SPot East 2018 Results

POTATOES

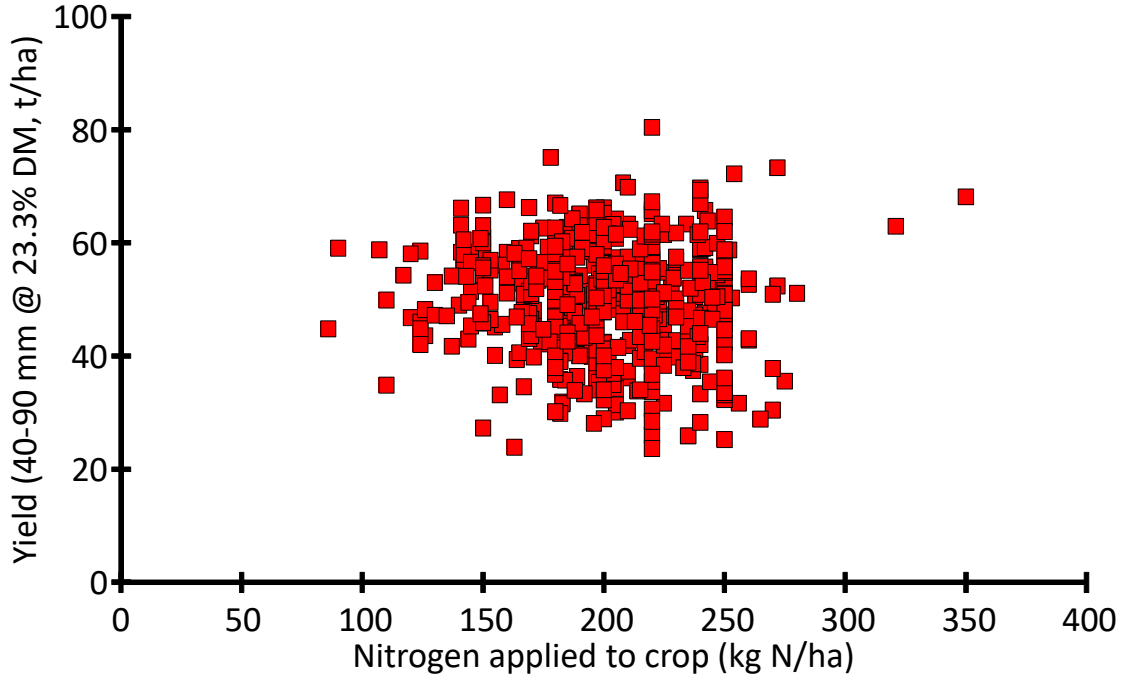
Marc Allison & Mark Stalh

Nitrogen work over three years

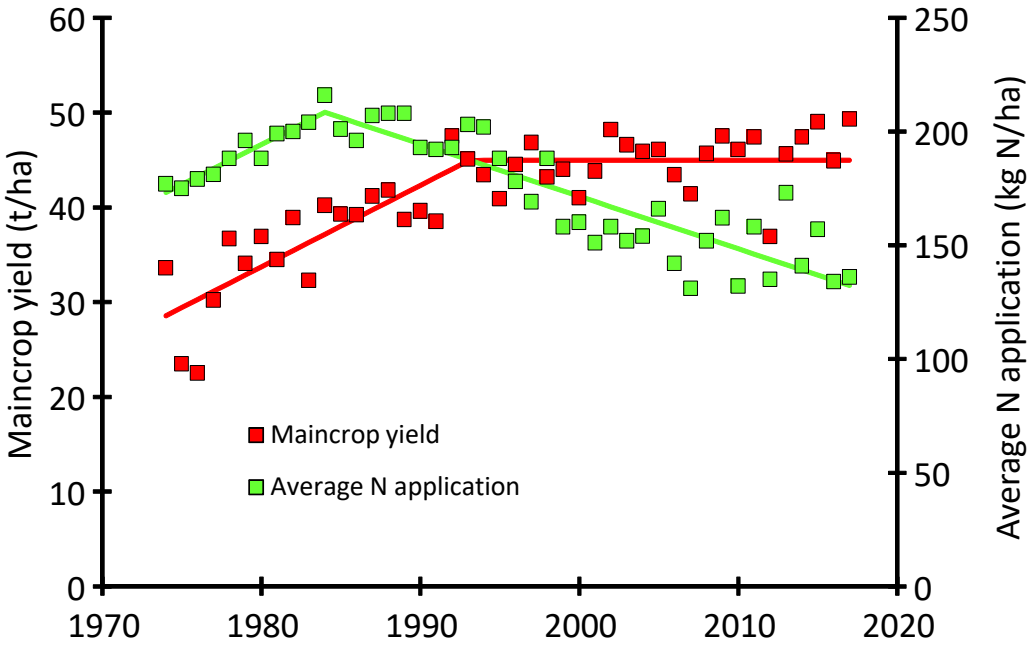
POTATOES

Hypothesis: does N application drive yield?

Data from 556 processing crops 2010-2016
Mean ware yield at 23.3 % DM = 50.0 t/ha
Mean N application rate = 201 kg N/ha



Survey data suggest otherwise



British Survey of Fertilizer Practice & AHDB

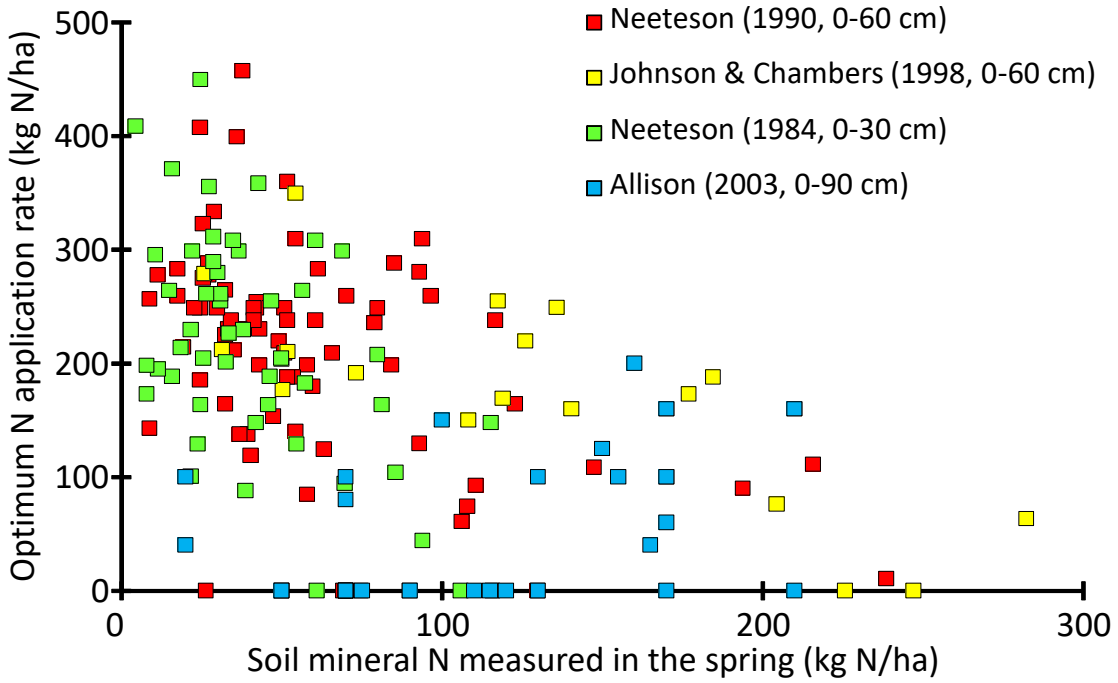
Summary of SPot N trials (2016-2018)

SPot site	Year	Variety	N treatments	Summary of N effects on yield	Yields >40 mm (t/ha)	Tuber DM (%)
East	2016	R Burbank	Split N, All N in seedbed (both 260)	**No effect**	68.2, 68.3	22.0, 22.1
	2017	Brooke	Split N, All N in seedbed, Placed N (all 220), 160, 180, 220, 160+30	**No effect of rate or timing. Placed lower**	61.0, 61.1, 55.7, 61.2, 59.2, 61.0, 62.3	24.5, 24.8, 25.0, 24.3, 24.3, 24.7, 24.3
	2018	Estima	180, 210, 240, 270	**No effect**	54.8, 56.9, 56.6, 55.1	18.9, 18.8, 18.4, 18.5
North	2018	M Piper	120, 150, 180, 150+30	**No effect**	49.7, 48.1, 49.3, 50.7	23.6, 23.4, 23.2, 23.4
South West	2017	Electra	90, 120, 150	**No effect**	58.7, 61.7, 61.3	17.1, 16.3, 16.4
	2018	Electra	0, 30, 60, 90, 120	**No effect**	72.0, 61.2, 72.4, 73.4, 72.3	16.4, 15.7, 15.6, 15.8, 16.4
Scotland	2017	M Piper	177, 147, Liquid, Injection	**Injection lower**	54.3, 51.2, 54.5, 49.8	19.2, 19.4, 18.5, 18.4
	2018	M Piper	176, 147, 120, Placed	**TBA**	TBA	TBA

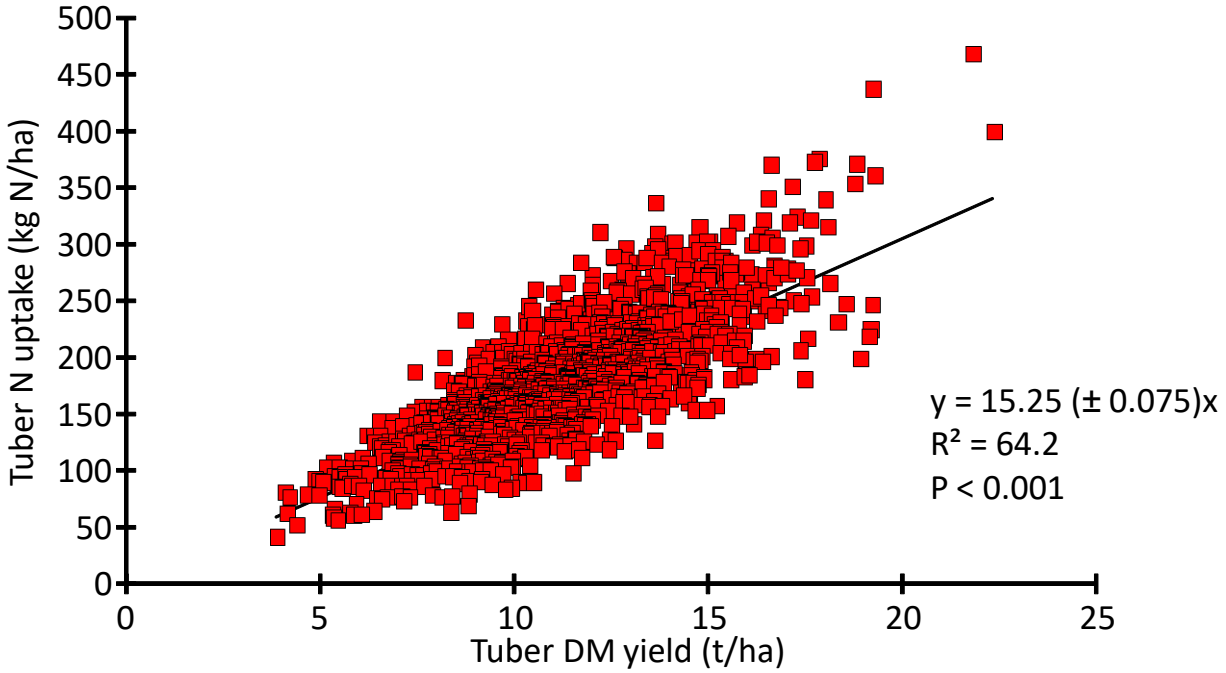
Setting the N rates for SPot East 2018

Step	Process	Factors	Outcome
1	Calculate soil nitrogen supply (SNS)	Cereal stubble, sand soil in a low rainfall area	SNS Index = 0 (soil will supply <60 kg N/ha)
2	Identify determinacy group	Estima	Variety group = 1 (determinate)
3	Calculate season length	24 May (emergence) to end August (defoliation)	Season length = 100 days
4	Calculate initial N requirement of crop		237 kg N/ha
5	Calculate supply from organic manures	Compost November 2016	0 kg N/ha (but soil OM is 2.7 %)
6	**Fertilizer required**		**240 kg N/ha**

Can we use soil tests to guide N fertilizer recommendations?

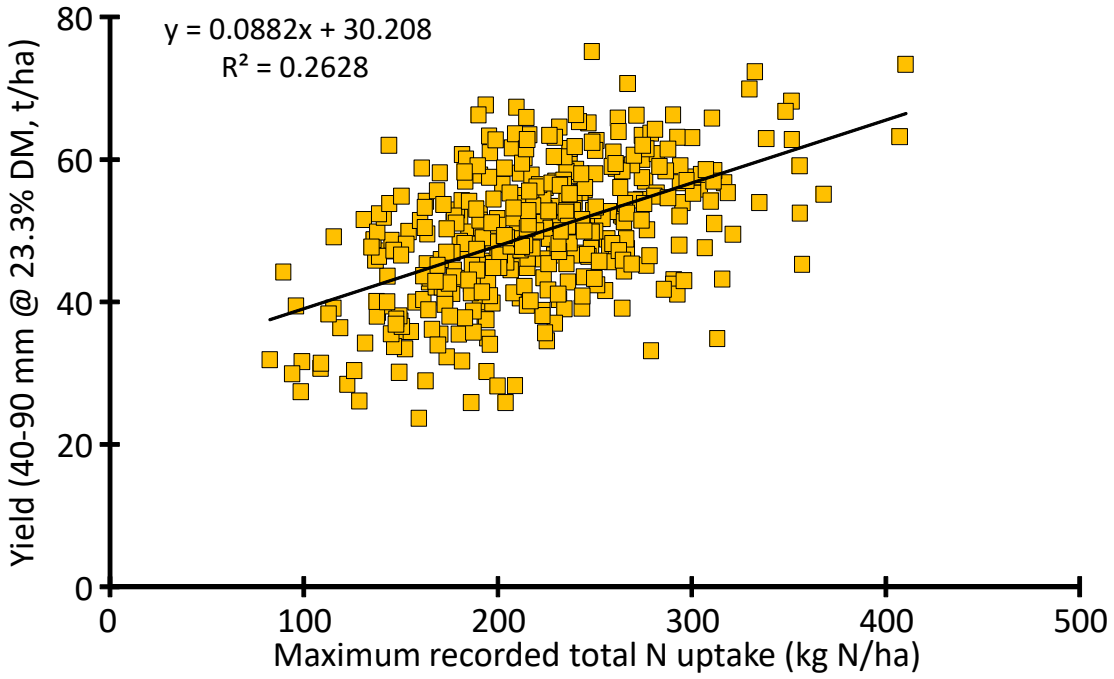


Relationship between tuber N uptake and tuber dry matter yield



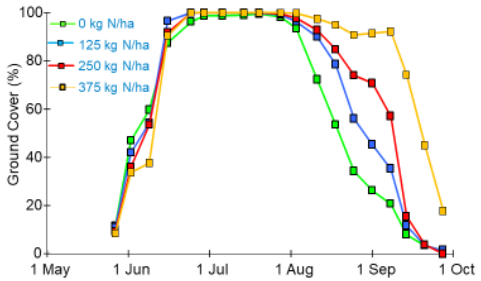
Big N uptake = big yield?

Data from 402 processing crops 2010-2016 where N uptake was measured
Mean ware yield at 23.3 % DM = 49.6 t/ha
Mean total N uptake = 220 kg N/ha



Effect of N on yield formation Russet Burbank, CUF 2008

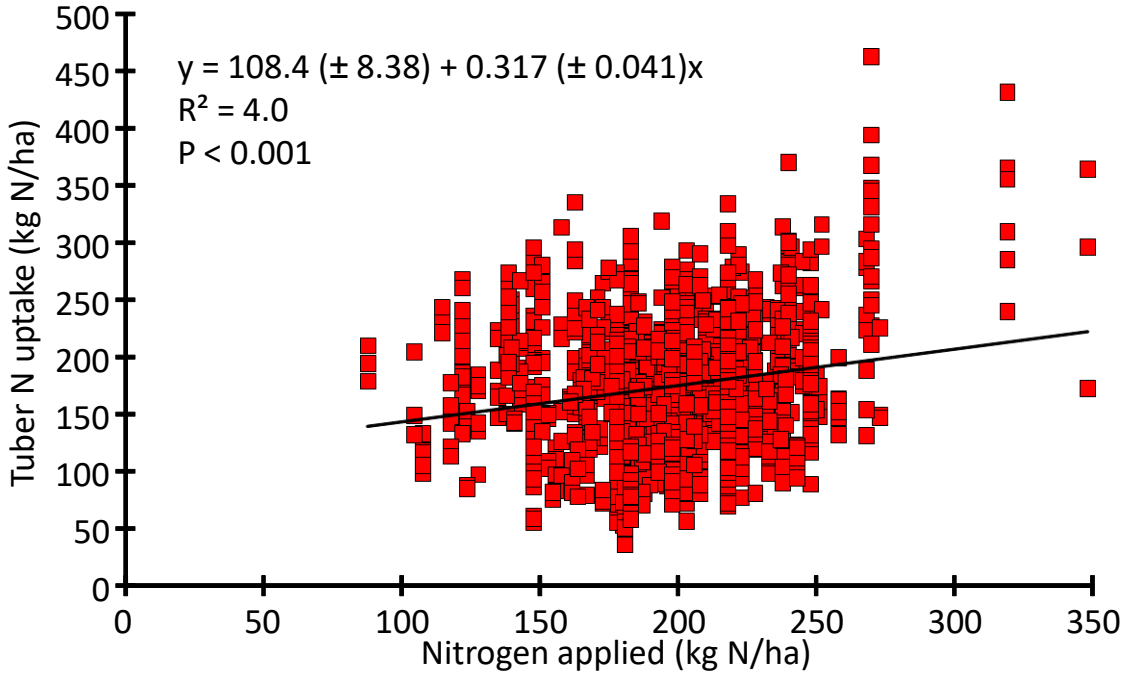
Effect of N application on ground cover development



Sampled 29 September

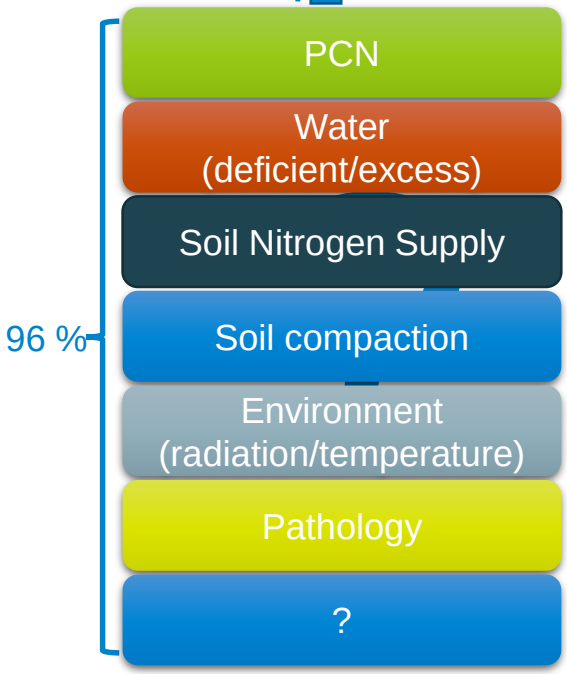
Nitrogen applied (kg N/ha)	Total N uptake (kg N/ha)	Integrated GC (% days)	Radiation absorbed (TJ/ha)	Total DM (t/ha)	RUE (t/TJ)	Harvest index (%)	Total FW yield (t/ha)
0	142	7843	12.78	14.22	1.12	93	56.7
125	197	8622	13.75	16.59	1.21	87	64.7
250	225	9071	14.16	17.49	1.24	87	69.1
375	308	10262	15.26	18.88	1.24	87	77.8
S.E.	25.1	318.2	0.381	1.275	0.071	2.5	3.78

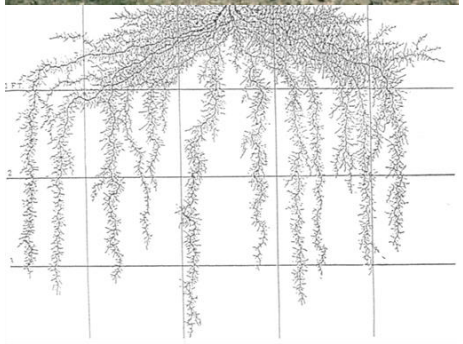
Relationship between N uptake by tubers and fertilizer N application



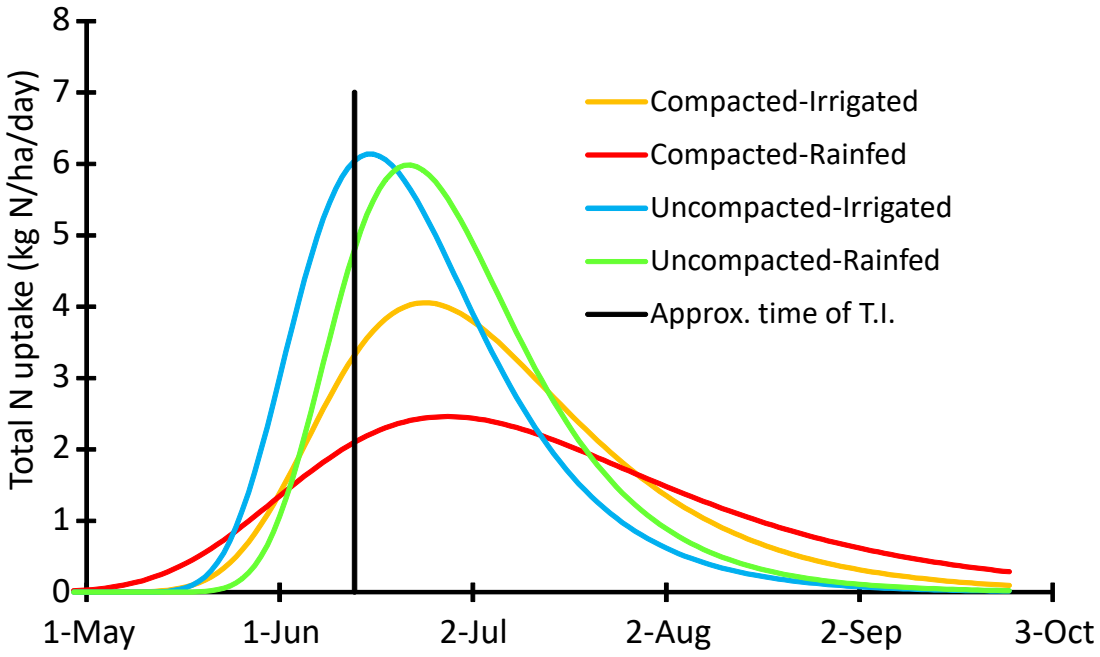
What factors affect the amount of N taken up by the crop?

N application → 4 % → N uptake → Tuber Yield



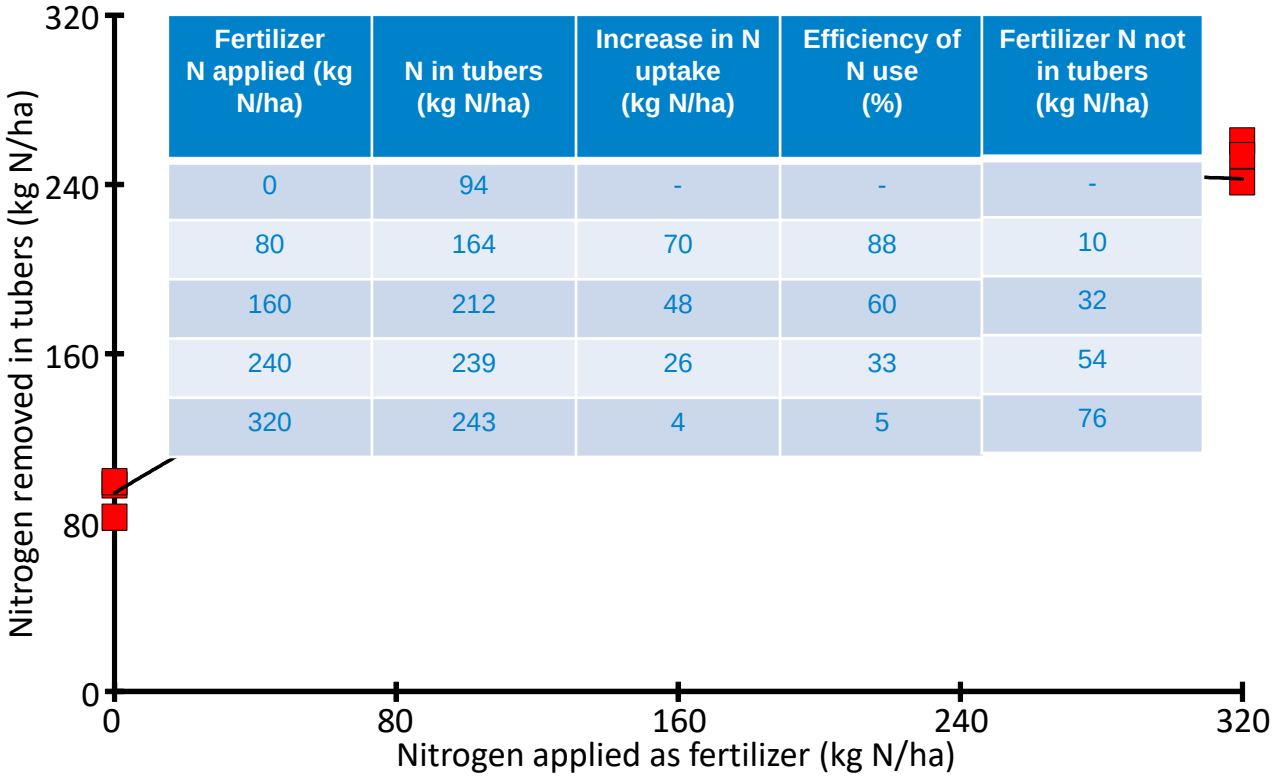


Effect of compaction and irrigation on nitrogen uptake. Maris Piper CUF 2006



What do we mean by N use efficiency?

Fertilizer N applied (kg N/ha)	N in tubers (kg N/ha)	Increase in N uptake (kg N/ha)	Efficiency of N use (%)	Fertilizer N not in tubers (kg N/ha)
0	94	-	-	-
80	164	70	88	10
160	212	48	60	32
240	239	26	33	54
320	243	4	5	76



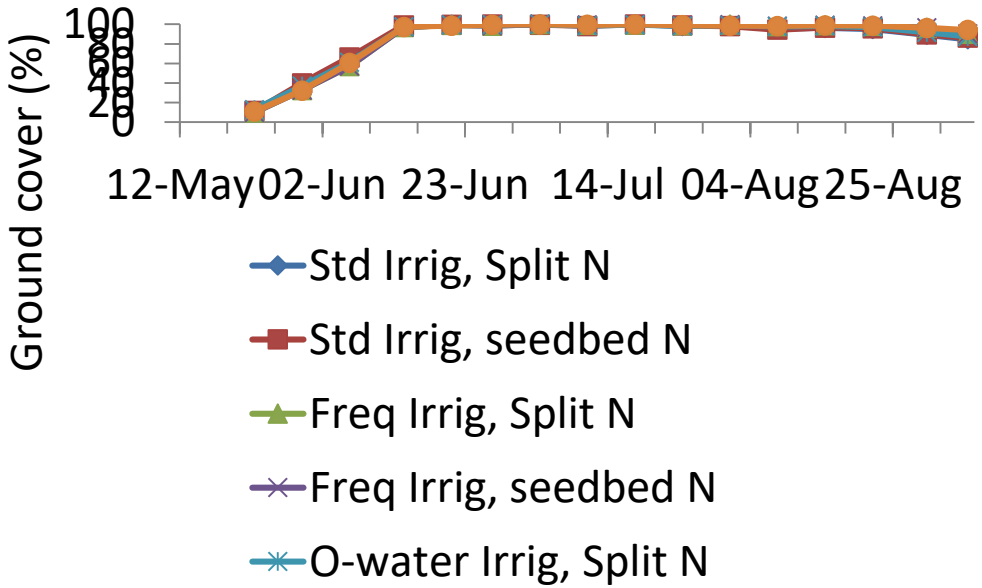
Effect of irrigation, N application and variety on tuber yield. CUF Reference Crop 2006-2017

	Estima				Cara			
	Rain-fed		Irrigated		Rain-fed		Irrigated	
	kg N/ha	t/ha	kg N/ha	t/ha	kg N/ha	t/ha	kg N/ha	t/ha
Mean	**146 ± 27.6**	**43.6 ± 4.77**	**193 ± 19.5**	**65.4 ± 3.42**	**87 ± 21.8**	**58.0 ± 3.53**	**87 ± 22.5**	**70.1 ± 4.74**

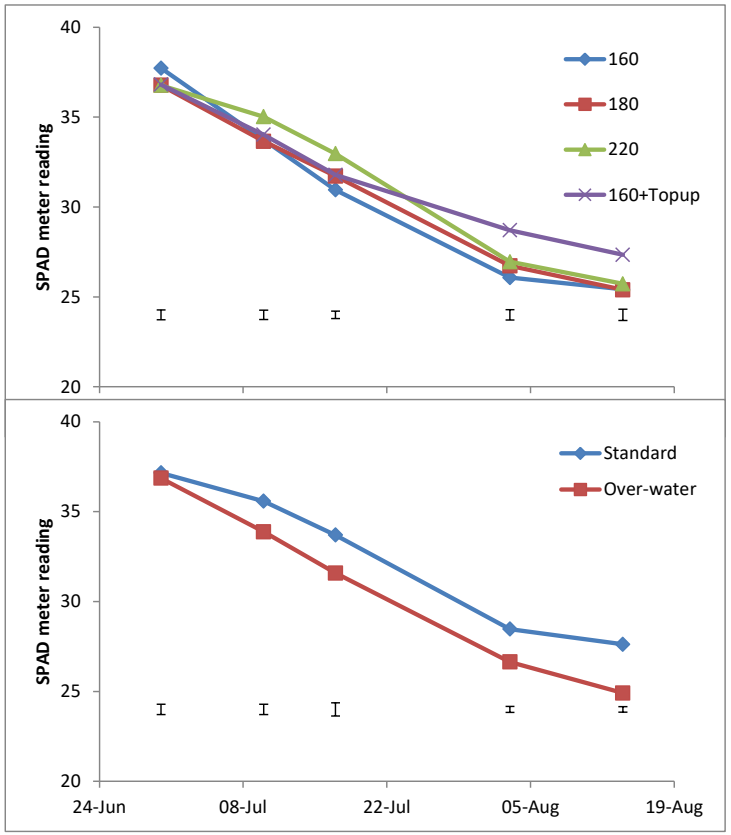
Irrigation increased optimum N application rate by 47 kg N/ha in Estima and 0 kg N/ha in Cara

Data from Firman

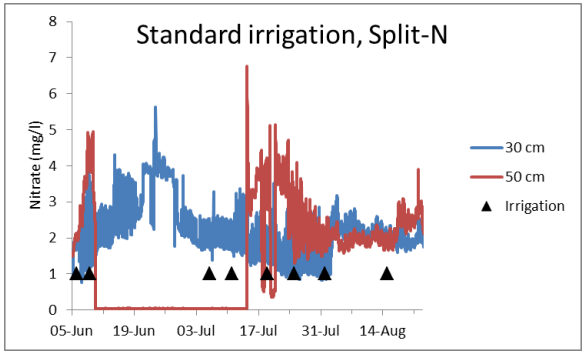
SPot Farm East 2016
Nitrogen x Water Comparison

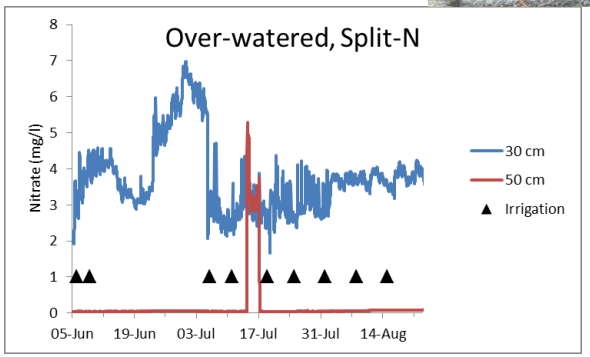


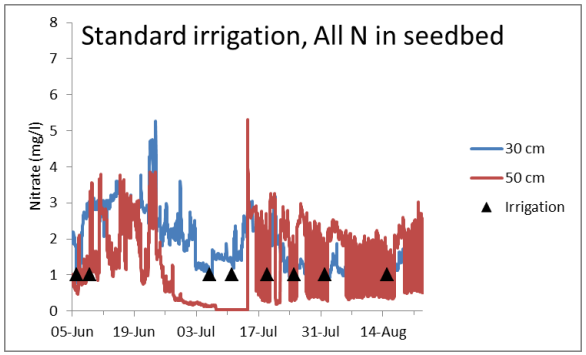
SPAD Meter: measuring leaf chlorophyll content for predictions of N deficiency

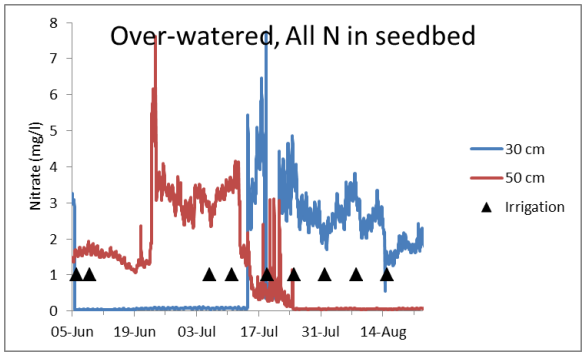


Soil NO_3 sensors (Tony Miller, JIC + Agrii)

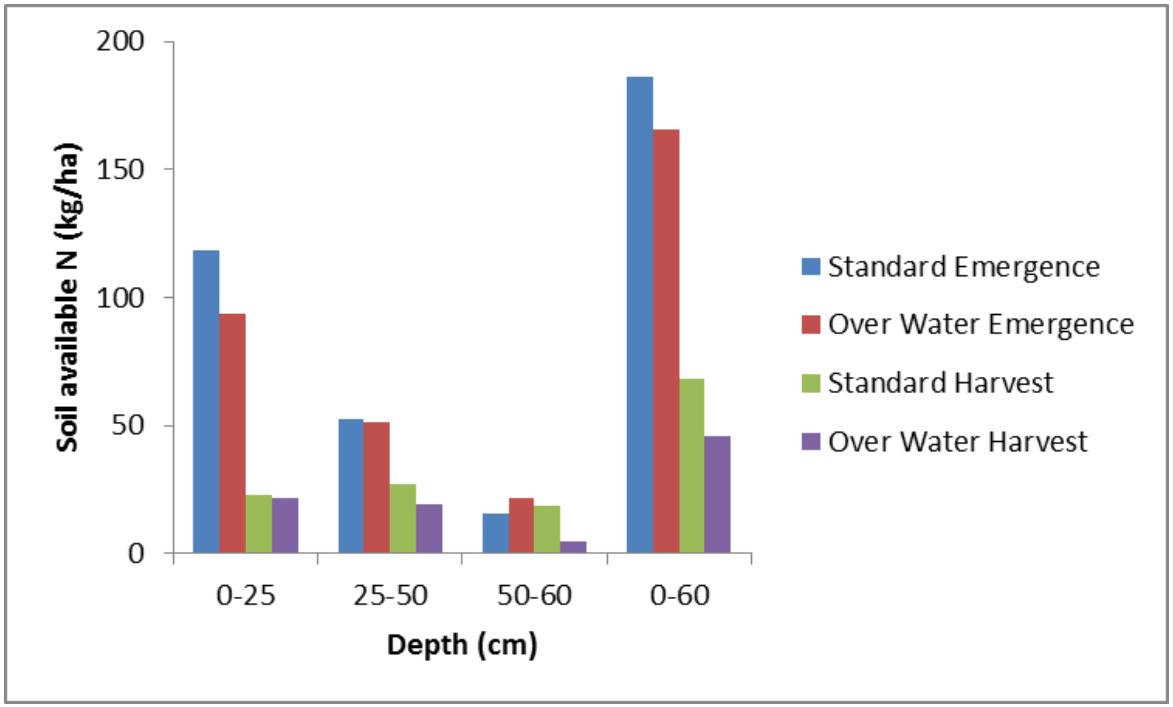




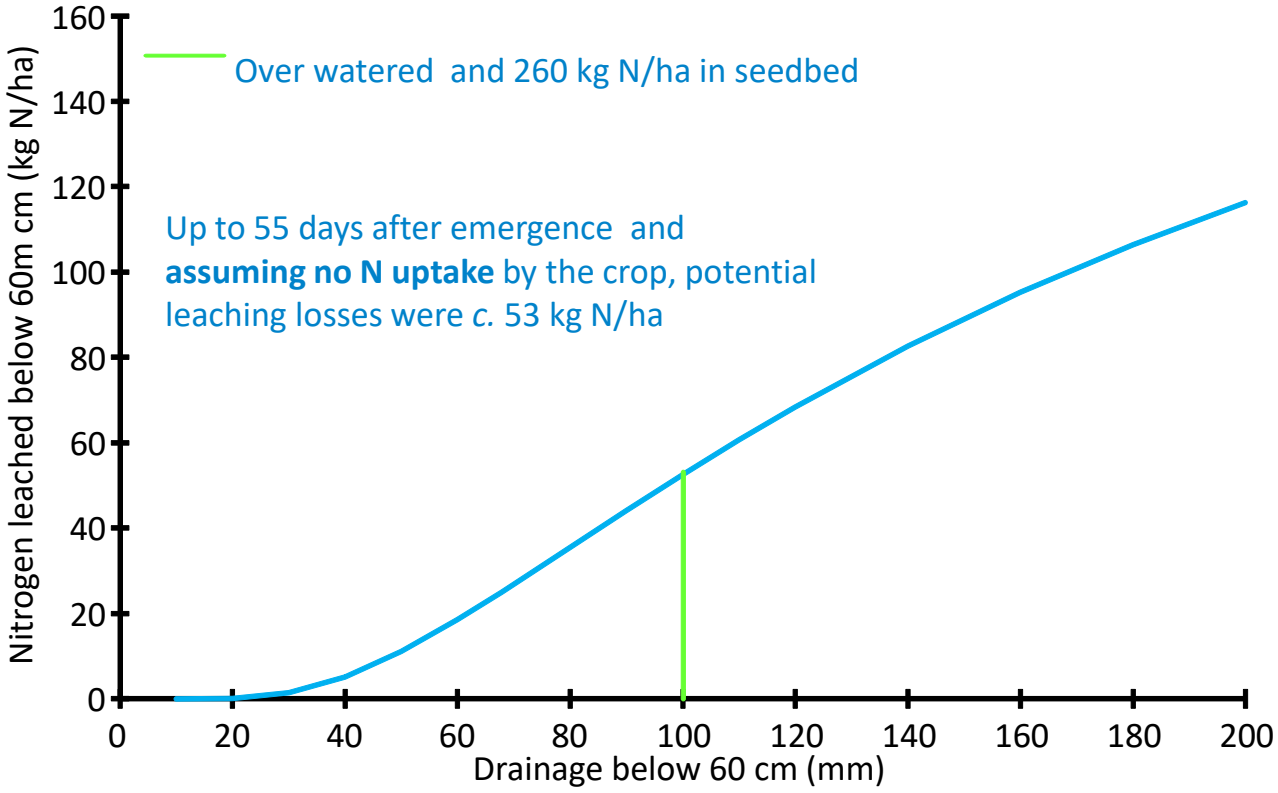




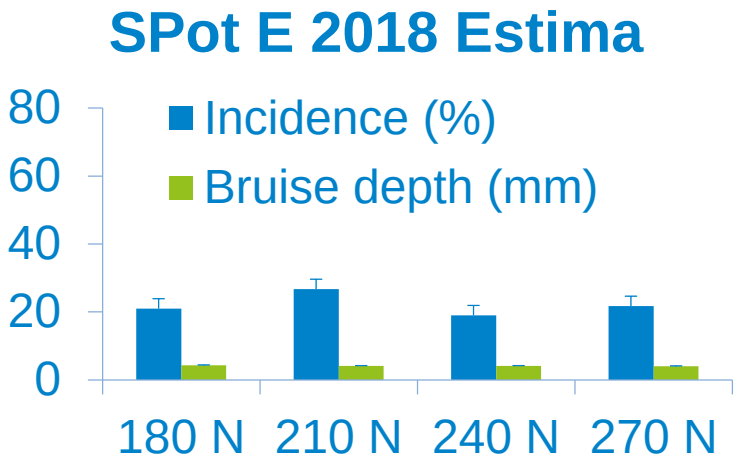
Soil mineral N from soil cores
Lower N in deepest profile in over-watered

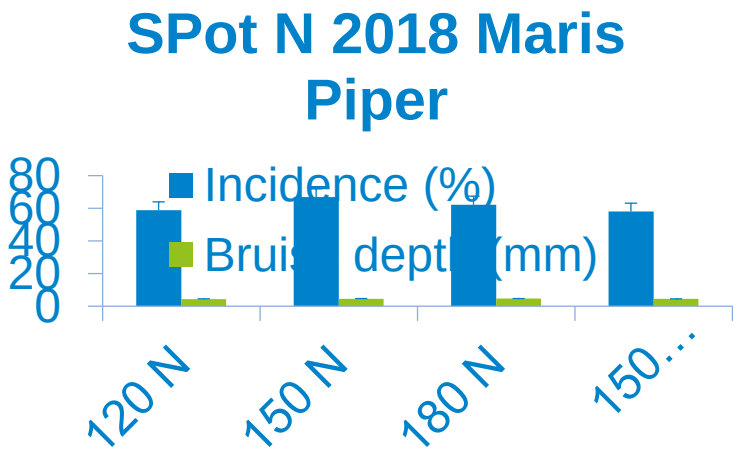


Effect of rainfall and irrigation strategy on estimates of N leaching at SPot Farm East



No evidence that reduced N increases bruising





Isn’t it about what is sold rather than yield digs? SPot Scotland 2017 Packout (Albert Bartlett)

	Trial	1	2	3	4
Treatment	Planting Top dress	Liquid Standard (177 N)	Standard Ridge inject (175 N)	**Standard** **No top dress** **(147 N)**	Standard Standard (176 N)
Crop harvested	No. boxes	23	24	**24**	22
Graded product	Tonnes	14.24	14.70	**15.88**	14.12
Packout	%	64.6	62.9	**67.6**	64.9
Yield packed	**t/ha**	**37.5**	**37.8**	**40.9**	36.1

Financial summary of SPot N trials to date

Commercial split N	All N in seedbed	Financial	Placed/injected	Financial
61.2 t/ha	+0.1 t/ha	+£20/ha	-4.9 t/ha	-£980/ha

Commercial rate	Optimal rate	N saving	Financial
57.2 t/ha	+0.8 t/ha	-53 kg/ha	+£197/ha

Summary

- Used RB209 to calculate N requirement for crop and site and mostly found 30-60 kg N/ha lower than commercial rate being used on surrounding crop
- Experiments and strip trials showed no evidence of loss of yield from these lower rates
- Placed or injected N tended to produce lower yields than broadcast
- No evidence that much N leached out of the rooting profile during the growth period on heavily irrigated sandy soils, but canopies were paler and shorter-lived where over-watering took place
- Decreased N did not result in increased bruising
- Decreased N resulted in better skinset

Acknowledgements

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- 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


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