Mark Stalham

# Nitrogen and Black Dot

Mark Stalham

# Nitrogen and Black Dot

# Background

- Disease development is difficult to assess during crop growth as there is a latent period between infection and symptom expression.
- Below-ground symptoms occur once the crop starts to senesce.
- While the presence of black dot on below-ground parts of stems and stolons can be observed between haulm destruction and harvest, there is little correlation with final disease on progeny tubers.
- Disease risk should be based on evaluation of seed infection and soil contamination (Potato Council, 2011)

# Hypotheses

- Delaying time from emergence and defoliation to harvest increases the risk of black dot development in store
- Reducing N increases the risk of black dot infection through premature senescence
- Reducing N advances skinset
- Reducing N increases the risk of bruising

# N * Black Dot Treatments

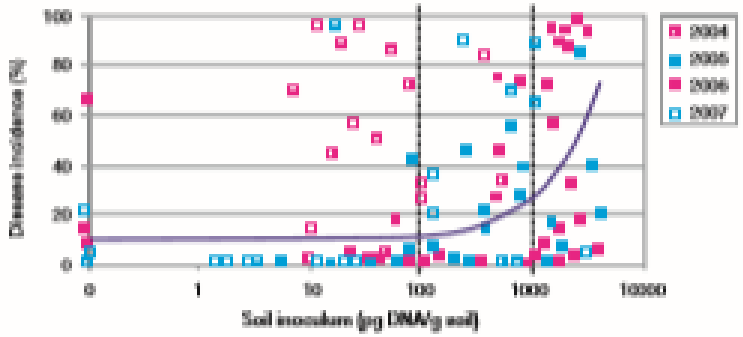
- Variety
  - Estima
- Nitrogen (all applied at planting as ammonium nitrate prills post-destoning and pre-bedtilling)
  - 180 kg/ha
  - 210 kg/ha
  - 240 kg/ha
  - 270 kg/ha
- Defoliation (Reglone 4 l/ha)
  - Early, D1 (31 July)
  - Late, D2 (20 August)
- Harvest (3.83 $m^2$)
  - Early, H1 (20 August)
  - Late, H2 (10 September)

# Site background

- All combinations of N, D and H, fully randomised
- 3 replicate blocks
- Loamy sand (86 % S, 7 % Z, 7 % C, 2.7 % OM)
- Destoned: 20 April
- Planted: 26 April
- Nematicide: 26 April
- Emerged: 24 May

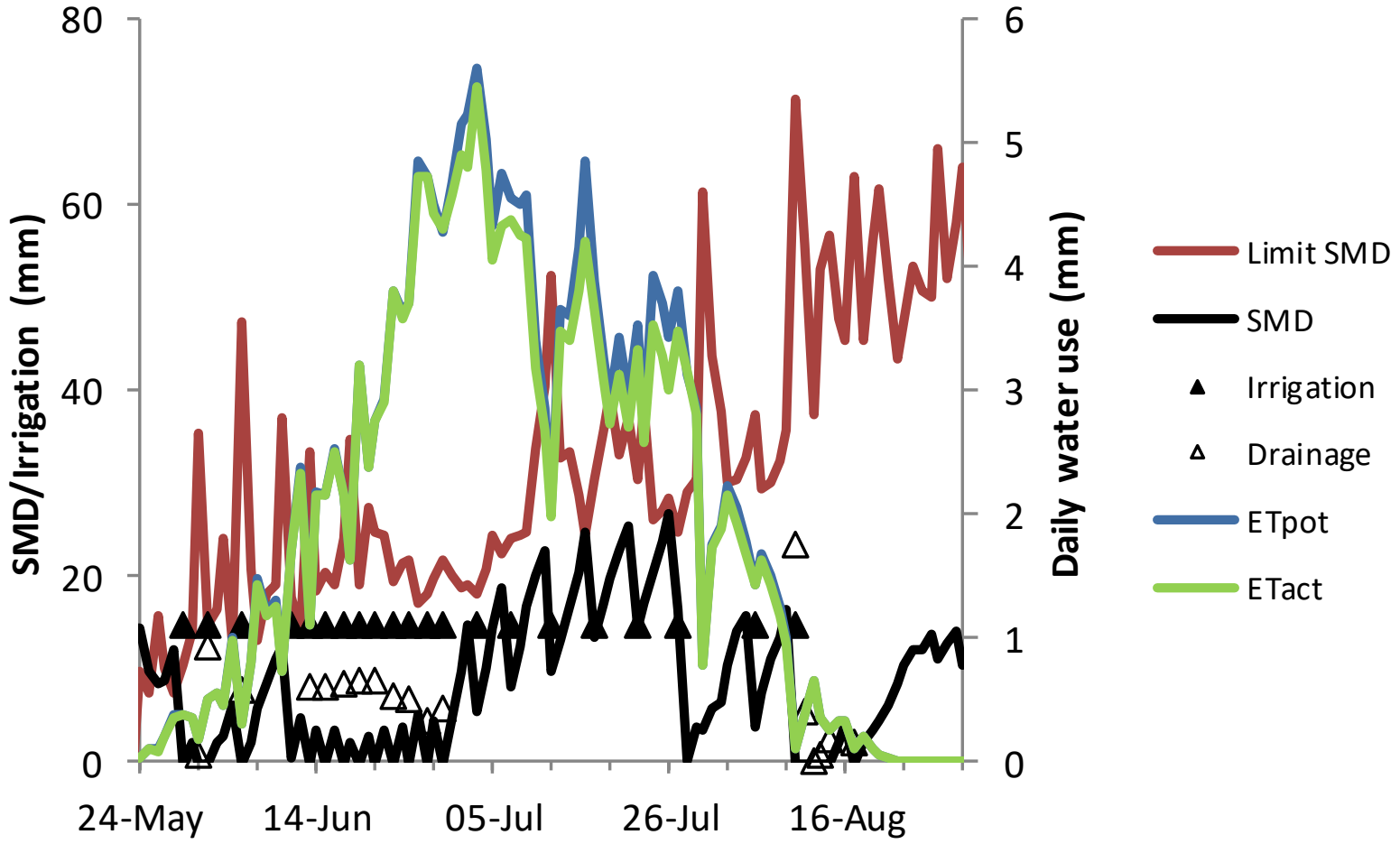
# Black dot soil test (NIAB)

- Soil inoculum twice as important as seed for infection (Denner *et al*. 1998)
- Four Score regarded as High Risk black dot by farm and agronomy team
- Soil sampled at planting
- Two replicate quantitative DNA tests performed on same sample
- Concentration *Colletotrichum coccodes* DNA
  - At lower limit of detection for test
  - 50 fg per g (0.000000000005 %)
  - 30 fg per g
  - Mean 40 fg (0-3 spores per g or 0-1.2 sclerotia per g, Cullen *et al*. 2002): LOW RISK

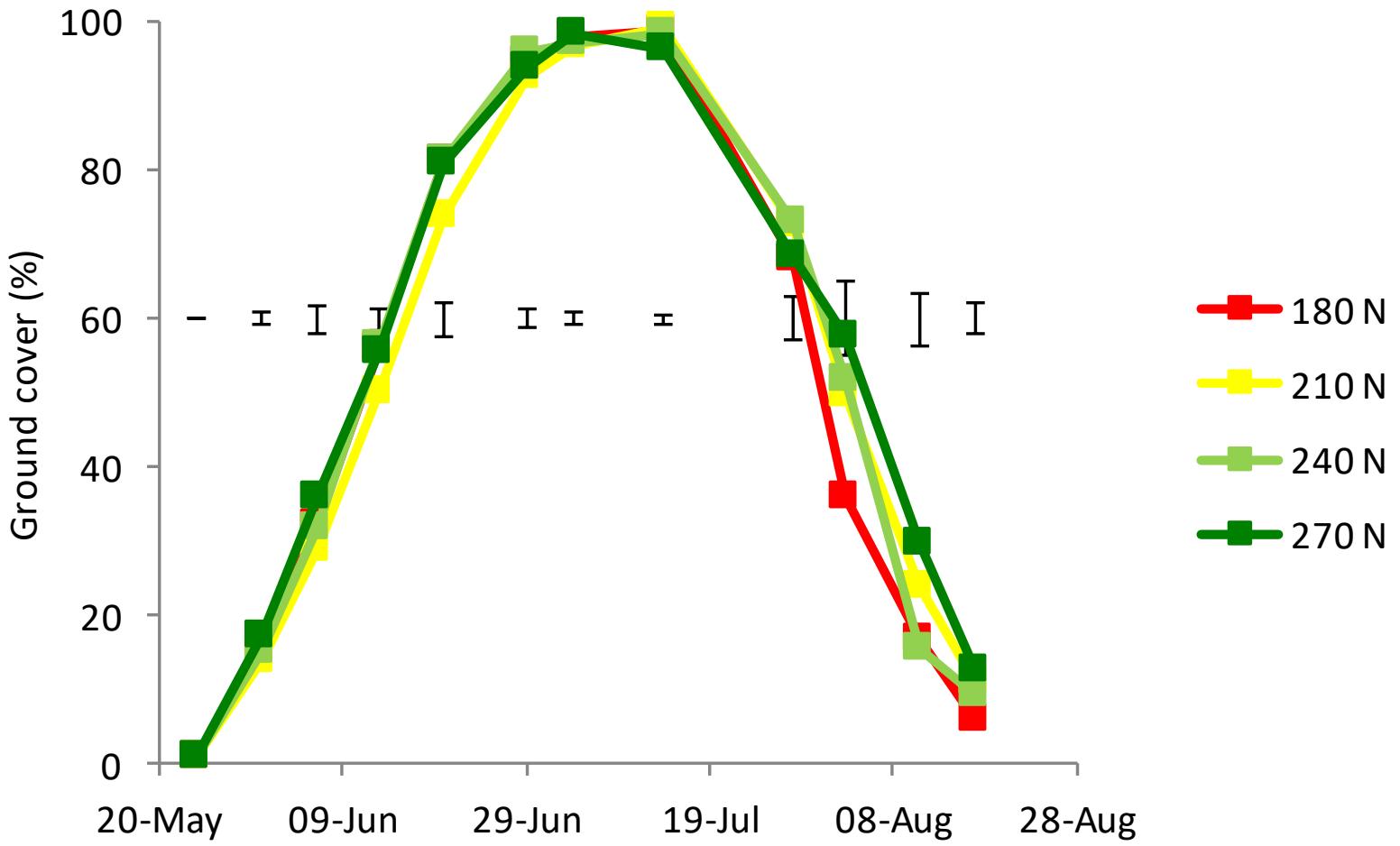



- **Do growers test soil?**
- Disease observed at harvest, now in store at Sutton Bridge EU

# Soil moisture deficits: well watered! Increased risk?



# Ground cover (D2 treatments only)



# Ground cover duration (main N effects)

| Nitrogen | GC duration (% days) |
|---|---|
| 180 | 5003 |
| 210 | 5063 |
| 240 | 5164 |
| 270 | 5271 |
| S.E. (30 D.F.) | 146.2 |

Little difference: <3 days at 100 % GC

# Treatment effects or something else?

# Yields (H1)

| Nitrogen | Defoliation | Yield >40 mm (t/ha) | Total yield (t/ha) | Tuber DM (%) | DM yield (t/ha) |
|---|---|---|---|---|---|
| 180 | Early | 47.1 | 50.3 | 19.3 | 9.7 |
| | Late | 61.2 | 64.0 | 19.3 | 12.4 |
| 210 | Early | 55.2 | 57.1 | 18.9 | 10.8 |
| | Late | 56.2 | 57.8 | 19.0 | 11.0 |
| 240 | Early | 50.2 | 52.0 | 18.2 | 9.5 |
| | Late | 59.1 | 61.6 | 18.1 | 11.2 |
| 270 | Early | 53.9 | 56.7 | 18.9 | 10.7 |
| | Late | 56.6 | 58.8 | 18.4 | 10.8 |
| S.E. (29 D.F.) | | 3.43 | 3.24 | 0.40 | 0.61 |

Early defoliation decreased yield, but no effect of N

# Yields (H2)

| Nitrogen | Defoliation | Yield >40 mm (t/ha) | Total yield (t/ha) | Tuber DM (%) | DM yield (t/ha) |
|---|---|---|---|---|---|
| 180 | Early | 52.3 | 55.1 | 18.4 | 10.1 |
| | Late | 58.4 | 60.2 | 18.7 | 11.2 |
| 210 | Early | 57.0 | 59.9 | 18.7 | 11.2 |
| | Late | 59.0 | 61.1 | 18.6 | 11.3 |
| 240 | Early | 54.5 | 57.0 | 18.5 | 10.6 |
| | Late | 62.5 | 64.4 | 18.9 | 12.1 |
| 270 | Early | 48.0 | 50.2 | 18.6 | 9.3 |
| | Late | 61.9 | 64.2 | 18.3 | 11.7 |
| S.E. (29 D.F.) | | 3.43 | 3.24 | 0.40 | 0.61 |

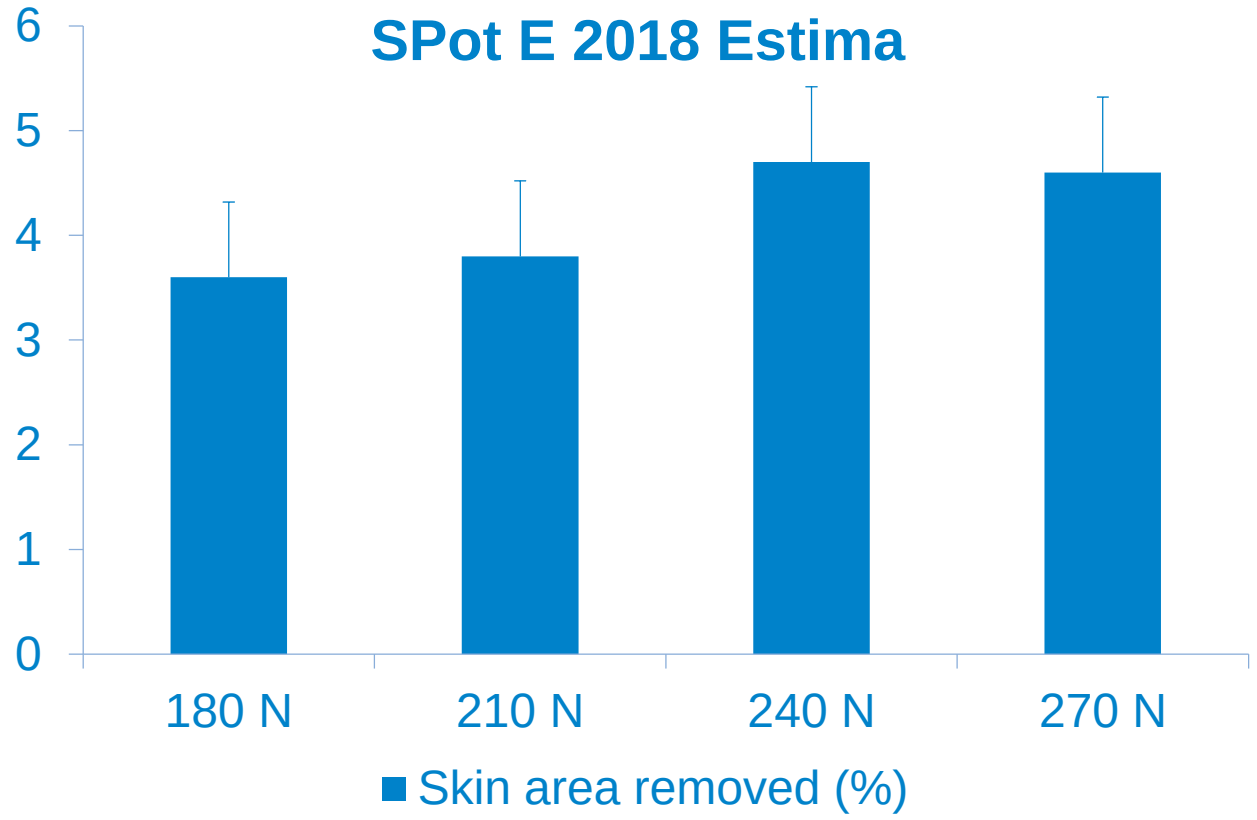
Early defoliation decreased yield, but no effect of N

# Yields (main effects of N)

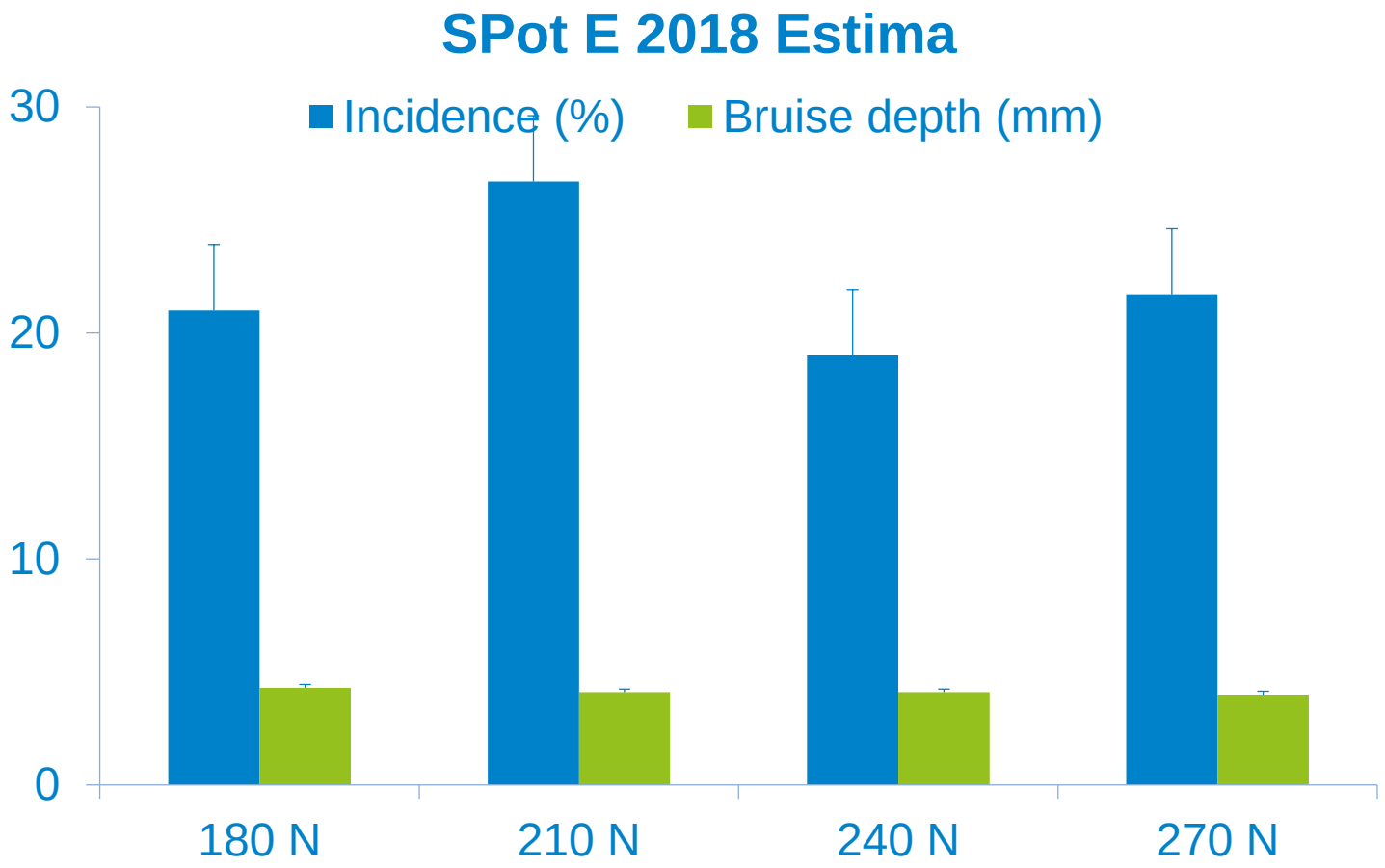
| Nitrogen | Yield >40 mm (t/ha) | Total yield (t/ha) | Tuber DM (%) | DM yield (t/ha) |
|---|---|---|---|---|
| 180 | 54.8 | 57.4 | 18.9 | 10.9 |
| 210 | 56.9 | 59.0 | 18.8 | 11.1 |
| 240 | 56.6 | 58.8 | 18.4 | 10.8 |
| 270 | 55.1 | 57.5 | 18.5 | 10.6 |
| S.E. (29 D.F.) | 1.72 | 1.62 | 0.20 | 0.30 |

No effect of N rate on yield, but directional effect on DM%

# Increased N delays skinset?



# Increased N reduces bruising?



# SPot Scotland 2017 Black dot (9 November assessment: early)


| No. | Regime | Incidence (%) | S.E. | Proportion < 5 % SA (%) | S.E. | Severity (% SA) | S.E. |
|---|---|---|---|---|---|---|---|
| 1 | Planting: Liquid<br>Top-dress: Standard<br>Total: 177 kg N/ha | 22.0 | 15.87 | 96.0 | 3.46 | 1.05 | 0.981 |
| 2 | Planting: Standard<br>Top-dress: Ridge Inject<br>Total 175 kg N/ha | 11.3 | 1.15 | 98.0 | 0.00 | 0.40 | 0.142 |
| 3 | Planting: Standard<br>Top-dress: 0<br>Total: 147 kg N/ha | 16.7 | 6.43 | 96.7 | 4.16 | 0.98 | 1.294 |
| 4 | Planting: Standard<br>Top-dress: Standard<br>Total: 176 kg N/ha | 21.3 | 7.02 | 93.3 | 6.43 | 1.91 | 2.074 |

- Black dot incidence from short-term storage was moderate
- Worse severity in the higher-yielding N treatments?

# Summary

- Soil test showed very low *C. coccodes* inoculum concentration
- No effect of N rate on early ground cover development
- Canopies lasted slightly longer with increased N, but <3 days at 100 % GC from 180 to 270 kg N/ha
- No effect of N rate on yield or grading, but trend for DM % to decrease with more N
- Higher N delayed skinset
- No effect of N on bruising
- Effects on Black Dot? TBC April 2019

# Acknowledgements


- NIAB CUF would like to thank Andrew Francis and Emma Kelcher and their team at Elveden for all their help and support in conducting experiments and trials during 2018-2018
- AHDB staff involved in the SPot East programme including: Jenny Bashford, Graham Bannister and Teresa Meadows
- Nick Winmill of Agrii and Tony Miller of John Innes Centre for supplying soil nitrate-measuring probes
- Peter Raatjes of RMA for installing Adcon soil water monitoring probes