	0.0	20.8	4.2 bc	12.5	0.0	12.5	ab
8	Batavia (spirotetramat; 0.45 l/ha) + adjuvant (Robbester; 1 l/ha)	IRS 770 (0.25 l/ha) + adjuvant (Robbester; 1 l/ha)	4.2	14.6	6.3 abc	18.8	0.0	13.2	ab
9	Teppeki (flonicamid) (0.14 kg/ha)	Closer (sulfoxaflor; 0.2 l/ha)	2.1	16.7	4.2 bc	4.2	4.2	8.3	bc
10	IRS 810 (0.2 l/ha)	-	2.1	10.4	4.2 bc	6.3	0.0	6.9	bc
P			0.42	0.773	0.045	0.186	0.551	0.009	
LSD 5%			-	-	9.24	-	-	8.05	

¹ *Myzus persicae* was inoculated on 1st of June.

² P-value interaction ‘assessment date’ x ‘treatment’ = 0.842.

4. Conclusions

The aim was to study the efficacy of different insecticides on the control of aphids in sugar beet. From this trial it can be concluded that:

- Due to a natural decline in the number of aphids in the second part of June, no effect of T2 could be observed;
- The numbers of *Myzus persicae* were too low to observe differences between treatments.
- Closer (sulfoxaflor), Batavia (spirotetramat), Teppeki (flonicamid), IRS 770 and IRS 810 were effective in the control of black bean aphids (*Aphis fabae*);
- Closer (sulfoxaflor), Batavia (spirotetramat), Teppeki (flonicamid) and IRS 810 were effective in the control of aphids in general;
- Closer (sulfoxaflor), Batavia (spirotetramat), Teppeki (flonicamid), IRS 770 and IRS 810 were save for sugar beet, no phytotoxicity was observed in any treatment.

5. Literature

Technische Commissie Techniekbeoordeling (2019). Lijst met indeling van spuitdoppen in DriftReducerende Dop-klassen (DRD-klassen). Versie 1 juli 2019.

<https://www.sklkeuring.nl/media/files/DRD%20Lijst%201%20juli%202019.pdf>.

Wauters, A. & Dewar, A.M. (1995). The effect of insecticide seed treatments on pest of sugar beet in Europe: Results of the IIRB co-operative trials with pesticides added to pelleted seed in 1991, 1992 and 1993. *Parasitica* 51 (4): 143-173.

Annex A GEP CERTIFICATE IRS



Netherlands Food and Consumer
Product Safety Authority
*Ministry of Agriculture,
Nature and Food Quality*

Certificate

of Official Recognition of Efficacy Testing Organisations in the Netherlands
This certifies that, in conformity with the request of December 13, 2019

Stichting IRS

Residing: Kreekweg 1, Dinteloord 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: December 19, 2020
and expires on: December 19, 2026

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

Utrecht, October 27, 2020

For the Minister of Agriculture, Nature and Food Quality,

Ton van Arnhem

Director Nppo (National Plant Protection Organization)

Annex

ORGANISATION is officially recognised as being competent to carry out efficacy trials/tests in the following categories:

- Outdoor crops of sugar beet and chicory

This annex has been approved by Ton van Arnhem
Director NPPO (*National Plant Protection Organisation*)

Annex B Location field trial

IRS trial field 21-11-12.06

GPS location:

51.79390, 4.46703



Annex C Trail scheme

Trial field: Westmaas
 Number of replications: 4
 Nett size (m): 12×3 Gross size (m): 15.5×3

C				D		
A				B		
8		3		7		4
6		9		1		5
4		7		10		6
1		5		9		2
2		10		3		8
7		6		5		9
3		4		2		7
10		8		6		1
9		2		4		3
5		1		8		10

gross 3 mtr.
 gross 6 mtr.
 gross 3 mtr.

Annex D General field data

soil type: marine soil (loam)
2.6% organic matter
pH-KCl = 7.5
%CaCO₃ = 6.8
% clay (<2µm): 22
% silt (2-50µm): 40
% sand >50µm): 29

preceding crop: 2020 winter barley

drilling date: 24 March 2021

variety: Yukon (SESVanderHave, Tienen, B.)

distance in row: 18.0 cm

distance between rows: 50 cm

Annex E Raw data number of aphids, beneficials and other pests

Table E.1. Number of aphids per 12 plants and percentage of plants with aphids per plot at the field trial in Westmaas (25th of May, 2021).

treatment	replicate	total number per 12 plants					percentage of plants with			
		green peach aphids	black bean aphids	other aphids	all aphids	beneficials	other pests	aphids	green peach aphids	black bean aphids
1	A	0	0	0	0	0	0	0.0	0.0	0.0
1	B	0	1	0	1	2	1	8.3	0.0	8.3
1	C	0	0	0	0	3	0	0.0	0.0	0.0
1	D	0	0	0	0	2	0	0.0	0.0	0.0
2	A	0	0	0	0	7	0	0.0	0.0	0.0
2	B	0	0	0	0	5	1	0.0	0.0	0.0
2	C	0	0	0	0	3	0	0.0	0.0	0.0
2	D	0	0	0	0	3	1	0.0	0.0	0.0
3	A	0	0	0	0	0	0	0.0	0.0	0.0
3	B	0	0	0	0	2	0	0.0	0.0	0.0
3	C	0	0	0	0	3	1	0.0	0.0	0.0
3	D	0	0	0	0	4	2	0.0	0.0	0.0
4	A	0	0	0	0	0	0	0.0	0.0	0.0
4	B	0	0	0	0	4	2	0.0	0.0	0.0
4	C	0	0	0	0	5	1	0.0	0.0	0.0
4	D	0	0	0	0	1	0	0.0	0.0	0.0
5	A	0	0	0	0	1	0	0.0	0.0	0.0
5	B	0	0	0	0	0	0	0.0	0.0	0.0
5	C	0	0	0	0	3	0	0.0	0.0	0.0
5	D	0	0	0	0	2	1	0.0	0.0	0.0
6	A	0	0	0	0	2	0	0.0	0.0	0.0
6	B	0	0	0	0	4	0	0.0	0.0	0.0
6	C	0	0	0	0	0	0	0.0	0.0	0.0
6	D	0	0	0	0	1	0	0.0	0.0	0.0
7	A	0	0	0	0	0	0	0.0	0.0	0.0
7	B	0	0	0	0	2	1	0.0	0.0	0.0
7	C	0	0	0	0	0	0	0.0	0.0	0.0
7	D	0	0	0	0	0	0	0.0	0.0	0.0
8	A	0	0	0	0	0	0	0.0	0.0	0.0
8	B	0	3	0	3	0	0	8.3	0.0	8.3
8	C	0	0	1	1	2	0	8.3	0.0	0.0
8	D	0	0	0	0	2	1	0.0	0.0	0.0
9	A	0	0	0	0	2	1	0.0	0.0	0.0
9	B	0	0	0	0	1	0	0.0	0.0	0.0
9	C	0	0	0	0	5	0	0.0	0.0	0.0
9	D	0	0	1	1	3	1	8.3	0.0	0.0
10	A	0	0	1	1	2	0	8.3	0.0	0.0
10	B	0	0	0	0	1	0	0.0	0.0	0.0
10	C	0	0	0	0	3	0	0.0	0.0	0.0
10	D	0	0	0	0	0	0	0.0	0.0	0.0

Table E.2. Number of aphids per 12 plants and percentage of plants with aphids per plot at the field trial in Westmaas (31st of May, 2021).

<i>treatment</i>	<i>replicate</i>	<i>total number per 12 plants</i>						<i>percentage of plants with</i>		
		green peach aphids	black bean aphids	other aphids	all aphids	beneficials	other pests	aphids	green peach aphids	black bean aphids
1	A	0	5	0	5	1	1	25.0	0.0	25.0
1	B	0	1	1	2	1	0	16.7	0.0	8.3
1	C	0	3	0	3	1	0	8.3	0.0	8.3
1	D	0	1	0	1	0	2	8.3	0.0	8.3
2	A	0	6	0	6	2	0	16.7	0.0	16.7
2	B	0	0	0	0	1	3	0.0	0.0	0.0
2	C	0	0	0	0	0	2	0.0	0.0	0.0
2	D	0	1	1	2	1	0	16.7	0.0	8.3

Table E.3. Number of aphids per 12 plants and percentage of plants with aphids per plot at the field trial in Westmaas (7th of June, 2021).

treatment	replicate	total number per 12 plants						percentage of plants with		
		green peach aphids	black bean aphids	other aphids	all aphids	beneficials	other pests	aphids	green peach aphids	black bean aphids
1	A	3	0	0	3	4	6	25.0	25.0	0.0
1	B	1	1	0	2	4	2	16.7	8.3	8.3
1	C	3	3	0	6	6	6	25.0	16.7	16.7
1	D	1	3	1	5	1	1	25.0	8.3	16.7
2	A	2	2	0	4	1	1	16.7	8.3	8.3
2	B	0	1	0	1	2	3	8.3	0.0	8.3
2	C	0	3	0	3	4	0	25.0	0.0	25.0
2	D	0	0	0	0	1	0	0.0	0.0	0.0
3	A	2	0	0	2	8	7	16.7	16.7	0.0
3	B	1	0	0	1	2	2	8.3	8.3	0.0
3	C	3	3	0	6	3	0	33.3	16.7	16.7
3	D	0	0	0	0	0	0	0.0	0.0	0.0
4	A	1	0	0	1	4	2	8.3	8.3	0.0
4	B	0	0	0	0	3	0	0.0	0.0	0.0
4	C	1	5	0	6	3	0	16.7	8.3	8.3
4	D	2	0	0	2	0	0	16.7	16.7	0.0
5	A	2	3	0	5	3	1	25.0	16.7	8.3
5	B	0	0	0	0	3	1	0.0	0.0	0.0
5	C	2	1	0	3	1	0	25.0	16.7	8.3
5	D	2	1	0	3	7	0	25.0	16.7	8.3
6	A	0	0	1	1	4	1	8.3	0.0	0.0
6	B	1	4	0	5	2	1	33.3	8.3	33.3
6	C	2	1	0	3	3	0	25.0	16.7	8.3
6	D	0	3	0	3	4	0	8.3	0.0	8.3
7	A	0	4	0	4	1	0	8.3	0.0	8.3
7	B	4	2	0	6	2	3	41.7	25.0	16.7
7	C	0	5	0	5	12	3	8.3	0.0	8.3
7	D	1	3	0	4	2	0	25.0	8.3	16.7
8	A	0	0	0	0	3	5	0.0	0.0	0.0
8	B	1	0	0	1	3	0	8.3	8.3	0.0
8	C	4	3	0	7	1	1	33.3	25.0	16.7
8	D	1	1	0	2	2	0	16.7	8.3	8.3
9	A	1	0	0	1	2	2	8.3	8.3	0.0
9	B	1	1	1	3	3	0	25.0	8.3	8.3
9	C	1	6	0	7	1	0	25.0	8.3	16.7
9	D	0	2	0	2	2	0	8.3	0.0	8.3
10	A	1	0	0	1	6	1	8.3	8.3	0.0
10	B	3	0	0	3	0	0	16.7	16.7	0.0
10	C	1	0	0	1	1	2	8.3	8.3	0.0
10	D	0	0	1	1	2	0	8.3	0.0	0.0

Table E.4. Number of aphids per 12 plants and percentage of plants with aphids per plot at the field trial in Westmaas (10th of June, 2021).

treatment	replicate	total number per 12 plants						percentage of plants with		
		green peach aphids	black bean aphids	other aphids	all aphids	beneficials	other pests	aphids	green peach aphids	black bean aphids
1	A	2	6	0	8	4	11	25.0	8.3	16.7
1	B	1	0	1	2	2	0	16.7	8.3	0.0
1	C	1	1	0	2	6	11	16.7	8.3	8.3
1	D	0	0	0	0	1	1	0.0	0.0	0.0
2	A	0	0	0	0	2	4	0.0	0.0	0.0
2	B	4	1	0	5	3	4	8.3	8.3	8.3
2	C	0	0	0	0	3	3	0.0	0.0	0.0
2	D	0	0	0	0	3	0	0.0	0.0	0.0
3	A	0	1	0	1	6	6	8.3	0.0	8.3
3	B	2	1	0	3	1	0	16.7	8.3	8.3
3	C	0	1	0	1	1	0	8.3	0.0	8.3
3	D	3	0	0	3	1	1	16.7	16.7	0.0
4	A	0	0	0	0	6	5	0.0	0.0	0.0
4	B	0	0	0	0	4	0	0.0	0.0	0.0
4	C	0	0	0	0	5	6	0.0	0.0	0.0
4	D	0	0	0	0	1	0	0.0	0.0	0.0
5	A	0	0	0	0	0	13	0.0	0.0	0.0
5	B	0	0	0	0	1	0	0.0	0.0	0.0
5	C	0	0	0	0	1	1	0.0	0.0	0.0
5	D	0	0	0	0	0	5	0.0	0.0	0.0
6	A	0	0	0	0	2	8	0.0	0.0	0.0
6	B	0	0	0	0	2	1	0.0	0.0	0.0
6	C	1	0	1	2	1	2	16.7	8.3	0.0
6	D	0	0	0	0	0	1	0.0	0.0	0.0
7	A	0	0	0	0	13	3	0.0	0.0	0.0
7	B	5	0	0	5	1	2	16.7	16.7	0.0
7	C	0	0	0	0	7	8	0.0	0.0	0.0
7	D	0	0	0	0	4	0	0.0	0.0	0.0
8	A	0	1	0	1	7	3	8.3	0.0	8.3
8	B	0	0	0	0	5	6	0.0	0.0	0.0
8	C	1	1	0	2	1	1	16.7	8.3	8.3
8	D	0	0	0	0	0	0	0.0	0.0	0.0
9	A	1	0	0	1	6	5	8.3	8.3	0.0
9	B	0	0	0	0	4	10	0.0	0.0	0.0
9	C	0	0	0	0	2	3	0.0	0.0	0.0
9	D	1	0	0	1	0	1	8.3	8.3	0.0
10	A	0	2	0	2	4	9	8.3	0.0	8.3
10	B	1	0	0	1	4	1	8.3	8.3	0.0
10	C	0	0	0	0	0	2	0.0	0.0	0.0
10	D	0	0	0	0	1	1	0.0	0.0	0.0

Table E.5. Number of aphids per 12 plants and percentage of plants with aphids per plot at the field trial in Westmaas (15th of June, 2021).

treatment	replicate	total number per 12 plants						percentage of plants with		
		green peach aphids	black bean aphids	other aphids	all aphids	beneficials	other pests	aphids	green peach aphids	black bean aphids
1	A	0	15	0	15	5	18	25.0	0.0	25.0
1	B	18	1	0	19	1	1	25.0	16.7	8.3
1	C	0	4	0	4	7	13	16.7	0.0	16.7
1	D	5	0	0	5	4	4	25.0	25.0	0.0
2	A	0	0	0	0	6	4	0.0	0.0	0.0
2	B	0	0	0	0	3	10	0.0	0.0	0.0
2	C	0	0	1	1	2	8	8.3	0.0	0.0
2	D	1	0	0	1	0	4	8.3	8.3	0.0
3	A	0	0	0	0	4	6	0.0	0.0	0.0
3	B	1	1	0	2	4	2	16.7	8.3	8.3
3	C	0	6	0	6	10	1	8.3	0.0	8.3
3	D	0	0	0	0	1	4	0.0	0.0	0.0
4	A	0	0	0	0	6	19	0.0	0.0	0.0
4	B	0	0	0	0	5	7	0.0	0.0	0.0
4	C	0	0	0	0	5	7	0.0	0.0	0.0
4	D	0	0	0	0	2	1	0.0	0.0	0.0
5	A	1	0	0	1	2	22	8.3	8.3	0.0
5	B	1	0	0	1	7	2	8.3	8.3	0.0
5	C	0	0	0	0	0	1	0.0	0.0	0.0
5	D	0	0	0	0	8	7	0.0	0.0	0.0
6	A	2	0	0	2	2	12	8.3	8.3	0.0
6	B	0	0	0	0	5	1	0.0	0.0	0.0
6	C	0	0	0	0	7	3	0.0	0.0	0.0
6	D	0	0	0	0	5	6	0.0	0.0	0.0
7	A	0	0	0	0	14	3	0.0	0.0	0.0
7	B	11	0	0	11	6	3	25.0	25.0	0.0
7	C	3	2	0	5	11	15	16.7	8.3	8.3
7	D	1	0	0	1	8	2	8.3	8.3	0.0
8	A	6	0	0	6	8	7	8.3	8.3	0.0
8	B	0	0	0	0	5	4	0.0	0.0	0.0
8	C	16	4	0	20	4	4	66.7	58.3	16.7
8	D	0	0	0	0	3	2	0.0	0.0	0.0
9	A	1	0	0	1	14	11	8.3	8.3	0.0
9	B	0	0	0	0	6	5	0.0	0.0	0.0
9	C	0	0	0	0	7	1	0.0	0.0	0.0
9	D	1	0	0	1	5	1	8.3	8.3	0.0
10	A	3	5	1	9	12	8	16.7	8.3	8.3
10	B	0	0	0	0	6	7	0.0	0.0	0.0
10	C	0	0	0	0	10	17	0.0	0.0	0.0
10	D	4	0	0	4	10	1	8.3	8.3	0.0

Table E.6. Number of aphids per 12 plants and percentage of plants with aphids per plot at the field trial in Westmaas (28th of June, 2021).

treatment	replicate	total number per 12 plants						percentage of plants with		
		green peach aphids	black bean aphids	other aphids	all aphids	beneficials	other pests	aphids	green peach aphids	black bean aphids
1	A	0	0	0	0	0	0	0.0	0.0	0.0
1	B	0	0	0	0	0	0	0.0	0.0	0.0
1	C	0	0	0	0	1	4	0.0	0.0	0.0
1	D	0	0	0	0	0	1	0.0	0.0	0.0
2	A	0	0	0	0	0	0	0.0	0.0	0.0
2	B	0	0	0	0	0	0	0.0	0.0	0.0
2	C	0	0	0	0	2	5	0.0	0.0	0.0
2	D	0	0	0	0	0	1	0.0	0.0	0.0
3	A	0	0	0	0	1	0	0.0	0.0	0.0
3	B	0	0	0	0	1	0	0.0	0.0	0.0
3	C	0	0	0	0	0	0	0.0	0.0	0.0
3	D	1	1	0	2	0	0	33.3	16.7	16.7
4	A	0	0	0	0	0	1	0.0	0.0	0.0
4	B	0	0	0	0	0	0	0.0	0.0	0.0
4	C	0	0	0	0	2	0	0.0	0.0	0.0
4	D	0	0	0	0	3	0	0.0	0.0	0.0
5	A	0	0	0	0	1	4	0.0	0.0	0.0
5	B	0	0	0	0	0	0	0.0	0.0	0.0
5	C	0	0	0	0	4	0	0.0	0.0	0.0
5	D	0	0	0	0	0	3	0.0	0.0	0.0
6	A	0	0	0	0	0	0	0.0	0.0	0.0
6	B	0	0	0	0	0	0	0.0	0.0	0.0
6	C	0	0	0	0	0	1	0.0	0.0	0.0
6	D	0	0	0	0	0	0	0.0	0.0	0.0
7	A	0	0	0	0	1	0	0.0	0.0	0.0
7	B	0	0	0	0	0	1	0.0	0.0	0.0
7	C	0	0	0	0	0	1	0.0	0.0	0.0
7	D	0	0	0	0	1	0	0.0	0.0	0.0
8	A	0	0	0	0	0	0	0.0	0.0	0.0
8	B	0	0	0	0	1	1	0.0	0.0	0.0
8	C	0	0	0	0	2	0	0.0	0.0	0.0
8	D	0	0	0	0	0	1	0.0	0.0	0.0
9	A	0	0	0	0	0	1	0.0	0.0	0.0
9	B	0	0	0	0	0	1	0.0	0.0	0.0
9	C	0	1	0	1	1	0	16.7	0.0	16.7
9	D	0	0	0	0	0	1	0.0	0.0	0.0
10	A	0	0	0	0	1	2	0.0	0.0	0.0
10	B	0	0	0	0	0	0	0.0	0.0	0.0
10	C	0	0	0	0	5	1	0.0	0.0	0.0
10	D	0	0	0	0	0	0	0.0	0.0	0.0

Annex F Raw data phytotoxicity

Table F.1. Number of plants per plot with phytotoxic symptoms at the field trial in Westmaas (2021).

treatment	replicate	<i>Number of plants with phytotoxic symptoms</i>				
		25 May	7 June	10 June	15 June	28 June
1	A	0	0	0	0	0
1	B	0	0	0	0	0
1	C	0	0	0	0	0
1	D	0	0	0	0	0
2	A	0	0	0	0	0
2	B	0	0	0	0	0
2	C	0	0	0	0	0
2	D	0	0	0	0	0
3	A	0	0	0	0	0
3	B	0	0	0	0	0
3	C	0	0	0	0	0
3	D	0	0	0	0	0
4	A	0	0	0	0	0
4	B	0	0	0	0	0
4	C	0	0	0	0	0
4	D	0	0	0	0	0
5	A	0	0	0	0	0
5	B	0	0	0	0	0
5	C	0	0	0	0	0
5	D	0	0	0	0	0
6	A	0	0	0	0	0
6	B	0	0	0	0	0
6	C	0	0	0	0	0
6	D	0	0	0	0	0
7	A	0	0	0	0	0
7	B	0	0	0	0	0
7	C	0	0	0	0	0
7	D	0	0	0	0	0
8	A	0	0	0	0	0
8	B	0	0	0	0	0
8	C	0	0	0	0	0
8	D	0	0	0	0	0
9	A	0	0	0	0	0
9	B	0	0	0	0	0
9	C	0	0	0	0	0
9	D	0	0	0	0	0
10	A	0	0	0	0	0
10	B	0	0	0	0	0
10	C	0	0	0	0	0
10	D	0	0	0	0	0

Annex G Weather data

Table G.1. Weather data from the nearest KNMI weather station (Rotterdam).

<i>date</i>	<i>wind speed (m/s)</i>	<i>average air temperature</i>	<i>minimum air temperature</i>	<i>maximum air temperature</i>	<i>precipitation (mm)</i>	<i>% humidity average</i>	<i>% humidity maximum</i>	<i>% humidity minimum</i>
20210301	3.8	4.6	2.7	8.5	0.0	91	99	78
20210302	1.9	6.1	-0.7	13.7	0.0	84	98	58
20210303	1.7	4.7	1.6	10.3	0.0	95	99	78
20210304	3.2	4.2	3.2	5.5	<0.1	87	98	69
20210305	3.1	2.5	-1.9	7.1	0.0	74	95	50
20210306	1.9	1.5	-4.1	6.9	0.0	81	98	54
20210307	1.2	2.7	-1.4	5.1	0.0	78	97	58
20210308	3.1	4.9	1.3	8.4	2.3	78	93	59
20210309	3.5	5.7	1.6	8.3	2.7	89	98	76
20210310	6.9	6.3	4.2	9.2	3.8	83	95	59
20210311	12.1	9.1	6.9	12.2	1.4	79	94	67
20210312	8.9	7.0	5.2	8.5	2.7	81	89	78
20210313	10.3	7.1	4.8	9.1	3.5	76	90	65
20210314	6.0	6.8	5.2	9.0	2.5	81	96	71
20210315	6.3	6.8	5.4	8.8	1.1	85	94	69
20210316	3.0	5.6	4.3	6.7	4.0	91	98	83
20210317	4.7	5.8	3.5	8.6	<0.1	83	95	69
20210318	3.2	5.3	1.6	8.3	0.1	86	98	78
20210319	4.1	5.0	-0.1	9.2	0.0	76	94	49
20210320	2.5	4.5	-1.6	9.1	0.2	87	98	65
20210321	5.1	6.5	4.8	8.2	<0.1	80	95	66
20210322	2.5	6.1	2.7	9.0	<0.1	79	91	61
20210323	3.4	6.8	2.8	10.7	0.0	85	94	73
20210324	3.3	7.8	2.4	13.8	0.0	80	95	60
20210325	4.2	8.8	4.4	12.6	0.1	78	97	48
20210326	6.5	9.8	5.1	13.7	2.7	73	90	58
20210327	7.3	7.2	4.5	9.4	5.2	73	90	58
20210328	8.5	9.9	7.2	12.0	0.0	72	81	65
20210329	6.5	11.3	5.6	17.5	0.0	68	84	44
20210330	1.8	13.2	4.3	22.2	0.0	60	90	29
20210331	1.1	14.7	5.2	22.7	0.0	66	97	37
20210401	4.1	9.7	4.1	14.1	0.0	76	89	59
20210402	4.7	5.9	3.3	7.6	<0.1	78	90	64
20210403	5.0	7.3	5.4	10.7	<0.1	67	73	60
20210404	3.8	6.2	4.5	8.8	0.0	78	89	69
20210405	8.2	4.1	0.1	8.6	6.5	78	92	57
20210406	6.0	2.2	-0.1	5.1	10.6	81	97	68
20210407	7.3	3.7	1.1	7.3	7.0	82	91	65
20210408	4.8	5.6	0.4	9.7	0.1	66	82	50
20210409	4.7	8.0	5.2	11.7	0.0	73	87	59
20210410	5.8	5.0	2.7	7.3	10.4	84	91	75
20210411	5.0	4.4	0.0	9.0	0.5	75	90	54
20210412	3.2	3.2	-0.8	8.2	4.1	79	95	54
20210413	2.2	4.8	-1.6	10.6	0.0	66	93	38
20210414	2.8	4.7	-0.2	9.1	0.6	74	92	53
20210415	3.0	5.3	-0.2	10.0	0.0	72	95	49
20210416	3.3	6.5	-1.1	12.0	0.0	67	94	40

<i>date</i>	<i>wind speed (m/s)</i>	<i>average air temperature</i>	<i>minimum air temperature</i>	<i>maximum air temperature</i>	<i>precipi-tation (mm)</i>	<i>% humidity average</i>	<i>% humidity maximum</i>	<i>% humidity minimum</i>
20210417	3.5	6.8	1.8	12.0	0.0	72	96	42
20210418	1.9	7.3	1.1	13.2	0.0	82	99	60
20210419	2.0	9.4	2.9	15.0	0.7	82	98	58
20210420	1.5	10.3	3.3	16.7	0.0	78	99	49
20210421	4.1	7.9	3.7	13.4	0.0	77	98	60
20210422	3.0	6.4	0.9	11.0	0.0	70	97	54
20210423	2.1	7.6	0.2	13.7	0.0	75	98	55
20210424	4.0	7.8	2.4	13.1	0.0	68	92	46
20210425	4.0	7.0	2.7	11.2	0.0	65	89	53
20210426	3.6	7.2	0.2	12.4	0.0	64	90	39
20210427	3.3	8.4	1.0	15.6	0.0	60	87	35
20210428	4.2	10.2	2.5	16.1	<0.1	57	73	38
20210429	5.5	7.6	6.1	10.4	9.5	83	92	74
20210430	2.5	7.2	2.5	9.5	2.4	85	98	67
20210501	3.3	7.1	0.8	11.7	<0.1	78	98	54
20210502	3.5	6.8	2.0	11.9	0.0	72	95	55
20210503	6.1	10.4	5.3	13.5	1.1	67	84	45
20210504	10.2	9.0	6.1	12.0	4.6	78	87	64
20210505	5.8	7.0	4.3	10.6	6.1	78	91	60
20210506	2.8	6.4	2.0	11.1	6.5	78	97	55
20210507	3.2	6.9	1.3	11.5	4.1	77	95	52
20210508	5.0	11.1	2.5	16.8	3.3	77	92	60
20210509	5.0	18.0	12.3	24.1	7.0	72	90	54
20210510	4.6	15.1	10.1	18.9	4.3	76	92	56
20210511	2.0	13.1	7.1	18.8	0.7	80	98	59
20210512	2.8	11.7	6.8	17.3	2.2	77	96	53
20210513	2.2	12.2	4.8	18.9	13.3	82	98	54
20210514	2.2	11.7	8.8	16.1	0.0	81	97	61
20210515	2.4	11.1	9.0	13.9	0.9	81	89	67
20210516	4.2	11.9	8.9	14.9	9.3	81	94	58
20210517	3.8	11.4	9.3	14.7	6.0	86	95	77
20210518	3.5	12.2	8.2	15.5	1.3	76	95	55
20210519	3.5	11.2	6.5	15.1	0.7	84	98	65
20210520	5.1	12.7	5.2	16.4	<0.1	70	98	55
20210521	11.2	12.8	10.5	16.8	0.3	64	83	44
20210522	5.6	10.4	8.7	12.5	14.6	87	94	76
20210523	5.2	11.9	8.5	15.2	1.9	73	94	53
20210524	4.6	11.0	8.1	15.0	8.2	84	90	67
20210525	5.2	10.3	6.5	13.8	18.2	83	93	67
20210526	5.5	11.1	7.6	13.4	2.1	84	95	68
20210527	4.5	10.5	5.2	14.3	0.1	84	98	72
20210528	2.1	13.0	3.9	18.9	0.0	72	99	42
20210529	2.8	13.3	7.8	18.7	0.0	76	94	56
20210530	3.6	14.8	7.0	21.8	0.0	72	95	40
20210531	3.3	17.2	9.1	23.2	0.0	66	95	44
20210601	3.3	19.0	10.1	25.1	0.0	53	94	31
20210602	2.8	21.3	12.3	28.0	0.0	55	83	26
20210603	3.5	20.1	14.5	24.5	0.0	73	89	63
20210604	2.1	19.8	13.2	25.9	0.2	74	93	51
20210605	3.2	14.4	10.2	16.6	0.0	90	97	82
20210606	2.8	15.5	9.1	20.7	0.0	68	97	40

<i>date</i>	<i>wind speed (m/s)</i>	<i>average air temperature</i>	<i>minimum air temperature</i>	<i>maximum air temperature</i>	<i>precipi-tation (mm)</i>	<i>% humidity average</i>	<i>% humidity maximum</i>	<i>% humidity minimum</i>
20210607	2.5	16.9	9.4	22.9	0.0	67	97	46
20210608	2.0	18.9	12.2	24.7	0.0	65	93	43
20210609	2.7	18.4	12.2	23.7	0.0	69	97	41
20210610	2.6	18.8	11.8	24.8	0.0	73	99	55
20210611	3.6	17.8	14.4	21.9	0.0	86	98	71
20210612	3.7	16.2	10.2	20.3	0.0	72	92	54
20210613	1.3	17.2	8.9	23.2	0.0	67	98	45
20210614	2.8	20.3	12.9	26.2	0.0	61	95	34
20210615	2.5	18.8	14.0	23.0	0.0	68	85	53
20210616	2.7	22.2	12.8	29.1	0.0	61	84	43
20210617	3.5	23.2	18.9	28.5	0.0	70	89	57
20210618	3.3	22.1	18.0	29.8	19.7	82	98	49
20210619	3.9	17.1	15.5	21.0	23.3	86	98	79
20210620	3.3	18.0	14.6	21.5	11.1	83	98	64
20210621	4.5	14.2	13.3	16.1	7.0	87	95	79
20210622	4.4	14.9	12.3	18.1	<0.1	69	93	59
20210623	2.8	14.7	11.7	18.0	<0.1	70	85	59
20210624	2.1	14.8	9.7	19.8	0.0	73	89	58
20210625	3.0	15.9	9.9	18.9	5.3	87	98	76
20210626	2.1	18.4	14.5	23.7	0.1	86	98	63
20210627	4.0	20.1	15.0	28.2	4.1	81	97	41
20210628	1.9	19.6	15.3	23.4	0.8	88	98	77
20210629	3.2	16.9	13.9	20.2	0.8	90	99	81
20210630	3.3	14.0	13.0	16.0	3.6	92	96	88
20210701	3.8	14.7	13.1	16.2	<0.1	86	94	79
20210702	2.3	16.9	13.1	21.0	<0.1	85	97	67
20210703	2.6	19.2	12.3	24.3	0.2	81	97	57
20210704	2.1	17.7	13.3	21.3	0.3	85	98	68
20210705	4.1	17.4	14.9	20.3	1.5	80	91	67
20210706	8.0	17.7	15.1	20.5	2.0	72	95	58
20210707	3.7	17.6	13.2	21.9	<0.1	74	92	61
20210708	2.5	17.8	13.3	22.0	0.0	76	95	61
20210709	2.3	17.0	11.2	21.5	0.0	81	98	58
20210710	1.3	17.5	13.1	21.7	1.2	85	98	61
20210711	2.0	18.1	14.4	22.2	0.1	83	98	59
20210712	2.2	19.2	13.9	23.9	2.9	84	98	60
20210713	3.8	17.8	14.3	19.9	0.0	92	99	84
20210714	5.4	17.2	16.5	18.3	0.0	93	97	88
20210715	6.4	17.8	16.5	20.2	0.0	85	98	77
20210716	4.1	17.3	14.3	20.5	0.0	77	93	68
20210717	3.4	19.3	13.7	24.5	0.0	76	98	53
20210718	2.5	19.7	13.2	25.6	0.0	78	99	56
20210719	2.5	18.3	13.5	23.4	0.0	76	97	60
20210720	2.0	18.1	11.7	23.6	0.0	72	96	49
20210721	1.7	19.8	12.7	25.5	0.0	71	98	47
20210722	2.7	18.0	12.9	22.4	0.0	77	98	61
20210723	3.0	17.1	11.9	21.7	0.0	80	98	61
20210724	3.0	17.7	14.2	21.5	6.2	88	99	76
20210725	2.4	19.8	16.1	25.6	4.8	83	98	57
20210726	2.2	18.4	15.2	22.3	28.5	91	98	80
20210727	3.9	17.7	15.8	22.0	9.8	88	96	70

<i>date</i>	<i>wind speed (m/s)</i>	<i>average air temperature</i>	<i>minimum air temperature</i>	<i>maximum air temperature</i>	<i>precipitation (mm)</i>	<i>% humidity average</i>	<i>% humidity maximum</i>	<i>% humidity minimum</i>
20210728	7.2	17.7	13.9	20.4	9.8	80	94	65
20210729	7.3	17.3	12.8	20.9	0.3	67	84	52
20210730	6.3	17.4	14.0	21.4	3.2	75	91	61
20210731	5.8	16.9	14.3	20.1	7.0	83	93	70
20210801	3.2	16.7	13.9	20.7	15.3	82	95	68
20210802	2.3	15.5	11.0	19.6	<0.1	75	95	57
20210803	2.4	15.5	10.0	20.0	0.0	78	99	60
20210804	1.8	16.6	11.1	22.6	1.8	80	98	53
20210805	2.1	18.9	11.8	23.7	0.2	73	99	52
20210806	7.0	18.5	16.1	21.7	1.6	77	92	64
20210807	5.1	17.2	14.9	22.0	4.0	80	94	54
20210808	8.0	16.9	14.1	19.9	14.0	78	90	67
20210809	6.3	17.2	15.0	19.9	2.2	76	83	67
20210810	4.0	17.4	12.5	21.2	0.1	78	97	59
20210811	2.6	18.0	13.4	22.9	0.0	82	97	66
20210812	2.3	18.8	12.7	23.8	<0.1	82	97	66
20210813	4.7	18.1	15.0	21.3	0.0	78	92	58
20210814	3.6	18.7	15.1	22.3	0.0	77	93	57
20210815	5.3	19.3	14.8	23.9	0.0	77	93	58
20210816	5.9	16.0	13.9	18.3	2.3	76	95	59
20210817	3.8	15.3	12.3	16.5	6.1	89	96	76
20210818	3.5	17.1	15.1	19.4	0.2	85	94	76
20210819	3.6	16.5	12.6	18.3	1.5	86	97	75
20210820	3.1	17.9	13.7	22.1	<0.1	87	98	73
20210821	2.0	19.4	12.8	24.5	4.6	82	99	59
20210822	3.7	18.0	15.0	20.4	10.1	90	98	78
20210823	4.3	18.4	15.3	22.3	0.0	74	91	53
20210824	3.9	17.5	13.3	21.7	0.0	76	96	53
20210825	2.9	16.4	10.8	21.4	0.1	85	99	64
20210826	4.0	16.1	11.9	18.5	1.3	80	91	72
20210827	3.9	15.7	10.6	19.7	<0.1	81	97	62
20210828	3.9	16.9	12.9	21.1	0.1	80	96	62
20210829	4.1	16.5	15.1	17.6	0.3	86	96	77
20210830	3.8	17.2	14.3	20.7	0.0	85	93	75
20210831	3.2	16.4	12.1	20.4	0.0	81	98	70
20210901	2.1	16.7	15.0	18.8	0.0	77	84	67
20210902	2.4	16.4	11.5	20.7	0.0	75	93	60
20210903	3.5	16.7	11.6	22.5	0.0	83	94	67
20210904	4.1	15.6	11.9	21.0	0.0	85	96	67
20210905	2.3	16.3	10.2	23.2	0.0	78	98	48
20210906	1.1	17.9	10.0	26.1	0.0	76	98	40
20210907	2.0	19.9	12.7	26.1	0.0	73	98	50
20210908	2.9	20.3	13.3	26.7	0.0	71	92	48
20210909	2.5	20.0	14.3	25.0	0.0	78	93	61
20210910	3.2	19.8	16.8	23.1	<0.1	85	94	75
20210911	4.7	18.4	16.4	20.8	<0.1	85	94	78
20210912	2.7	16.5	11.4	21.8	0.0	84	98	62
20210913	2.1	15.4	10.8	19.5	<0.1	86	98	69
20210914	3.0	18.2	12.0	23.5	<0.1	83	96	62
20210915	2.7	16.7	12.9	19.7	<0.1	86	99	73