Project title:	Investigation of the effect of cultivation timing on damage caused to vining peas (*Pisum sativum*) by bean seed fly larvae (*Delia platura*)
Project number:	FV 462
Project leader:	Dr Becky Howard, Processors and Growers Research Organisation (PGRO)
Report:	Annual report, September 2020
Previous report:	NA
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Location of project:	Stubton, Lincolnshire
Industry Representative:	Matthew Hayward, Swaythorpe Growers Ewan Findlay, Stemgold Peas
Date project commenced:	1st April 2020

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The results and conclusions in this report are based on an investigation conducted over a one-year period. The conditions under which the experiments were carried out and the results have been reported in detail and with accuracy. However, because of the biological nature of the work it must be borne in mind that different circumstances and conditions could produce different results. Therefore, care must be taken with interpretation of the results, especially if they are used as the basis for commercial product recommendations.

AUTHENTICATION

We declare that this work was done under our supervision according to the procedures described herein and that the report represents a true and accurate record of the results obtained.

Dr Becky Howard

R and D Manager

Processors and Growers Research Organisation

Signature .... Date ....

Report authorised by:

[Name]

[Position]

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Signature .... Date ....

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GROWER SUMMARY

Headline

A period of at least 7 days between cultivation and drilling vining peas helped reduce damage to vining peas from bean seed fly larvae. At earlier crop growth stages, damage was reduced from 19.87% to 1.06% by leaving a period of 21 days, saving approximately £350 in potential losses per hectare.

Background

There is currently no chemical control for bean seed fly larvae or adults and, following the removal of seed treatment options for vining peas the problem has increased considerably and some vining pea groups are experiencing high establishment losses. Later sown peas (late April onwards) are most affected, as the bean seed fly overwinters in soils as pupae and development and emergence are reliant on accumulated day degrees.

A survey of pea crops carried out in 2019 by PGRO, Swaythorpe Growers and Stemgold Peas indicated that the period between spring cultivation and drilling peas was an important factor affecting damage to plants by bean seed fly larvae, with a period of around 14 days leading to reduced damage levels compared to cultivations taking place at the same time as drilling. This finding is supported by literature that cites conservation tillage and reduced cultivations to help manage damage to crops by bean seed fly larvae.

This trial aimed to determine whether cultivation timing may be used as a cultural method to help manage damage to crops by bean seed fly larvae, and the minimum period between cultivation and drilling to lead to optimum reduction of damage.

Summary

Monitoring traps containing plant volatile lures were found to provide a good indication of bean seed fly adult activity at the time of drilling and could be used to aid decision-making. Ideally this would be targeted to help determine location and date of drilling to avoid damage, and a day-degree model (currently not available but in development) would provide a valuable addition for monitoring and forecasting.

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Cultivation treatments were as follows:

Table A. Treatments used at Stubton, Lincolnshire, including description and date of operations. All cultivations were undertaken using a power harrow.

Treatment	Description	Date of cultivation
1	Cultivated and drilled	27th April 2020
2	Cultivated 7 days before drilling	20th April 2020
3	Cultivated 13 days before drilling	14th April 2020
4	Cultivated 21 days before drilling	6th April 2020
5	Cultivated 28 days before drilling	30th March 2020

Vining peas were drilled at the site on 27th April 2020 and poultry layers mash added to plots to attract adult bean seed flies to the trial. The trial was rolled after drilling.

Two assessments were carried out on 26th May and 17th June 2020 to evaluate seedling establishment, damage to seedlings by bean seed fly larvae and infection of seedlings with soil-borne foot rot disease.

The results showed that there were no statistically significant differences in seedling establishment between treatments. There were statistically significant differences in damage caused by bean seed fly between treatments on 26th May, and there were statistically significant differences in seedling infection with foot rot between treatments on 17th June (Table B). The results showed that a period of 7 days between cultivation and drilling peas reduced damage from bean seed fly larvae by half, and that the greatest benefit was found when the period was extended to 21 days or more (Table B). The level of seedling infection with foot rot was significantly greater when cultivation and drilling took place on the same day. Leaving a period between cultivation and drilling of 7 days or more led to reduced infection in all treatments.

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Table B. Mean percentage of seedlings damaged by beans seed fly larvae recorded on 26th May, and mean percentage of seedlings infected with soil-borne foot rot disease recorded on 17th June 2020.

Treatment		Mean percentage of seedlings damaged by bean seed fly larvae recorded on 26th May	Mean percentage of seedlings infected with foot rot recorded on 17th June
1	Cultivated and drilled 27th April 2020	19.87[a]	30.65[a]
2	Cultivated 20th April 2020 (D-7days)	9.60[b]	4.38[b]
3	Cultivated 14th April 2020 (D-13 days)	8.89[bc]	10.10[b]
4	Cultivated 6th April 2020 (D-21 days)	1.06[d]	14.28[b]
5	Cultivated 30th March 2020 (D-28 days)	2.16[cd]	11.74[b]
	CV%	106.91	85.69
	LSD @ p = 0.05	7.2798	12.3896
	Probability	<0.001 (SIG)	0.0021

Financial Benefits

At the level of bean seed fly damage indicated in this trial, approximately 20% damage being the greatest damage to seedlings, there could be a saving to growers by the prevention of seedling losses of approximately £300 to £350 per hectare if this was reduced to 1 or 2% damage.

Action Points

Further study is required to confirm results. Results from this trial represent only a single year of trialling. Because of the biological nature of the work it must be borne in mind that different circumstances and conditions could produce different results.

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SCIENCE SECTION

Introduction

Bean seed fly (*Delia platura*) affects more than 40 different host plants and is an important pest of peas, maize and beans. Hosts include *Phaseolus* beans, peas, broad beans, cucumber, melon, onion, pepper, potato, maize (alfalfa, cotton, strawberry and tobacco are secondary hosts) and the bean seed fly larva is a common pest found in most temperate countries. In severe infestations plant loss at seedling stage may be high, often resulting in re-drilling and subsequent loss of production of high value vegetable crops at an early growth stage. Adult flies are attracted to freshly disturbed soil containing debris from previous crops, high levels of organic matter such as farmyard manure, or weed debris. Eggs are laid on the soil surface and larvae hatch after a few days and feed on newly planted seeds or plant and crop debris. After 10-14 days, larvae pupate and emerge as a second generation of flies, which move to suitable feeding sites. There may be several overlapping generations per year, occurring from late spring until early autumn. Seed of later planted peas or beans is attacked during germination and larvae feed on newly planted seeds and seedlings, tunnelling into freshly imbibed seeds and the stems of small seedlings.

There is currently no chemical control for bean seed fly larvae or adults and, following the removal of seed treatment options for vining peas the problem has increased considerably and some vining pea groups are experiencing high losses at establishment. Later sown peas (late April onwards) are most affected, as the bean seed fly overwinters in soils as pupae and development and emergence are reliant on accumulated day degrees.

Increased tillage is associated with increased numbers of bean seed fly larvae, and minimum tillage may help to manage the pest (Hammond, 1997). Hammond (1997) described the results of a long-term experiment to determine the impact of no-tillage systems on the abundance of the pest *D. platura* in soya-maize cropping systems. In 9 out of 12 years of the study, the lowest level of *D. platura* adults was recorded in the no-till plots. The highest number of adults were collected in the areas where the soil was more disturbed by cultivations. Schmidt *et al*. (2017) also cited conservation tillage to reduce attack by bean seed fly, due to the generally higher levels of natural enemies recorded in no-till systems, and the fact that residual plant material is not incorporated into soils, bean seed flies being more attracted to incorporated, decomposing material. The use of reduced cultivations and stale seedbeds may therefore aid management of bean seed fly.

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A survey of pea crops carried out in 2019 by PGRO, Swaythorpe Growers and Stemgold Peas indicated that the period between spring cultivation and drilling peas was an important factor affecting damage to plants by bean seed fly larvae, with a period of around 14 days leading to reduced damage levels compared to cultivations taking place at the same time as drilling.

This trial aimed to determine whether cultivation timing may be used as a cultural method to help manage damage to crops by bean seed fly larvae, and the minimum period between cultivation and drilling to lead to optimum reduction of damage.

Materials and methods

A trial was established at Stubton in Lincolnshire (OS grid reference SK89375179) in March 2020. The trial design was a randomised complete block design (Figure 1) and the first cultivation took place on 30th March 2020, 28 days prior to drilling peas on 27 April 2020, using a power harrow. Cultivations took place at weekly intervals until the date of drilling (Table 1). Soil type was sandy loam.

Discard	4	3	5	1	2	Discard
Discard	5	1	2	3	4	Discard
Discard	3	1	4	5	2	Discard
Discard	2	3	5	4	1	Discard

Figure 1. Randomised complete block trial design

Adult bean seed fly presence was monitored between 20th April and 15th May 2020 to determine that there were sufficient for trial success. This was done using a sticky card attached to a post and baited with a plant volatile lure (Figure 2) supplied by AgBio Inc. (Kuhar, *et al.,* 2006). The components in the lure were 2-phenylethanol and n-valeric acid from decomposed onion pulp, synthesised for slow-release.

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Figure 2. Example of bean seed fly adult monitoring trap containing sticky card and plant volatile lure.

Table 1. Treatments used at Stubton, Lincolnshire, including description and date of operations. All cultivations were undertaken using a power harrow.

Treatment	Description	Date
1	Cultivated and drilled	27th April 2020
2	Cultivated 7 days before drilling	20th April 2020
3	Cultivated 13 days before drilling	14th April 2020
4	Cultivated 21 days before drilling	6th April 2020
5	Cultivated 28 days before drilling	30th March 2020

The vining pea variety Amalfi was drilled using a Zurn small plot drill with Lemken double disc coulters on 27th April 2020, on the same day as the final cultivation treatment. Poultry layers mash was applied to all treatments along the rows to ensure a sufficient level of bean seed fly infestation, at a rate of 50g per metre. The trial was rolled following drilling.

Assessments were carried out on 26th May and 17th June 2020 to determine levels of damage to seed and seedlings as seed and stem tunnelling. On 26th May, three rows of pea seedlings, each one metre long, were removed from each plot and assessed. The number of emerged and non-emerged seedlings were recorded, and each seedling evaluated for damage caused by bean seed fly larvae. On 17th June two rows of pea seedlings, each one metre long, were

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removed from each plot and assessed. The same evaluation was conducted, and the number of seedlings infected with soil-borne foot rot diseases was recorded as an additional measure.

The trial received no maintenance treatments and was not harvested.

Data were analysed using Analysis of Variance in STAR® version 2.0.1 (International Rice Research institute, 2014).

Results

Monitoring trap records confirmed that there was enough adult activity at the time of drilling to justify continuing with the trial at the Stubton location (Table 2). Peak adult activity occurred a few days after drilling.

Table 2. Number of bean seed fly adults recorded at Stubton during late April and early May 2020.

Date	Adult bean seed fly recorded on sticky card
20th April 2020	30
24th April 2020	20
1st May 2020	57
7th May 2020	4
15th May 2020	2

Figure 3. Bean seed fly damage to pea seed (seed tunnelling)

Establishment of seedlings was slow and variable at Stubton in 2020 due to dry weather following sowing (Table 5, Appendix A) and growth stage at the first assessment on 26th May

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was variable with most plants at BBCH 13-14. Damage to seedlings was apparent mainly as damage to imbibed seed (Figure 3). There were no significant differences in the number of germinated seedlings between treatments (Table 3). There were statistically significant differences in damage caused to seedlings by bean seed fly larvae when the assessment was carried out on 26th May 2020 (Table 3, Figure 4). Pea seedlings in the plots that were drilled on the same day as cultivation had significantly higher levels of damage than all plots in which cultivation took place prior to drilling (19.87%). In treatments 4 and 5, cultivated 21 and 28 days prior to drilling, seedlings had significantly lower levels of damage (1.06% and 2.16% respectively) than treatments 1 and 2 (19.87% and 9.60% respectively) which were cultivated on the day of drilling and 7 days prior to drilling respectively. Seedlings in plots that were cultivated 14 days prior to drilling (treatment 3) had significantly lower levels of damage (8.89%) than those cultivated on the same day as drilling.

Table 3. Number of germinated seedlings per metre row and percentage of seedlings damage by bean seed fly larvae at Stubton on 26th May 2020 (BBCH growth stage 13-14). Means with the same letter are not significantly different from each other.

Treatment		Mean number of germinated seedlings per metre row	Mean percentage of seedlings damaged by bean seed fly larvae
1	Cultivated and drilled 27th April 2020	13.83	19.87[a]
2	Cultivated 20th April 2020 (D-7days)	12.25	9.60[b]
3	Cultivated 14th April 2020 (D-13 days)	14.08	8.89[bc]
4	Cultivated 6th April 2020 (D-21 days)	12.58	1.06[d]
5	Cultivated 30th March 2020 (D-28 days)	10.50	2.16[cd]
	CV%	28.20	106.91
	LSD @ p = 0.05	NA	7.2798
	Probability	0.1168 (NS)	<0.001 (SIG)

There were no statistically significant differences in the levels of damage caused to seedlings by bean seed fly larvae between treatments when the second assessment was carried out

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on 17th June 2020 (Table 4, Figure 4). Plants at this growth stage were better established, and damage to seed and seedlings caused by the larvae appeared to have less effect on growth than where plants were attacked at imbibition or early germination. Although there were no statistically significant differences between the treatments, peas that were drilled on the same day as cultivation had higher levels of damage (Table 4). Significantly different levels of seedling foot rot infection were recorded between treatments on 17th June 2020 (Table 4, Figure 5). Higher levels of infection were recorded on seedlings from plots that were cultivated and drilled on the same day compared to all other treatments.

Table 4. Mean percentage of seedlings damaged by bean seed fly larvae and mean percentage of seedlings infected with foot rot per metre row at Stubton on 17th June 2020 (BBCH growth stage 59). Means with the same letter are not significantly different from each other.

Treatment		Mean percentage of seedlings damaged by bean seed fly larvae	Mean percentage of seedlings infected with foot rot
1	Cultivated and drilled 27th April 2020	46.86	30.65[a]
2	Cultivated 20th April 2020 (D-7days)	17.99	4.38[b]
3	Cultivated 14th April 2020 (D-13 days)	31.71	10.10[b]
4	Cultivated 6th April 2020 (D-21 days)	30.13	14.28[b]
5	Cultivated 30th March 2020 (D-28 days)	23.50	11.74[b]
	CV%	68.33	85.69
	LSD @ p = 0.05	NA	12.3896
	Probability	0.0843	0.0021

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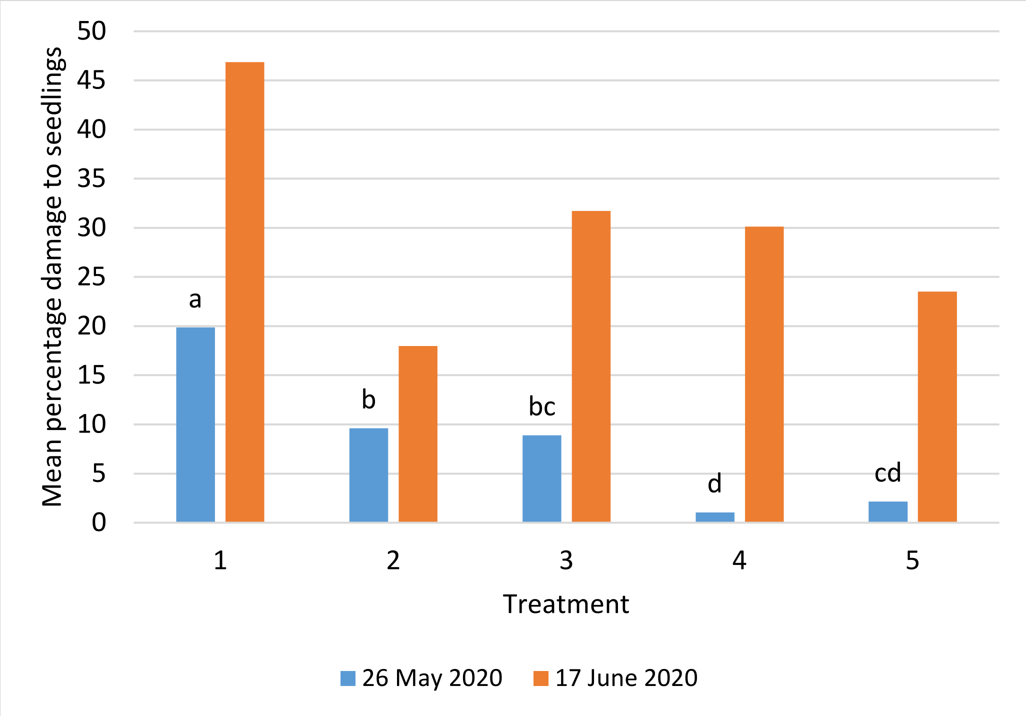

Figure 4. Mean percentage damage to seedlings caused by bean seed fly larvae at Stubton on 26th May and 17th June 2020. Means with the same letter are not significantly different from each other.

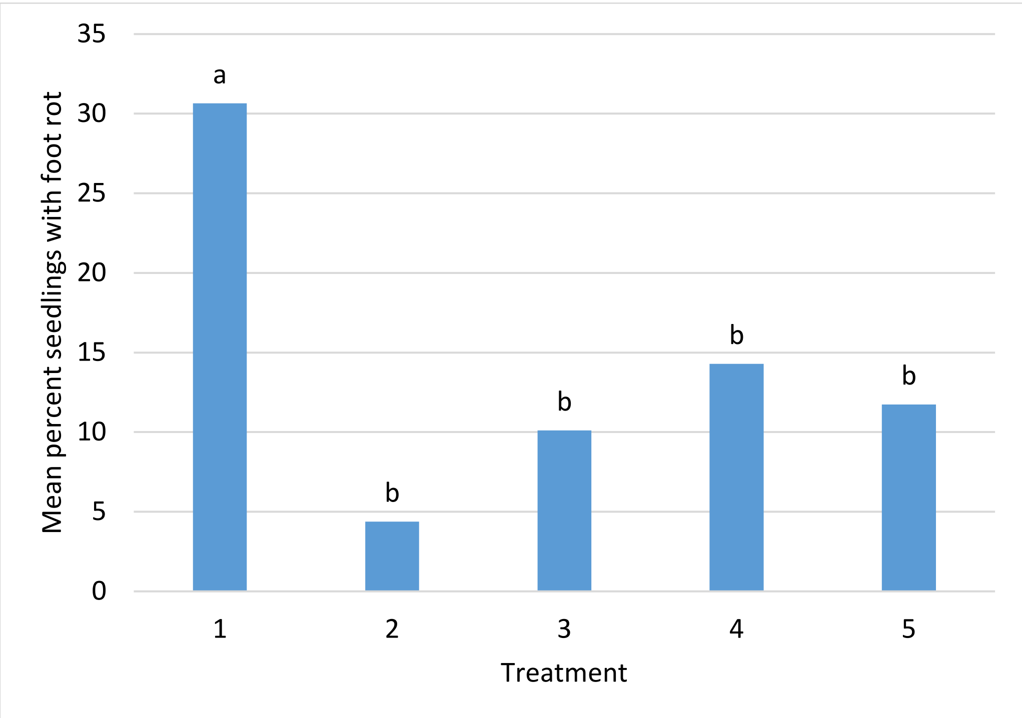

Figure 5. Mean percentage of seedlings with foot rot infection at Stubton on 17th June 2020. Means with the same letter are not significantly different from each other.

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Discussion

Monitoring traps containing plant volatile lures were found to provide a good indication of bean seed fly adult activity at the time of drilling and could be used to aid decision-making. Ideally this would be targeted to help determine location and date of drilling, and a day-degree model (currently not available but in development) would provide a valuable addition for monitoring and forecasting.

The results from this trial strongly indicated that a cultural approach to management of bean seed fly damage in crops may be appropriate. Levels of larval damage to seed and seedlings were reduced in the treatments in which cultivations were carried out prior to the date of drilling, and the longer the period between cultivation and drilling, the greater the reduction in damage recorded at the early assessment. A short period of 7 days between cultivation and drilling led to approximately 10% reduction in damage to imbibed seed and small seedlings compared to plots that were cultivated and drilled on the same day. On 26th May the seedlings were at BBCH growth stage 13 to 14 and very vulnerable to attack from larvae and results from the early assessment showed statistically significant differences. There was an increase in damage to seed from bean seed fly larvae by the date of the second assessment on 17th June 2020. Plants were at BBCH growth stage 59 on 17th June, and although the results were not statistically significant, the differences between the treatments were still apparent, with higher levels of larval damage observed in plots drilled and cultivated on the same day. A reduction of between 15.15 and 28.87% larval damage was recorded at the second assessment in plots in which cultivations were carried out between 7 and 28 days prior to drilling. This is an encouraging message that even short periods between cultivation and drilling may offer growers the opportunity to better manage bean seed fly attacks in legume crops.

The trial also indicated that the level of foot rot may be linked to increased levels of bean seed fly larval attack to seedlings, although this requires further testing. Lower levels of foot rot infection were recorded in all treatments in which cultivation took place at least 7 days prior to drilling. More detailed assessment is required to determine whether this effect is specifically related to damage from larvae, or whether it is related to soil conditions at drilling.

The trial should be repeated in 2021 due to difficult establishment conditions experienced in 2020.

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Conclusions

- It was beneficial to leave a period of at least 7 days between cultivation and drilling to help reduce levels of bean seed fly larval attack in peas;
- At earlier more vulnerable crop growth stages, the level of damage was reduced further by leaving a period of 21 to 28 days between cultivation and drilling;
- Foot rot infection may be related to bean seed fly larval damage, but this hypothesis requires further testing;
- The trial should be repeated in 2021 due to difficult establishment conditions experienced in 2020.

Knowledge and Technology Transfer

The Horticulture Strategic Centre for Field vegetables has helped to develop an iPhone and android application to report incidence of bean seed fly in all susceptible crops. This can be found in the PGRO App at Google and Apple stores – search for PGRO Pea and Bean Guide. The reporting application was made available in mid-March 2019. Nine reports were submitted in 2019 and eight in 2020. The application continues to be available to growers to report incidence of bean seed fly in crops. We strongly encourage growers to use the application so that activity can be monitored each year and over several years. This will help us to provide more accurate guidance about management of the pest for the future.

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Appendix A

Table 5. Stubton weather data for trial period 2020

	Air temperature [°C]			Relative humidity [%]	Rainfall [mm]	Wind speed [m/s]	Soil temp [°C]
Date/Time	**avg**	**max**	**min**	**avg**		**avg**	**avg**
17th March	10.4	14.7	6.5	81.1	0.0	4.3	9.8
18th March	8.8	12.1	5.8	94.8	3.2	2.4	10.2
19th March	6.4	8.5	4.7	80.3	0.2	0.5	9.2
20th March	6.0	9.6	3.6	83.6	0.0	2.3	8.2
21st March	5.2	9.5	2.2	75.3	0.0	1.6	7.2
22nd March	4.7	11.1	0.1	77.1	0.0	1.0	6.8
23rd March	6.2	14.0	-0.6	67.9	0.0	2.3	7.0
24th March	8.4	16.5	0.8	63.5	0.0	2.8	8.0
25th March	8.1	15.7	0.7	57.2	0.0	1.3	8.2
26th March	5.5	14.6	-3.6	69.4	0.0	0.5	7.0
27th March	5.3	12.7	-2.2	75.0	0.0	2.1	6.8
28th March	6.1	11.5	2.0	76.0	0.0	4.4	7.2
29th March	4.6	9.0	1.3	65.4	0.0	4.8	6.3
30th March	5.5	10.9	0.4	79.7	0.8	3.0	6.9
31st March	5.7	11.4	0.8	76.7	0.0	1.4	7.5
1st April	6.5	10.9	3.1	73.0	0.0	1.3	8.2
2nd April	8.4	13.9	4.1	75.3	0.0	2.5	8.8
3rd April	7.4	12.3	3.1	70.7	0.0	1.4	8.6
4th April	9.8	16.0	2.1	67.3	0.0	2.2	9.6
5th April	13.1	21.5	4.6	54.5	0.0	3.9	10.6
6th April	13.3	18.0	4.4	58.1	0.2	2.9	11.9
7th April	10.9	19.5	0.2	59.3	0.0	1.5	10.5
8th April	14.2	22.3	6.0	57.1	0.0	0.4	12.3
9th April	10.8	17.0	5.2	79.4	0.0	0.9	12.3
10th April	14.1	23.3	7.0	69.3	0.0	1.8	13.5
11th April	16.9	25.2	8.2	58.1	0.0	1.5	14.4
12th April	12.9	22.6	7.1	76.5	4.2	1.5	13.9
13th April	7.0	10.2	5.4	63.4	0.8	2.8	11.8
14th April	8.0	13.8	2.4	53.6	0.0	0.8	11.1
15th April	11.2	19.5	3.1	52.7	0.0	1.1	11.7
16th April	11.1	20.0	1.3	61.3	0.0	0.7	11.7
17th April	9.5	14.4	6.0	74.9	0.4	0.9	12.4
18th April	7.6	12.2	4.5	84.1	1.2	0.7	11.3
19th April	9.5	16.5	4.2	69.6	0.0	1.2	11.3
20th April	10.0	16.5	3.6	67.1	0.0	1.4	11.8
21st April	11.4	17.5	7.0	68.0	0.0	1.1	12.6
22nd April	11.9	19.2	5.5	70.6	0.0	1.2	13.3
23rd April	11.8	22.0	4.6	72.6	0.0	1.3	13.7
24th April	10.9	20.4	1.9	69.3	0.0	0.7	13.3

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	Air temperature [°C]			Relative humidity [%]	Rainfall [mm]	Wind speed [m/s]	Soil temp [°C]
Date	avg	max	min	avg		avg	avg
25th April	10.7	17.3	6.4	71.9	0.0	1.0	13.7
26th April	13.7	22.2	3.8	64.7	0.0	1.2	14.2
27th April	11.2	14.6	8.4	67.5	0.0	1.3	13.9
28th April	8.0	10.9	6.1	90.4	9.4	0.4	12.4
29th April	8.6	12.2	6.2	92.8	2.0	1.7	11.9
30th April	9.3	12.2	6.5	81.6	1.0	3.0	12.4
1st May	9.9	15.7	6.4	75.3	0.2	2.2	11.9
2nd May	10.9	17.4	5.4	71.4	0.0	1.4	12.3
3rd May	10.1	15.9	3.9	84.5	0.0	0.5	11.9
4th May	10.4	16.2	4.5	82.6	0.0	0.4	12.5
5th May	8.8	15.2	3.2	71.7	0.0	1.0	11.8
6th May	9.7	18.2	0.3	68.1	0.0	0.7	12.2
7th May	13.7	22.3	2.7	61.6	0.0	0.8	14.1
8th May	16.2	23.5	8.4	66.8	0.0	0.6	15.5
9th May	15.8	25.2	7.1	68.8	0.0	0.6	15.5
10th May	9.1	13.2	4.7	80.4	6.6	3.2	12.9
11th May	6.6	12.6	0.5	69.0	0.2	2.9	11.0
12th May	7.2	13.3	-0.7	71.0	0.0	1.3	10.1
13th May	7.1	12.7	1.7	64.0	0.0	1.6	10.6
14th May	7.6	15.8	-2.6	62.7	0.0	0.8	10.5
15th May	10.3	18.2	1.3	63.6	0.0	1.1	11.7
16th May	11.3	17.6	5.6	64.6	0.0	1.2	12.4
17th May	14.6	20.9	7.8	56.1	0.0	1.9	14.5
18th May	15.9	21.7	10.4	63.5	0.0	2.7	15.9
19th May	17.6	24.5	12.7	73.3	0.0	1.6	16.9
20th May	19.5	27.7	9.4	62.2	0.0	1.1	18.5
21st May	18.7	25.0	11.5	52.9	0.0	1.4	18.3
22nd May	17.2	21.6	12.2	51.6	0.2	4.6	17.8
23rd May	14.2	19.3	10.2	55.5	0.0	4.8	16.1
24th May	15.0	19.0	9.7	68.3	0.0	2.4	16.0
25th May	16.0	24.6	6.2	57.4	0.0	1.3	17.7
26th May	17.3	24.7	9.1	59.4	0.0	1.0	17.7
27th May	16.3	24.2	8.8	66.4	0.0	0.7	17.9
28th May	16.0	23.9	7.1	60.8	0.0	1.3	18.7
29th May	15.7	24.1	6.4	54.8	0.0	0.9	19.0
30th May	15.7	24.5	6.7	67.5	0.0	0.7	18.4
31st May	16.2	26.4	6.8	63.8	0.0	0.9	18.5
1st June	16.3	26.2	7.1	65.4	0.0	0.7	18.3
2nd June	16.1	24.9	5.9	61.9	0.0	0.8	17.9
3rd June	12.6	14.8	10.0	89.2	2.8	2.1	16.0
4th June	10.8	15.8	8.7	83.1	1.2	1.6	14.6
5th June	10.1	15.0	7.6	78.0	8.2	2.1	13.8
6th June	10.5	17.2	6.9	77.9	3.4	3.4	13.2

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Date	Air temperature [°C] avg	max	min	Relative humidity (%) avg	Rainfall (mm)	Wind speed [m/s] avg	Soil temp [°C] avg
7th June	10.4	12.7	5.6	88.8	2.4	2.0	12.9
8th June	11.0	14.5	6.0	75.6	0.0	1.6	13.5
9th June	11.8	17.9	3.0	72.0	0.0	0.7	14.1
10th June	11.9	14.3	9.8	91.1	4.8	1.0	14.4
11th June	12.4	17.1	10.2	95.6	7.4	1.7	14.3
12th June	13.8	15.4	12.1	99.0	1.8	0.6	14.8
13th June	17.6	24.9	11.3	79.6	0.0	0.9	17.3
14th June	16.8	24.4	11.3	86.0	0.0	0.5	17.4
15th June	16.6	24.3	12.5	86.4	0.0	0.4	17.9
16th June	16.6	24.3	12.6	87.9	0.0	0.4	17.9
17th June	16.7	24.8	11.9	86.1	0.2	0.7	18.1
18th June	14.1	18.2	10.9	95.9	17.6	1.4	16.6
19th June	14.1	17.7	10.2	87.7	0.8	2.2	16.5
20th June	15.9	22.1	9.6	81.2	0.2	1.8	17.0
21st June	16.0	20.9	11.5	80.1	8.0	2.3	17.5
22nd June	16.6	23.5	7.4	69.0	0.0	2.1	17.4
23rd June	20.2	26.8	12.2	65.0	0.0	1.8	19.3
24th June	22.4	30.6	13.4	66.0	0.0	1.2	21.0
25th June	23.0	30.5	13.6	64.1	0.0	0.8	21.4
26th June	22.5	31.1	12.1	69.3	0.0	1.2	21.8
27th June	17.4	22.5	13.4	79.2	2.2	3.0	19.9
28th June	15.2	20.7	11.6	69.0	0.0	3.8	18.0
29th June	13.9	15.2	12.4	75.2	0.0	3.9	16.6
30th June	16.2	21.5	13.2	72.7	0.0	1.9	17.8

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