The benefits of the AHDB Spot Farm programme in improving irrigation, nutrition and soil management for growers

Mark Stalham

Are the following statements about splitting N applications still true?

- “splitting the dressing was inferior to applying it all to the seedbed in practically all experiments on medium and heavy soils…..there were (very small) advantages from splitting the dressing on half the experiments on light soils” Cooke et al. (1957)
- “When a crop’s total nitrogen requirement is supplied with a single pre-plant or at-planting application, most of the N must “wait” for the target crop’s future needs and that means the window for potential loss remains open longer. By postponing a portion of the N treatment until the crop is better able to utilize the nutrient, plants take up the nitrogen more quickly and efficiently.” The Fertilizer Institute, Washington D.C.

Typical N split at Elveden Estate

- Standard split N
  - 20 kg N as DAP 23 March
  - 80 kg N as Chafer N30+S 24 March
  - 80 kg N as Chafer N30+S 10 May
  - 80 kg N as Extran 16 June
- Seedbed N
  - 20 kg N as DAP 23 March
  - 240 kg N as Chafer N30+S 24 March

Fertilizer spreading/spraying

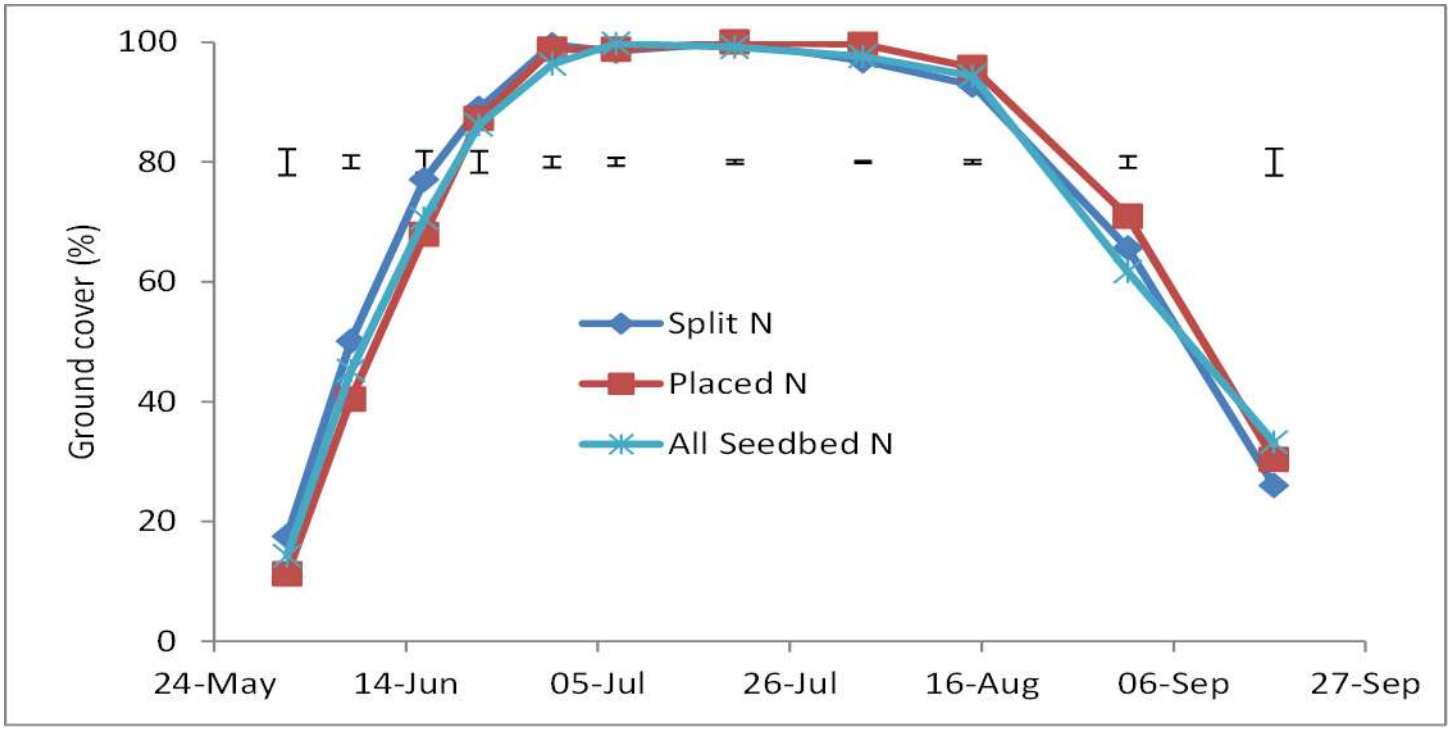
N x irrigation experiment 2017

Sand soil (1.9 % OM)

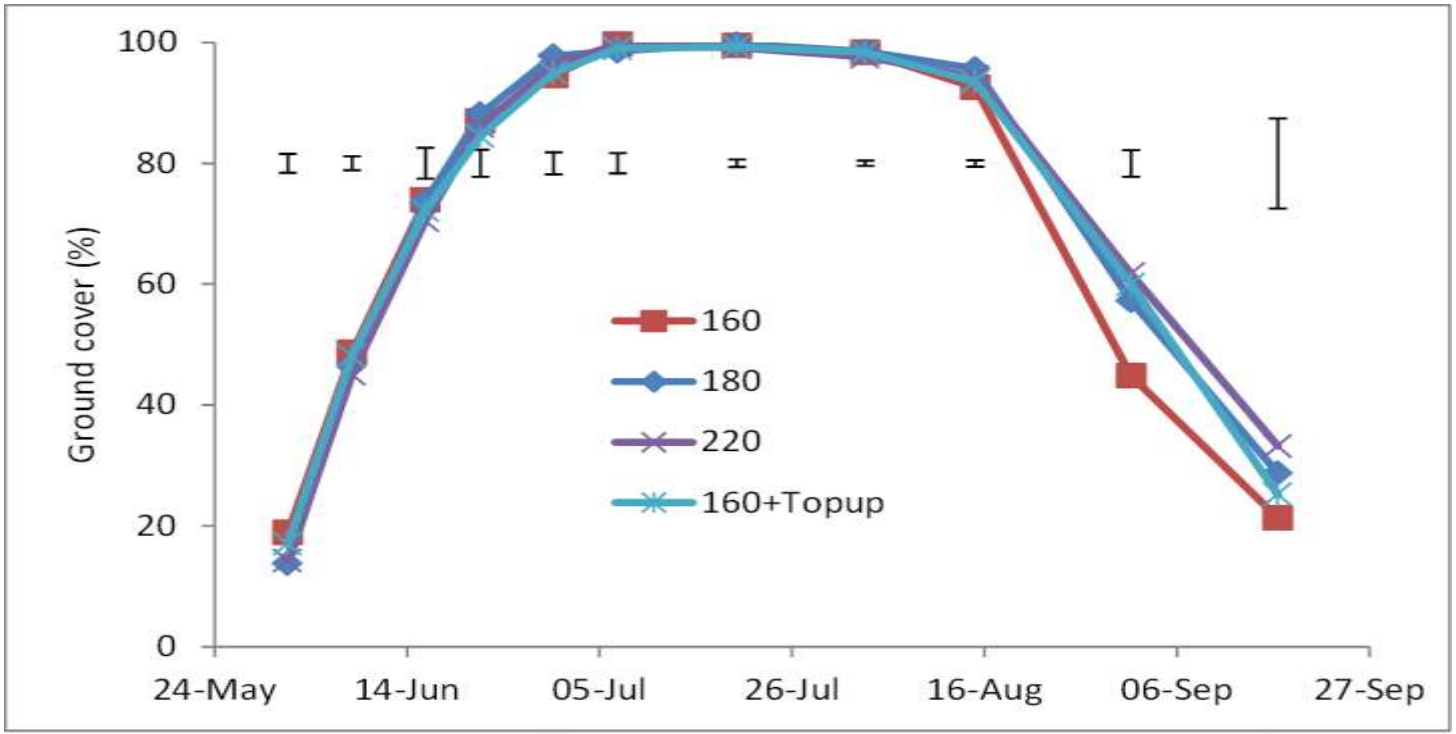
Planted: 24 April Emerged: 24 May

- N method
  - Standard Split N
  - All N applied to top of bed pre-planting
  - All N placed on-planter
- N rate
  - 160 kg/ha
  - 180 kg/ha
  - 220 hg/ha
  - 160 + top-up

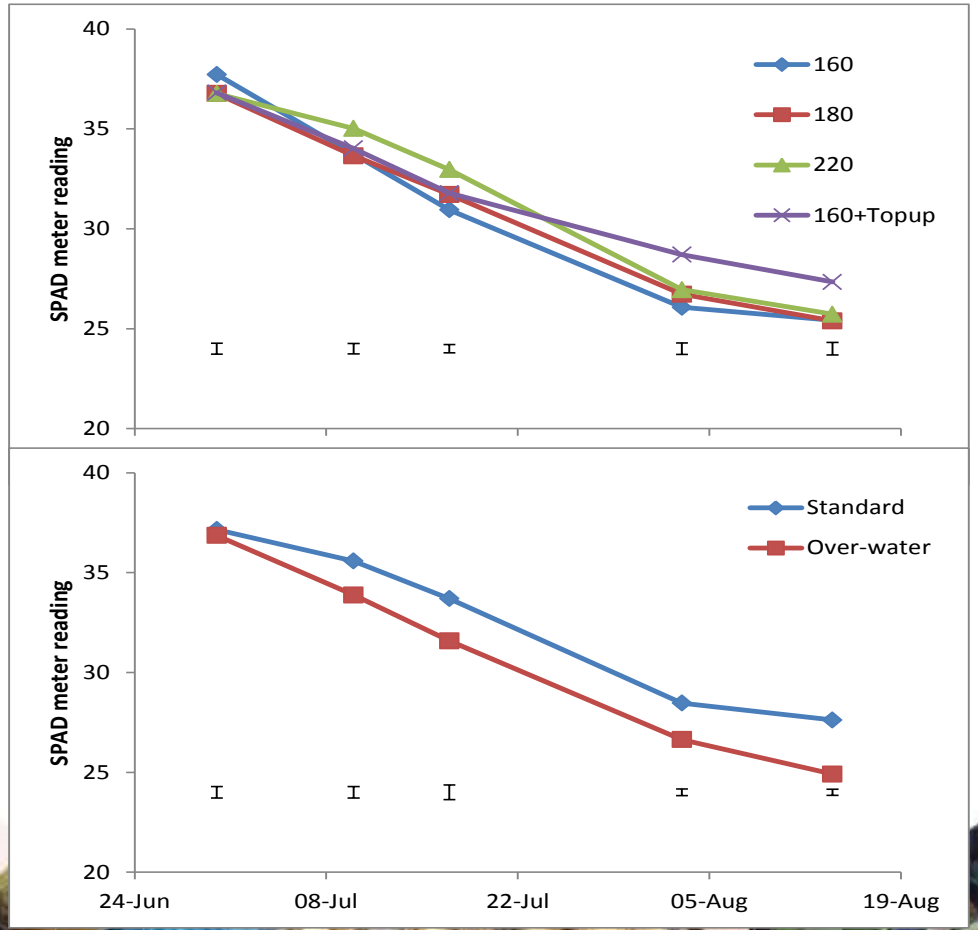
Nitrogen x Irrigation: ground covers
a) Nitrogen method



Nitrogen x Irrigation: ground covers
b) Nitrogen rate



SPAD Meter: measuring leaf chlorophyll content for predictions of N deficiency



N method yield: 2016 and 2017

2016 (Russet Burbank) N method	Total yield (t/ha)	Tuber DM (%)	DM yield (t/ha)
Split	70.4 (± 8.15)	22.0 (± 0.88)	15.5 (± 2.22)
Seedbed	69.7 (± 4.16)	22.1 (± 0.66)	15.4 (± 1.39)

2017 (Brooke) N method	Total yield (t/ha)	Tuber DM (%)	DM yield (t/ha)
Split	62.5	24.4	15.3
Seedbed	62.2	24.7	15.4
Placed	56.8	25.0	14.2
S.E. (12 D.F.)	2.53	0.25	0.60

Was 220 kg N sufficient?
Comparison vs farm 260 kg N

Nitrogen	Total yield (t/ha)	Tuber DM (%)	DM yield (t/ha)
Split 220	**65.0**	24.4	15.9
S.E. (12 D.F.)	3.58	0.35	0.84
Split 260	**64.8**	23.6	15.2
S.E. (3 D.F.)	2.08	0.95	0.57

Was 160 kg N sufficient?

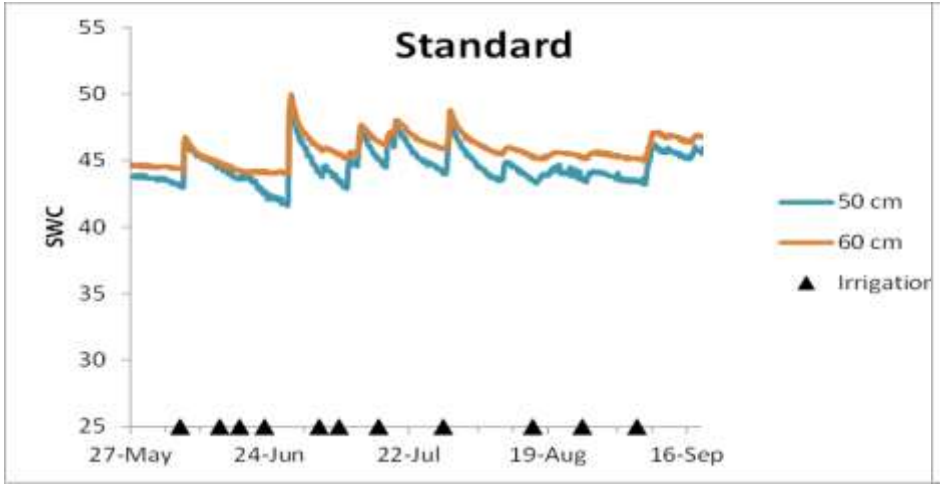
N rate (kg/ha)	Total yield (t/ha)	Tuber DM (%)	DM yield (t/ha)
160	**62.9**	24.3	15.3
180	61.4	24.6	15.1
220	**62.2**	24.7	15.4
160+30	63.7	24.3	15.5
S.E. (12 D.F.)	2.35	0.31	0.50

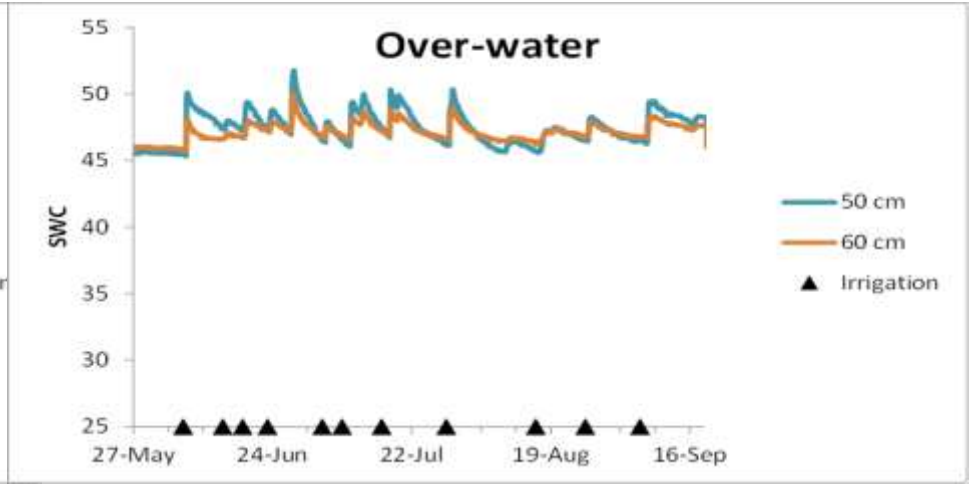
Irrigation and drainage: Standard vs Over-water

	Irrigation (mm)	Drainage (mm)	Efficiency† (%)	Modelled yield (t/ha)
Standard	199	**182**	98.0	61.2
Over-water	296	**278**	98.2	60.4

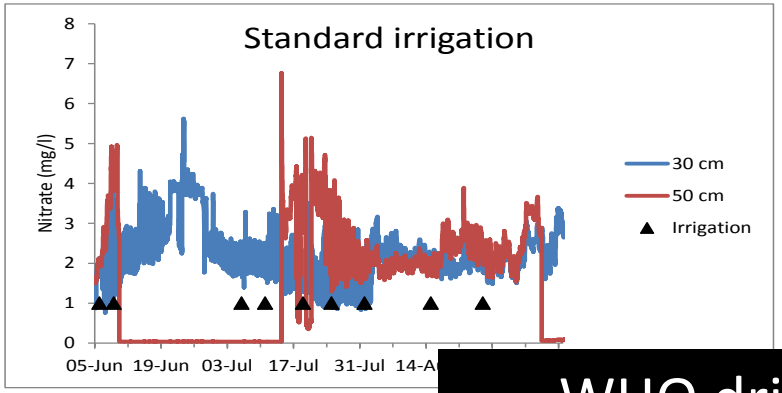
†Efficiency in meeting water requirement of canopy and ET demand

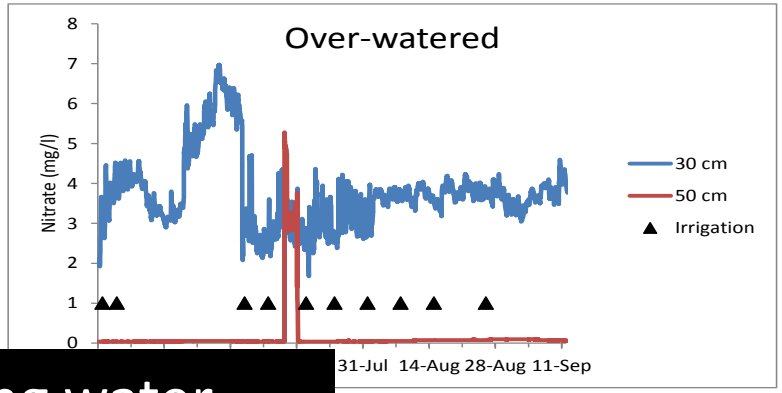
Agrii Soil Water Sensor Data
Showing drainage events at 50-60 cm in both Standard as well as Over-water



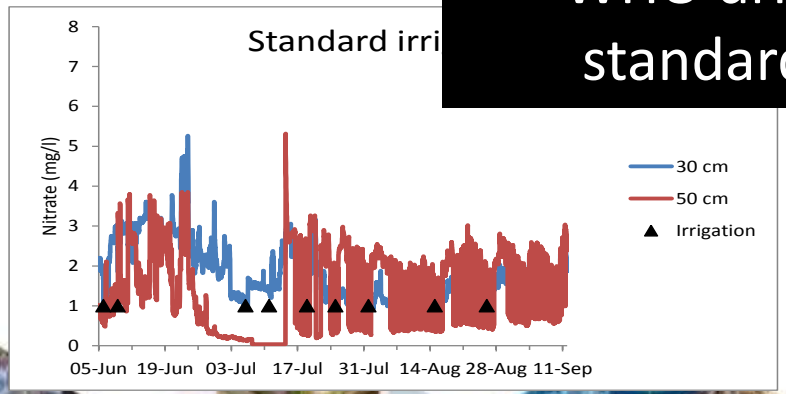


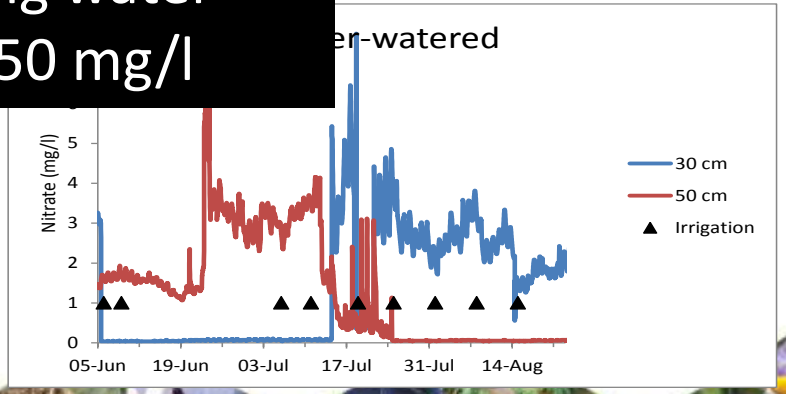
Soil NO_3 sensors (Tony Miller, JIC + Nick Winmill, Agrii) No evidence of leaching?



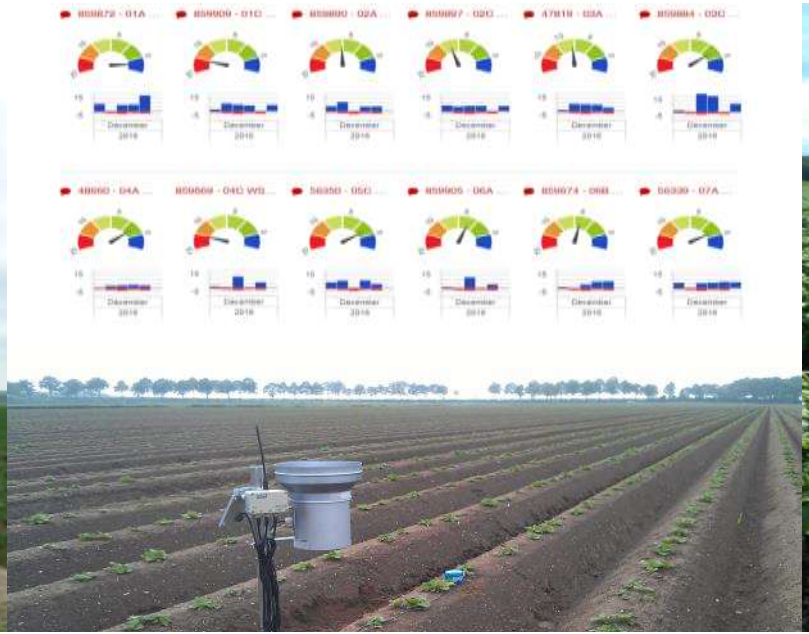


WHO drinking water standard = 50 mg/l



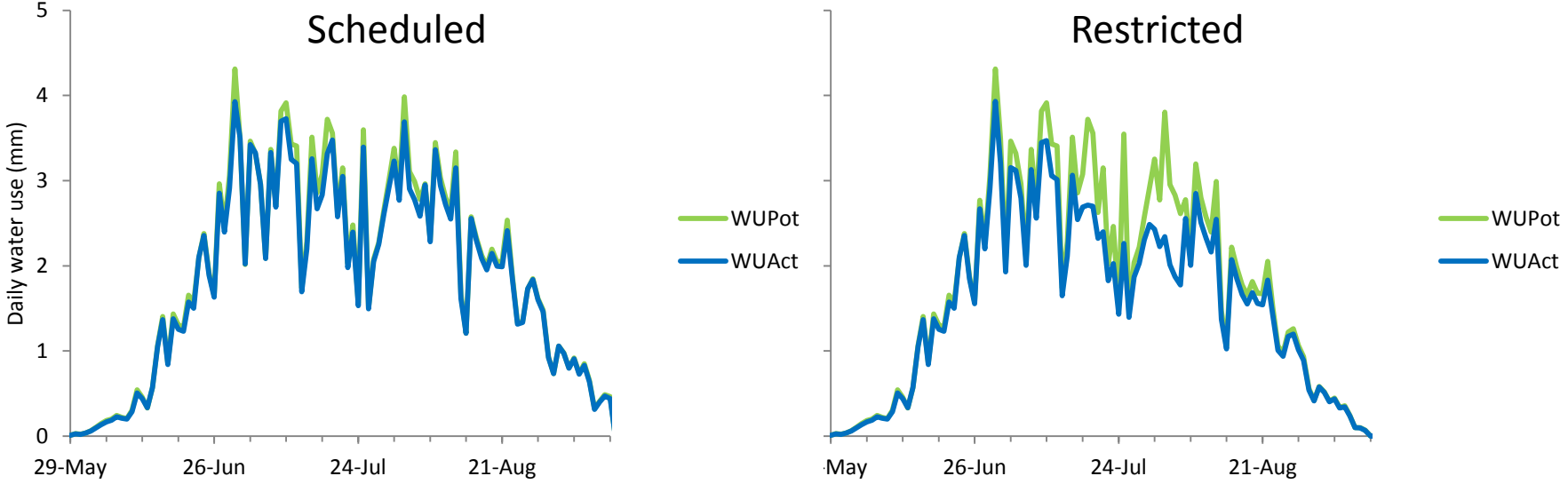


ET and soil water probe data from Agrii/RMA (3-4 probes per treatment)

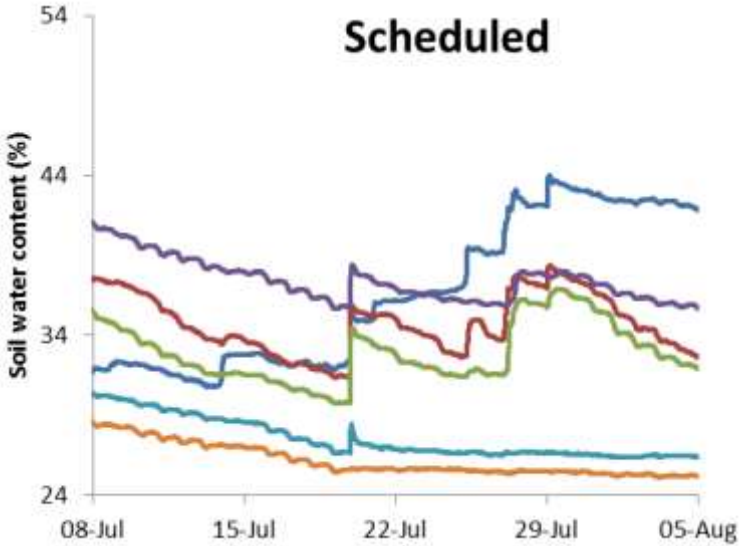


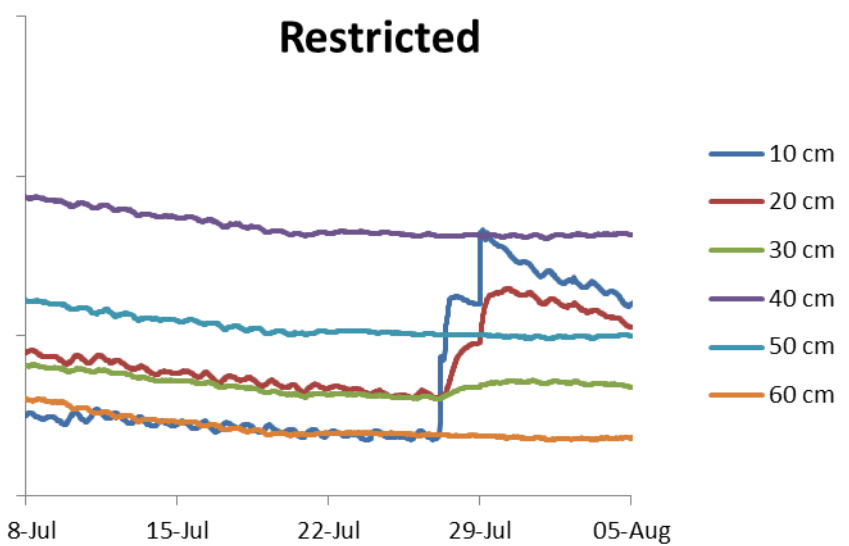
Every irrigation event (boom) measured with 3 or 4 raingauges

Soil moisture deficits, SPot West 2015



Soil Moisture Probe Plots





Note almost complete cessation of water uptake in all horizons in Restricted treatments by 26 July

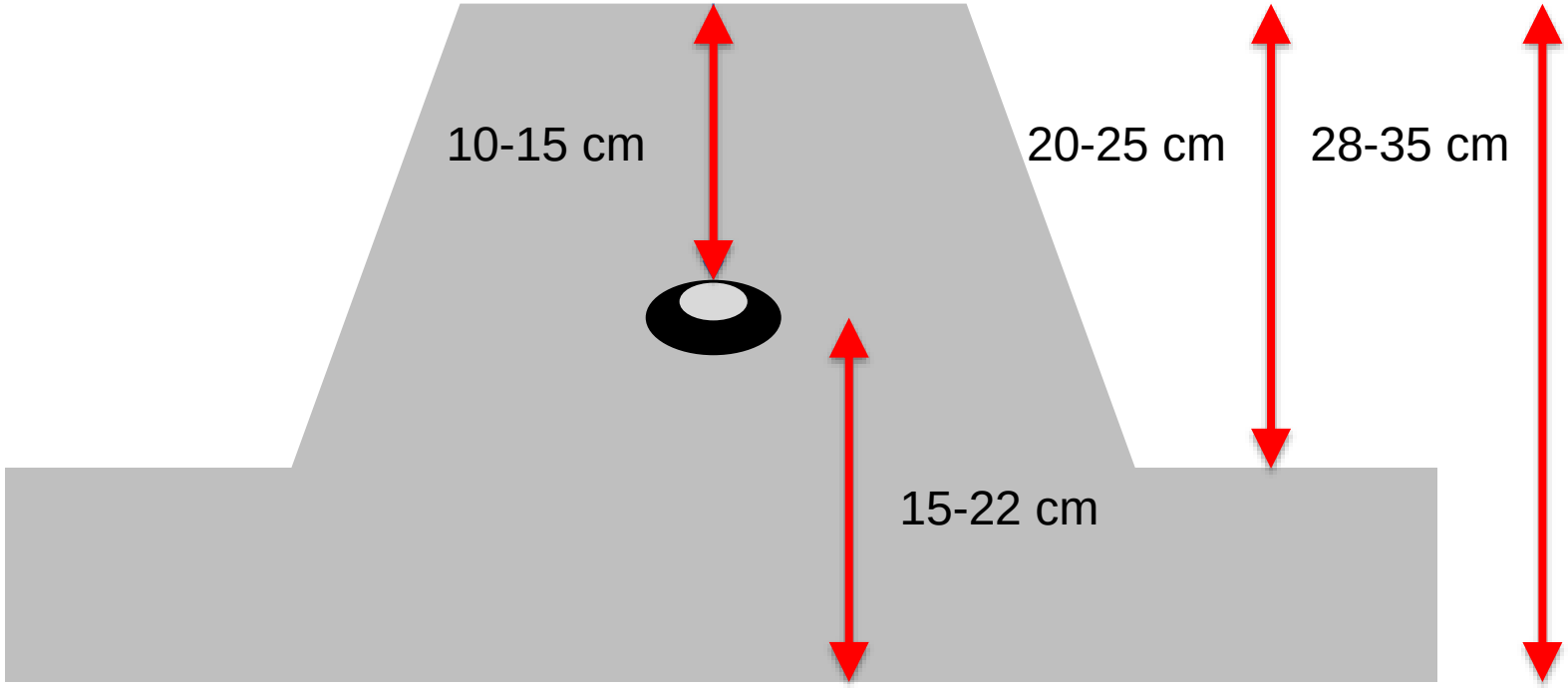
Better practice SPot East
Tested scientific confidence to:

- Delay all irrigations by 1 day
- Use the weather forecast and delay by 1 day if the chance of rain the following day is > 50 %

	Standard			Better practice		
	No. of irrigation events	Total applied (mm)	Drainage total (mm)	No. of irrigation events	Total applied (mm)	Drainage total (mm)
2016						72
2017						115
Savings				3	53	46

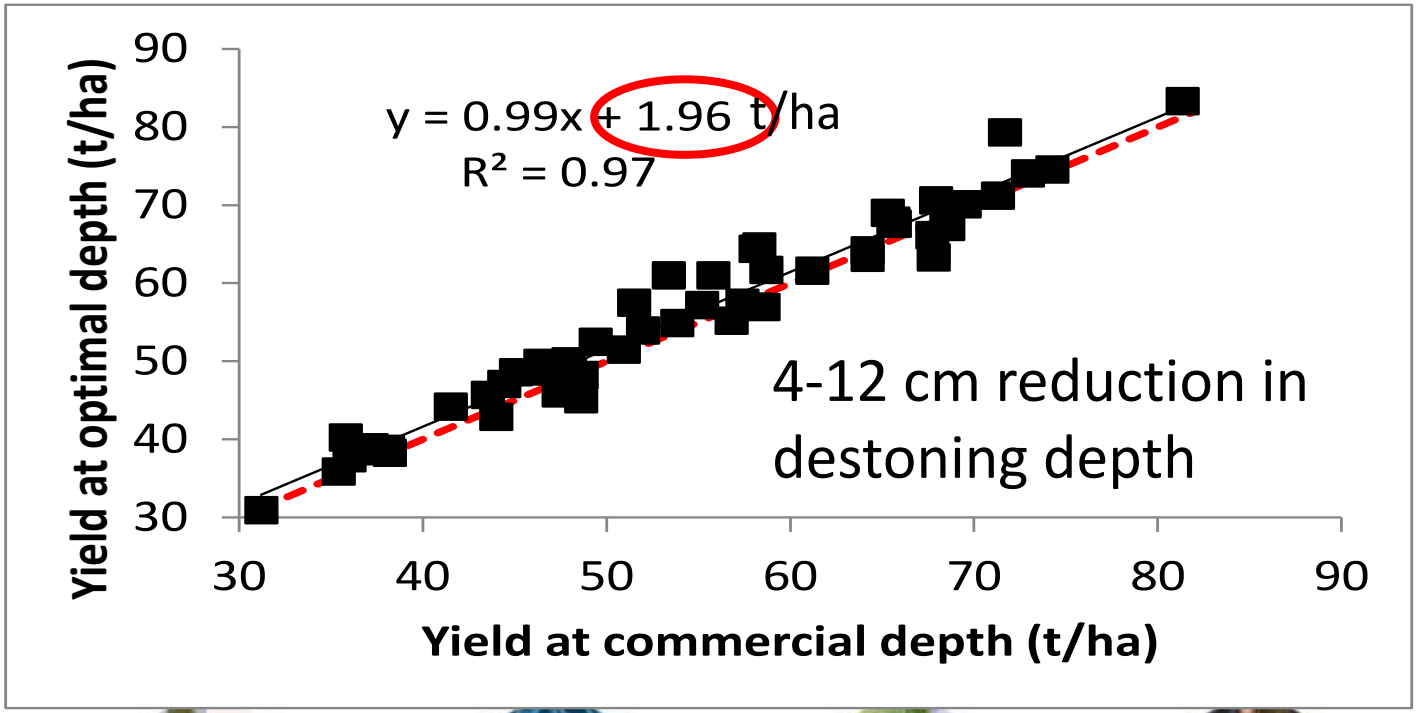
254 000 m^3 saving at Elveden!

Why do we cultivate so deeply if we plant at 10-15 cm depth?



Are we confident that yield will ***improve*** with shallower cultivation? **78 % of the time**

1 in 25 chance of (significantly) lower yield



Benefits: the bottom line
Testing at SPot Farm West 2016

	Bedformer		Bedtiller		Destoner			
Cultivation	Rate (ha/h)	Fuel+ labour (£/ha)	Rate (ha/h)	Fuel+ labour (£/ha)	Rate (ha/h)	Fuel+ labour (£/ha)	Total (£/ha)	Yield (t/ha)
Best Practice (-6 cm)	4.40	8.25	-	0.00	0.51	45.18	53.43	69.7
Standard	**4.37**	**9.77**	**1.72**	**24.76**	**0.49**	**47.19**	**81.72**	**68.9**
Difference (%)	+ 1	- 16	-	-	+ 4	- 4	- 35	+ 1

1 % improvement in yield, with 35 % saving in costs, removal of bedtiller operation and 4 % increase in slowest operation.

SPot Scotland: fine-tuning cultivations
Mean 2016 + 2017 data

Bedform depth (cm)	Bedtill depth (cm)	Destone depth (cm)	Fuel + Labour (£/ha)	Total yield (t/ha)	Packed yield (t/ha)	Packed value (£/ha)
30	**30**	**30**	**87.66**	**50.5**	**27.8**	**4587**
30	15	30	79.65	55.5	33.4	5511
30	None	25	55.23	53.1	34.8	5742

Acknowledgements: