



Session 3: Metrics to improve performance

Chair: Nick Anderson *Velcourt*

Daniel Kindred *ex-ADAS, now Crop Scientist, Anglo-American*

David Fuller-Shapcott *Farmer, Scottish Borders*

James Mayes *Sentry*

Sajjad Awan *NRM Laboratories*

Jonathan Telford *LanCrop*





Session 3:

Metrics to improve performance

Chair:

Nick Anderson, Velcourt



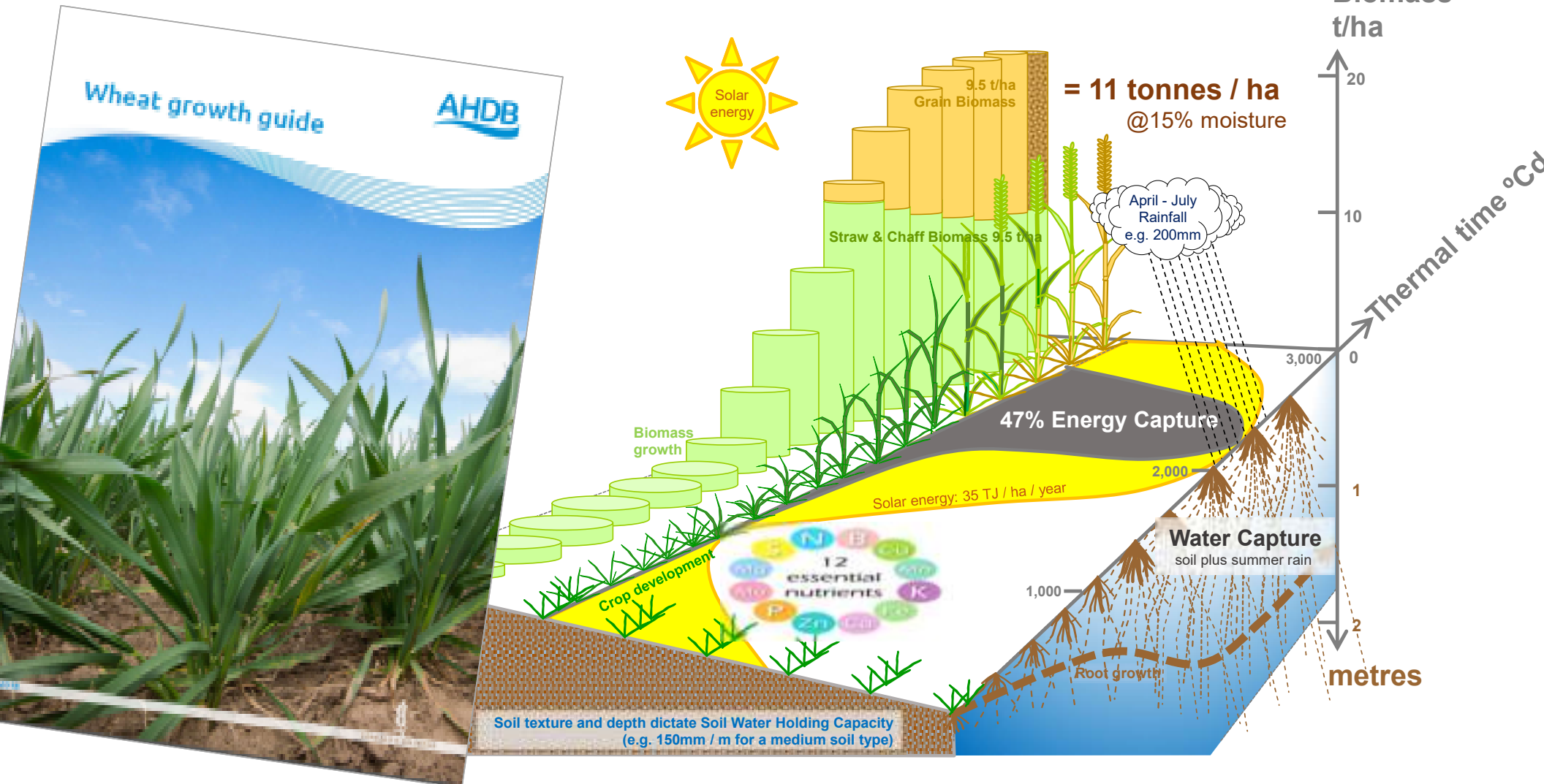


What metrics are important in understanding and improving performance?

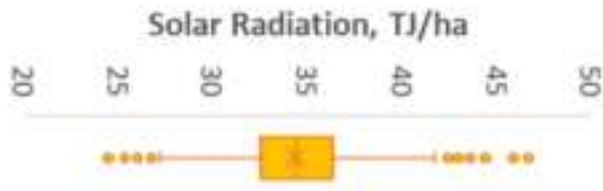
Daniel Kindred,
ex-ADAS, Crop Scientist at Anglo American



Our conceptual framework, metrics & Benchmarks...



Knowing your potential

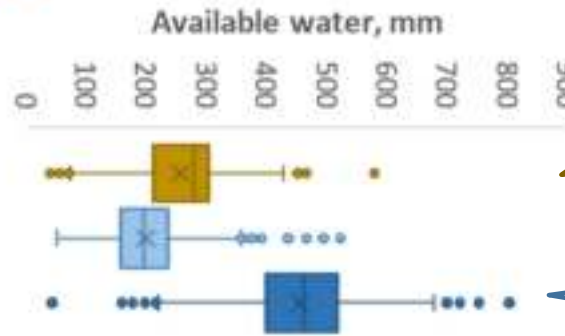


1.4t/ha biomass possible per TJ ... if capture 60% annual sunlight - 30t/ha

Soil water holding capacity

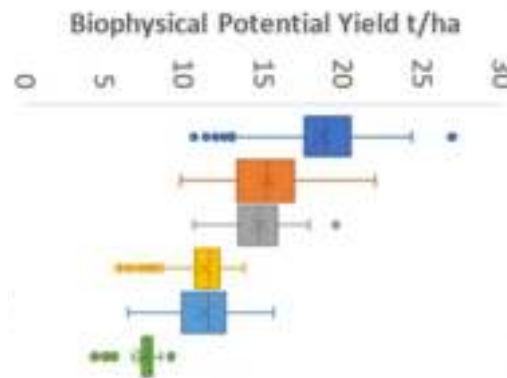
Rainfall, April-July

Total available water



Sandy soils hold ~12% water, clays ~17% and silts 20%

20mm water needed per t biomass... 20t/ha needs 400mm



Winter wheat

Spring barley

Oats

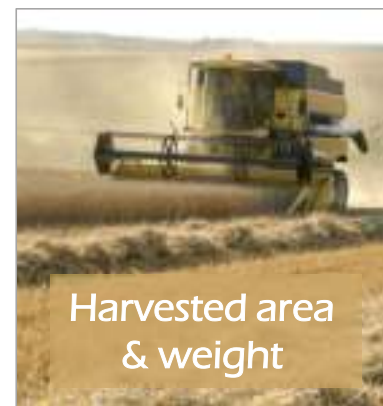
OSR

Beans

Peas

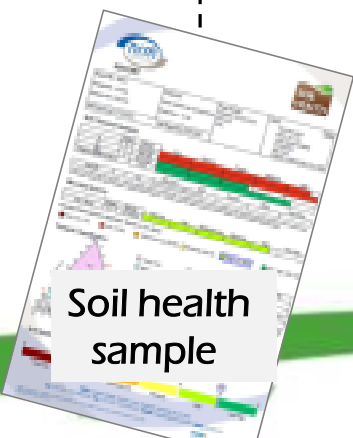


Metrics collected through the season



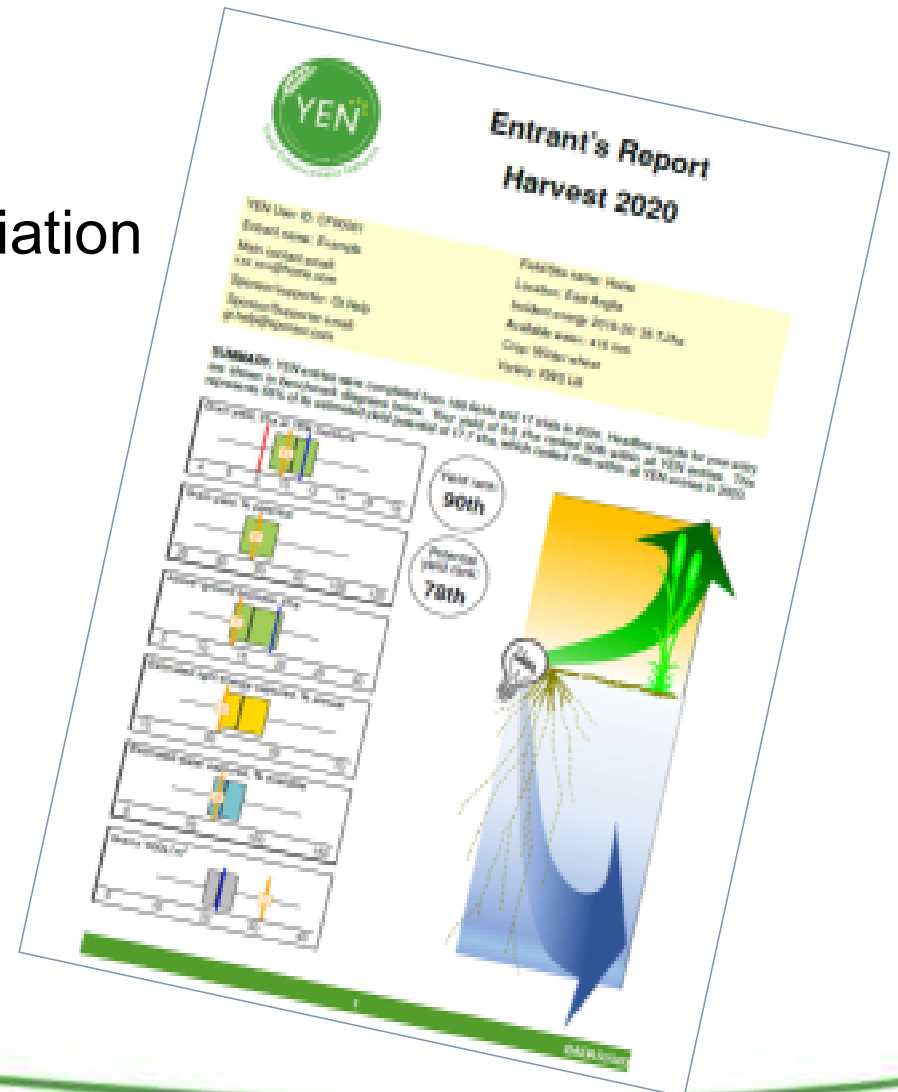
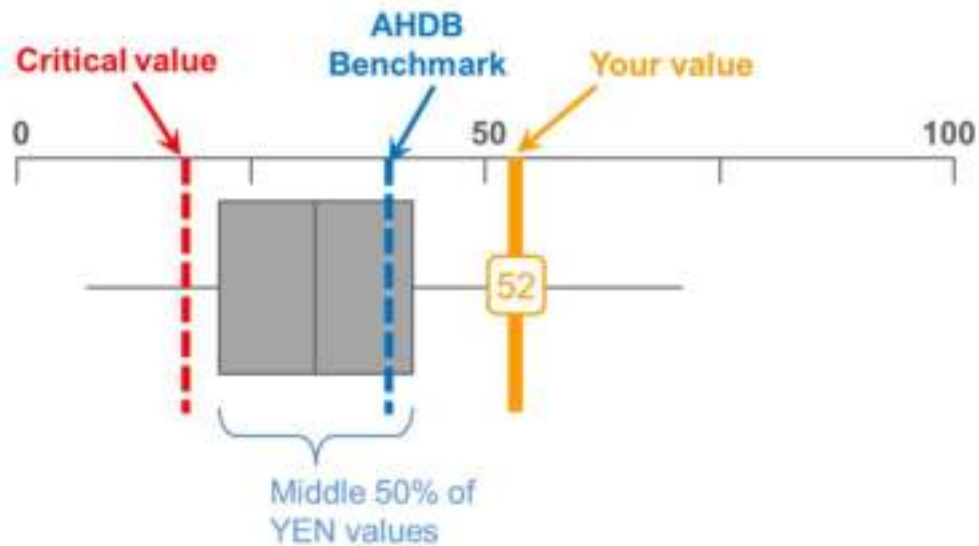
Winter/Spring

Post Harvest



YEN Reports

- Identify possible causes of yield variation
- Explanatory metrics - benchmarked



YEN Reports – Comparative Metrics & benchmarking



Entrant's Report
Harvest 2018

Name: **Field / Title:** **Wolton Farm**

YEN team: **Dr. David Bell**

Region: **North East**

Crops: **Wheat**

Primary contact email: **enr@helenbell.co.uk**

Support/Responder email: **enr@helenbell.co.uk**

2018 Field responder email:

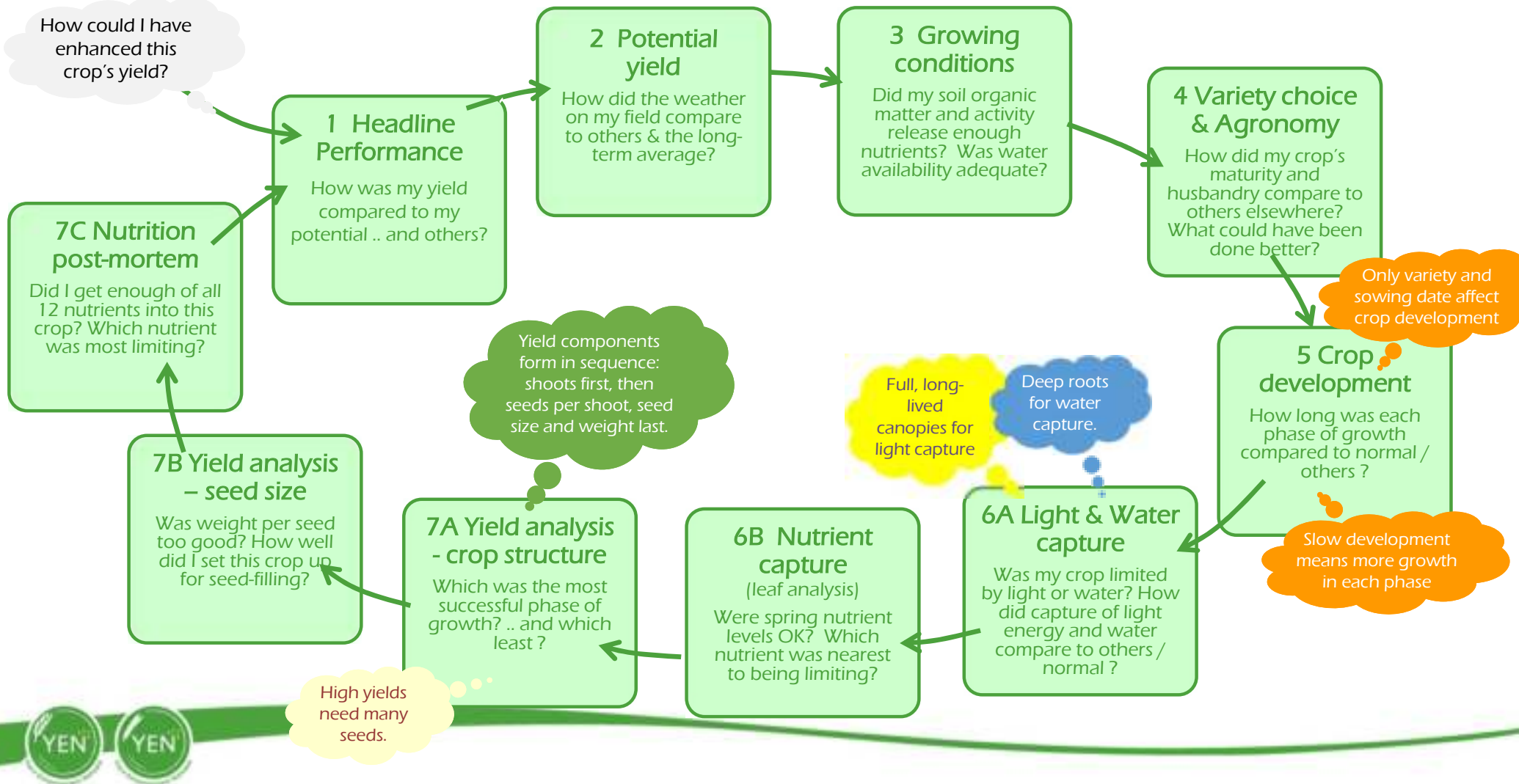
The 2018 YEN competition was coordinated with the 2018 North and Yorkshire.

- The date of the competition was 20.10.18 for the autumn field work.
- The average yield achieved was 11.7 t/ha and the average % of potential yield achieved was 12%.
- The average yield of 11.7 t/ha is a record for the autumn field work in the North East.
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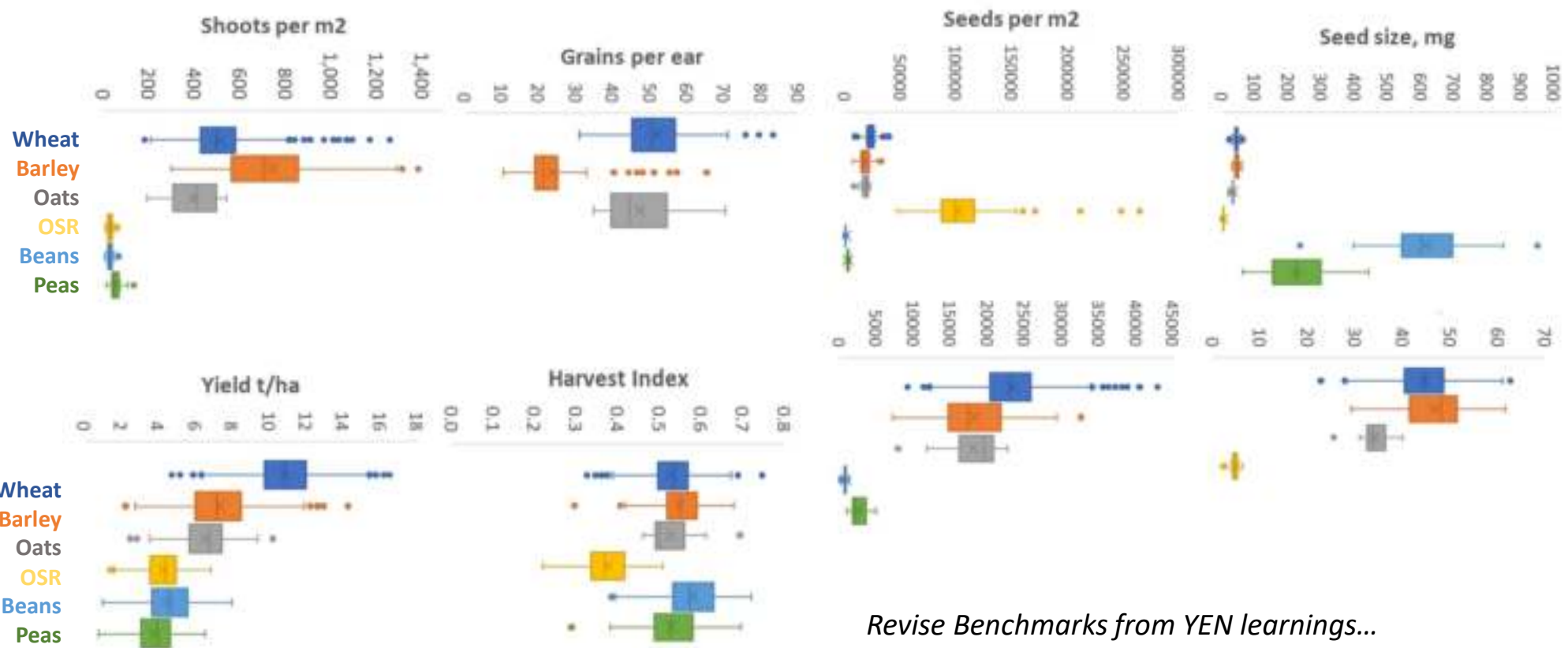
Field	Yield (t/ha)	Yield (t/ha)	Yield (t/ha)
1	11.7	11.7	11.7
2	11.7	11.7	11.7
3	11.7	11.7	11.7
4	11.7	11.7	11.7
5	11.7	11.7	11.7
6	11.7	11.7	11.7
7	11.7	11.7	11.7
8	11.7	11.7	11.7
9	11.7	11.7	11.7
10	11.7	11.7	11.7
11	11.7	11.7	11.7
12	11.7	11.7	11.7
13	11.7	11.7	11.7
14	11.7	11.7	11.7
15	11.7	11.7	11.7
16	11.7	11.7	11.7
17	11.7	11.7	11.7
18	11.7	11.7	11.7
19	11.7	11.7	11.7
20	11.7	11.7	11.7
21	11.7	11.7	11.7
22	11.7	11.7	11.7
23	11.7	11.7	11.7
24	11.7	11.7	11.7
25	11.7	11.7	11.7
26	11.7	11.7	11.7
27	11.7	11.7	11.7
28	11.7	11.7	11.7
29	11.7	11.7	11.7
30	11.7	11.7	11.7
31	11.7	11.7	11.7
32	11.7	11.7	11.7
33	11.7	11.7	11.7
34	11.7	11.7	11.7
35	11.7	11.7	11.7
36	11.7	11.7	11.7
37	11.7	11.7	11.7
38	11.7	11.7	11.7
39	11.7	11.7	11.7
40	11.7	11.7	11.7
41	11.7	11.7	11.7
42	11.7	11.7	11.7
43	11.7	11.7	11.7
44	11.7	11.7	11.7
45	11.7	11.7	11.7
46	11.7	11.7	11.7
47	11.7	11.7	11.7
48	11.7	11.7	11.7
49	11.7	11.7	11.7
50	11.7	11.7	11.7
51	11.7	11.7	11.7
52	11.7	11.7	11.7
53	11.7	11.7	11.7
54	11.7	11.7	11.7
55	11.7	11.7	11.7
56	11.7	11.7	11.7
57	11.7	11.7	11.7
58	11.7	11.7	11.7
59	11.7	11.7	11.7
60	11.7	11.7	11.7
61	11.7	11.7	11.7
62	11.7	11.7	11.7
63	11.7	11.7	11.7
64	11.7	11.7	11.7
65	11.7	11.7	11.7
66	11.7	11.7	11.7
67	11.7	11.7	11.7
68	11.7	11.7	11.7
69	11.7	11.7	11.7
70	11.7	11.7	11.7
71	11.7	11.7	11.7
72	11.7	11.7	11.7
73	11.7	11.7	11.7
74	11.7	11.7	11.7
75	11.7	11.7	11.7
76	11.7	11.7	11.7
77	11.7	11.7	11.7
78	11.7	11.7	11.7
79	11.7	11.7	11.7
80			



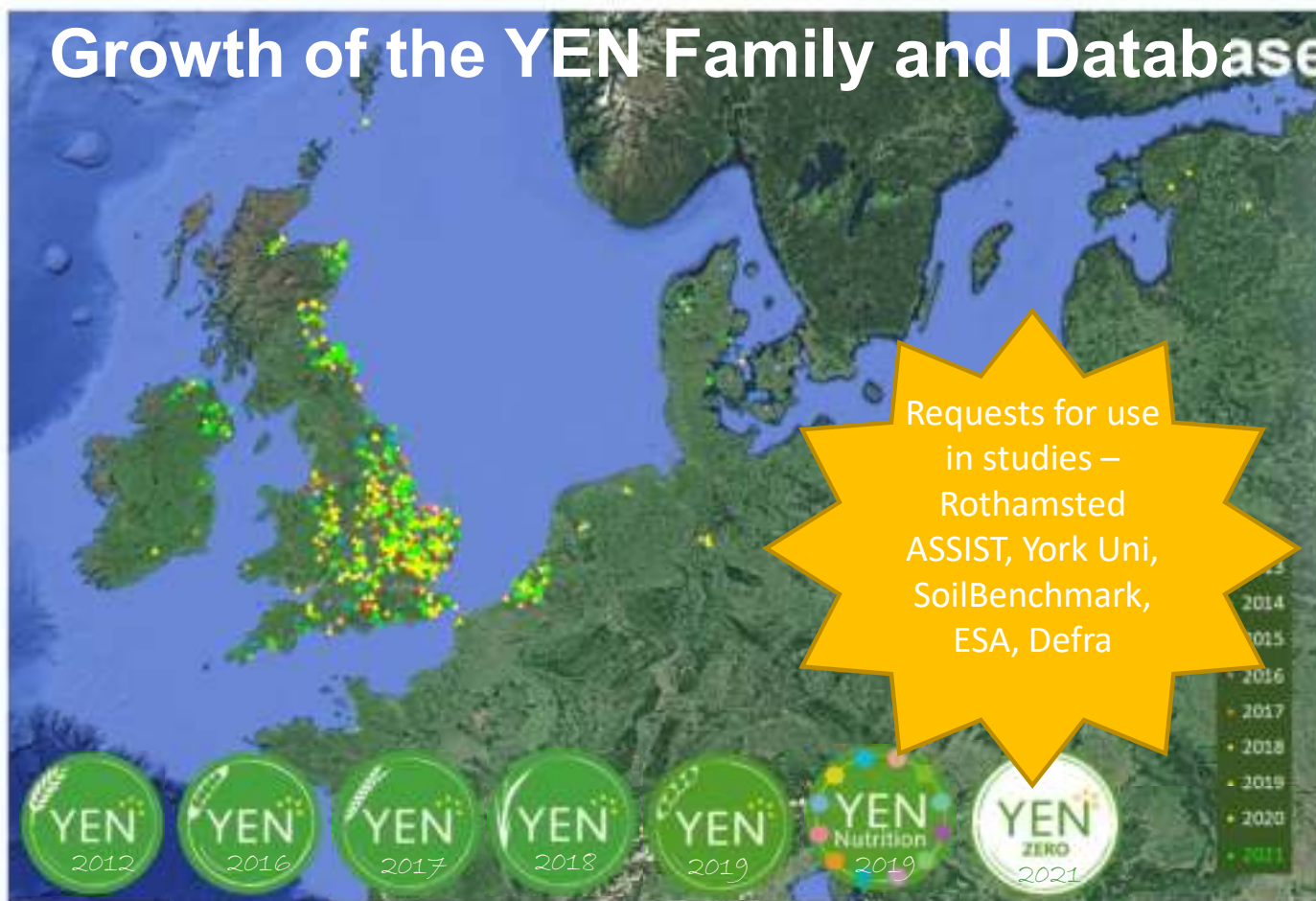
Guide to digesting a YEN report



Assessing sink capacity



Growth of the YEN Family and Database

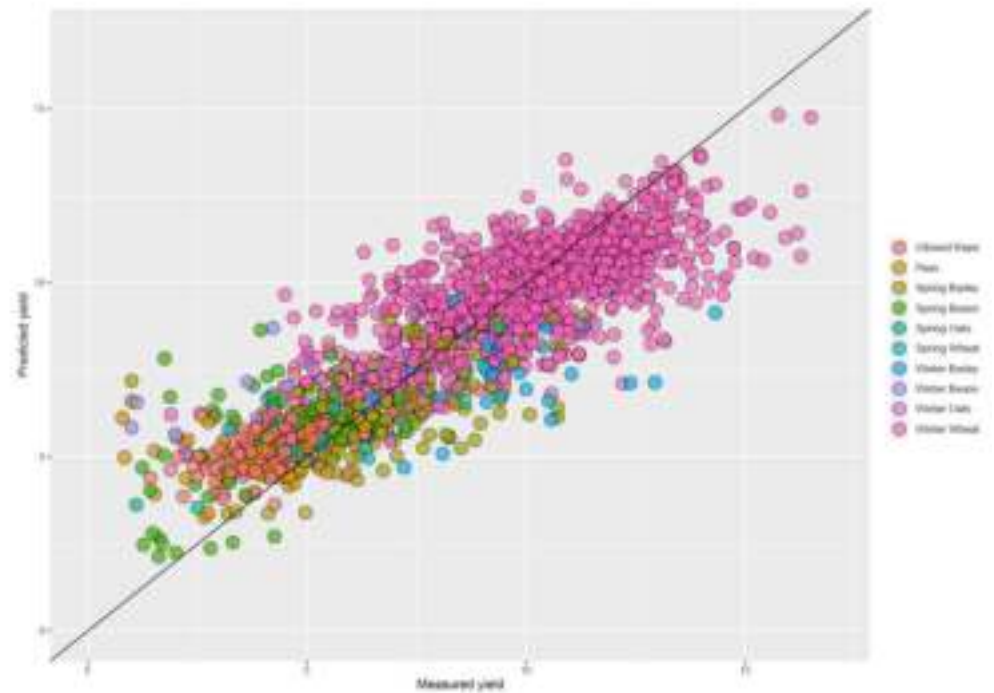
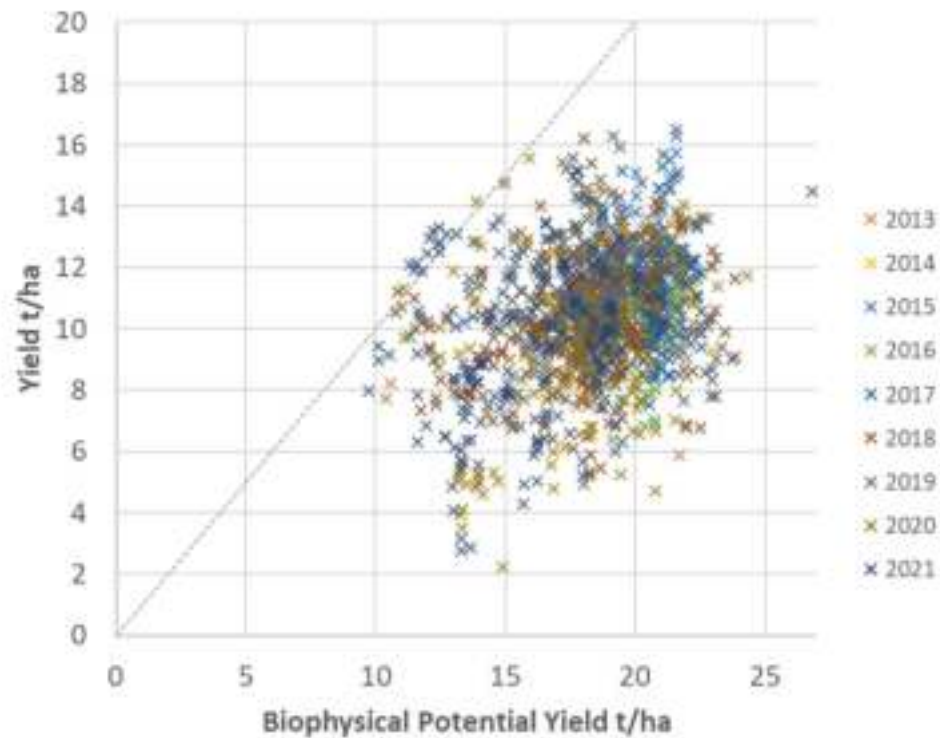


Data collected & metrics calculated:

- **weather**
- **Soils**
- **Potent**
 - Texture, depth, stoniness, SOM%, soil sample analysis
- **Field & crop info**
 - Cultivations, variety, agronomic inputs, previous crop, manure history ...
- **Crop observations**
 - Photos, dates of key growth stages
- **Verified yields**
- **Grain sample**
 - Protein & specific wt
 - Quality parameters
 - Full nutritional analysis
 - Grain size & shape distribution
- **Grab sample**
 - Yield components
 - Harvest Index, Biomass
 - N uptake
- **GHG Intensities**
- **Nutrient offtakes**
 - (NUE Metrics)
- (Profitability metrics)



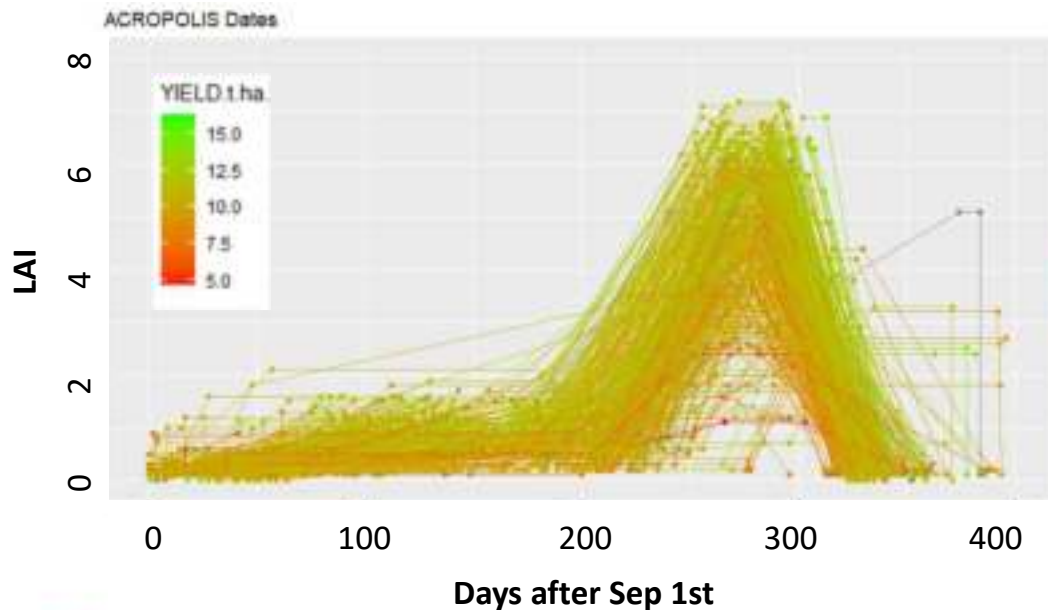
Exploring the data – still lots to learn...



 soil benchmark



Crop metrics from Satellite data – Acropolis project

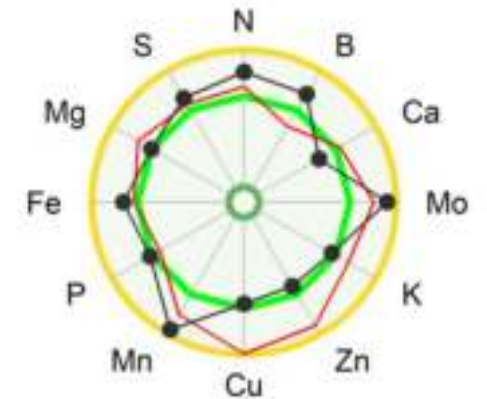
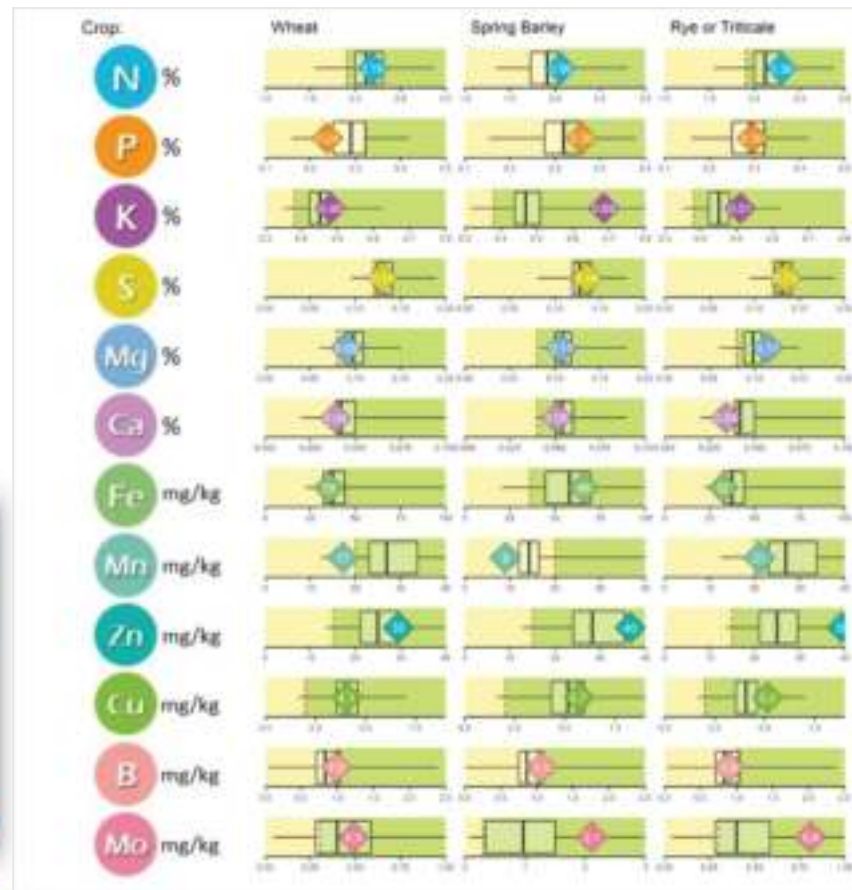


- Worked with ~600 YEN wheat fields from 2018-2021
- Used Sentinel 2 Satellite data to calculate LAI & FAPAR (Fractional light interception) through season
- Fit 'trapezoids' to get key metrics
 - Date emergence
 - Over winter canopy size*
 - Date canopy expansion
 - Date full canopy*
 - Max Canopy size*
 - Start / End senescence*
- *shown significant association with yield

Prototype dashboard for displaying crop metrics via Dynamic Benchmarking



Nutrition metrics – YEN Nutrition



Key significant relationships:

Applied N with wheat



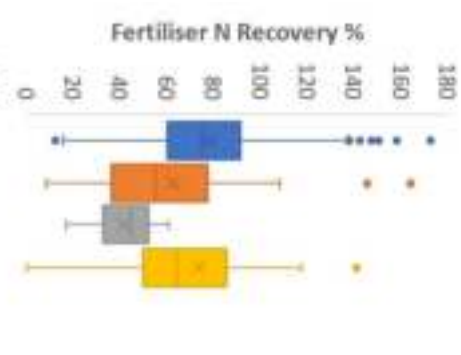
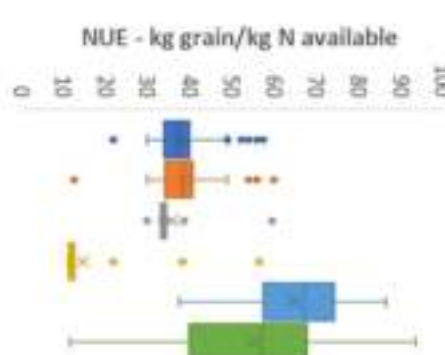
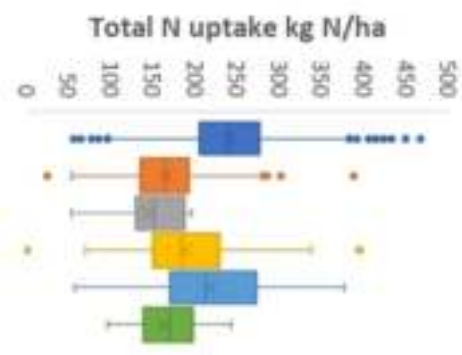
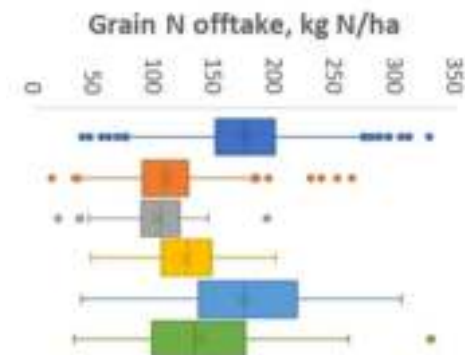
Nutrition metrics

	Wheat	OSR	Beans
N fertiliser applied	*** 5kg grain/kg N	NS	NA
P applied	NS	NS	NS
K applied	NS	* +4kg/ kg K ₂ O	NS
S applied	NS	NS	NS
Soil P	** 0.013 t/ha per 1 mg/l	NS	Sig diff of P Index 0
Soil K	NS	-ve??	~ ?
Soil Mg	NS	***	*
Soil pH	* +ve	* -ve	NS
SOM%	NS	NS	NS
Grain nutrients	No positive?	Fe, P, Ca, N:S	K**
Micronutrient apps	None so far?	*	None so far
Biostimulant apps	None so far?	None so far	None so far

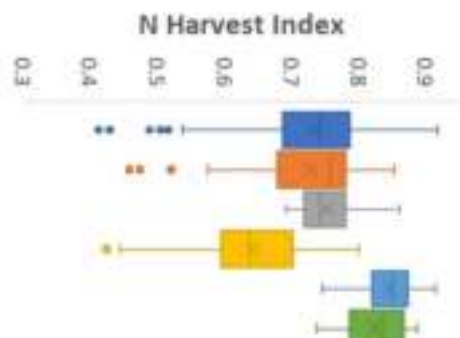
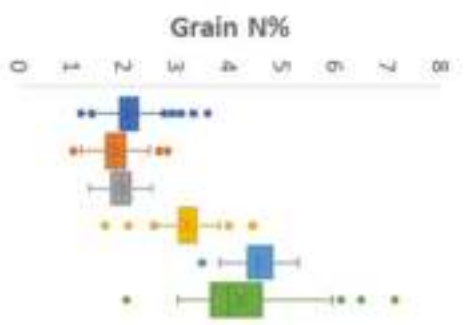


NUE Metrics

Wheat
Barley
Oats
OSR
Beans
Peas



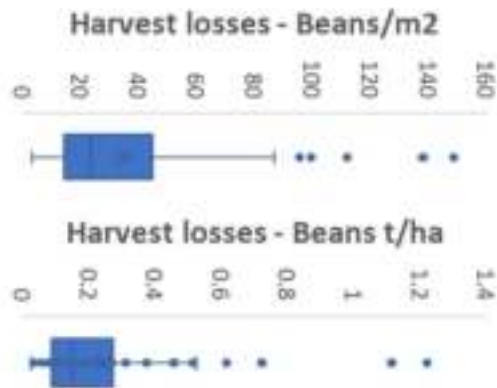
Wheat
Barley
Oats
OSR
Beans
Peas



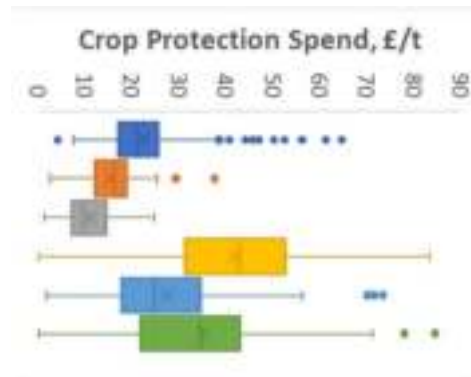
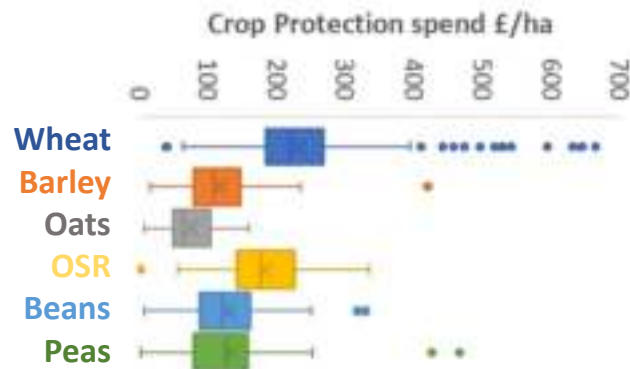
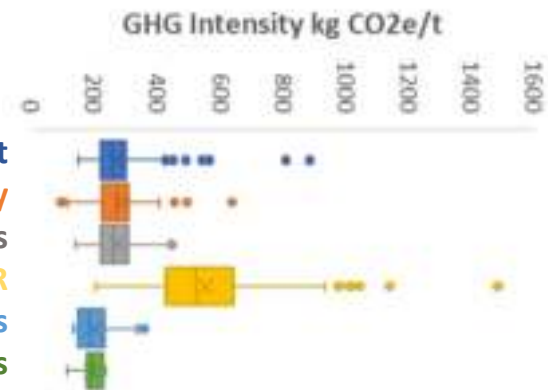
Department
for Environment
Food & Rural Affairs



Other metrics?



Wheat
Barley
Oats
OSR
Beans
Peas



Should we focus on profitability metrics?



Questions to consider

- Can we get to a condensed list of 5-10 key metrics or KPIs?
 - What are they?
- Or should we accept that the system is complex and context differs between farms (as do the limitations), so farmers & advisors need to consider many metrics?
 - If so, how to structure, prioritise and make valuable?



Sli.do word cloud poll ...

- What are the most useful and important metrics to enhance crop performance on-farm?
- **WiFi** Network: **xxx**
- We are using **Sli.do** to make panel discussions more interactive
Take part in live polls or submit questions via your smart phone ...
Go to: **sli.do.com**
& use the Event Code: **#YENis10**





Sweethope Farm



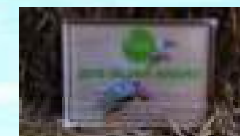
- ❑ 369 ha farmed - 281 ha owned, 88 ha rented. Property lets. Renewables
- ❑ 290 ha arable, 32 ha permanent grass (grass park lets), 17 ha woodland
- ❑ Staff – myself plus 1 full time and additional 1.5 at harvest
- ❑ Rotation: OSR / WW / SO / WW / SB / WB (with some rotational grass for silage and 6 ha SRDP-AECS)
- ❑ Transitioning from min-till to direct drill

David Fuller-Shapcott
JN Fuller-Shapcott & Co.
Sweethope
Kelso





YEN 2015



Character	Units	Your ENTRY	YEN 2015 highest	Benchmark
Fertile shoots i.e. Ears	# / m ²	818	773	460
Spikelets	# / ear	15	22	NA
Grains	# / ear	43	81	48
Thousand Grain weight @ 15% MC	g / 1000	52.9	57	50
Grain specific weight	kg / hl	69.1	83	NA
Grain protein	% grain DM	9.7	14.5	11.6
Total biomass at harvest	t / ha	27.2	27.9	18.4
Harvest index (grain dry matter)	% biomass	44%	58%	51%
Total grain N offtake	kg / ha	203	282	189
Grain Yield achieved (15% MC)	t / ha	14.1	16.5	11.0
Grain Yield achieved	% YEN average	110%	130%	NA
	(& rank)	11		
Grain Yield achieved	% Potential	77.8%	81%	NA
	(& rank)	3		

YEN highest values and benchmark figures refer to wheat entries only

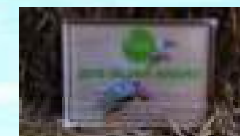
Hopes Park (2.5 ha)		
at your site	metres	1.5
ile water	% volume	Clay loam, (17%)
ile water	% volume	Clay, (14%)
eld capacity	mm	223
ic. summer rain	mm	466
y your crop	mm	544
LIGHT ENERGY		
Total Solar Radiation (Sept – Aug)	TJ / ha (% LT average)	30.5, (98%)
Radiation captured by your crop	% annual incident	74%
Potential cause of yield limitation	light / water	Light
Potential Grain Yield (15% MC)	td/ha	18.1

Comments on your entry:

- Summer rainfall was normal this year for your part of the world, and our estimate of available soil water was 223 mm if rooting was effective to 1.5 m (or rock).
- Your crop appeared to capture more water than we calculated was available.
- Solar radiation for the season was normal compared to your long term local average and, judging from the way the crop grew, it was able to capture as much of this as we believe is possible for an annual cereal crop, so that's impressive!



YEN 2016



Character	Units	Your ENTRY	YEN 2016	Bench-mark
Fertile shoots i.e. Ears	# / m ²	455	Sample Ref	NO 14
Skeletons	# / ear	19	Sample No	006052 / 8448438
Grains	# / ear	55	Crop	WHEAT
Thousand Grain Weight @ 15% MC	g / 1000	47		
Grain specific weight	kg / hl	71		
Grain protein	% grain DM	10.3		
Total biomass at harvest	t / ha	16.7		
Harvest index (grain dry matter)	% biomass	60%		
Total grain N offtake	kg / ha	181		
Grain Yield achieved (15% MC)	t / ha	11.8		
Grain Yield achieved	% YEN av.	115%		
	(& rank)	6		
Grain Yield achieved	% Potential	64%		
	(& rank)	2		

Date Received: 21/04/2016

Sample prior to T0

Analysis	Result	Guideline	Interpretation	Comments
Nitrogen (%)	3.88	3.00	Normal	Adequate level.
Phosphorus (%)	0.39	0.30	Normal	Adequate level.
Potassium (%)	2.77	3.50	Slightly Low	Consider YARAVITA FOLIAR POTASH or increase fertilizer inputs.
Calcium (%)	0.21	0.40	Low	Low priority. See comments below.
Magnesium (%)	0.09	0.12	Slightly Low	4 l/ha MAOFLO 300. Timings see product label.
Manganese (ppm)	25.7	35.0	Low	2 x 1 l/ha MAMFOL ADVANCE. Timings see product label.
Boron (ppm)	2.7	6.0	Slightly Low	Consider treatment with Bortrac at 1 l/ha.
Zinc (ppm)	13.1	25.0	Low	1 l/ha ZINTRAC 700. Timings refer to product label.
Iron (ppm)	30	50	Normal	Adequate level.
Copper (ppm)	5.0	7.0	Low	2 x 0.5 l/ha COPTRIEL 500. Timings see product label.
Molybdenum (ppm)	0.38	0.10	Normal	Adequate level.
Sulphur (%)	0.24	0.25	Slightly Low	Consider foliar applications of SULPHUR F3000.

Sample Ref NO14
Sample No E155452 / 8483944
Crop WHEAT (WINTER)

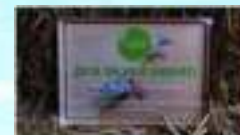
Date Received: 06/06/2016

Sample prior to T2

Analysis	Result	Guideline	Interpretation	Comments
Nitrogen (%)	3.78	3.00	Normal	Adequate level.
Phosphorus (%)	0.27	0.30	Slightly Low	Consider foliar MAGPHOS-K or increase fertilizer inputs.
Potassium (%)	1.94	3.50	Low	Consider YARAVITA FOLIAR POTASH or increase fertilizer inputs.
Calcium (%)	0.25	0.40	Slightly Low	Low priority. See comments below.
Magnesium (%)	0.12	0.12	Normal	Adequate level.
Manganese (ppm)	65.9	35.0	Normal	Adequate level.
Boron (ppm)	7.7	6.0	Normal	Adequate level.
Zinc (ppm)	26.9	25.0	Normal	Adequate level.
Iron (ppm)	108	50	Normal	Adequate level.
Copper (ppm)	20.0	7.0	Normal	Adequate level.
Molybdenum (ppm)	0.43	0.10	Normal	Adequate level.
Sulphur (%)	0.23	0.25	Slightly Low	Consider foliar applications of SULPHUR F3000.

Variety is still Zulu as 2015, and field is next door to 2015 entry.

JNF-S
& Co



@Sweethopefarm www.sweethope-farm.co.uk

www.facebook.com/pages/Sweethope-Farm

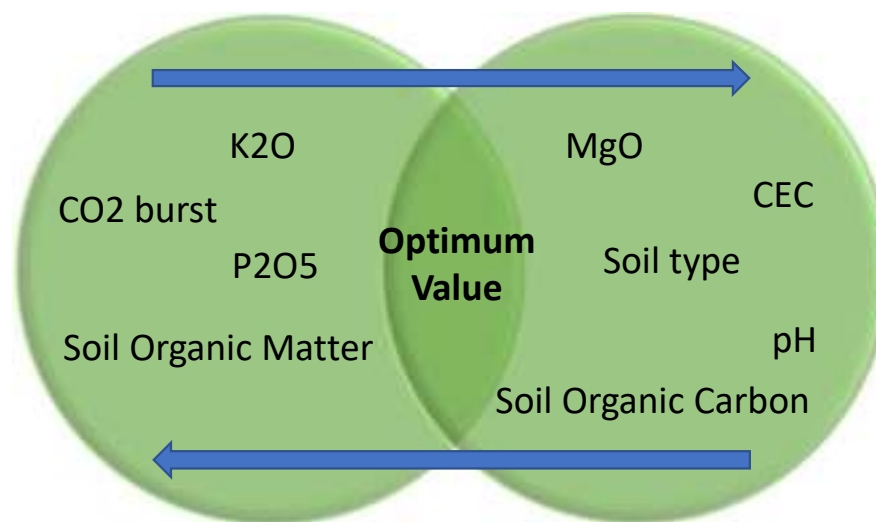


YEN Conference 2022

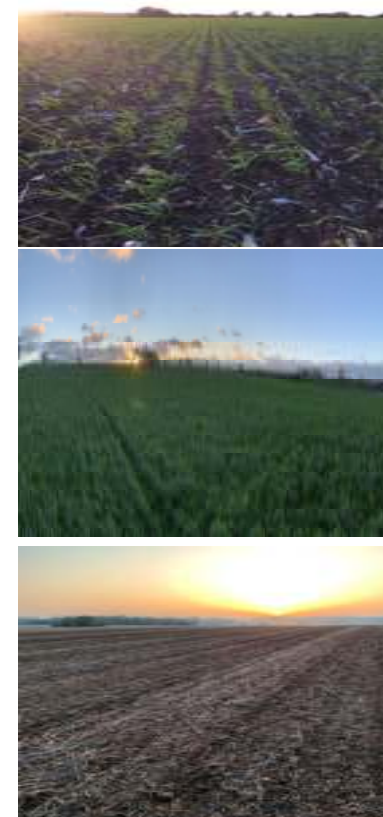
James Mayes
Farm Manager – Bentfield Bury

Tuesday 24th January 2023

SOIL METRICS



- Do we understand the fundamentals of what is under our feet?
- What is in our control?
- Can soil characteristics be changed?
- YEN experiences have shown importance of water availability and root development



CROP BENCHMARKING



- Sentry & BCS: 7 years in YEN with 8 managers, mostly cereal YEN
- Acts as an internal discussion/ development group
- How do we benchmark ourselves?
- Soil testing
- Tissue testing
- Introduction of technologies
- Grain analysis
- YEN competition rankings
- YEN wheat quality rankings
- Season end review
- Future planning

Top 25% producers, group using learnings to influence future crop production methods that are increasing productivity and profits



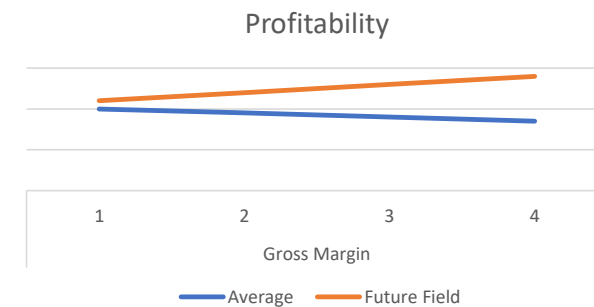
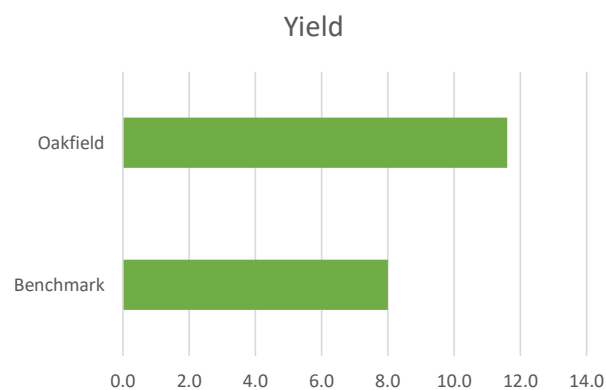
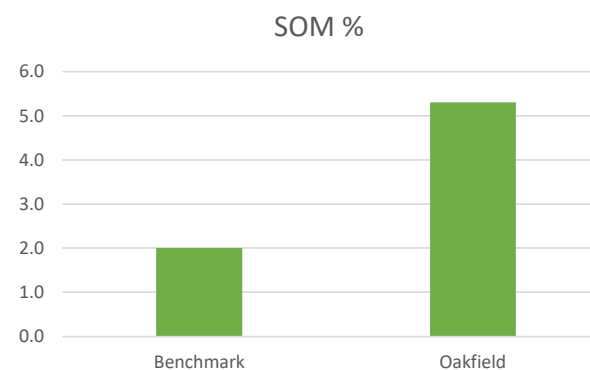
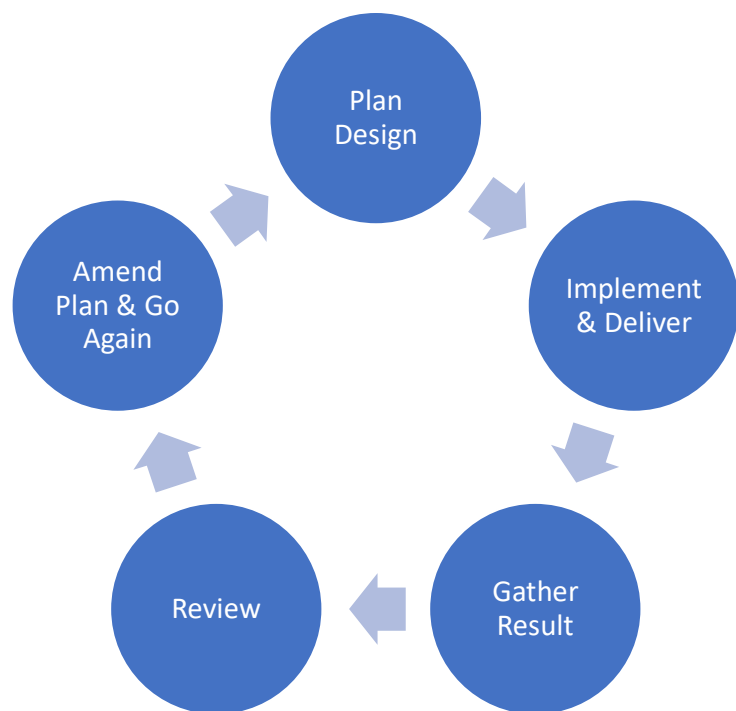
BUSINESS BENCHMARKING

- Sentry has >30 years of benchmarking experience
- Comfortable at all levels comparing ourselves with colleagues and industry
- Annual exercise for all managers
- Looking at all aspects of the business
- Acknowledge that we are not all the same!
- Where are our businesses?
- How to improve performance?
- What are our KPI's per business?

Appropriate setup for specific business model, aiming to be in top 25% of businesses for profitability



DELIVERY AND REVIEW



1



The Challenge

2



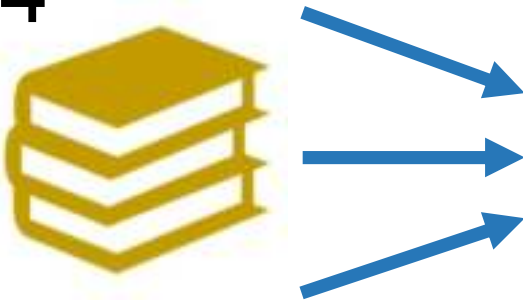
Stop firefighting

3



Start optimising

4



Using our archive

5



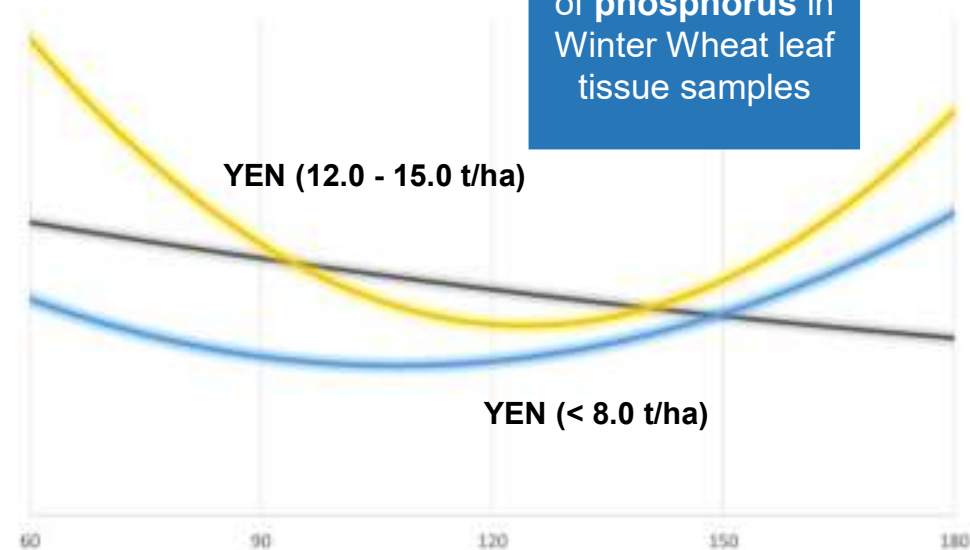
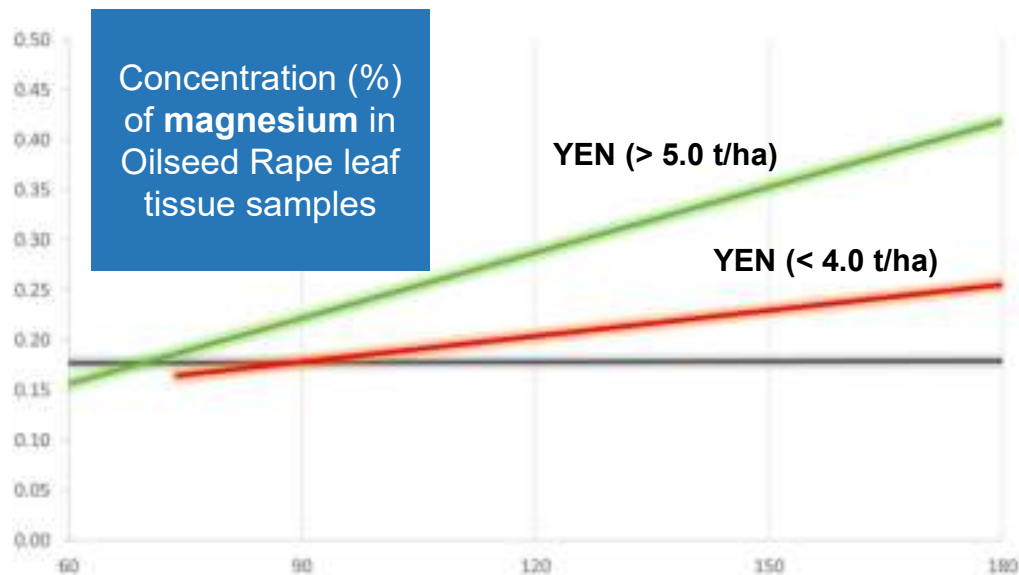
Testing the hypothesis

6



Creating the benchmarks

7



Dr.Sajjad Awan

Soil and Crop Nutrition Agronomist

24th January 2023



Summary

Three Key metrics;

1. Sustainability
2. Productivity
3. Use of Data

Measure, Manage and Monitor