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Kerchesters winter wheat: Field notes

Field	Smiddy (Mintill)	Smiddy (Direct drill)	Hill
Soil type	Clay loam	Clay loam	Clay loam
Establishment	Min till	Direct Drill	Conventional establishment - Ploughed
Previous crop	WOSR	WOSR	WW
Mironutrient application	Pre Test 1: 29th May: Bitter salts (Mg sulphate)	Pre Test 1: 29th May: Bitter salts (Mg sulphate)	Pre Test 1: 29th May: Bitter salts (Mg sulphate)

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Kerchesters Winter wheat: Soil test results

Soil Tests		Smiddy Mintill	Smiddy Direct	Hill	Target
		23/06/2020	23/06/2020	23/06/2020	
pH		6.1	6.2	6.3	6.2
Phosphorus	mg/l	5.75	5.03	2.56	4.5-9.4
Potassium	mg/l	389	366	202	76-140
Boron	mg/l	0.96	0.95	1.2	0.6-1
Copper	mg/l	2.88	3.16	2.79	1.6-8.4
Magnesium	mg/l	159	182	281	61-200
Manganese	mg/l	8.6	7.2	7.6	2.6-20
Sulphur	mg/l	12	9.4	10	6.1-10
Zinc	mg/l	2	1.8	1.2	1.6-10
Calcium	mg/l	2000	2100	2200	1000-3000
Organic Matter	%	5.9	5.24	5.18	`4-10
Sodium	mg/l	11.3	12.7	14.3	
Lime required (arable)	t/ha	1.9	0	0	

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Kerchesters winter wheat: Tissue Result

Plant tissue		Smiddy Mintill		Smiddy Direct		Hill		Target	
Growth Stage		GS57	GS65	GS57	GS65	GS55	GS65	Target Early	Target Later
Dry Matter	g/kg	235.29	339.46	269.03	348.52	231.22	313.09		
Nitrogen	% by Wt DM	2.049	1.564	1.898	1.35	1.79	1.612	3.5	2
Phosphorus	% by Wt DM	0.219	0.122	0.189	0.111	0.205	0.139	0.3	0.3
Potassium	% by Wt DM	1.58	1.06	1.43	1.16	1.76	1.1	4	2.5
Magnesium	% by Wt DM	0.0919	0.0761	0.0909	0.0778	0.0865	0.0662	0.1	0.1
Calcium	% by Wt DM	0.158	0.127	0.15	0.128	0.183	0.142	0.05	0.7
Sodium	% by Wt DM	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.2	0.2
Copper	mg/kg DM	4.81	3.77	4.49	3.56	5.55	4.3	4	4
Zinc	mg/kg DM	14.6	9.75	15.5	8.65	15.7	12.1	20	20
Boron	mg/kg DM	3.09	<2.32	3.06	<2.32	2.58	<2.32	2	2
Iron	mg/kg DM	53.6	42.1	53.8	38	79.5	50	150	150
Sulphur	% by Wt DM	0.132	0.107	0.121	0.107	0.136	0.114	0.2	0.2
Sulphur	N:S Ratio	15:1	`15:1	16:1	14:01	13:1	`14:1	N:S ratio <15:1	
Manganese	mg/kg DM	22.5	23.70	25.9	23.4	20	15.9	20	

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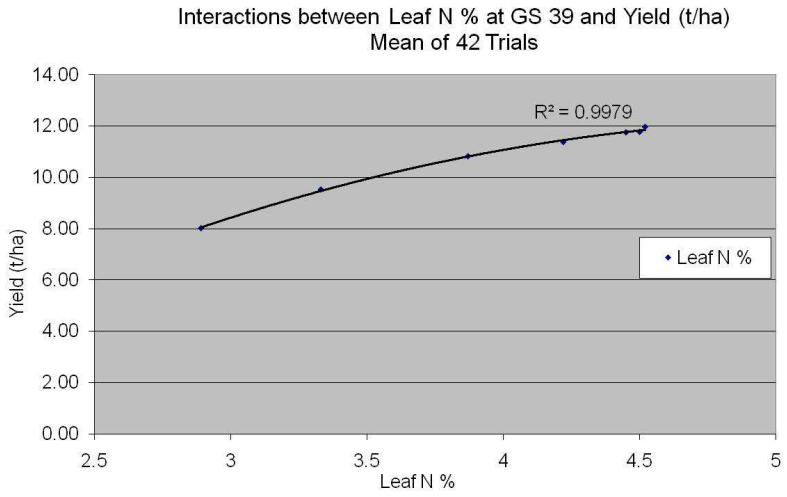
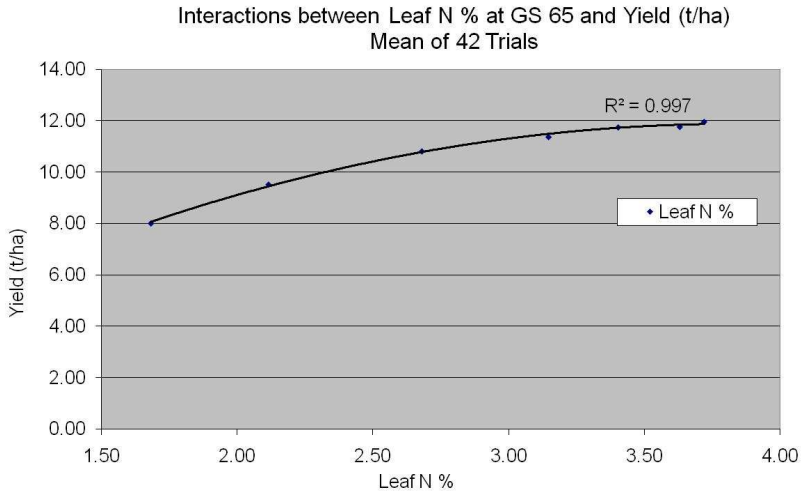
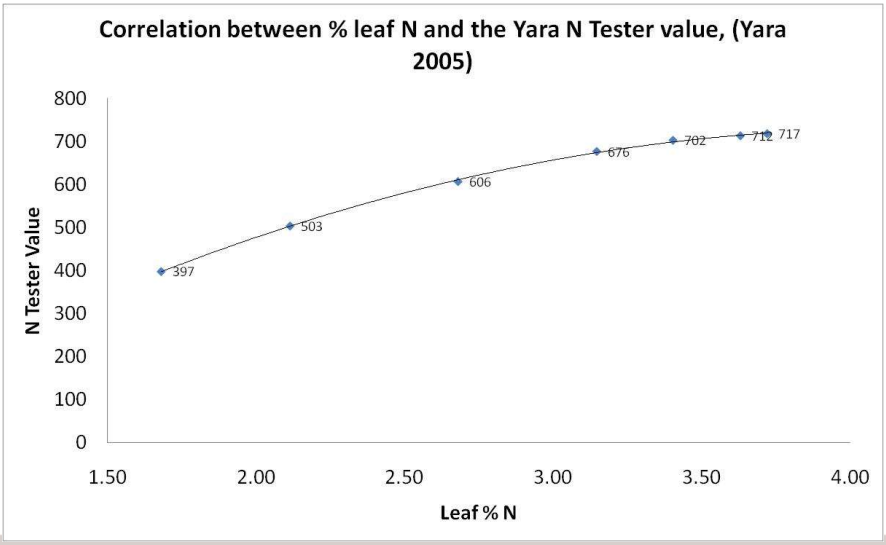
The optimum yield correlates well with the leaf %N @ GS 39,



....and at GS 65...



The Yara N Tester is a non destructive leaf nitrogen diagnostic tool.....



Kerchesters Spring Barley: Field notes

Field	Sprouston Hill	Greenside	East Brae
Soil Type	Clay loam	Sandy loam	Sandy loam
Previous Crop	WW	WW	PGRS
Micronutrient applications	3 weeks Before test 1: Received 2l/ha 15% Mn	2 weeks Before test 1: Received Cu/Mn (Headland trice 1.1l/ha)110g/l Cu 84g Zn 330 Mn	3 weeks Before Test 1: Received 12l/ha 15% Mn
Other		Historicly copper deficient	

Kerchesters Spring barley: Soil test results

Soil		Sprouston Hill	Greenside	East Brae	Target
		23/06/2020	23/06/2020	23/06/2020	
pH		6.1	6	5.8	
Phosphorus	mg/l	7.44	4.72	2.98	4.5-9.4
Potassium	mg/l	247	127	210	76-140
Boron	mg/l	0.87	0.55	0.69	0.6-1
Copper	mg/l	4.07	2.31	0.95	1.6-8.4
Magnesium	mg/l	181	139	101	61-200
Manganese	mg/l	8.4	7.4	8.8	2.6-20
Sulphur	mg/l	12	22	6.2	6.1-10
Zinc	mg/l	2.3	0.67	0.96	1.6-10
Calcium	mg/l	1900	1200	1200	1000-3000
Organic Matter	%	4.23	3.9	5.64	`4-10
Sodium	mg/l	13.7	10.9	9.46	
Lime required (arable)	t/ha	1.8	2.4	3.6	

Kerchesters Spring barley: Plant tissue results

Plant tissue		Sprouston Hill		Greenside		East Brae		Target	
Growth stage		GS49	59	GS49	59	GS39	51	Early	Later
Dry Matter	g/kg	212.71	242.38	195.54	251.6	176.43	189.41		
Nitrogen	% by Wt DM	2.088	1.854	2.496	2.92	4.083	3.249	3.5	>2.0%
Phosphorus	% by Wt DM	0.232	0.182	0.226	0.209	0.298	0.273	0.3	
Potassium	% by Wt DM	2.16	1.89	2.23	1.48	3.48	2.78	4	2.5-3.0%
Magnesium	% by Wt DM	0.0849	0.0758	0.103	0.0807	0.137	0.0875	0.1	
Calcium	% by Wt DM	0.272	0.227	0.338	0.189	0.414	0.237	0.05	0.7-0.8%
Sodium	% by Wt DM	0.0194	0.0234	0.0518	0.0207	0.1561	0.0197	0.2	
Copper	mg/kg DM	5.07	5.52	8.34	6.08	7.04	8.26	4-8mg/kg	
Zinc	mg/kg DM	18.1	16.8	15.5	17.7	34.8	28	20-30mg/kg	
Boron	mg/kg DM	3.75	3.42	3.41	3.95	3.14	3.08	2-5mg/kg	
Iron	mg/kg DM	65.7	54.5	126	48.5	119	124	150-500	
Sulphur	% by Wt DM	0.142	0.147	0.176	0.157	0.261	0.258	>0.2%	
Sulphur	N:S Ratio	`15:1	`14:1	14:1	`19:1	16:1	13:01	N:S ratio <15:1	
Manganese	mg/kg DM	23.9	11.4	27.5	12.9	67.7	20.6	>20mg/kg	

Stand out points to consider

- Soil nutrient levels don't always equal high tissue P levels
  - Can be affected by biomass dilution, or other soil parameters
- The value of having good Organic Matter levels e.g. East Brae field, Smiddy for improved nutrient availability
- Nitrogen in min till vs direct drill – lower, could be the low disturbance = low mineralisation
- N:S ratios creeping up in Green Side spring barley and Smiddy direct drilled wheat
  - Direct drilling has limited soil movement thus potentially lower mineralisation

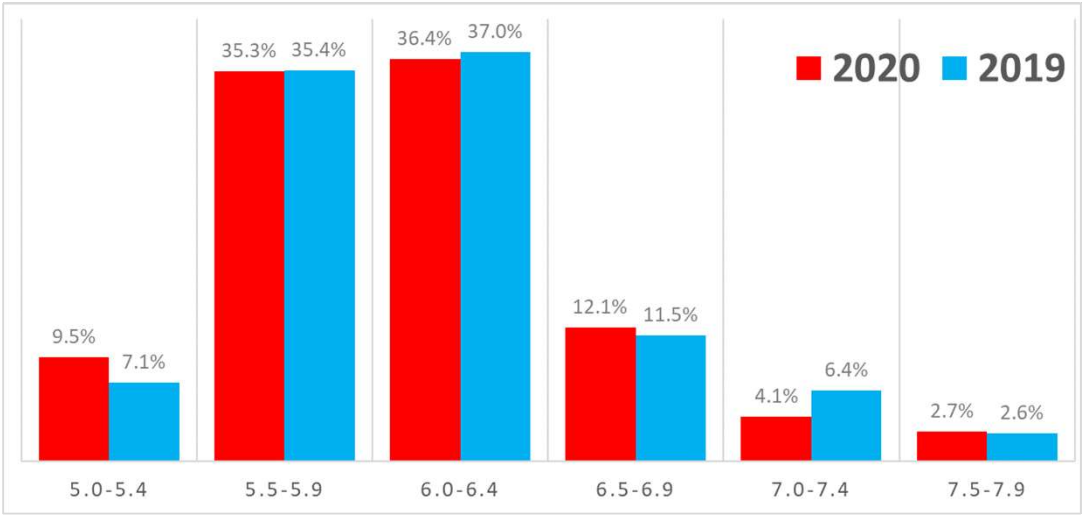
YARA

Knowledge grows

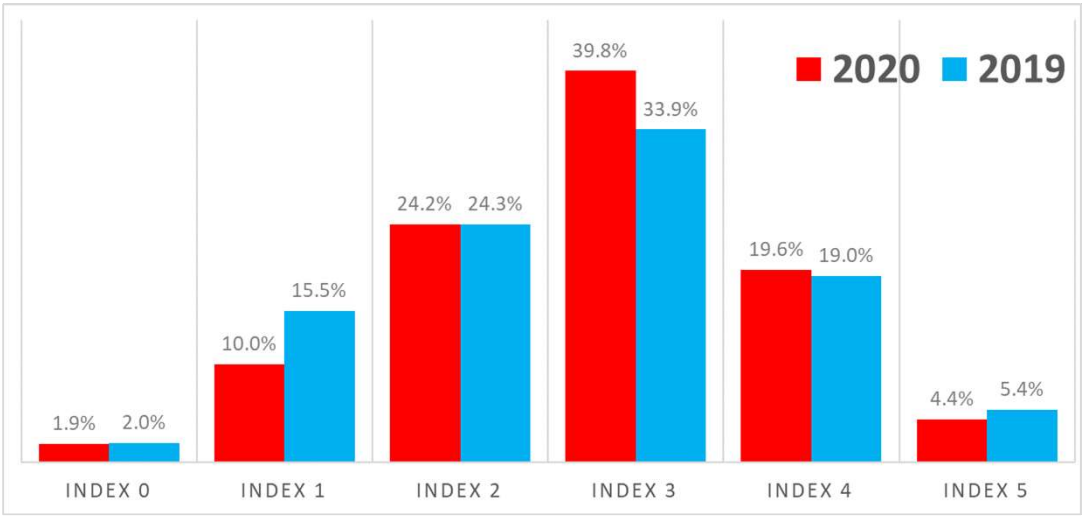
Scotland Soil Status Feb 2019 vs 2020

3,500 samples

pH – All Soils



P – All Soils



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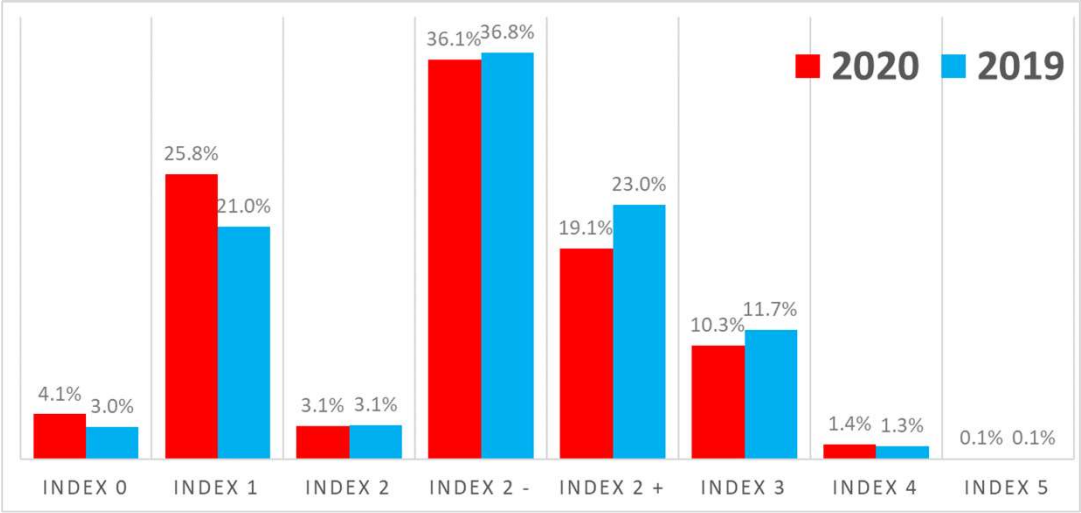
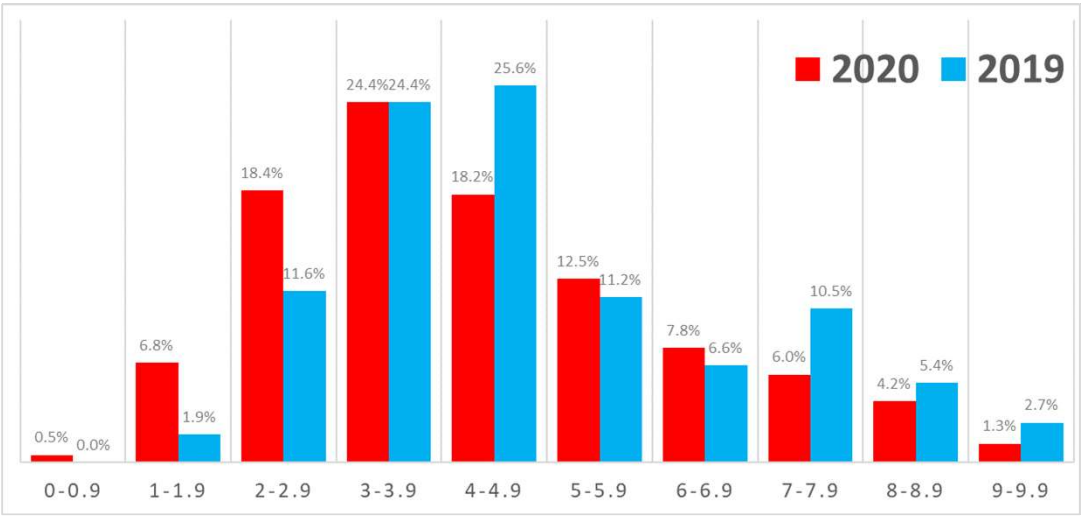
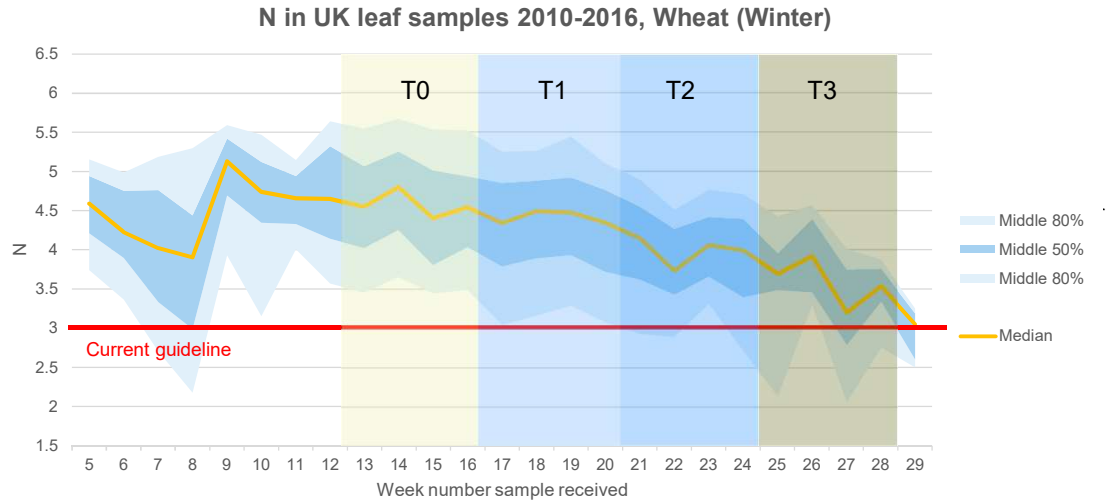


OM – All Soils



Move Towards Growth-stage Specific Guidelines



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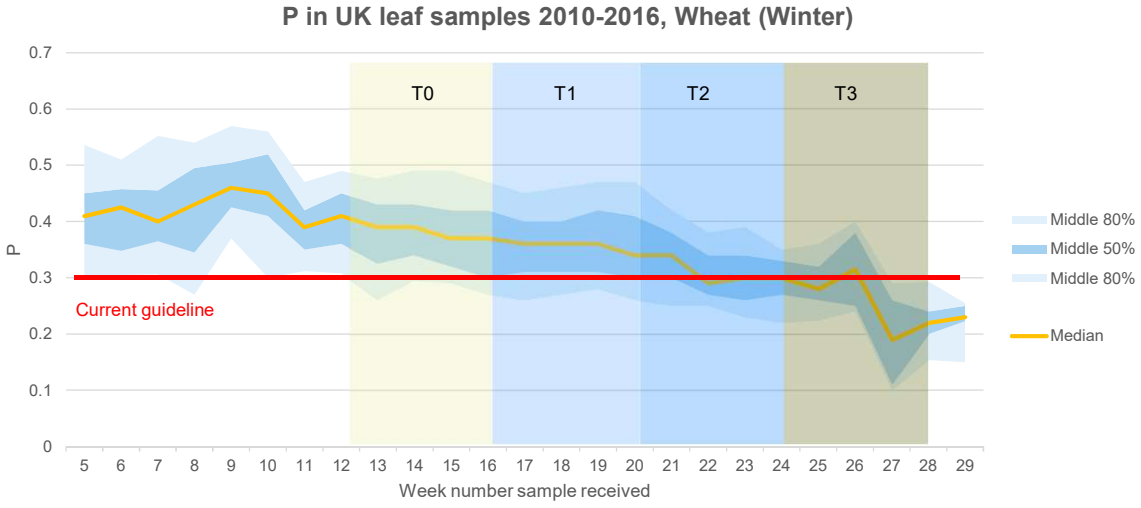
Move Towards Growth-stage Specific Guidelines



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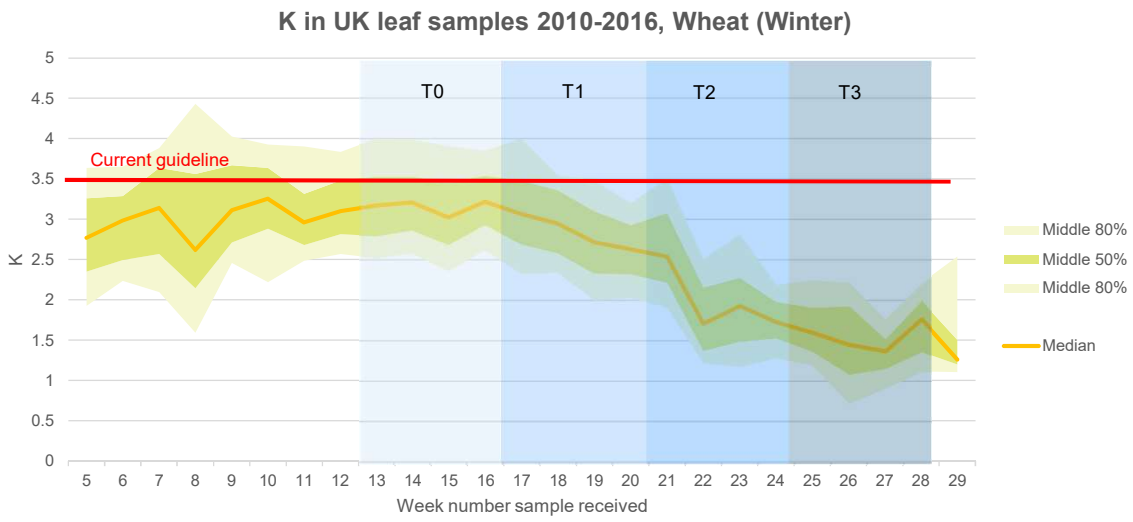
Move Towards Growth-stage Specific Guidelines



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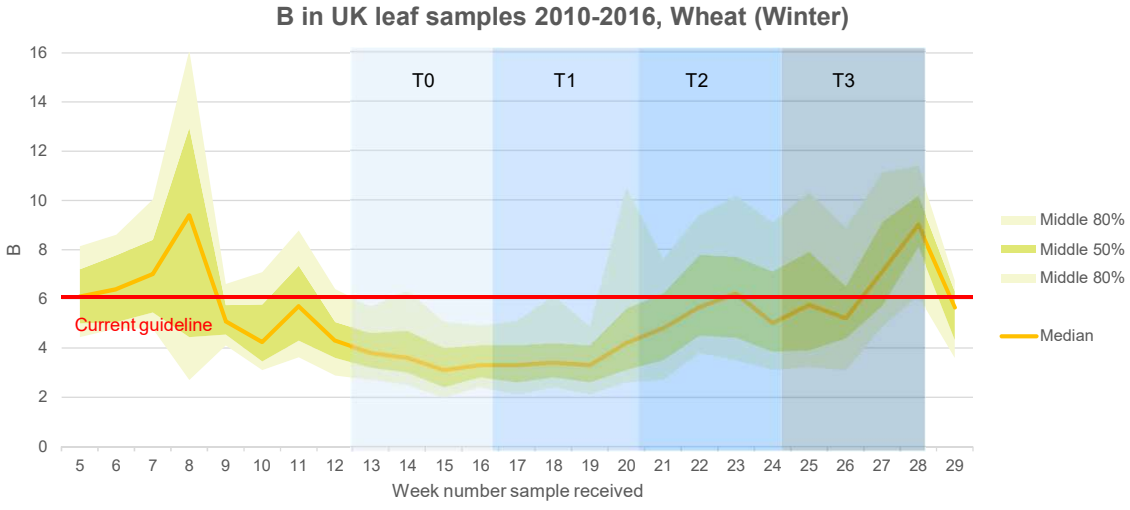
Move Towards Growth-stage Specific Guidelines



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Grain Nutrient Benchmarking – to complete the analysis jigsaw

Fig. 2 Occurrences of nutrient levels in grain samples analysed from YEN harvests in 2016, 2017 & 2018. Dotted red lines show critical levels determined from recent UK research, or from the scientific literature. Note that S deficiency is detected by N:S ratio which becomes critical when it is exceeded.

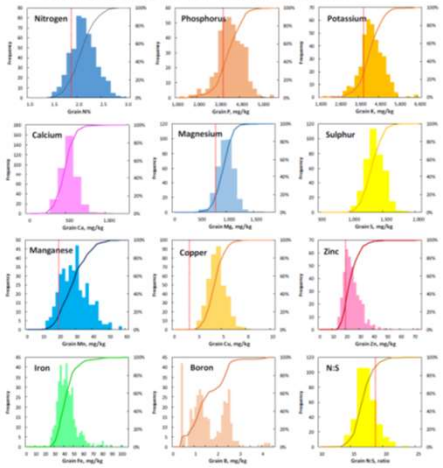

Table 1. Occurrence of nutrient deficiencies, as diagnosed from two grain analysis exercises (i) YEN in 2016-2018, and (ii) Grain Nutrient Benchmarking (GNB) in 2017 & 2018.

Nutrient	Critical value in grain dry matter		Occurrence of deficiencies	
		units	YEN	GNB
N	1.90	%	21%	38%
P	0.32	%	39%	59%
K	0.38	%	30%	29%
S (expressed as N:S)	17	*ratio*	30%	14%
Mg	800	*ppm*	25%	1%
Mn	20	*ppm*	19%	29%
Zn	20	*ppm*	37%	8%
Cu	2	*ppm*	0%	1%

Key considerations with testing.

- Data out is only as good as the sample taken
- Are you prepared to act on results? If not why not.
  - You measure to manage
- Start testing early in the season – GS 30
- Consider the practicalities
  - Time between testing, results and actions to be taken.
    - E.g. Tissue testing – test 2 weeks before each timing to avoid multiple field operations.
- Look for the new ways of data interpretation – Critical Guidelines that vary during the season
- Grain Nutrient Benchmarking as a way of reviewing the nutrient strategy

Soil = Plan → Tissue = Tactical/Dynamic Field management → Grain = review the strategy

References

- Yara's website
- Peter Baraclough – RRS Minolta Spad 502 meter research
- Sylvester-Bradley, R., Rollett, A., Downing, E., Dudman, S., Slater, M., Morris, N. & Withers, P. (2019). Cost-effective Phosphorus Management on UK arable farms. AHDB Research Report 570-3. 60 pp.