# Use of Sensor Data for Decision Support in Foliar Disease Management

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## Introduction

In 2018, a pilot was started in the Netherlands to investigate the use of temperature and humidity sensors in the sugar beet canopy to calculate a Daily Infection Value (DIV)[1]. DIV were used to optimise the moment of fungicide application in the management of *Cercospora beticola*. Using the damage threshold, farmers are usually advised to visit the sugar beet fields each week to monitor the leaf spots, from canopy closure to the end of September. Only after a fungicide application a next visit could be postponed by 2-3 weeks.

**Figure 1.** LoRa sensor for temperature and relative humidity in the sugar beet canopy

## Materials & methods

On six trial fields (2019-2021) with natural infection of *Cercospora beticola*, a sensor (AE-1RhT-LoRa, AE Sensors Dordrecht, NL) recording at a height of 15 cm above soil level was installed. Temperature and relative humidity recordings were sent every 10 minutes via the LoRa (Low Radiation) telephone network to the server of Cosun Beet Company. These data were used to calculate the DIV for *C. beticola* and *Stemphylium beticola*. For *C. beticola* a minimal relative humidity of 85% was taken and for *S. beticola* 89%. The number of hours the minimal relative humidity or higher was measured in combination with the maximum temperature in this period determines the DIV[1,2]. The DIV range from 0 (low risk of infection) to 7 (very high risk of infection). The DIV were used for fungicide applications in treatments without monitoring and in treatments after the observation of the first leaf spots. In the reference treatment, fungicides were applied based on visual monitoring using the Dutch damage threshold[3].

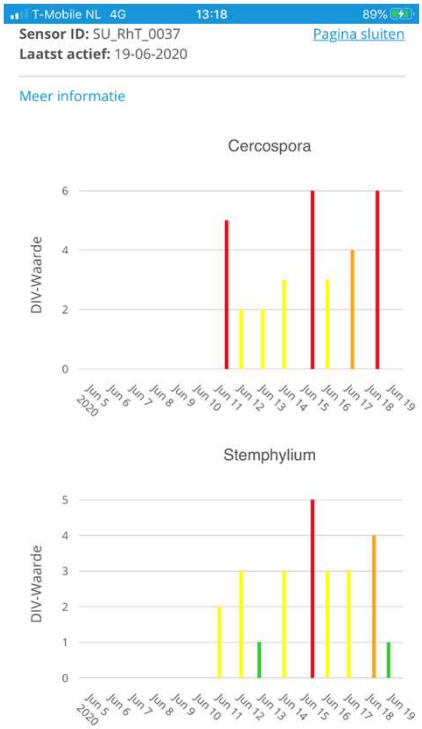


**Figure 2.** Typical DIV from the sensor output, serving as decision tool for fungicide application.

## Results

The use of DIV without monitoring resulted in a significantly higher number of fungicide applications and in a significantly higher sugar yield compared to the reference treatment. Monitoring for the first leaf spots and subsequently applying fungicides based on DIV did not differ significantly from the reference treatment.

**Table 1.** Results of the applications, cercospora infestation and relative sugar yield using Daily Infection Values on six field trails in the Netherlands (2019 – 2021).

| treatment | applications (#) | cercospora infestation (1-10)* | relative sugar yield (%) |
|---|---|---|---|
| untreated control | 0.0 a | 4.8 a | 100 a |
| reference | 3.8 b | 7.4 b | 109 b |
| DIV after first infection | 3.8 b | 7.9 b | 111 bc |
| DIV without monitoring | 4.2 c | 8.0 b | 114 c |
| P | <0.001 | <0.001 | <0.001 |
| lsd 5% | 0.20 | 0.63 | 4.30 |

* 1 = extremely severe infestation; canopy completely dead – 10 = no infestation; foliage completely healthy)

## Conclusions

The use of DIV generated by a sensor for temperature and relative humidity can optimise the timing of fungicide applications for *Cercospora beticola* management. It also reduces the number of monitoring visits to the sugar beet field. Using the DIV without monitoring resulted in a significantly higher sugar yield, although the number of fungicide applications increased significantly too. Using DIV in *C. beticola* management still urges for effective fungicides.

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## References

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