



## Potential for Cultural Management of Lettuce Drop (*Sclerotinia sclerotiorum*) in High Tunnels through Modification of Soil Moisture, Planting Date, and Cultivar

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Lettuce is a high-value crop commonly grown in high tunnels. However, the fungal disease lettuce drop, caused by *Sclerotinia sclerotiorum*, can significantly impact lettuce production and profitability. Crop loss from lettuce drop can be especially severe in high tunnels because of intensive cropping and limited options for non-host rotations. In Kentucky, lettuce drop affects lettuce crops in high tunnels between mid-April and mid-May as soil temperatures rise, resulting in average losses of 60% in infested high tunnels. This is also the time when farmers markets are experiencing increased demand by consumers, and lettuce prices are at their peak. The aim of this study was to examine the potential for cultural management of lettuce drop by identifying more tolerant lettuce cultivars and by modifying planting date and soil moisture.

### Methods

Experiments were conducted in a 3,000 sq ft high tunnel with a history of lettuce drop (*Sclerotinia sclerotiorum*). Research plots were maintained at varying soil moisture levels (high: 60-100% plant-available water; low: 40-80% plant-available water). These main plots were split into subplots based on planting dates (early: late February; mid: mid-March; and late: early April) and lettuce cultivar (Galactic, Harmony, Pirat, and Vulcan). No fungicides were used, and insecticides were applied as needed.

### Results

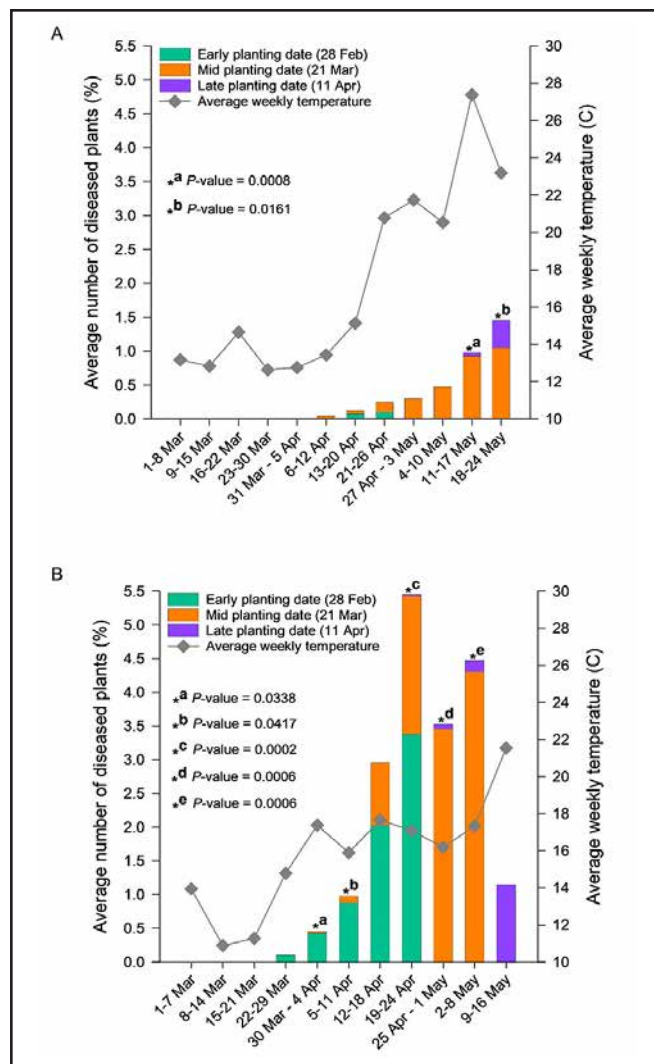
Soil water did not consistently affect lettuce drop incidence or yield, but planting date and cultivar consistently affected incidence in both years.



**FIGURE 1.** PROGRESSION OF LETTUCE DROP SYMPTOMS (LEFT TO RIGHT) ON CULTIVARS (A) HARMONY AND (B) PIRAT PLANTED IN A HIGH TUNNEL IN LEXINGTON, KENTUCKY (PHOTOS: EDWARD DIXON AND KIM LEONBERGER, UK)

- The mid planting date (mid-March, the typical planting date for lettuce in central Kentucky) had the highest disease incidence in both years, but yield was not consistently affected by planting date.
- ‘Pirat’ had the highest disease incidence in both years, but yield varied each year. The soil moisture factor did not result in significant differences in disease or yield.
- Cultivars labeled as resistant to lettuce drop (Pirat and Galactic) and two cultivars of unknown host status (Harmony and Vulcan) were used for this trial, and differences in levels of resistance were observed.
  - ‘Pirat’ was reported to have intermediate resistance, but it had the highest disease incidence.
  - ‘Galactic’ was also reported to have resistance to lettuce drop and performed as predicted, having the lowest disease incidence.
  - ‘Harmony’ and ‘Vulcan’ were not listed as resistant to lettuce drop, and they demonstrated moderate to high susceptibility.
- In general, the marketable weight of each cultivar was not influenced by disease, but marketable head count was significantly affected by lettuce drop.
  - ‘Galactic’ had the lowest marketable weight, despite few losses to disease. This was likely due to its compact growth habit and small size.
  - ‘Pirat’ had the highest disease incidence in both years, resulting in fewer marketable heads per plot.

**FIGURE 2.** FIELD IMAGE FROM 2023 SHOWS PLANTS AFFECTED BY LETTUCE DROP IN THE MID PLANTING DATE TREATMENT. IN THE FOREGROUND, CULTIVAR HARMONY FROM EARLY PLANTING DATE (64 DAYS AFTER PLANTING AND 10 DAYS AFTER HARVEST), FOLLOWED BY MID PLANTING DATE CULTIVARS PIRAT, HARMONY, GALACTIC, AND VULCAN (44 DAYS AFTER PLANTING). (PHOTO: NICOLE GAUTHIER, UK)



**FIGURE 3.** WEEKLY LETTUCE DROP INCIDENCE AND AVERAGE SOIL TEMPERATURES AT 5 CM (2 IN) DEPTH IN A HIGH TUNNEL NATURALLY INFESTED WITH *SCLEROTINIA SCLEROTIORUM* IN LEXINGTON, KENTUCKY FOR YEARS (A) 2022 AND (B) 2023. IN EACH CORRESPONDING YEAR, EARLY, MID, AND LATE PLANTING DATES WERE PERFORMED ON FEB 28, MAR 21, AND APR 11, RESPECTIVELY. ASTERISK (\*) INDICATES SIGNIFICANT DIFFERENCES ( $P < 0.05$ ) AMONG PLANTING DATES WITH RESPECT TO THE DISEASE INCIDENCE [(NUMBER OF DISEASED PLANTS/TOTAL NUMBER OF PLANTS) X 100].

### Practical applications for growers

This study identified cultural practices that can be used to reduce disease incidence in high tunnel lettuce production. Targeting an earlier or later planting date, outside of the higher risk mid-March planting date, can result in reduced yield loss. Selection of cultivars with some disease resistance are practices that can be adopted by growers with fields or high tunnels that have a history of lettuce drop. Additional information on lettuce drop can be found in the UK Extension publication *Sclerotinia Diseases of Vegetable Crops* (PPFS-VG-29) available here: <https://plantpathology.ca.uky.edu/files/ppfs-vg-29.pdf>.

**TABLE 1.** EFFECT OF PLANTING DATE, PLANT AVAILABLE WATER, AND CULTIVAR ON MEAN LETTUCE DROP DISEASE INCIDENCE AND MEAN YIELD FOR LETTUCE PLANTED IN A HIGH TUNNEL NATURALLY INFESTED WITH *SCLEROTINIA SCLEROTIUM* IN LEXINGTON, KY IN 2022 AND 2023.

Plot variable	Year					
	2022 <sup>1</sup>			2023 <sup>1</sup>		
Plant Available Water <sup>2</sup>	Disease Incidence (%) <sup>3</sup>	Marketable Weight (kg)	Marketable Head Count (%)	Disease Incidence (%) <sup>3</sup>	Marketable Weight (kg)	Marketable Head Count (%)
High	6.50 a <sup>4</sup>	0.73 a	85.7 a	29.50 a	0.75 a	67.7 a
Low	3.83 b	0.67 a	88.7 a	29.33 a	0.71 a	69.3 a
<i>P</i> value	0.0295	0.1792	0.2791	0.955	0.4837	0.6269
Planting Date <sup>5</sup>	Disease Incidence (%)	Marketable Weight (kg)	Marketable Head Count (%)	Disease Incidence (%)	Marketable Weight (kg)	Marketable Head Count (%)
Early	1.00 c	0.59 b	96.5 a	33.75 b	0.78 a	69.0 b
Mid	10.50 a	0.66 b	74.5 b	43.00 a	0.71 a	52.5 c
Late	4.00 b	0.85 a	90.5 a	11.50 c	0.69 a	84.0 a
<i>P</i> value	< 0.0001	< 0.0001	< 0.0001	< 0.0001	0.4253	< 0.0001
Lettuce Cultivar <sup>6</sup>	Disease Incidence (%)	Marketable Weight (kg)	Marketable Head Count (%)	Disease Incidence (%)	Marketable Weight (kg)	Marketable Head Count (%)
Galactic	2.33 b	0.43 c	92.0 a	8.67 c	0.66 b	91.3 a
Harmony	3.33 b	0.71 b	84.0 b	35.33 b	0.83 a	61.3 bc
Pirat	9.67 a	0.77 b	79.3 b	42.67 a	0.62 b	54.7 c
Vulcan	5.33 b	0.90 a	93.3 a	31.00 b	0.82 a	66.7 b
<i>P</i> value	0.0002	< 0.0001	0.0011	< 0.0001	0.0133	< 0.0001

<sup>1</sup> INTERACTION OF FACTORS (PLANT AVAILABLE WATER X PLANTING DATE X CULTIVAR) WAS NOT SIGNIFICANTLY DIFFERENT, THEREFORE ONLY MAIN EFFECTS ARE PRESENTED.

<sup>2</sup> HIGH = 60-100% PLANT AVAILABLE WATER; LOW = 40-80% PLANT AVAILABLE WATER.

<sup>3</sup> INCIDENCE = PERCENT OF DISEASED PLANTS AT THE TIME OF HARVEST.

<sup>4</sup> LEAST SQUARE = VALUES FOLLOWED BY THE SAME LETTER IN THE SAME COLUMN ARE NOT SIGNIFICANTLY DIFFERENT ( $\alpha = 0.05$ ).

<sup>5</sup> EARLY PLANTING DATE = LATE FEBRUARY; MID PLANTING DATE = MID-MARCH; LATE PLANTING DATE = EARLY APRIL IN BOTH YEARS.

<sup>6</sup> 'GALACTIC' AND 'PIRAT' WERE PREVIOUSLY IDENTIFIED AS RESISTANT TO LETTUCE DROP (CAUSED BY *SCLEROTINIA SCLEROTIUM*). THE RESISTANCE STATUS OF 'HARMONY' AND 'VULCAN' WERE UNKNOWN.

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### Complete research study can be found at

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