Wheat
Genetic
Improvement
Network

John Innes Centre

2. Tools, resources, genotyping and phenotyping

Clare Lister and Simon Griffiths

28/6/2018

Department
for Environment
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Continuing WGIN3 Projects

1. Drought tolerance in Paragon x Garcia
2. Paragon Library
3. Chromosome Segment Substitution Library for A x C

Continuing WGIN3 Projects

1. Drought tolerance in Paragon x Garcia

Trial repeated

No Spring drought during grain number formation

But current drought during grain filling ….

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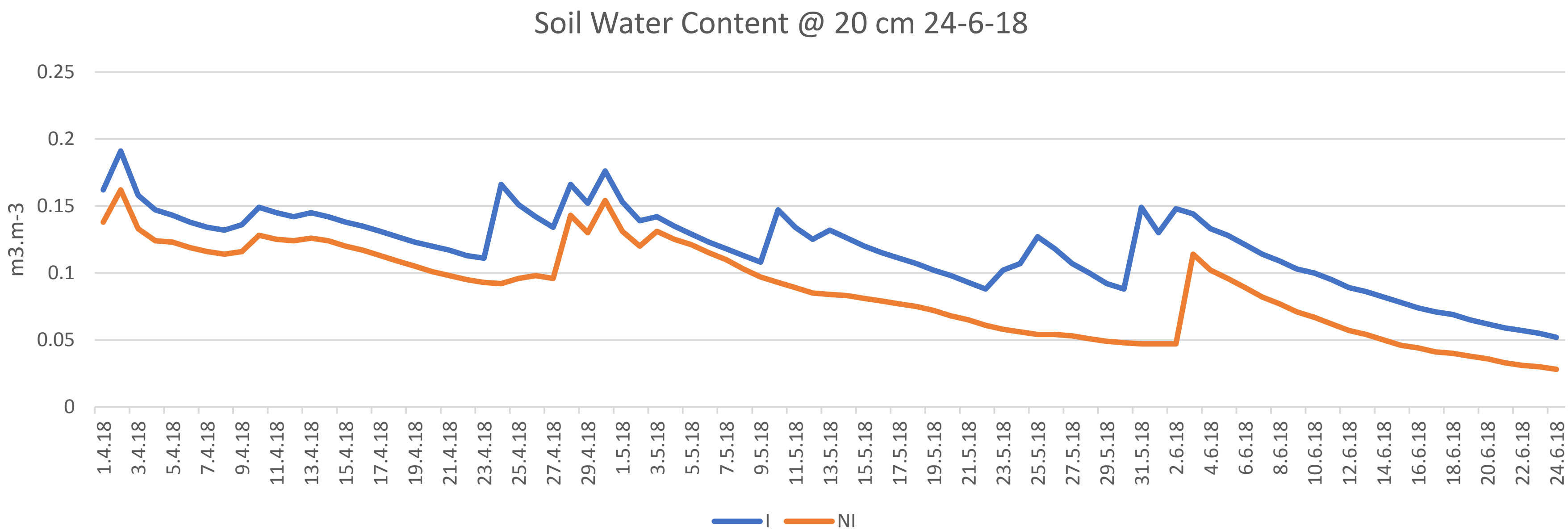

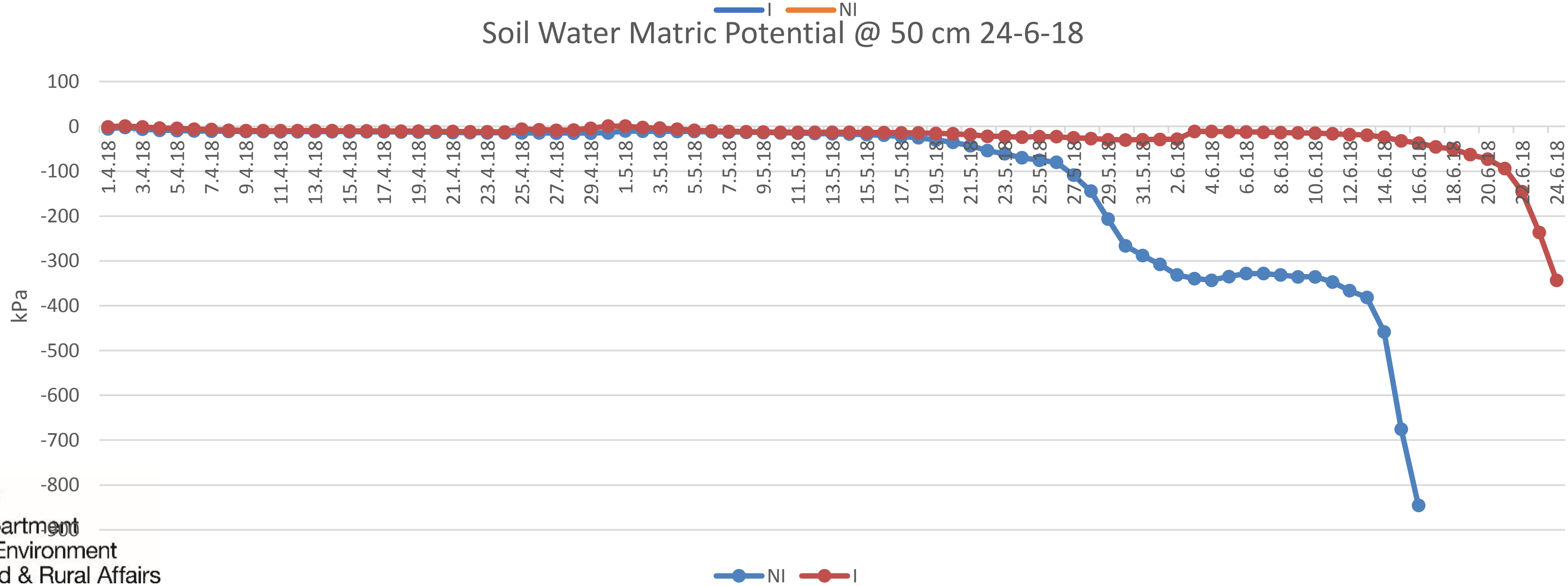

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2. Paragon Library

DNA and seed from single plants

Genotyped on Axiom 35K Breeders Array

(Data to WGIN website – WGIN4)

(Seed stocks to GRU - WGIN4)

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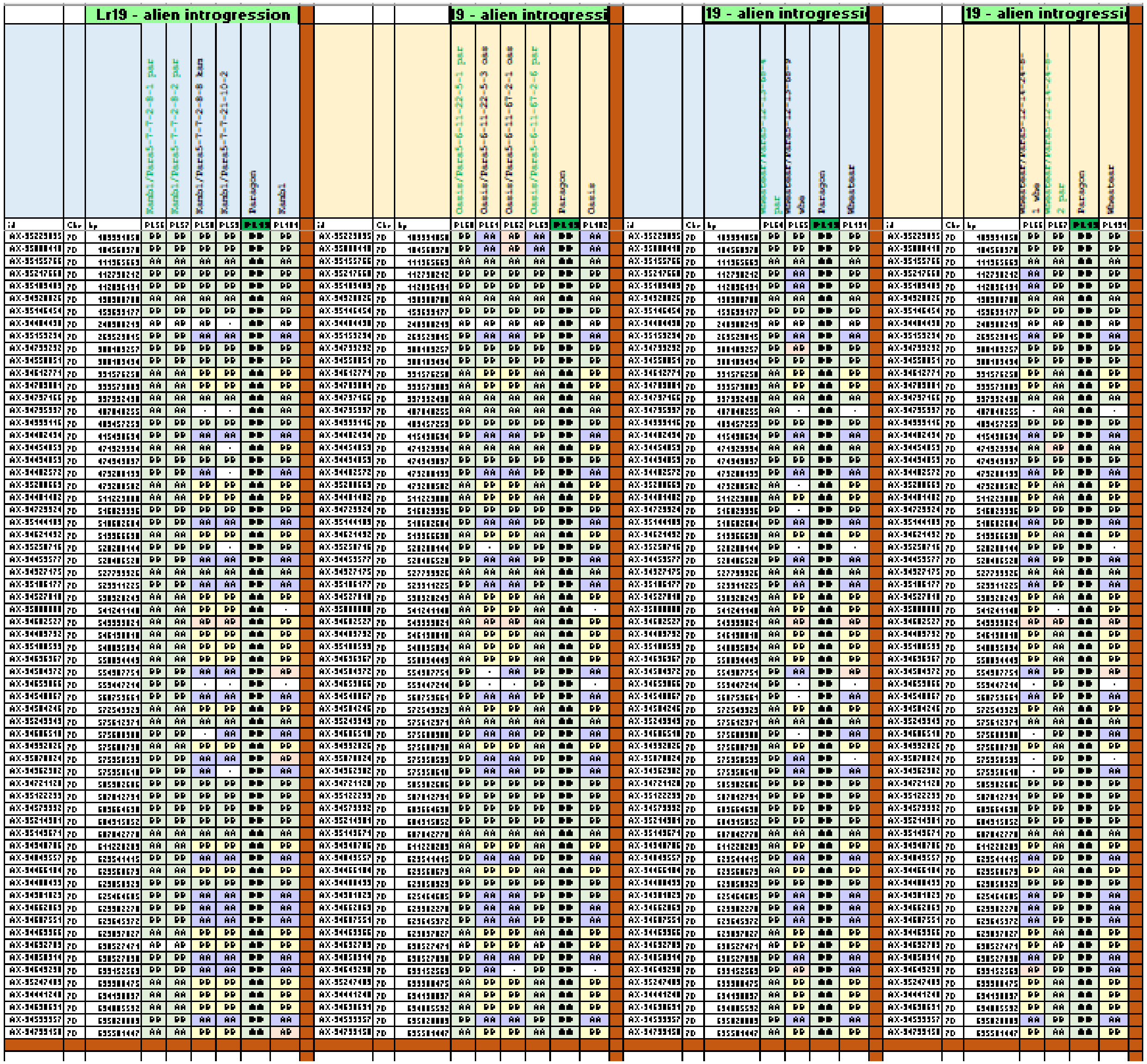

Example of Paragon Library genotyping data

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	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
1				EMS MUTANTS																	
2				Par EMS 95b	Par EMS 1189a	Par EMS 2316b	Par EMS 480a	Par EMS 555a	Par EMS 734a	Par EMS 894a	Par EMS 1385b	Par EMS 1389a	Par EMS 1974a	Par EMS 2056a	Par EMS 2150b	Par EMS 2171a	Par EMS 2375a	Par EMS 2474b	Par EMS 2514a	Par EMS 2939a	Paragon
2083	AX-95186189	2B	40905140	AA	AA	AA	AA	AA	–	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA
2084	AX-94652634	2B	40905185	AB	AB	AB	AB	AB	AA	AB	AB	AB	AB	AB	AB	AB	AB	AB	AB	AB	AB
2085	AX-94933020	2B	41146525	AB	AB	AB	AB	AB	AA	AB	AB	AB	AB	AB	AB	AB	AB	AB	AB	AB	AB
2086	AX-95003644	2B	41960630	AA	AA	AA	AA	AA	–	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA
2087	AX-95146413	2B	42276971	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA
2088	AX-94717768	2B	42277022	BB	BB	BB	BB	BB	–	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
2089	AX-94604134	2B	42954004	BB	BB	BB	BB	BB	–	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
2090	AX-95142610	2B	44941285	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
2091	AX-95138874	2B	45609421	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
2092	AX-94639155	2B	45609714	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
2093	AX-94845205	2B	45675505	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
2094	AX-94488059	2B	45788579	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA
2095	AX-94584968	2B	45915148	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA
2096	AX-94653059	2B	47179269	AB	AB	AB	AB	AB	AB	AB	AB	AB	AB	AB	AB	AB	AB	AB	AB	AB	AB
2097	AX-94680974	2B	48041863	AA	AA	AA	AA	AA	–	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA
2098	AX-94901457	2B	50412216	AB	AB	AB	AB	AB	BB	AB	AB	AB	AB	AB	AB	AB	AB	AB	AB	AB	AB
2099	AX-94527740	2B	51930329	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA
2100	AX-94395539	2B	52871546	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
2101	AX-94459800	2B	52911813	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA
2102	AX-94842402	2B	54768699	AA	AA	AA	AA	AA	–	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA
2103	AX-95232150	2B	55879328	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA
2104	AX-94572385	2B	63783125	BB	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA
2105	AX-94459558	2B	63847339	–	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
2106	AX-95160459	2B	64072439	–	AA	AA	–	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA
2107	AX-94768203	2B	64988255	AA	AA	AA	AA	AA	–	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA
2108	AX-94503018	2B	64992309	AA	AA	AA	–	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA
2109	AX-94561290	2B	65375329	BB	–	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
2110	AX-94501692	2B	69648755	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
2111	AX-94889709	2B	70881247	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA
2112	AX-94860010	2B	72610516	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB

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EMS does more than point mutations!

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3. Chromosome Segment Substitution Library for A x C

DNA and seed from single BCF2 plants (57 lines)

Markers generated by Polymarker

(Genotyping with markers for substituted regions – WGIN4)

(Lines available and genotyping data to WGIN website – WGIN4)

(Seed stocks to GRU – WGIN4)

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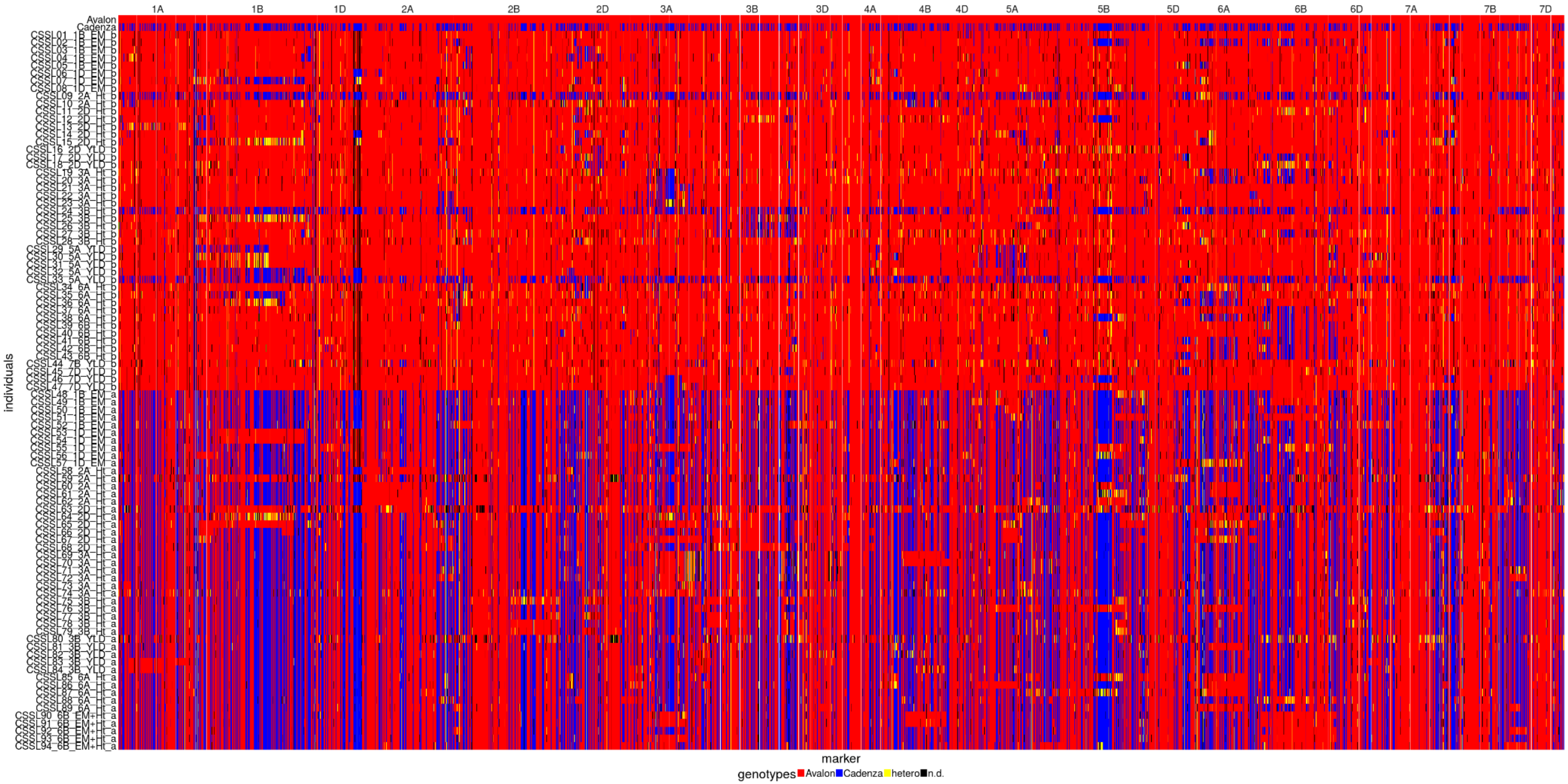

Red = Avalon

Blue = Cadenza

Yellow = Het

Black = nd

Luzie Wingen

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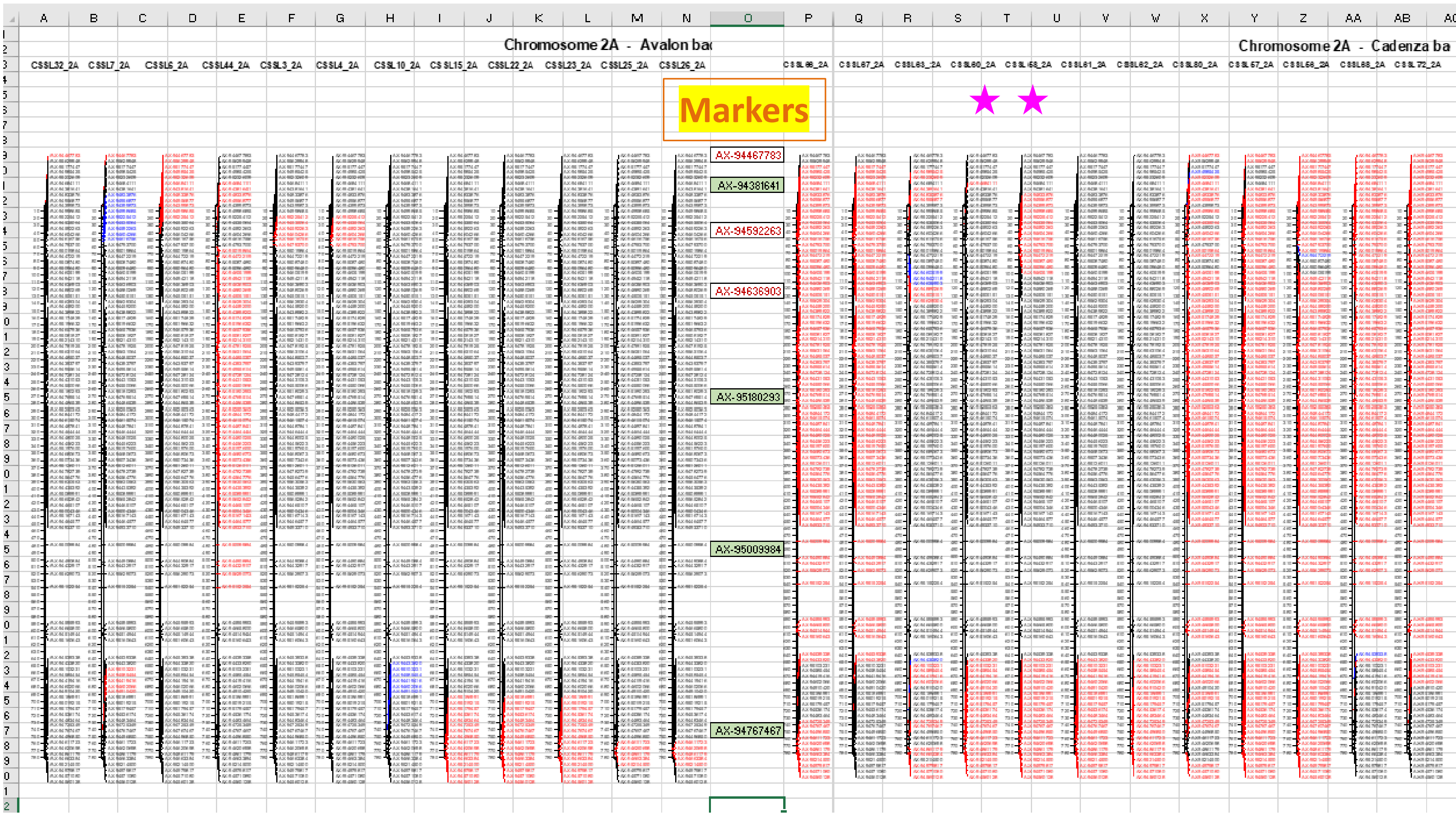

Chr2A

Avalon background

Cadenza substitution

Hets

Cadenza background

Avalon substitution

Hets

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Chr2A

	F2 from BCF2 CSSL58			F2 from BCF2 CSSL60		
	AX-94381641	AX-95180293	AX-95009984	AX-94381641	AX-95180293	AX-95009984
1	H	H	H	H	H	H
2	C	H	H	C	C	C
3	A	A	A	H	A	A
4	H	A	A	C	C	C
5	H	C	C	H	C	C
6	H	C	C	C	C	C
7	A	H	H	A	A	A
8	H	C	C	C	H	H
9	H	C	C	A	A	A
10	H	C	C	A	H	H
11	A	H	H	H	H	H
12	H	H	H	C	C	C
13	H	H	H	H	H	H
14	C	H	H	H	H	H
15	H	A	A	A	A	A
16	C	C	C	A	A	A
17	H	A	A	A	A	A
18	H	C	C	A	A	A
19	C	H	H	C	H	H
20	C	A	A	A	A	A
21	H	H	H	H	H	H
22	C	H	H	H	H	H
23	H	C	C	H	H	H
24	H	C	C	H	A	A
25	C	C	C	A	H	H

Cadenza background
Avalon substitution
Hets

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WGIN4 Projects

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1. Drought tolerance – selection of lines
2. Anchorage and lodging – selection of lines
3. Resistance to slug damage
4. CSSL (continuing from WGIN3)
5. CSSL and ParLib data to WGIN webpage when analysis complete*
6. Gene content around 2D, 3A and 6A*
7. Promotome*
8. Organise workshop on Yield Stability
9. QTL nominated to DFW Breeders Tool Kit – 2 drought QTL
10. Curation and distribution of WGIN germplasm – ongoing

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* Once sequence available

Drought and Lodging

Possible Drought and Lodging lines	Lodging status	Drought resistance?	Note	2018-19 RL	Lodging - PGR	Lodging +PGR	Height	Popns	
Baj	?	Mega Environment 1	CIMMYT					Y	
Becard Kachu	?	Mega Environment 1	CIMMYT					Y	
Borlaug 100	?	Mega Environment 1	CIMMYT					?	
CIMCOG 47	?	Mega Environment 1	CIMMYT					Y	
CIMCOG 49	?	Mega Environment 1	CIMMYT					Y	
MISR1	?	Mega Environment 1	CIMMYT					Y	
Pfau	?	Mega Environment 1	CIMMYT					Y	
Super 152	?	Mega Environment 1	CIMMYT					Y	
Synth Type	?	Mega Environment 1	CIMMYT					Y	
Waxwing	?	Mega Environment 1	CIMMYT					Y	
Weebill	?	Mega Environment 1	CIMMYT					Y	
Watkins 126	?	?	Indian dwarf					Y	
Watkins 110	Lodging resistant	?						Y	
Paragon EMS semi dwarves	?	?	5 lines					x	
Paragon RhtB1	?	?						N/A	
Paragon RhtD1	?	?						N/A	
Paragon Rht D1 x B1	?	?						N/A	
Paragon RhtB1 x Rht8	?	?						N/A	
Paragon RhtD1 x Rht8	?	?						N/A	
DFW Breeder Toolkit H17	?	?	3 QTLs					N/A	
DFW Breeder Toolkit H18	?	?	3 QT					N/A	
Avalon	?	x						Y	
Cadenza	?	x						Y	
Fiorello	?	Mediterranean Rainfed	Italy					Y	
Garcia	?	Drought tolerant						Y	
Glasgow	?	?	UK					Y	
Maestro	?	?	OAT					N/A	
Pamyati Azieva	?	Drought tolerant	Kazakhstan					Y	
Paragon	?	x	Parent					Y	
Pomerello	?	Rainfed	USA					Y	
Treasure	?	Rainfed	USA					Y	
Wyalkatchem	?	Rainfed	Australia					Y	
Cordiale 3N (Rec 5-1)	?	?						x	
Lr19	?	?						x	

Any comments to help with selection?

Selection of lines for drought and lodging trials

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Drought and Lodging

Possible Drought and Lodging lines	Lodging status	Drought resistance?	Note	2018-19 RL	Lodging - PGR	Lodging +PGR	Height	Popns	
Stress Adapted Wheat Yield Nursery (SATYN)		YT - hot irrigated & dry environments	Selected lines						Control
Sokoll		Drought and heat adapted							Control
Atilla		Early, semi-dwarf	CIMMYT						Control
LG Skyscraper			Feed wheat	Y	3	7	Medium - Tall		Control
Freiston	Lodging prone			Y	6	6	Medium - Tall		Control
KWS Silverstone	Lodging prone			Y	6	6	Medium		Control
LG Sundance	Lodging prone			Y	6	7	Medium		Control
Savello	Lodging prone			Y	6	7	Medium		Control
Graham				Y	7	8	Medium		Control
JB Diego			UK	Y	7	8	Medium		Control
KWS Santiago			UK	Y	7	7	Medium	Y	Control
RGT Illustrious	Lodging resistant			Y	7	8	Medium		Control
KWS Siskin				Y	6	7	Short		Control
LG Motown	Lodging prone			Y	6	6	Short		Control
Cordiale				Y	7	8	Short	Y	Control
Costello	Lodging resistant			Y	7	8	Short		Control
KWS Zyatt	Lodging resistant			Y	7	8	Short		Control
Reflection				Y	7	8	Short		Control
Grafton				Y	8	8	Short	Y	Control
Skyfall	Lodging resistant			Y	8	8	Short		Control
Panorama	Lodging resistant								Control
Charger	Lodging prone						Short	Y	Control
Solstice	Lodging resistant							Y	Control

Any comments to help with CONTROLS selection?

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Selection of lines for drought and lodging trials - **CONTROLS**

Resistance to slug damage

Introduction/Aim:

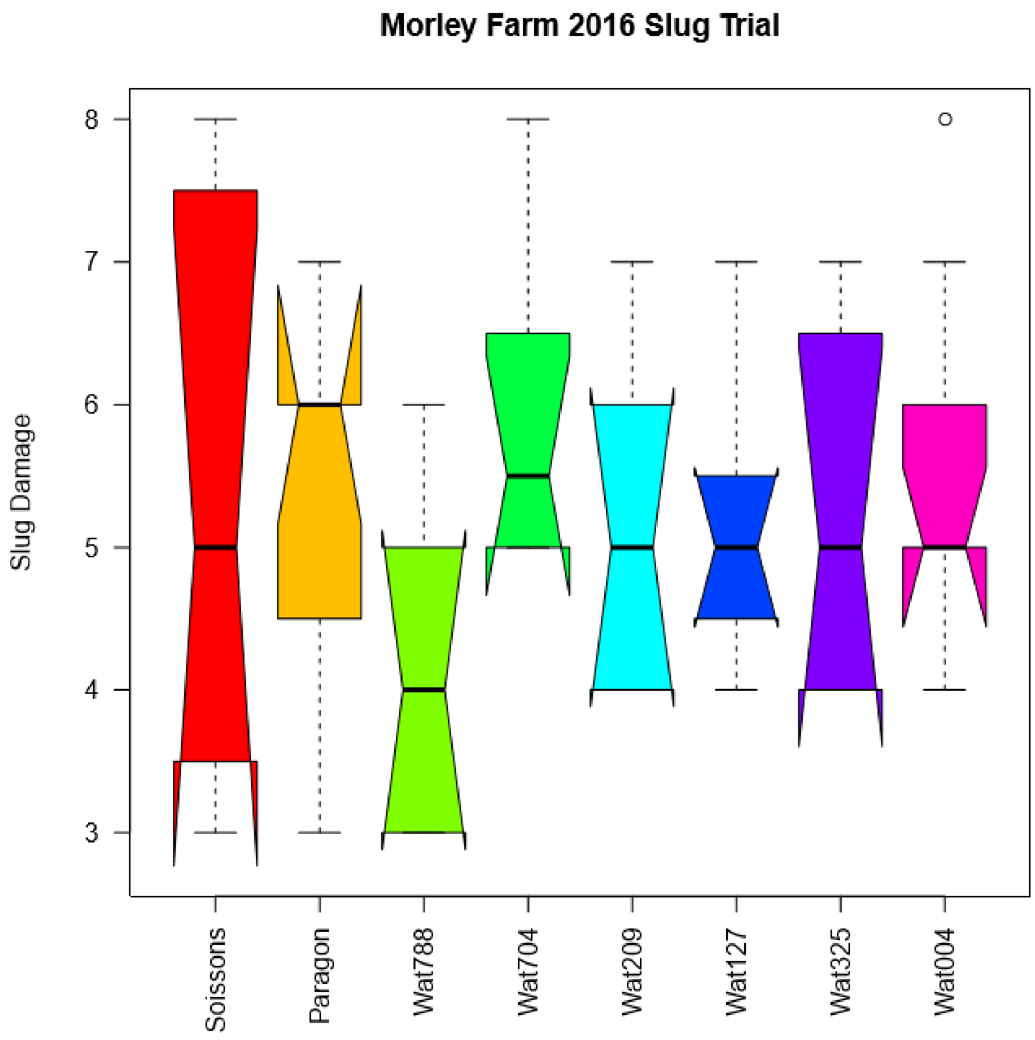
- Approval for use of methiocarb slug pellets withdrawn 2015.
- further restriction likely due to presence in water courses

- Some screening by commercial breeders but very few leads on genetic resistance to slug damage.

- Work in WGIN 3 identified promising leads for resistance in the AE Watkins landrace collection.
- One Watkins line exhibits resistance to grey slug damage in choice chambers, field plots, and no choice chambers.

Objectives: We will show whether this Watkins line still expresses significant resistant to slug damage when easy to reach alternative wheat genotypes are absent.

Resistance to slug damage



WGIN4 Projects

Promotome…

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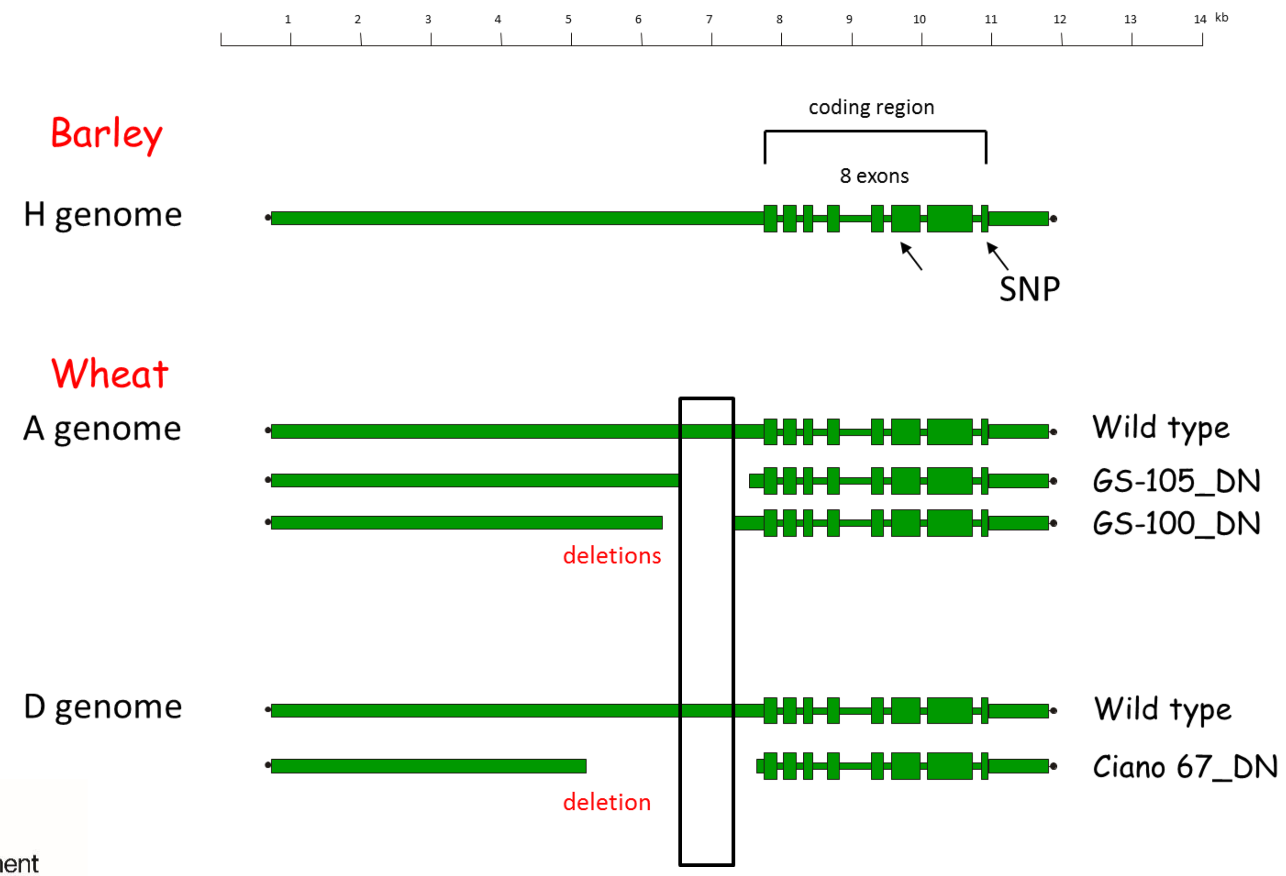
Positional cloning of *Ppd-H1* in barley revealed the allelic variation underlying photoperiod insensitive alleles from the D and A genomes of bread wheat



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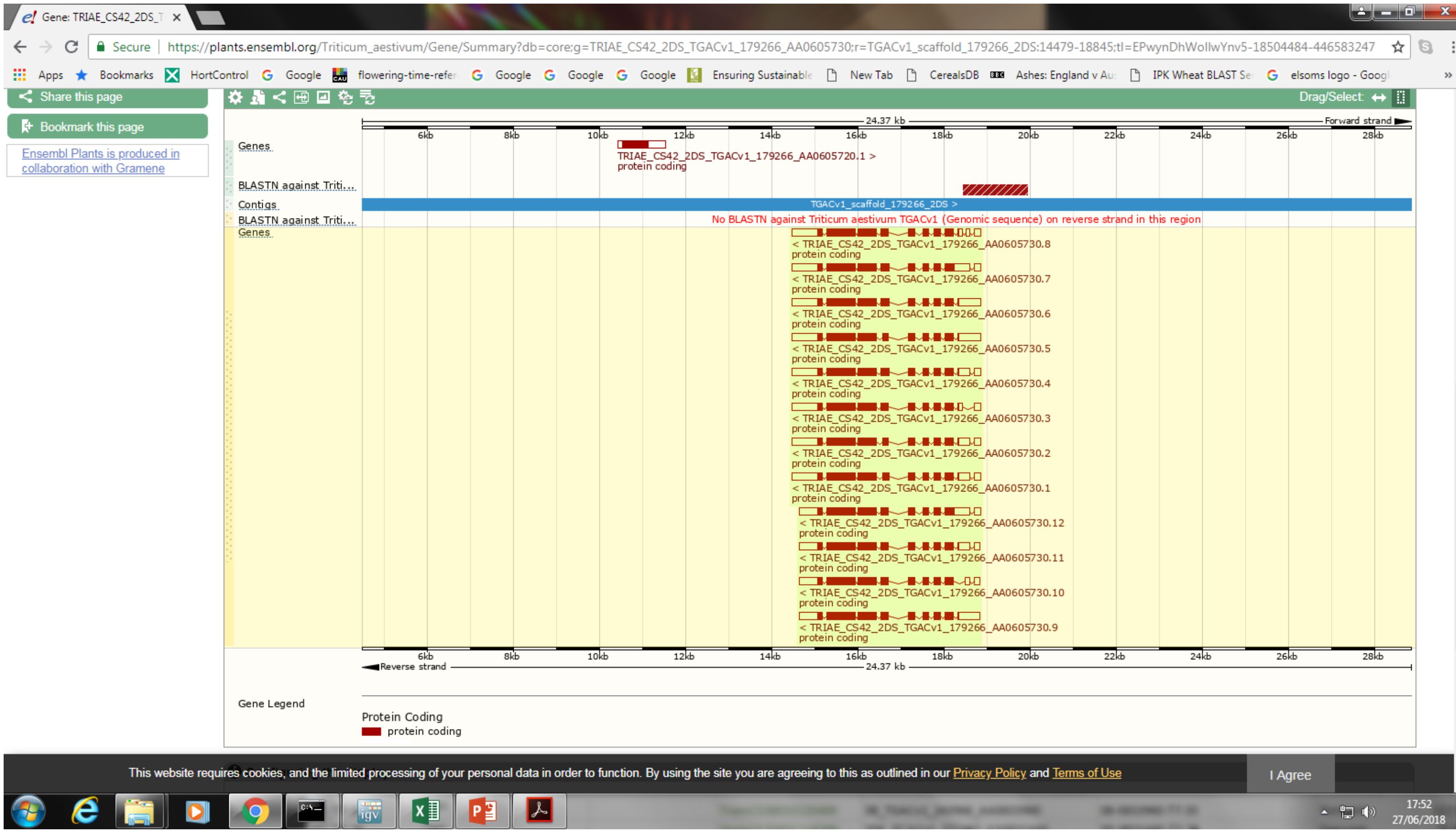

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WGIN4 Projects

WGIN_Promotome_PER_TRAIT_final.xlsx - Excel

	trait&gene no.	gene	homoeologues	IWGSC gene ID	ensembl ID	WGIN Promotome ID	orientation	ATG	comments	sequence
68	T7-3	FT3 = Ppd-2	ABD	TraesCS1A01G338600	1AL_TGACv1_002602_AA0043540.1	1A-0043540-T7-3	reverse	528,066,476		ATACTGGA
69	T7-3	FT3 = Ppd-2		TraesCS1B01G351100	1BL_TGACv1_030923_AA0103850.1	1B-0103850-T7-3	reverse	581,414,952	only (1441bp)	ATACTGGA
70	T7-3	FT3 = Ppd-2		TraesCS1D01G340800	1DL_TGACv1_061682_AA0201670.1	1D-0201670-T7-3	reverse	430,469,335		ATACTAGA
71	T7-30	TaKS	ABD	TraesCS2A01G425400	2AL_TGACv1_095602_AA0312750.1	2A-0312750-T7-30	reverse	679,267,800		GGGTTGGG
72	T7-30	TaKS		TraesCS2B01G445700	2BL_TGACv1_130687_AA0416140.2	2B-0416140-T7-30	reverse	638,759,820		GGGTTGGG
73	T7-30	TaKS		TraesCS2D01G423300	2DL_TGACv1_158432_AA0518570.1	2D-0518570-T7-30	reverse	536,511,156	429N:x2,359-x2,787	GGGTTGGG
74	T7-31	TaKO	ABD	TraesCS7A01G362300	7AL_TGACv1_556473_AA1763880.2	7A-1763880-T7-31	reverse	536,777,086		GGGGGTCG
75	T7-31	TaKO		TraesCS7B01G265800	7BL_TGACv1_577358_AA1873370.1	7B-1873370-T7-31	reverse	488,374,797		ATGGGCGC
76	T7-31	TaKO		TraesCS7D01G360700	U-TGACv1-642210-AA2113450	7D-2113450-T7-31	forward	463,698,654		ATTTGTTCT
77	T7-32	TaKAO	AD	TraesCS7A01G029600	7AS_TGACv1_572167_AA1851630.1	7A-1851630-T7-32	forward	12,095,995	340N: x4,464-803	AAGAAGTT
78	T7-32	TaKAO	no B	TraesCS7D01G026000	7DS_TGACv1_623691_AA2055390.2	7D-2055390-T7-32	forward	12,458,865		AGCGTCAG
79	T7-33 & T9-23	Rht1	ABD	TraesCS4A01G271000	4AL_TGACv1_289881_AA0978250.1	4A-0978250-T7-33	reverse	582,479,578		GATCTCGC
80	T7-33 & T9-23	Rht1		TraesCS4B01G043100	4BS_TGACv1_328892_AA1095100.4	4B-1095100-T7-33	forward	30861382		CTCCGCGA
81	T7-33 & T9-23	Rht1		TraesCS4D01G040400	4DS_TGACv1_361329_AA1165870.1	4D-1165870-T7-33	forward	18,781,062	307Ns: x9,717 - x0,023	TTTTAATGA
82	T7-34	Bri1	ABD	TraesCS3A01G245000	3AL_TGACv1_193648_AA0616220.1	3A-0616220-T7-34	forward	458,681,484	991bp downstr, mid CDS?	TTATCCCA
83	T7-34	Bri1		TraesCS3B01G275000	3B_TGACv1_227850_AA0824910.1	3B-0824910-T7-34	forward	443,806,079	2414bp upstr, mid CDS?	CCGCCAAG
84	T7-34	Bri1		TraesCS3D01G246500	3DL_TGACv1_250416_AA0867790.1	3D-0867790-T7-34	reverse	344339522	2710bp upstr, mid CDS?	CCCCTCCA
85	T7-35	TaGI	ABD	TraesCS3A01G116300	3AS_TGACv1_213408_AA0706870	3A-0706870-T7-35	forward	84,190,136		GATGTTTT
86	T7-35	TaGI		TraesCS3B01G135400	3B_TGACv1_243966_AA0833960	3B-0833960-T7-35	forward	117,927,557		TCCATCAA
87	T7-35	TaGI		TraesCS3D01G118200	3DS_TGACv1_273467_AA0931440	3D-0931440-T7-35	forward	71,969,562		TGGAGAAT
88	T7-36	Ppd-1	U, D	TraesCSU01G196100	2BS_TGACv1_147969_AA0489460.1	U-0489460-T7-36	reverse	293,692,277	100N: x2,896-995	TTGGGGTC
89	T7-36		A 'not found'	TraesCS2D01G079600	2DS_TGACv1_179266_AA0605730.12	2D-0605730-T7-36	reverse	33,955,668		GTTGGGGT
90	T7-37	Vrn1	AABD	TraesCS5A01G286800	5AL_TGACv1_374543_AA1202840.1	5A-1202840-T7-37	forward	494,863,148		GTCGGCCA
91	T7-37	Vrn1		TraesCS5A01G391700	5DS_TGACv1_457465_AA1486810	5A-1486810-T7-37	reverse	587,423,240		CTCCGCTC
92	T7-37	Vrn1		TraesCS5B01G396600	5BL_TGACv1_405351_AA1325650.1	5B-1325650-T7-37	reverse	573,815,903		CTCCGCTG
93	T7-37	Vrn1		TraesCS5D01G401500	5DL_TGACv1_434261_AA1432830	5D-1432830-T7-37	reverse	467,184,278	332N: x5,284-615	CTCCGCTC
94	T7-38	Vrn2 = ZCCT1/ZCCT2	DD	TraesCS4D01G364400	4DL_TGACv1_342601_AA1117600	4D-1117600A-T7-38	reverse	509,340,956		ACTGCTAG
95	T7-38	Vrn2 = ZCCT1/ZCCT2		TraesCS4D01G364500	4DL_TGACv1_342601_AA1117610	4D-1117610B-T7-38	reverse	509,284,203		ACTGCAGC
96	T7-39	Tb1	ABD	TraesCS4A01G271300	4AL_TGACv1_290526_AA0986290.1	4A-0986290-T7-39	reverse	582840989		GCTTTAGT
97	T7-39	Tb1		TraesCS4B01G042700	4BS_TGACv1_327850_AA1076210.1	4B-1076210-T7-39	forward	30,362,277		TATAAAGA
98	T7-39	Tb1		TraesCS4D01G040100	4DS_TGACv1_361050_AA1159720.1	4D-1159720-T7-39	forward	18,464,255	153Ns: x3,657 - x3,809	AAATGACT
99	T7-4	FT4	ABD	TraesCS2A01G132300	2AS_TGACv1_113639_AA0358780.1	2A-0358780-T7-4	reverse	79,333,386		AATATTTT

TRAIT 1 | TRAIT 2 | TRAIT 3 | TRAIT 4 | TRAIT 5 | TRAIT 6 | TRAIT 7 | TRAIT 8 | TRAIT 9 | TRAIT 10 | duplicates

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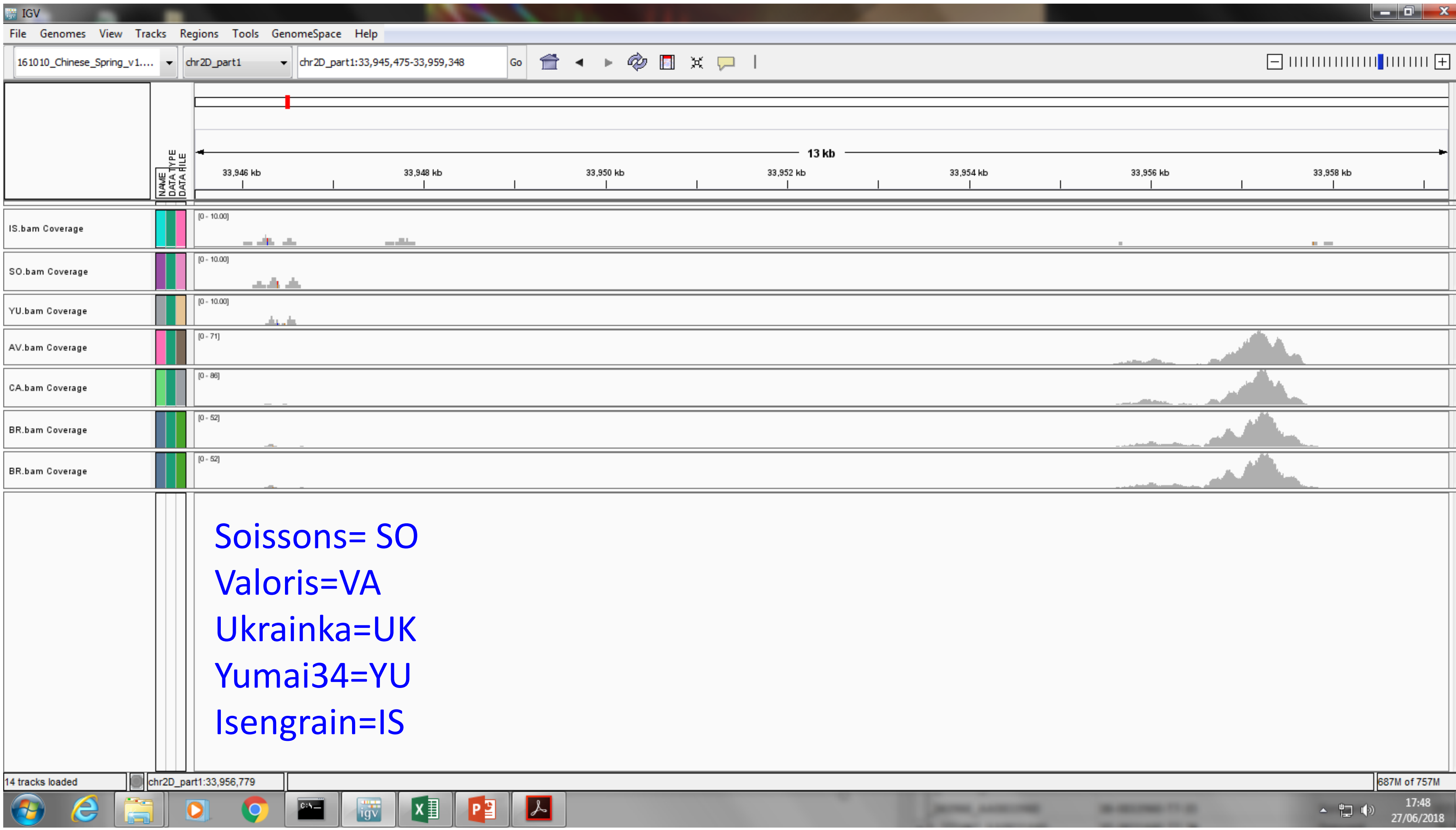
WGIN4 Projects



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3. Wgin Diversity Trial Update

Components of yield

Yield = TGW x Grains/spike x spikes/unit area

2014-2017 spikes were counted as part of anthesis sampling, 2017 TGW data not yet received, so mean of 3 years

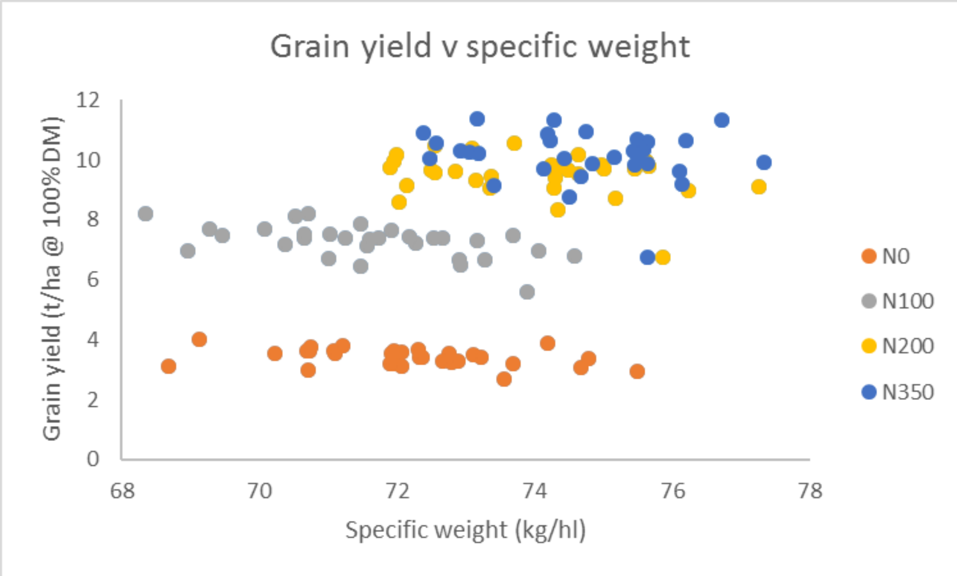
ROTHAMSTED RESEARCH

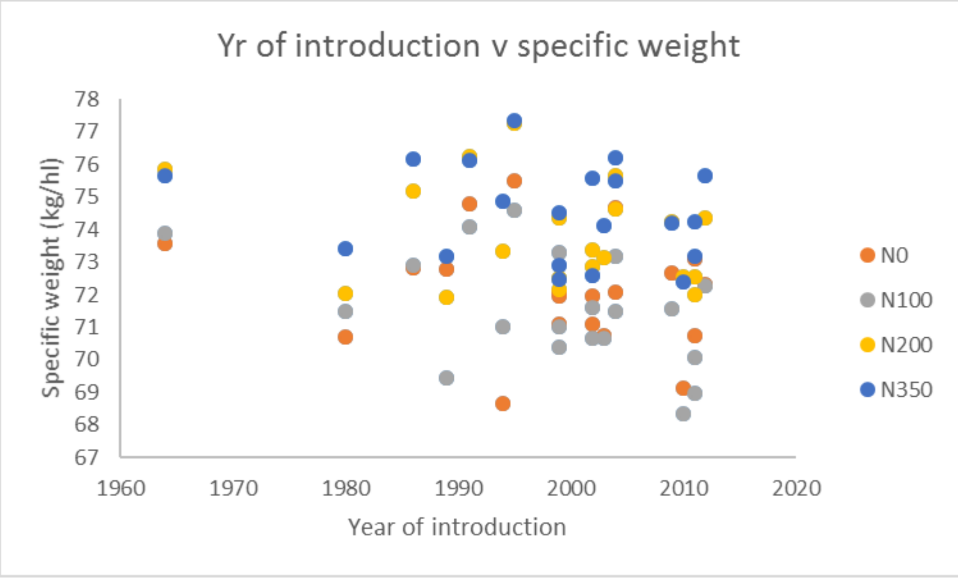
Components of yield – Specific weight 3 yrs data 2015-2017, 21 varieties

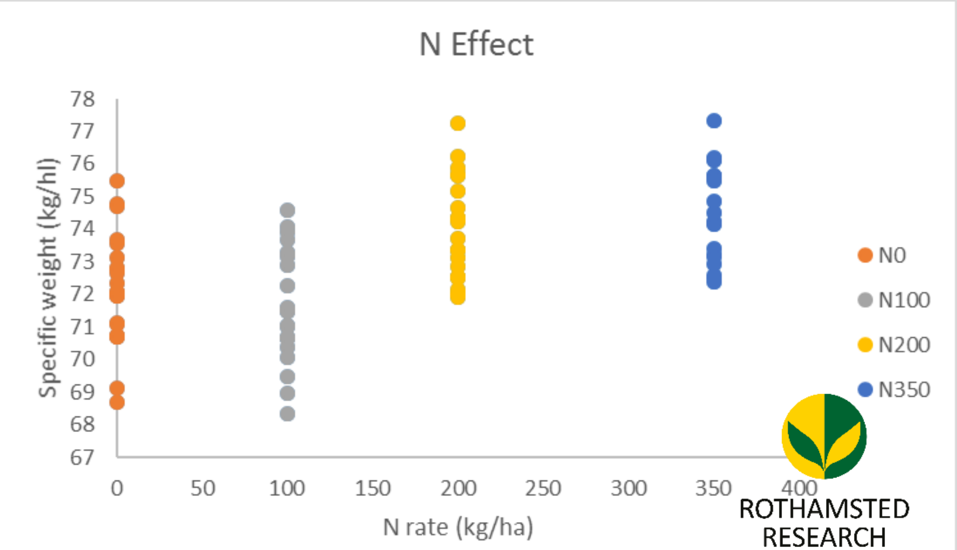
N200 & 350, higher sp wt & higher yield

N200 & 350 have an effect on SpWt

No evidence that breeding has affected SpWt





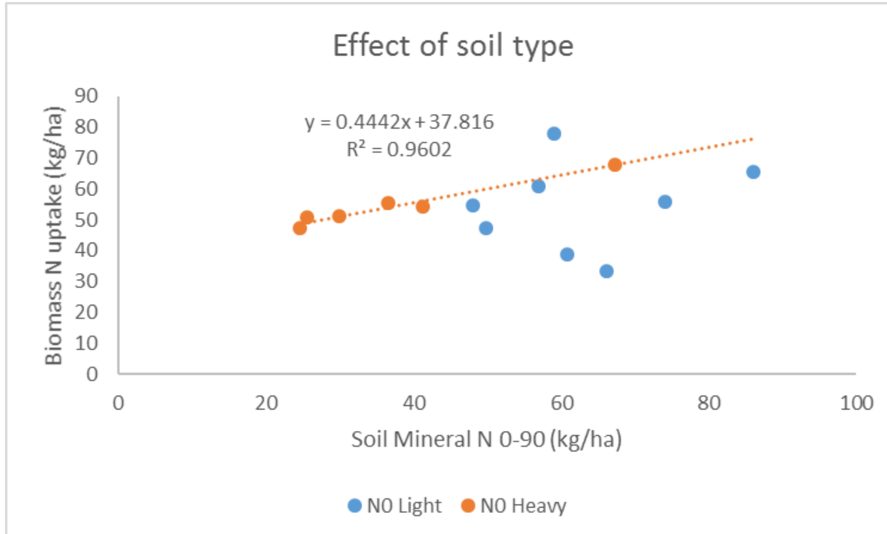


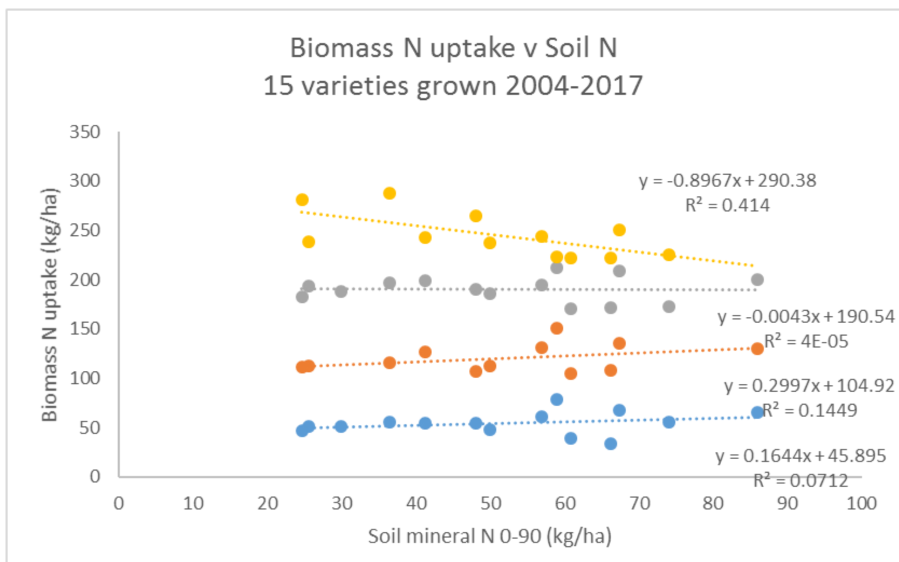
ROTHAMSTED RESEARCH

Nitrogen

Wgin:
N0
N100
N200
N350

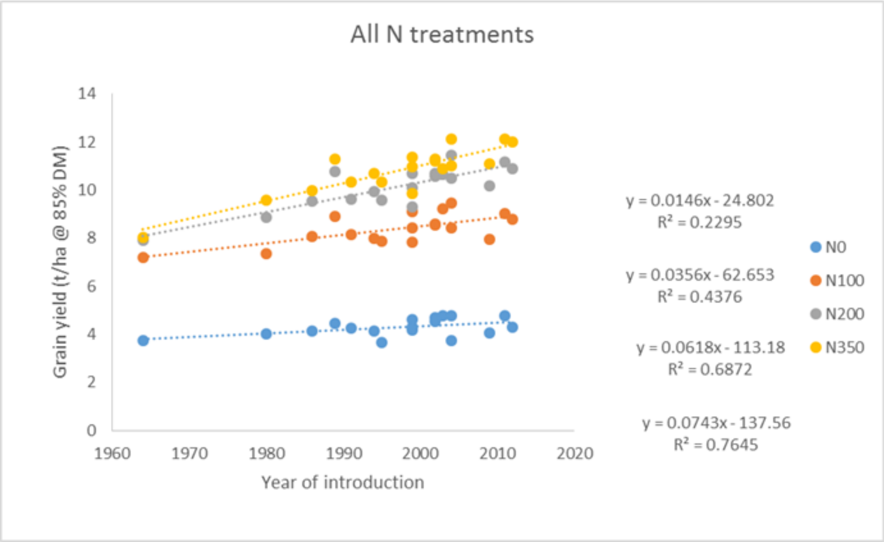
Measure N in:
Soil post-winter
Grain and straw at final harvest

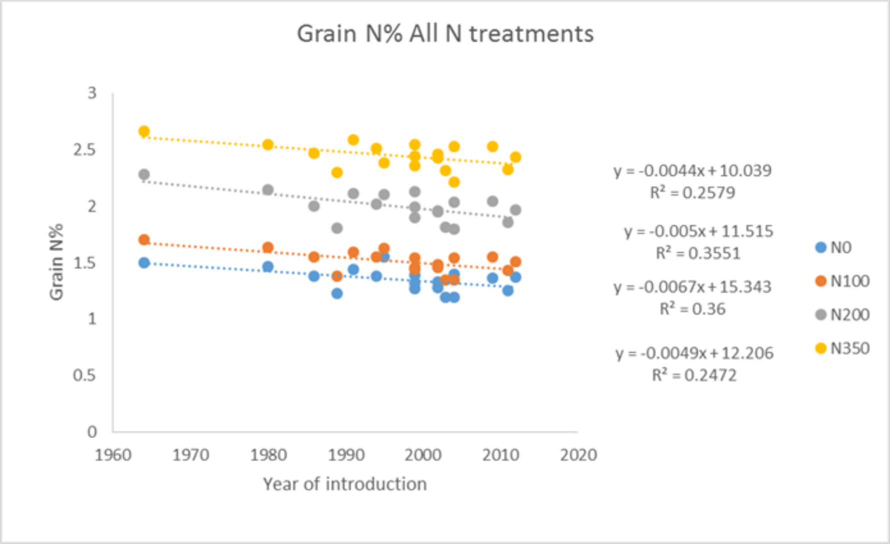




ROTHAMSTED RESEARCH

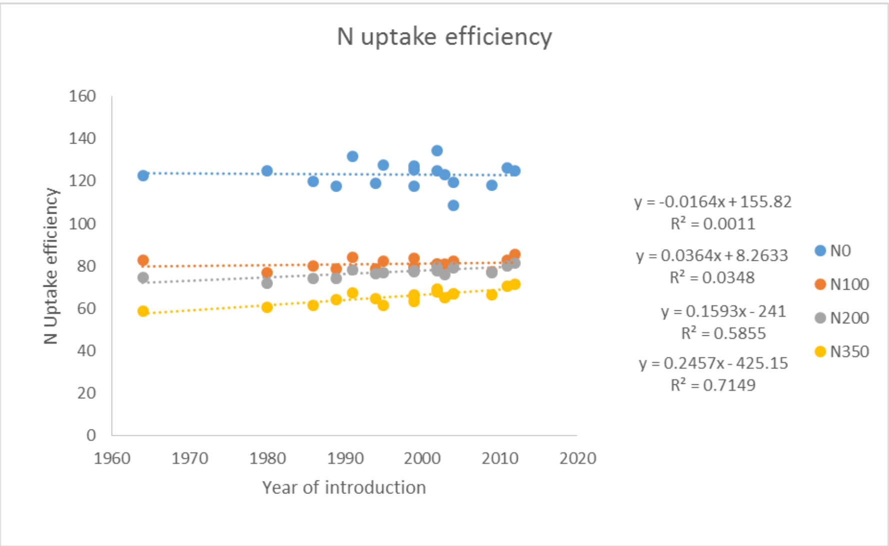
Yields increasing, grain protein decreasing

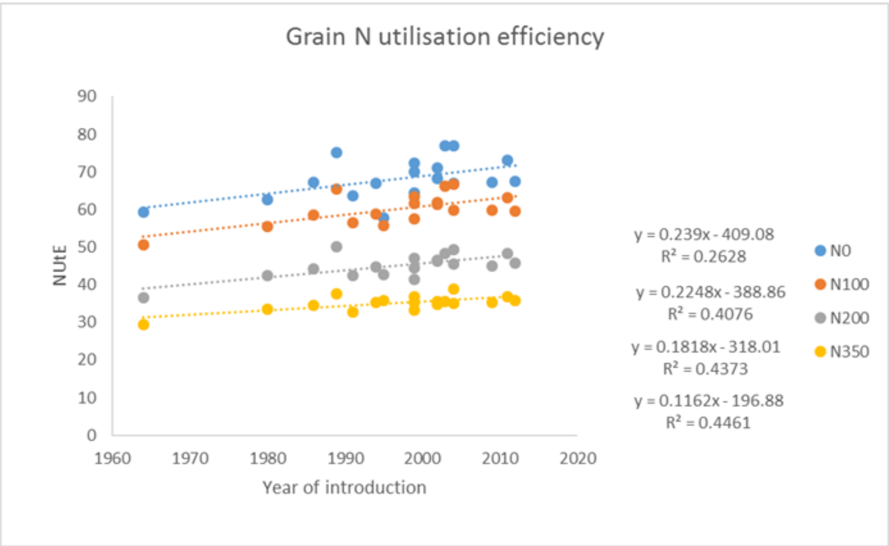


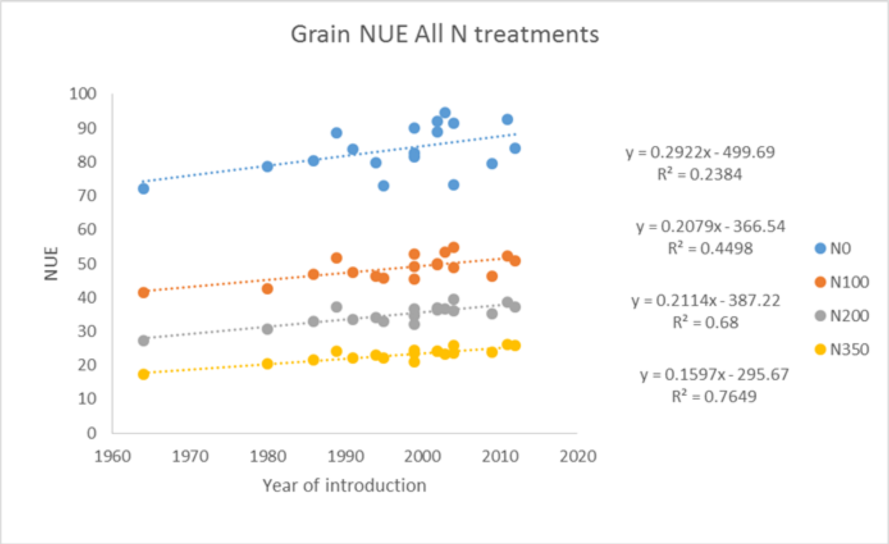


ROTHAMSTED RESEARCH

N Use efficiency







NUpE = kg taken up per 100kg available (soil + fertilizer)

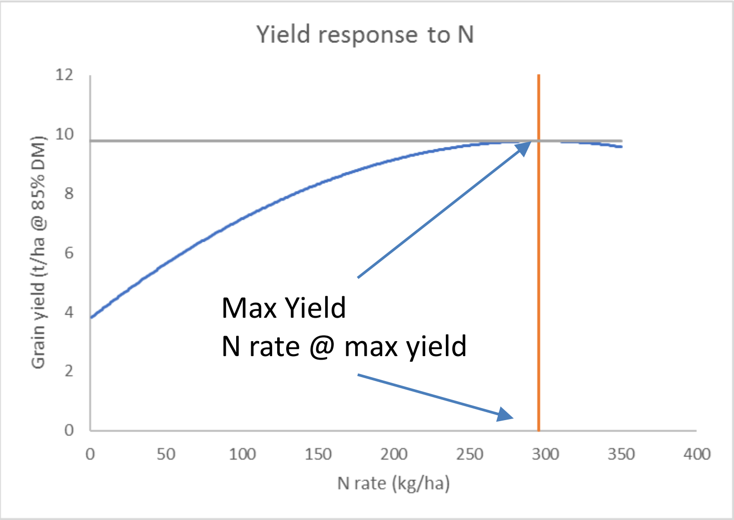
NUtE = kg of grain per kg N taken up

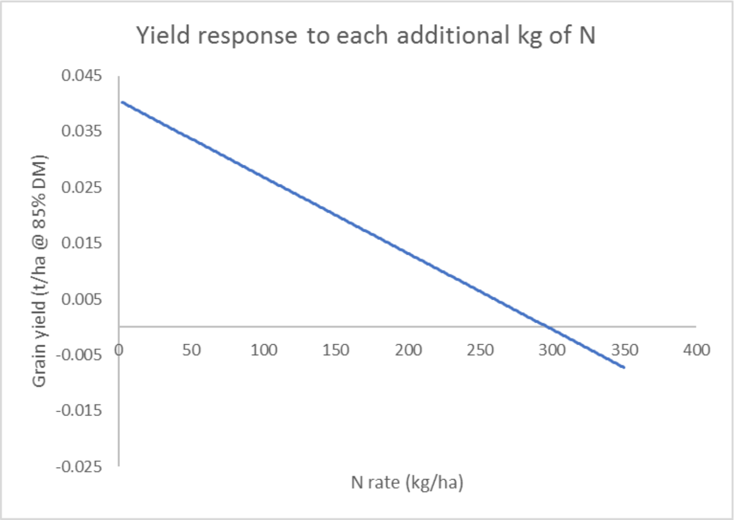
NUE = kg of grain per kg N available

i.e. @ 200kg N, 2 kg per decade more grain per kg of N

ROTHAMSTED RESEARCH

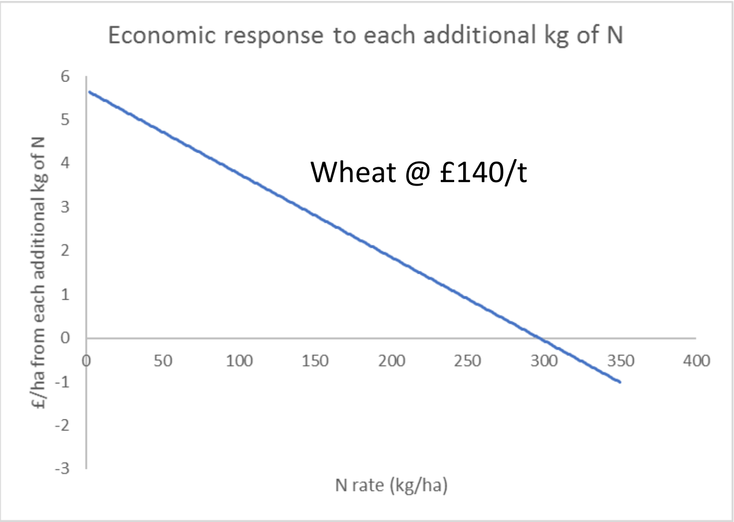
N response

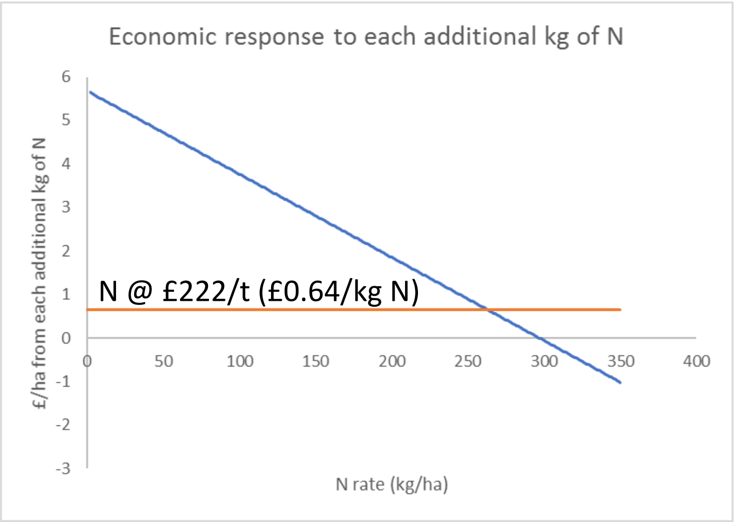


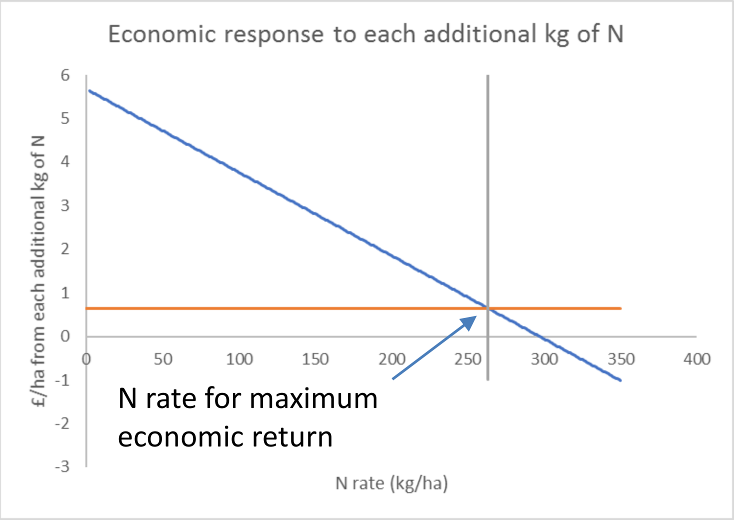


ROTHAMSTED RESEARCH

N response

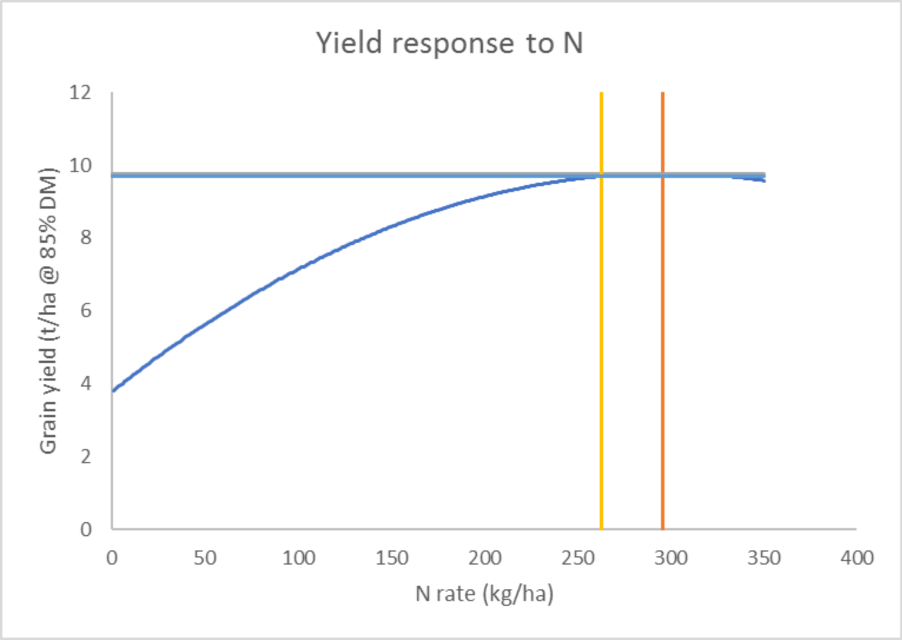






ROTHAMSTED RESEARCH

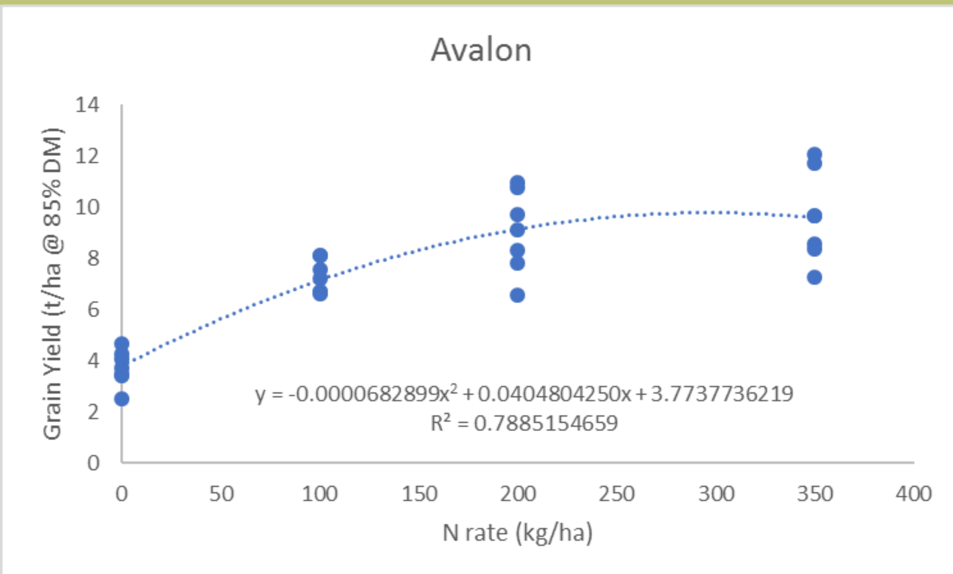
N response

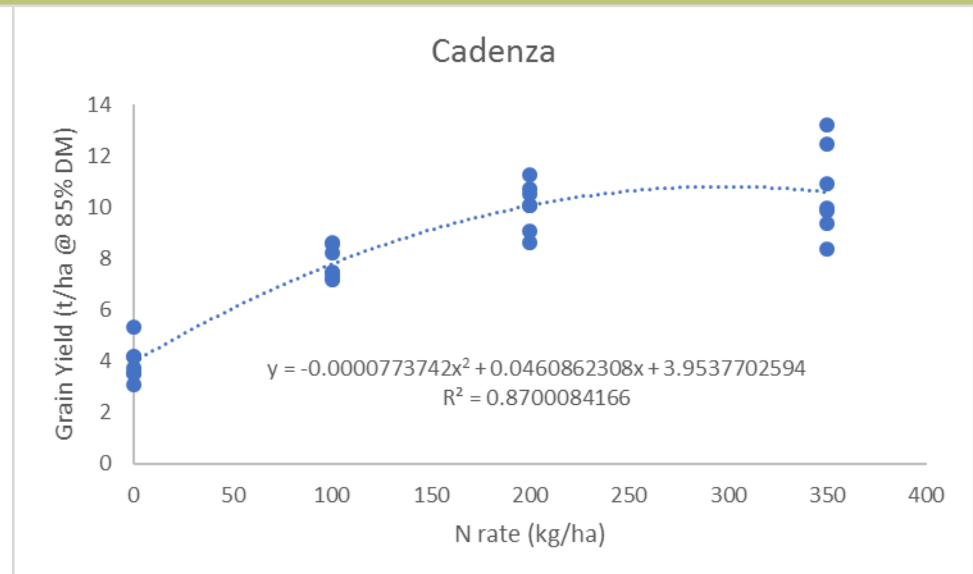


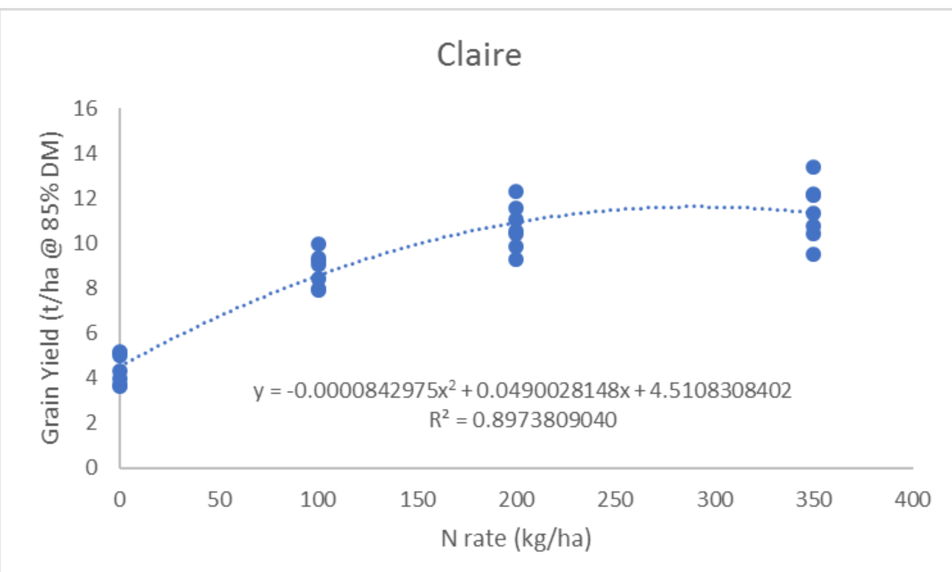
	N	Grain
	kg/ha	t/ha
Max yield	296	9.77
Max return	263	9.70
Difference	33	0.08

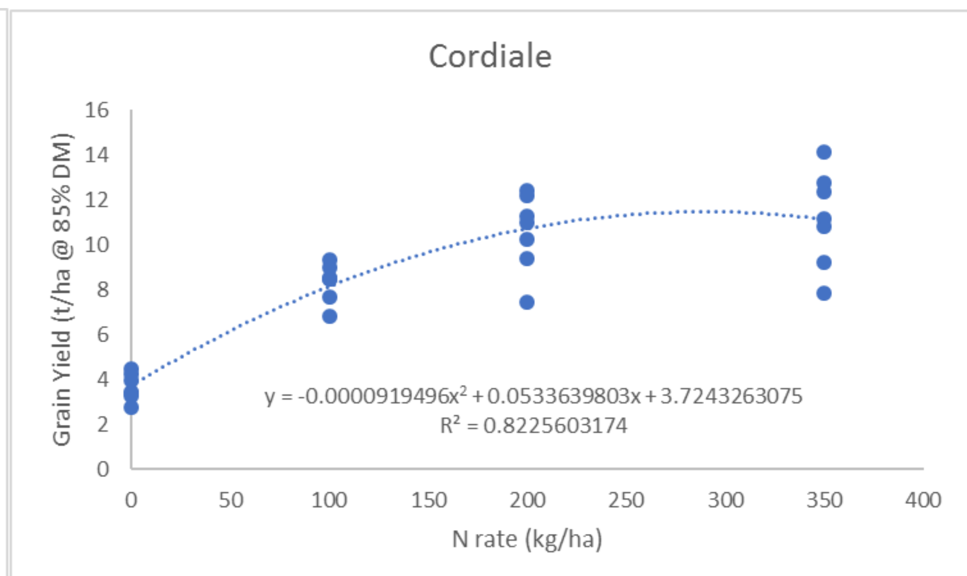
ROTHAMSTED RESEARCH

N Response by varieties grown 2011-2017 incl

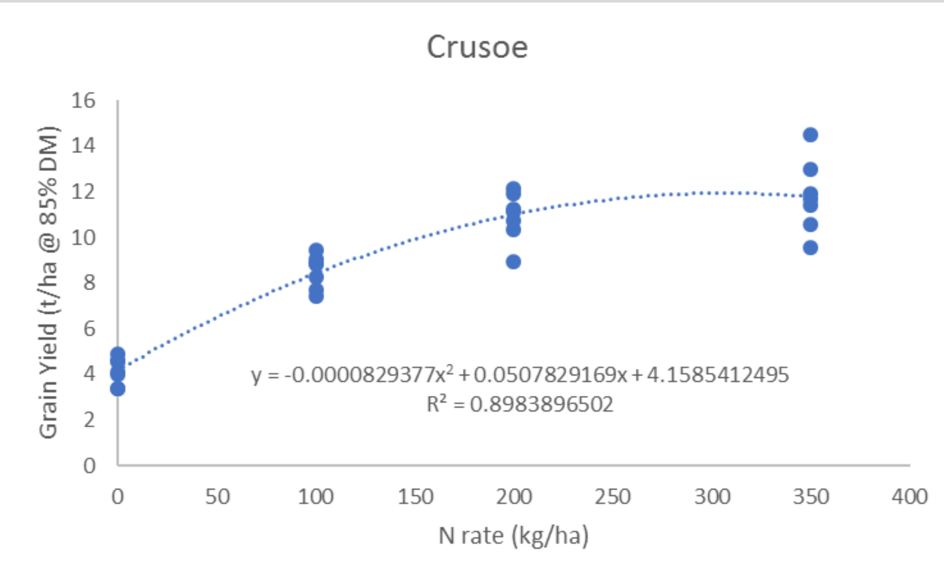


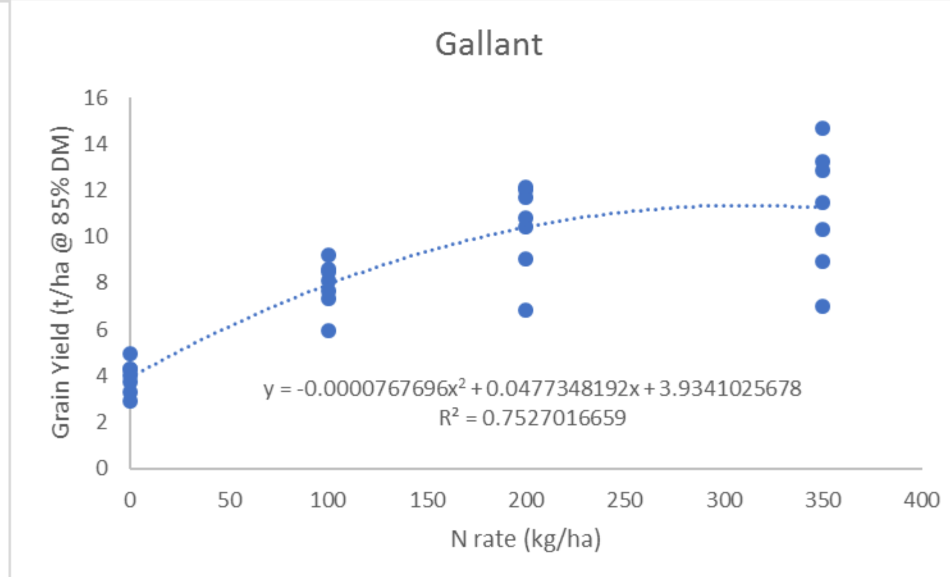


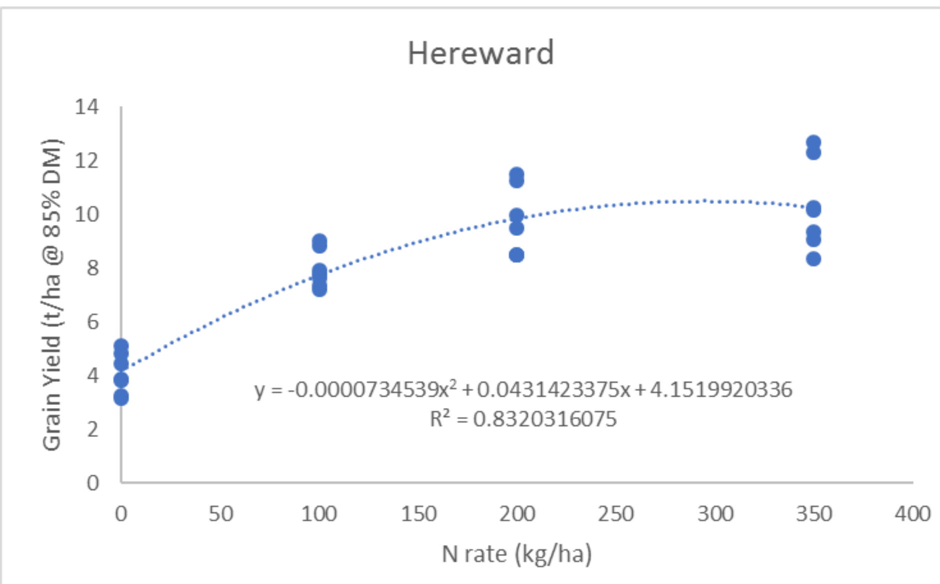


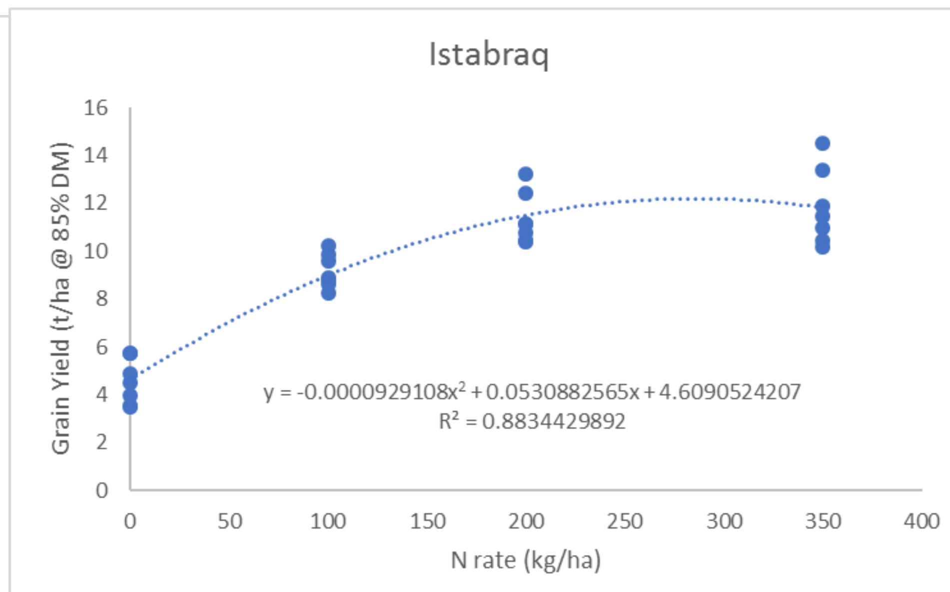


N Response by varieties grown 2011-2017 incl

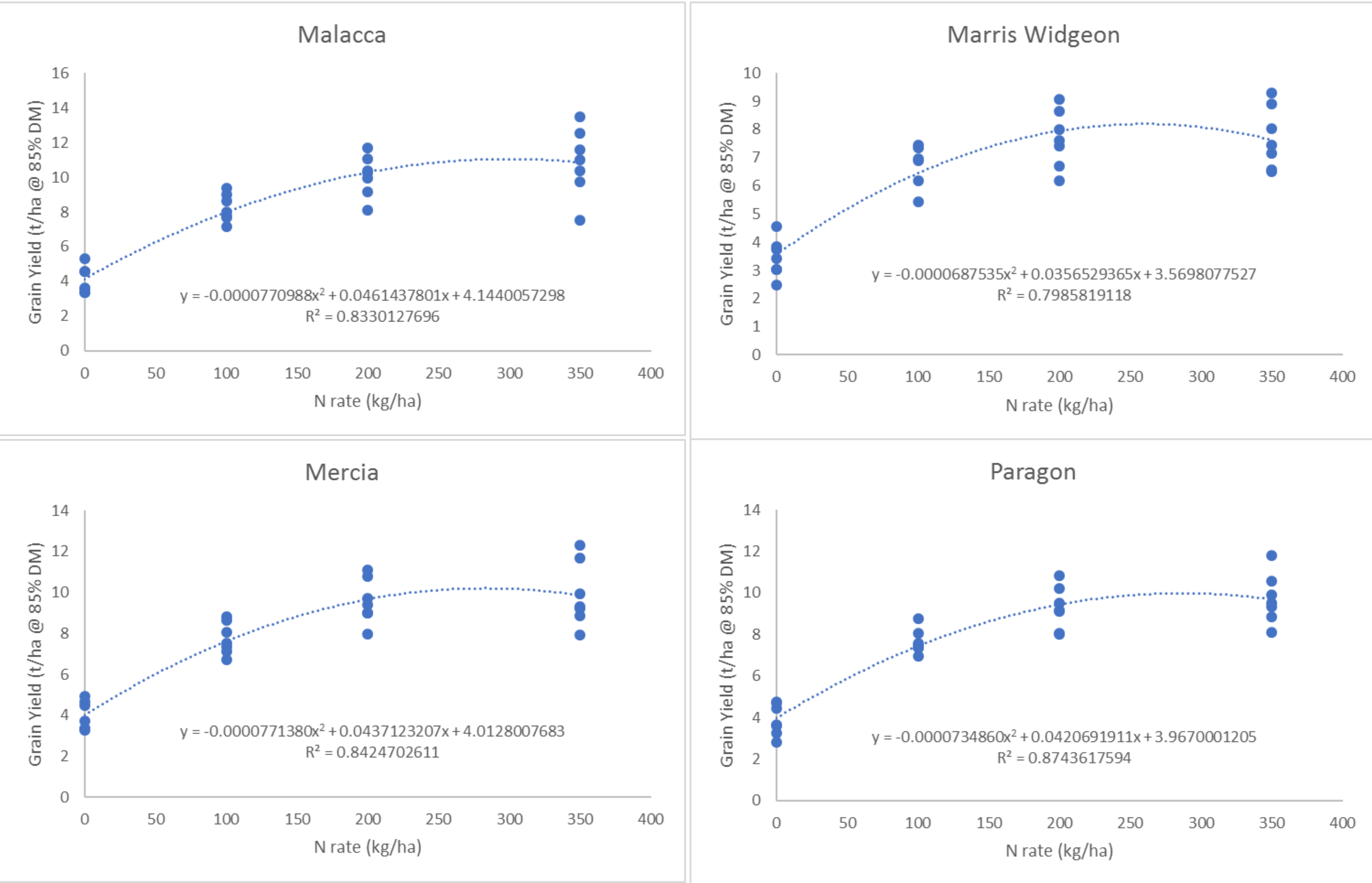




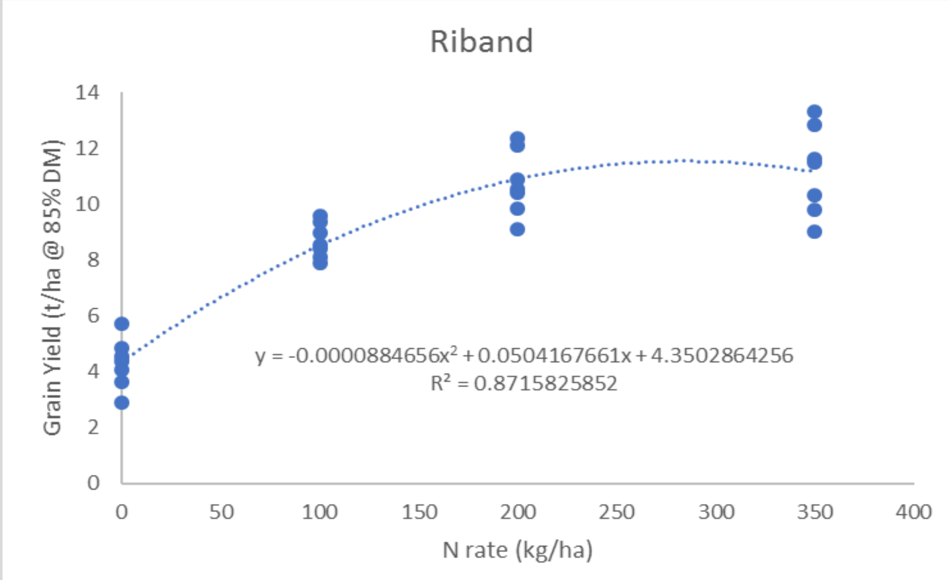


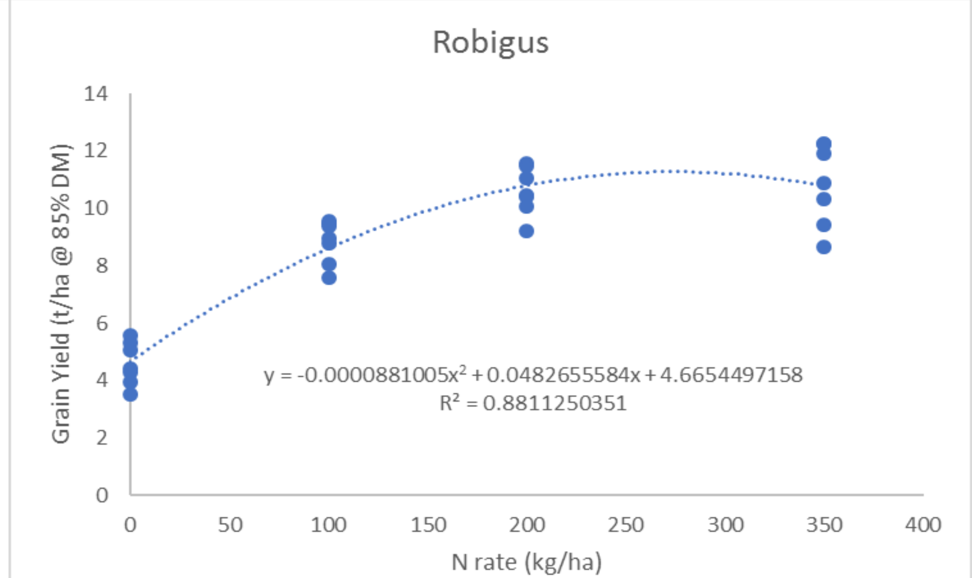


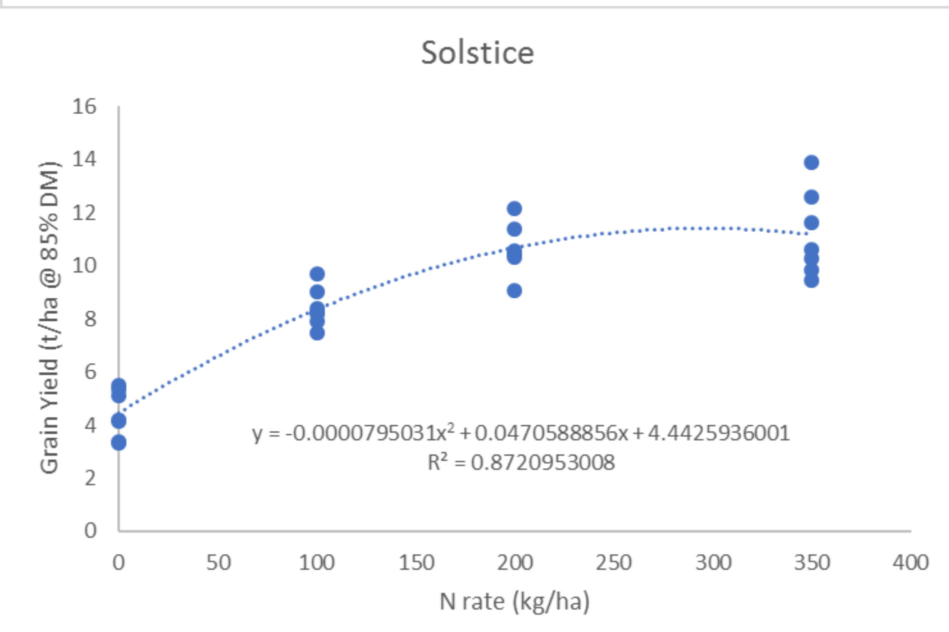
N Response by varieties grown 2011-2017 incl

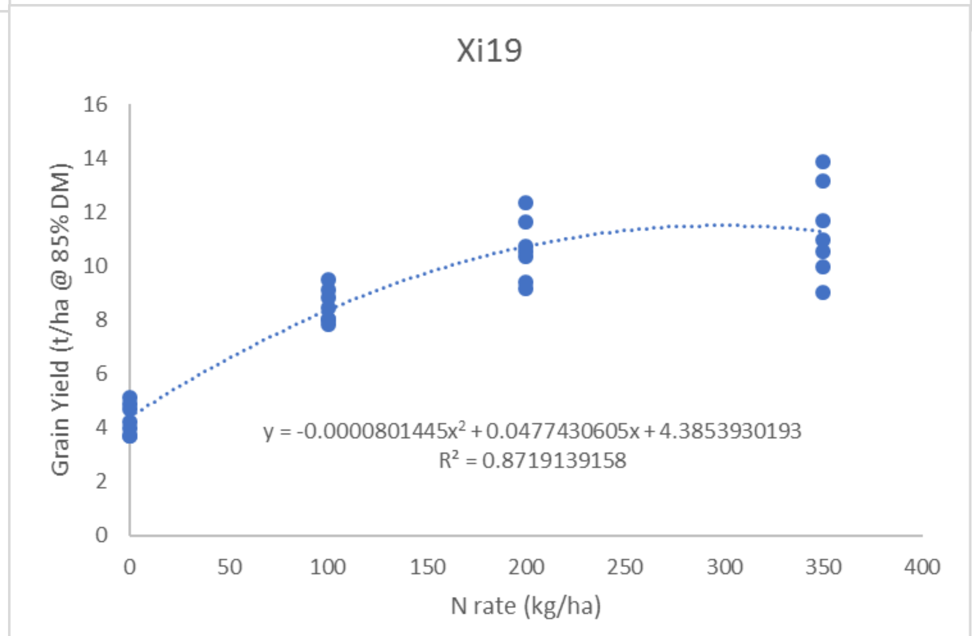


N Response by varieties grown 2011-2017 incl

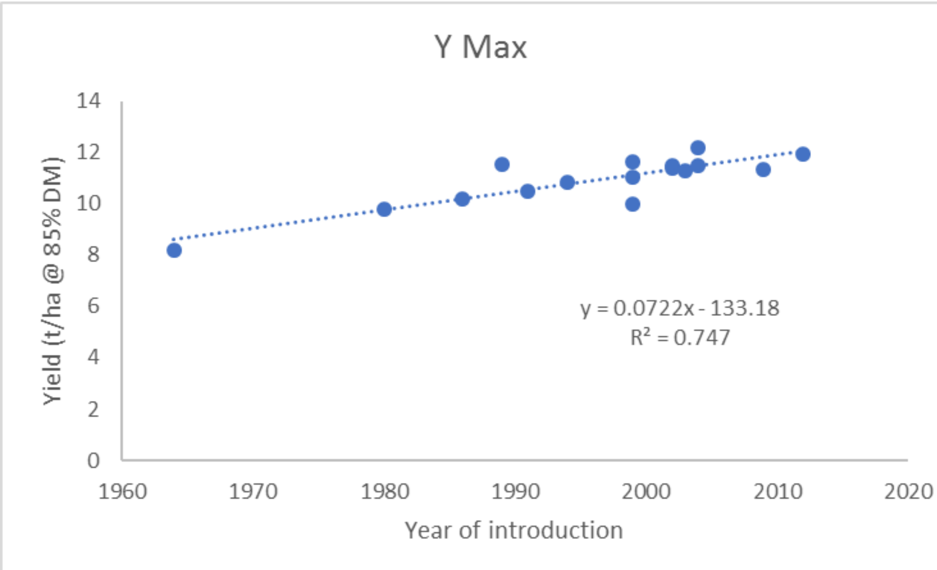


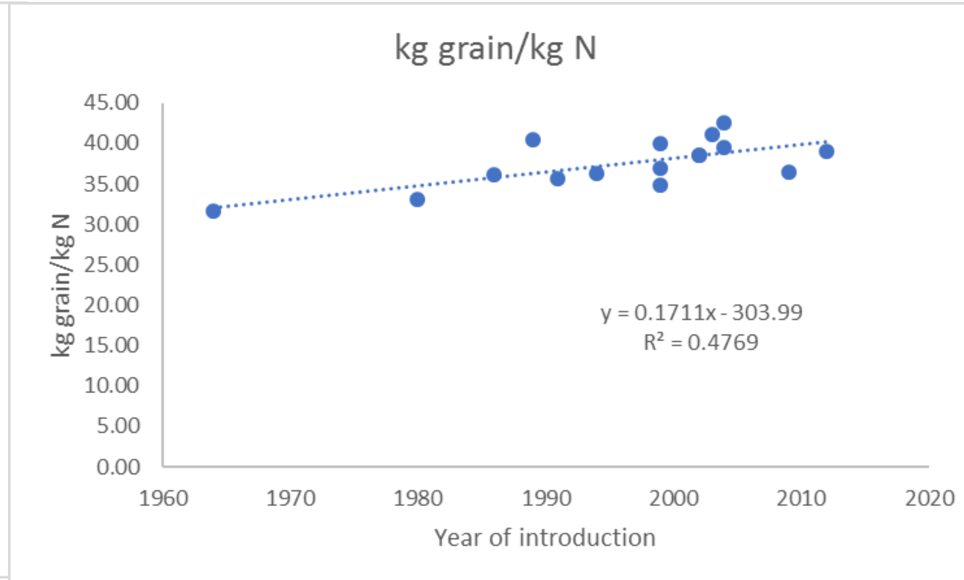


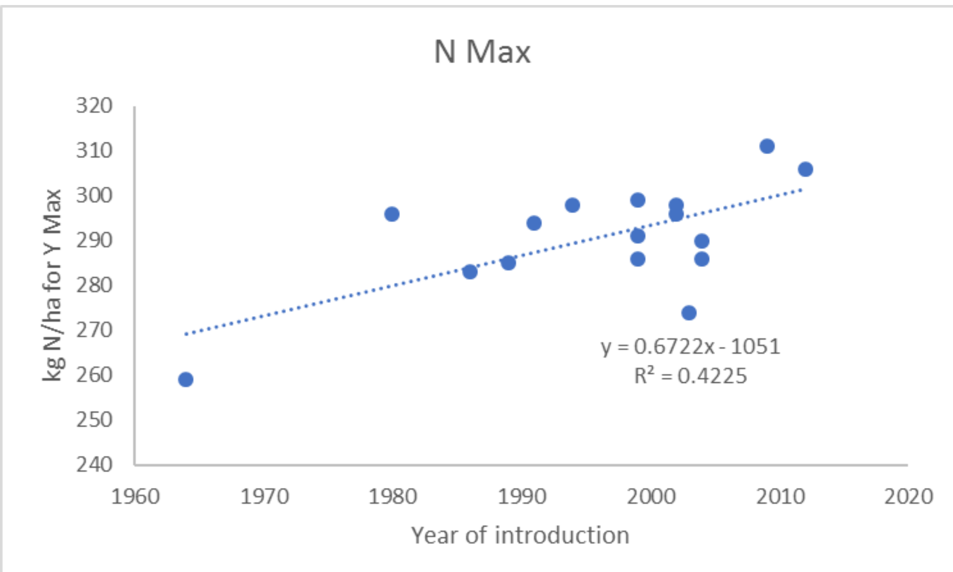




N requirement for Max yield







Yield	0.722	t/ha/decade increase
N	6.722	kg/ha/decade increase
kg grain/kg N	1.711	kg/ha/decade increase

ROTHAMSTED RESEARCH

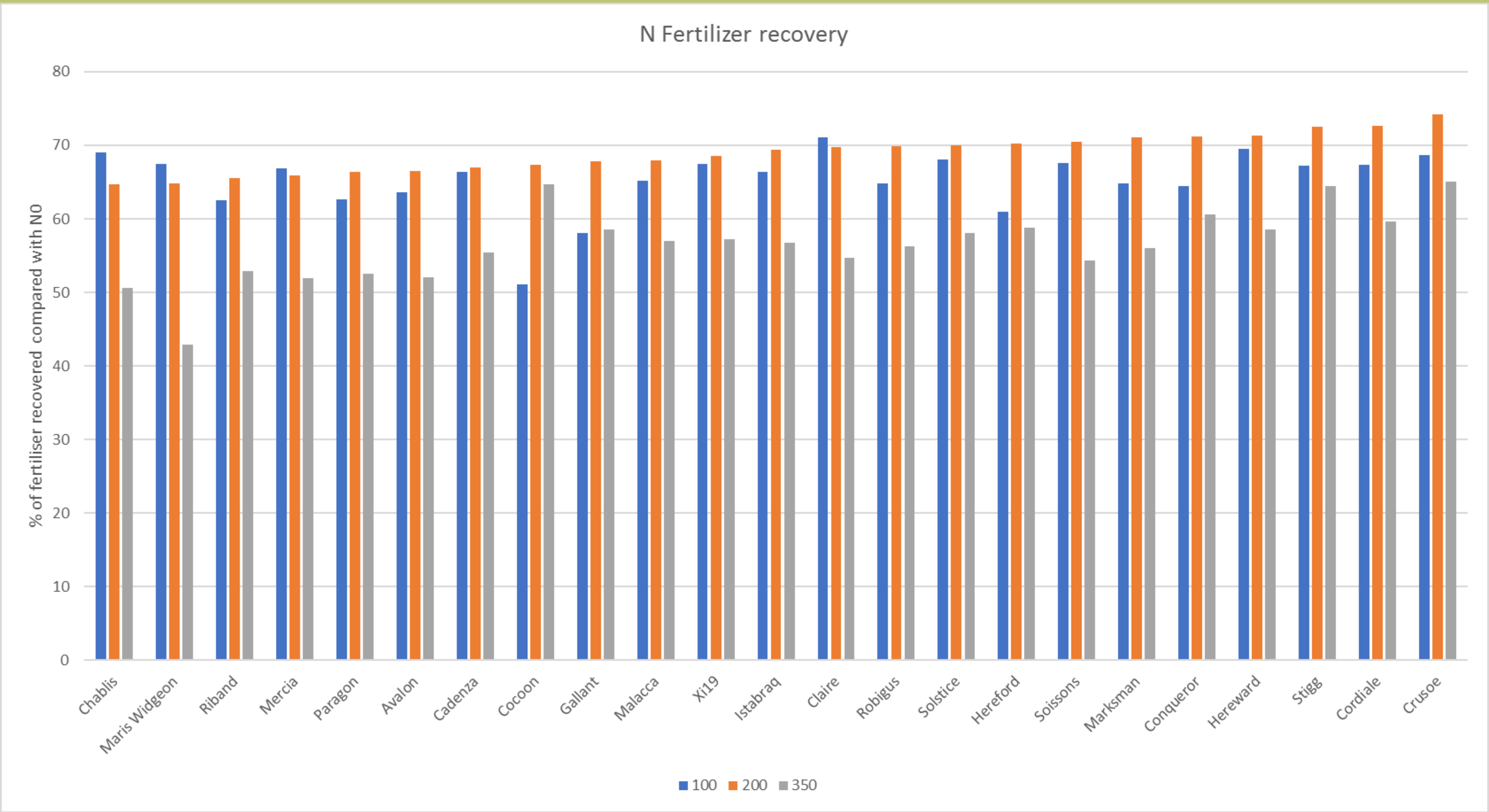
N Fertiliser recovery

A different way of assessing N uptake efficiency:

- Ignore soil N data
- Take the N0 uptakes to represent ‘background’ N – then calculate the % of fertilizer applied taken up at each N level, subtracting the N0 uptakes first

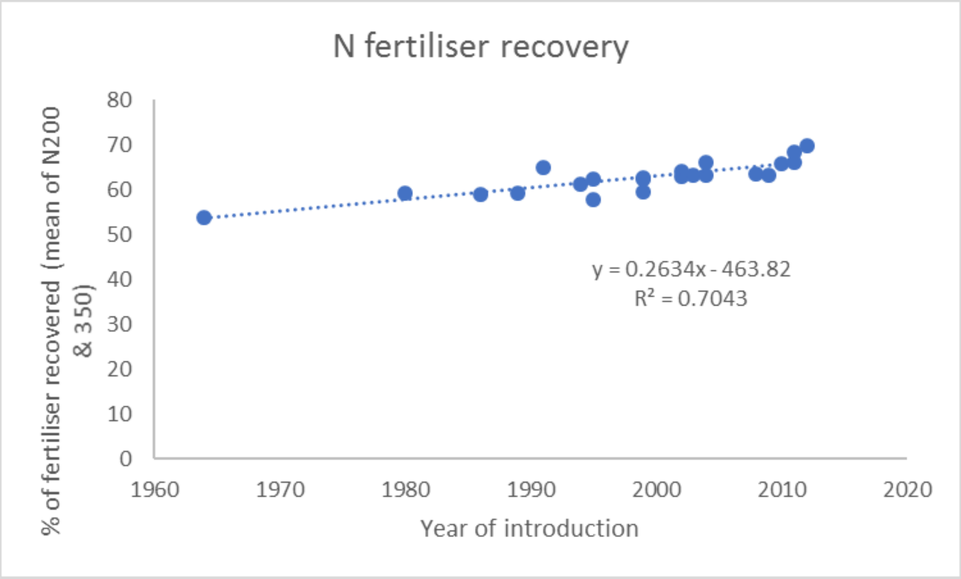
ROTHAMSTED RESEARCH

N Fertiliser recovery



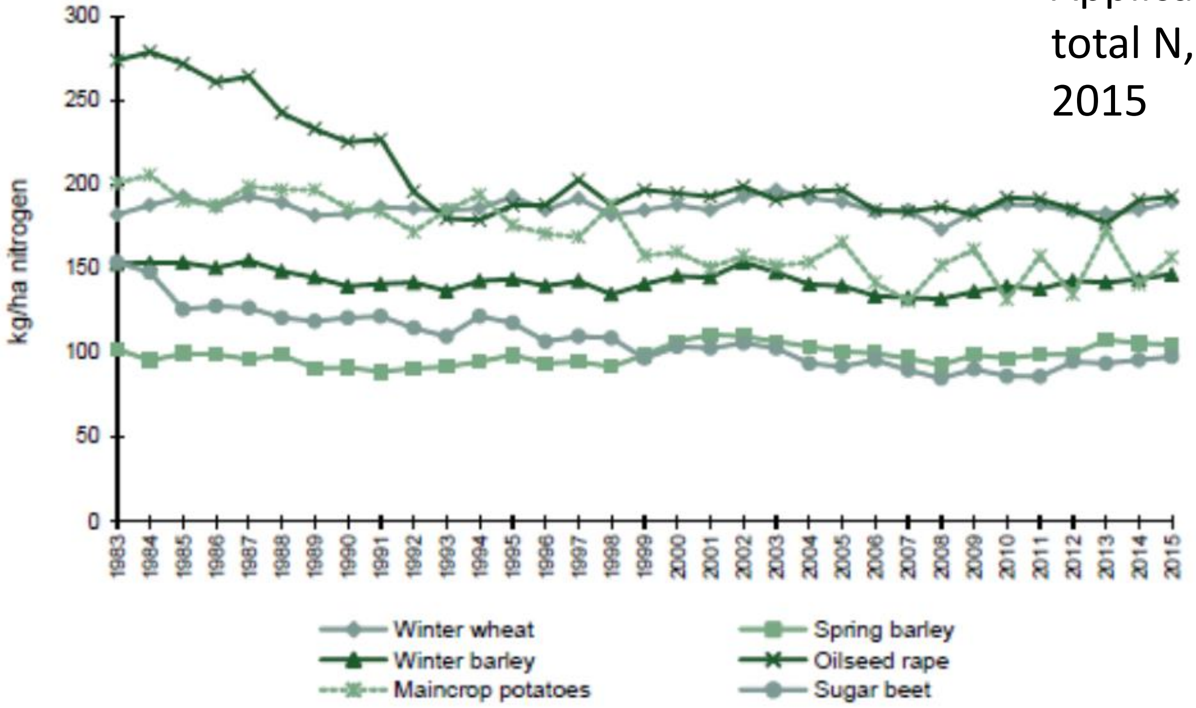
ROTHAMSTED RESEARCH

N Fertiliser recovery



ROTHAMSTED RESEARCH

N Use by growers



Application rates of total N, Gt Britain 1983 - 2015

https://www.gov.uk/government/statistics/british-survey-of-fertiliser-practice-2015

ROTHAMSTED RESEARCH

Conclusions

1. Soil N level has little impact on N uptakes
2. At high N levels modern elites are more efficient at taking up N
3. Modern elites are more efficient at converting N taken up to grain yield
4. Therefore NUE is increasing
5. Yield potentials are increasing, as are N requirements
6. N uptake is more efficient at N200 than N100
7. N fertiliser use is not increasing




ROTHAMSTED
RESEARCH

2019 Varieties

Line	Group	No Yrs in Diversity	Yr of Intro	2019 Justification
Avalon	1	16	1980	Core
Barrel	3	1	2016	New in 2018
Cadenza	2	16	1994	Core
Conqueror	4	8	2010	Common from 2010s
Crusoe	1	9	2012	Common from 2010s
Graham	4	2	2016	New in 2017
Hereward	1	16	1991	Core
Hylux	???	4	2016	Hybrid - kept to see if hybrids yield consistently
Istabraq	4	15	2004	Common in 2000s
Malacca	1	16	1999	Core
Maris Widgeon	1	16	1964	Core
Mercia	1	15	1986	Core
Paragon	1	16	1999	Core
Reflection	4	4	2015	Common in 2010, disease susceptibe
Riband	3	16	1989	Core
Siskin	2	2	2016	New in 2016
Soissons	2	16	1995	Core
Solstice	1	16	2002	Core
Xi19	1	16	2002	Common in 2000s
Zyat	1	1	2018	New in 2019

	No Yrs in Diversity
Leeds	3
Claire	14
Cordiale	13
Hereford	7
Hystar	4
Robigus	14
Skyfall	4
Evolution	3
KWS Lili	3
RGT Illustrious	3

ROTHAMSTED RESEARCH

Acknowledgments

Rothamsted
Malcolm Hawkesford
March Castle
David Steele
Saroj Parmar
Peter Barraclough

Farm Staff
Stephen Goward
Chris Mackay
Nick Chichester-Miles
Mark Gardener

ROTHAMSTED RESEARCH

BBSRC bioscience for the future

Department for Environment Food & Rural Affairs

Wheat Genetic Improvement Network

DFW

4. Cereal aphids

Rhopalosiphum padi

Sitobion avenae

Current season

ROTHAMSTED
RESEARCH

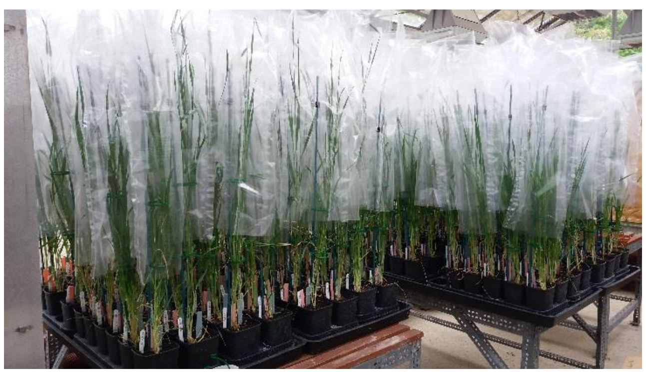
18th June 2018 @ Rothamsted farm

WGIN 3 - Wheat resistance to cereal aphids

ROTHAMSTED RESEARCH

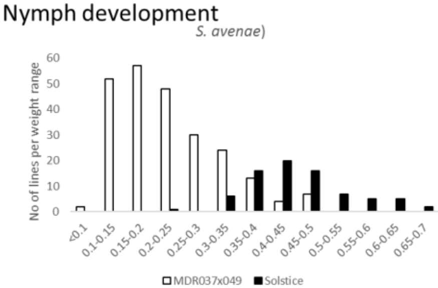
Crosses

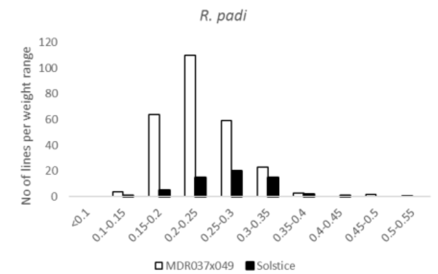
MDR037 x MDR045
MDR037 x MDR049
MDR037 x MDR657



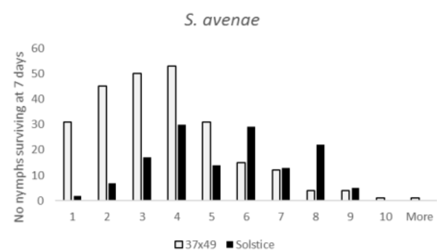
Cross MDR037 x MDR049 (F3)

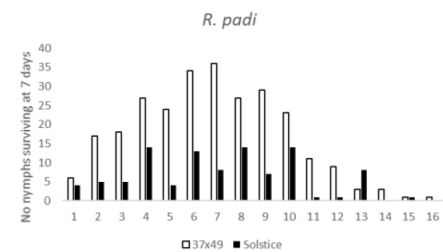
Nymph development





Number of nymphs surviving at 7 days





F1, F2 and F3 generations of these crosses have been tested in the phenotyping screen against the English grain aphid and the bird cherry-oat aphid.

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Neonicotinoid ban

ROTHAMSTED RESEARCH

Farmers Guardian | Topics | Insights | Events | Buy & Sell | Jobs

Neonic ban dates announced

News 01 Jun 2018 Marianne Curtis

The European Commission has said that the sale and supply of neonicotinoid actives clothianidin, imidacloprid and thiamethoxam for outdoor use will cease by September 19, 2018 at the latest, with the sale, storage and use of seed treated with them ending on December 19, 2018 at the latest, according to the Agricultural Industries Confederation (AIC).

Marianne Curtis
Growing up on a family farm in North Yorkshire - Marianne had an early introductio

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Science & Environment

UK 'will support' neonicotinoid pesticide ban

By Roger Harrabin
BBC environment analyst

9 November 2017 Share

FW | LATEST | KNOW HOW | MARKETS | 25° Sutton

Tips on managing BYDV in cereals without neonic seed treatments

Louise Impey
25 June 2018

More in
Arable | Barley | Crop management | Disease management | Pest management | Wheat

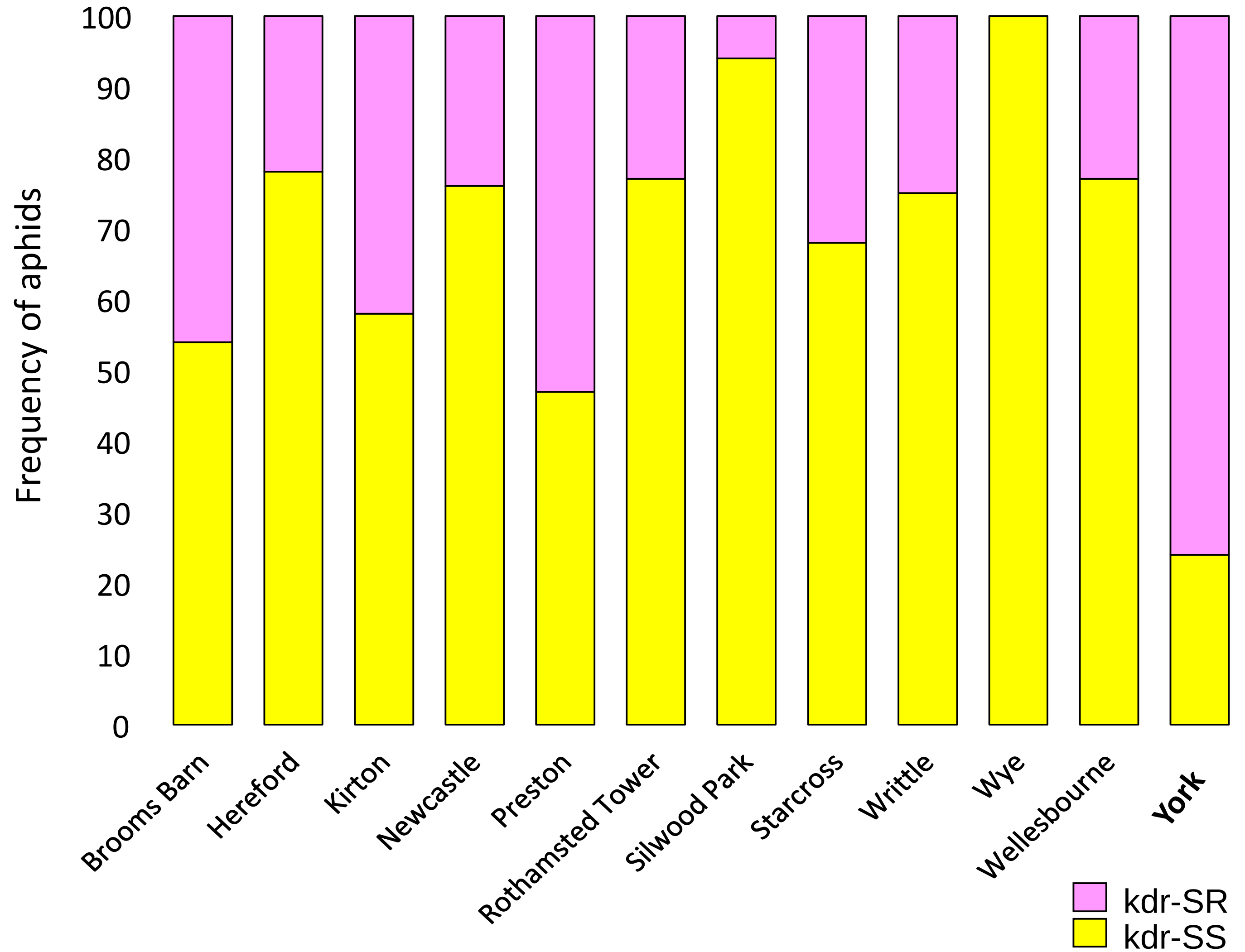

BYDV symptoms in wheat crop © Blackthorn Arable

The loss of neonicotinoid seed treatments means that cereal growers will be up against it when it comes to barley yellow dwarf virus (BYDV) control in the future, according to one expert.

The EU has moved to ban three key neonic insecticides for use as seed

Pyrethroid susceptible (SS) and resistant (SR) *Sitobion avenae* in suction traps (2015)

ROTHAMSTED RESEARCH

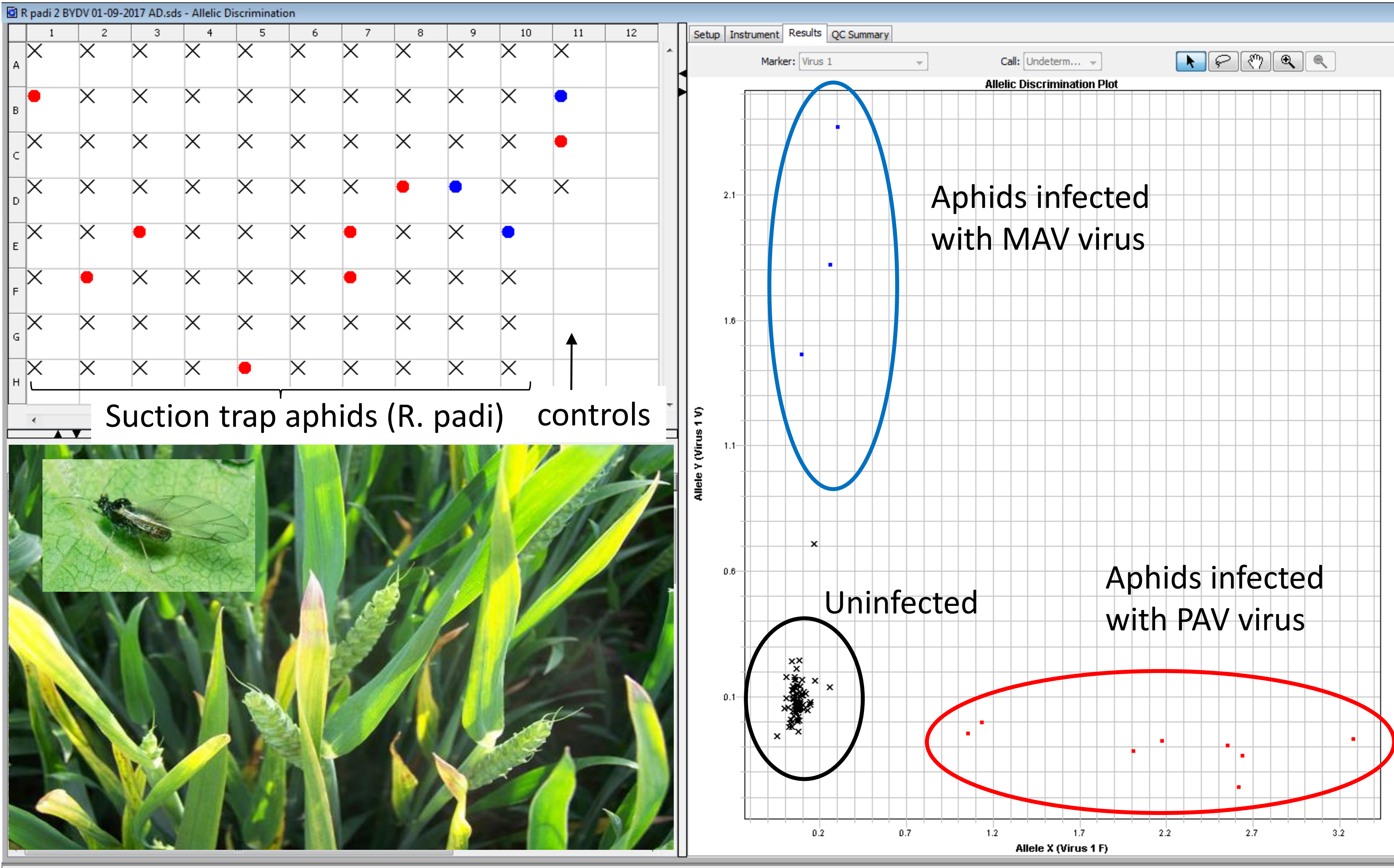


POTATO COUNCIL

Foster et al. (2013) Pest Man. Sci.

A real-time PCR assay for detecting BYDV in cereal aphids

ROTHAMSTED RESEARCH



Martin Williamson

WGIN 4 Cereal aphid overview

ROTHAMSTED RESEARCH

- Screen for resistance/tolerance to BYDV
  - Prioritise by existing data on resilience to *R. padi* and *S. avenae*
    - UK recommended list
    - Cadenza TILLING lines
    - Watkins
    - Diploids e.g. *T. monococcum* and *Ae. Tauschii*
  - Controlled environment – more involved screening
    - Disease severity
    - Plant growth traits measured e.g. no florets per head, number of ears per plant, heading date, seed weight, root length, root-to-shoot ratio
    - BYDV confirmed by qPCR
- On farm trials
  - Starting in year 2, looking at BYDV prevalence and yield effects

Identification and assessment of aphids and BYDV in wheat

ROTHAMSTED RESEARCH

- Assessing BYDV infection and variation in a field trial with 21 lines (18 landraces and 3 modern varieties)
- Recruiting a technician for screening

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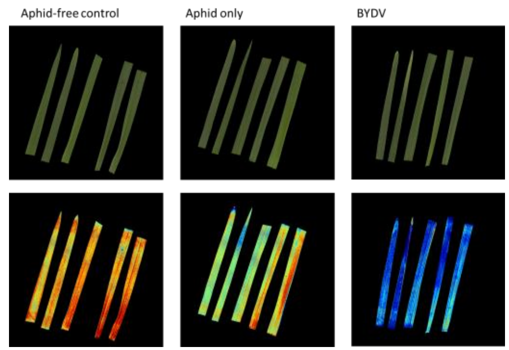
Department for Environment Food & Rural Affairs

AOB

ROTHAMSTED RESEARCH

- Call for lines to test!



- Keeping an eye out for emerging problems

Yellow wheat blossom midge (*Contarinia tritici*)

Cereal leaf beetle (*Oulema melanotus*)

5.

ROTHAMSTED RESEARCH

Resistance to take-all and foliar diseases plans for WGIN 4 –
Vanessa McMillan / Kim Hammond-Kosack *(RRes)*

WGIN MM 28th June 2018 @ JIC

WGIN4@RRes

- **WGIN diversity 15th year + drone analyses**
- **Plans for new Diversity trial + / - biotic stress devised**

  (run over 4 years)

  - 20 cultivars (6-8 from the core cultivar set)

  - 3 N rates: 100kg/ha 50:50:0

  200kg/ha 50:100:50

  350kg/ha 50:250:50

  Split plot design or blocked design

  + / - fungicide programme targeted to control Yellow Rust and Septoria

  - depend on AHDB recommendations
  - chemistry availability (resistant in UK pathogen pop^{n})

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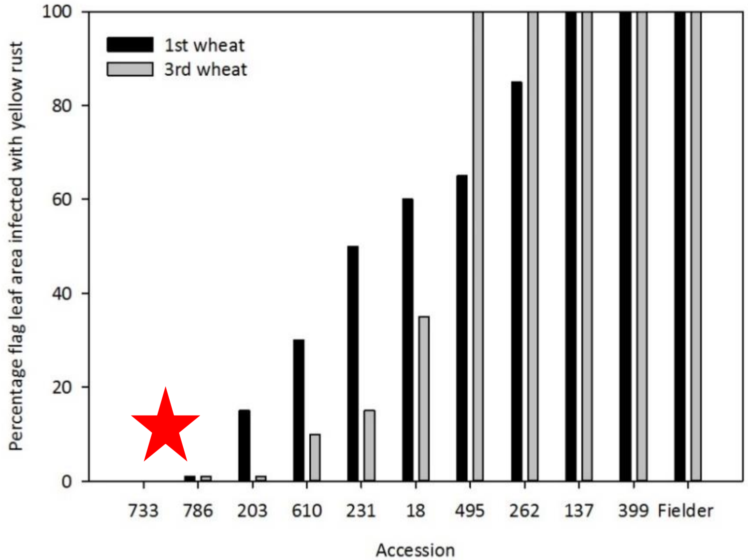
Department for Environment Food & Rural Affairs

Moderate to strong yellow rust resistance identified in Watkins genotypes

ROTHAMSTED RESEARCH



WGIN 3: Five Watkins genotypes with moderate to strong resistance against yellow rust

★ **WGIN4 = F_3 bulked segregant analysis on two most resistant Watkins genotypes**

NIAB – will test the five Watkins lines with specific current / previous YR races

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WGIN 4 Other biotic stress experiments – observation plots + seed bulking

ROTHAMSTED RESEARCH

- **Resistance to Septoria leaf blotch**

(Watkins genotypes, known *Stb* genes,
CIMMYT germplasm)

Septoria leaf blotch

- **3N ancestral introgression rooting trait**

Does this confer resistance/tolerance to take-all disease?

- ***mlo* mediated resistance in wheat**

Are there trade offs under field conditions?

Aegilops uniaristata

Wheat Genetic Improvement Network

Department for Environment Food & Rural Affairs

Wheat Genetic Improvement Network

Additional WGIN3 Populations

John Innes Centre

- 3N alien introgressions (from *Aegilops uniaristata*) into Chinese Spring (three lines Rec4-1, Rec5-1 and Rec 6-3)
- Shows aluminium tolerance
- Al toxicity primarily affects the division and elongation of the root apex

- **3N line shows prolific root phenotype**.
- Crossed to winter elite lines – **Cordiale**, Napier and Robigus

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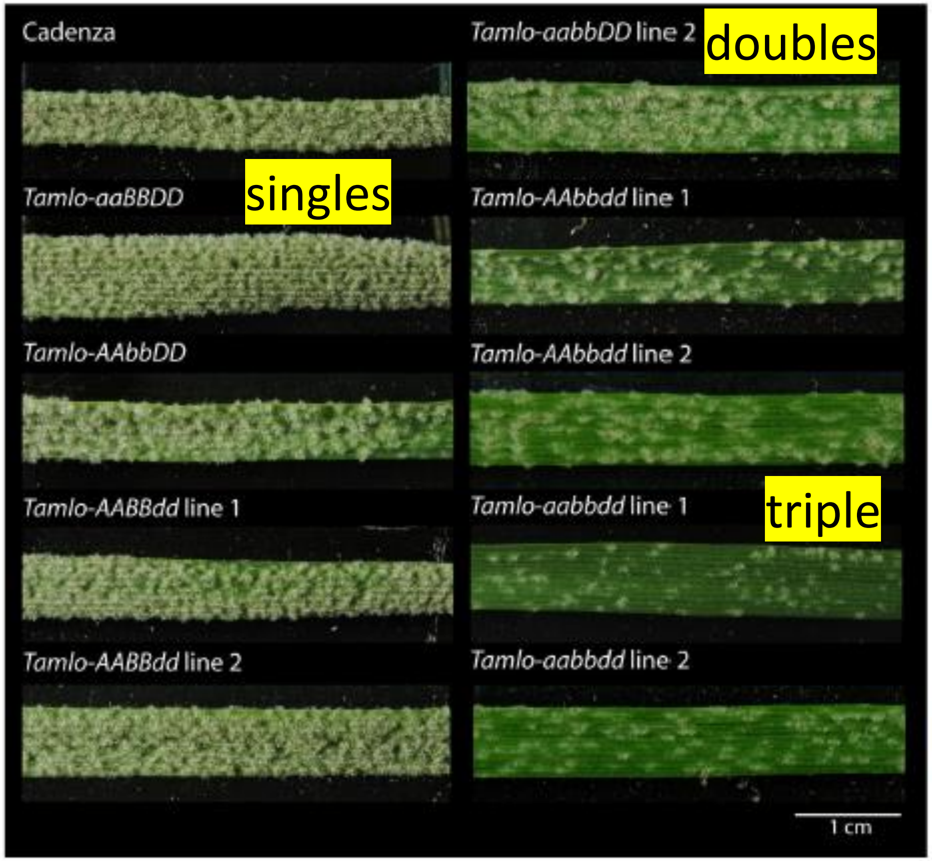
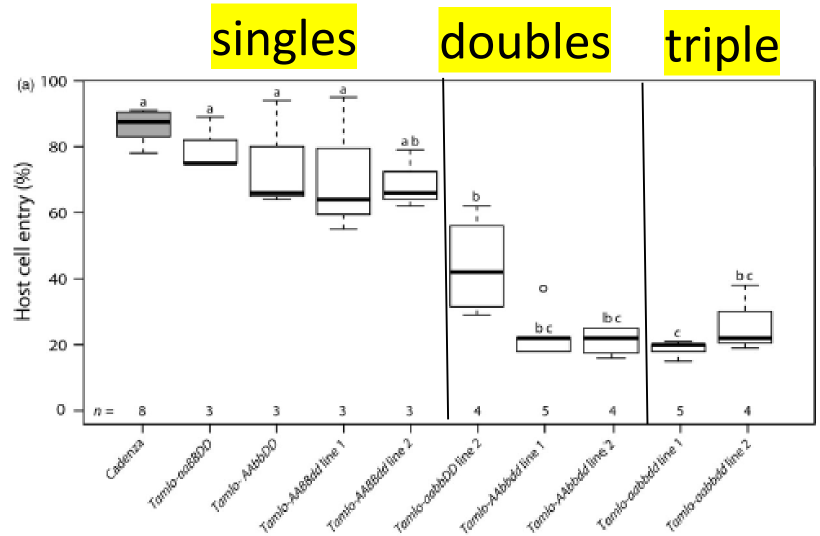
TILLING wheat for *mlo* mediated mildew resistance





Cv Cadenza

Initially WGIN funded

Plant Biotechnology Journal 2017

Plant Biotechnology Journal (2017) 15, pp. 367–378 doi: 10.1111/pbi.12631

mlo-based powdery mildew resistance in hexaploid bread wheat generated by a non-transgenic TILLING approach

Johanna Acevedo-Garcia[1], David Spencer[1], Hannah Thieron[1], Anja Reinstädler[1], Kim Hammond-Kosack[2], Andrew L. Phillips[2] and Ralph Panstruga[1]*

Funders: German Federal Ministry of Food and Agriculture

Germany Society for the Advancement of Plant Innovation

WGIN 4 : *mlo* wheat

2018 Field grown 18 selected double and triple lines (as a spring crop)

Observed for growth, development and senescence

2019 and 2020

To explore the double and triple lines susceptibility/resistance to additional pathogens (as a winter crop)

– yellow rust, brown rust, septoria and fusarium

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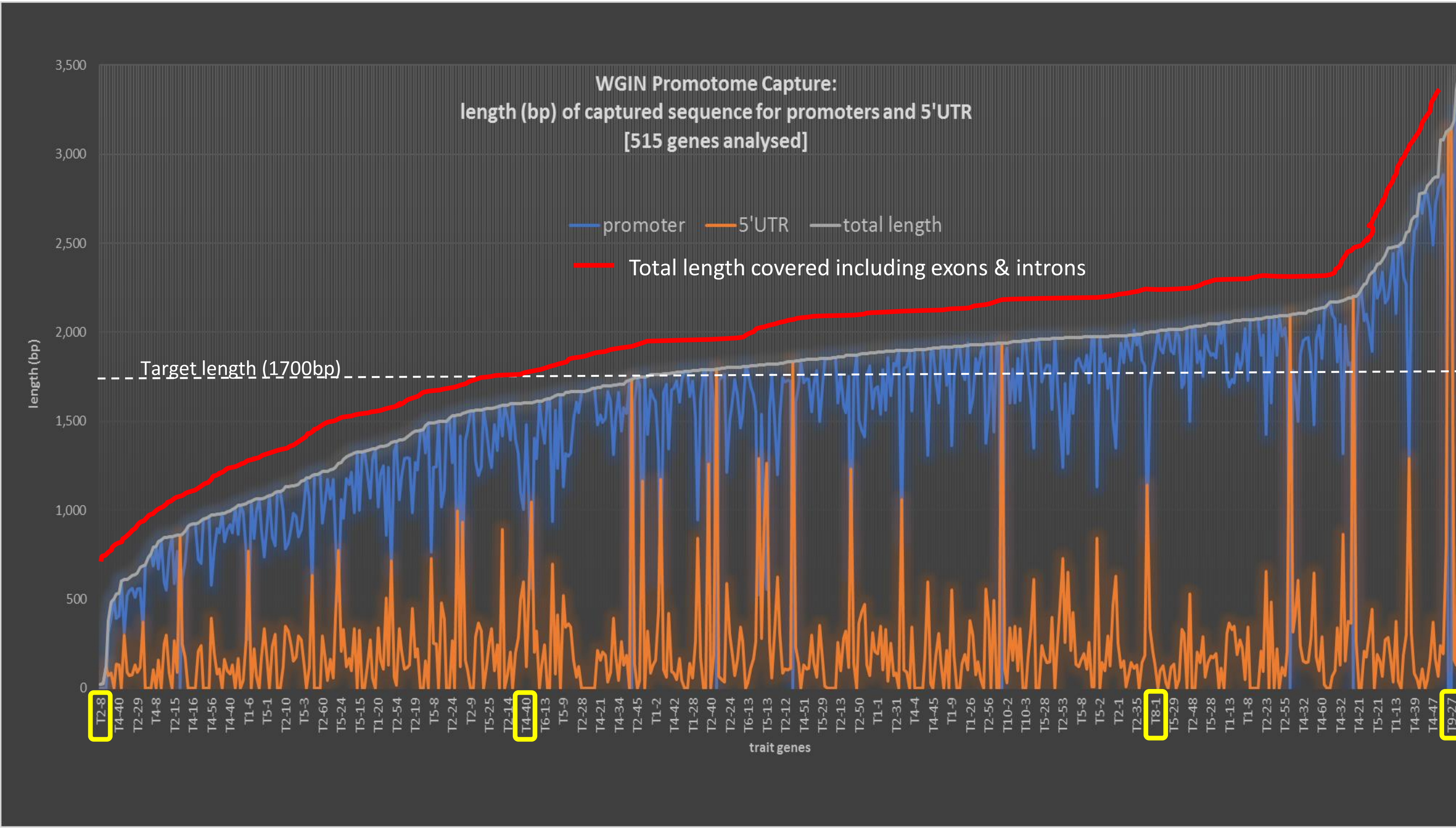
Wheat Genetic Improvement Network

6. Update on WGIN Promotome Capture

Michael Hammond-Kosack (WGIN PA)

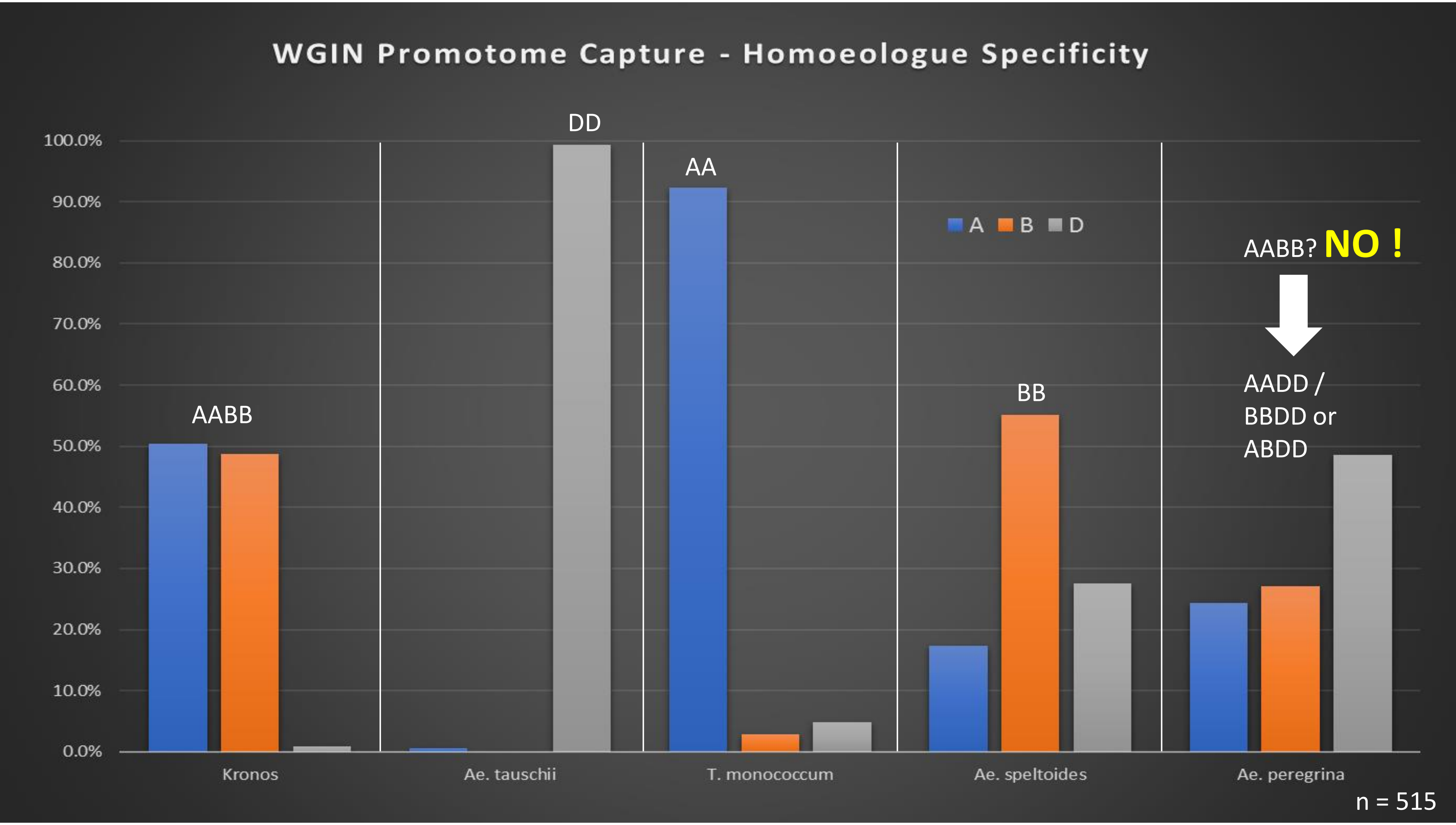
WGIN MM June 28th 2018 @ JIC


WGIN Promotome Capture:
length (bp) of captured sequence for promoters and 5'UTR
[515 genes analysed]
promoter
5'UTR
total length
Total length covered including exons & introns
Target length (1700bp)
length (bp)
3,500
3,000
2,500
2,000
1,500
1,000
500
0
T2-8 T4-40 T2-29 T4-8 T2-15 T4-16 T4-56 T4-40 T1-6 T5-1 T2-10 T5-3 T2-60 T5-24 T5-15 T1-20 T2-54 T2-19 T5-8 T2-24 T2-9 T5-25 T2-14 T4-40 T6-13 T5-9 T2-28 T4-21 T4-34 T2-45 T1-2 T4-42 T1-28 T2-40 T2-24 T6-13 T5-13 T2-12 T4-51 T5-29 T2-13 T2-50 T1-1 T2-31 T4-4 T4-45 T1-9 T1-26 T2-56 T10-2 T10-3 T5-28 T2-53 T5-8 T5-2 T2-1 T2-35 T8-1 T5-29 T2-48 T5-28 T1-13 T1-8 T2-23 T2-55 T4-32 T4-60 T4-32 T4-21 T5-21 T1-13 T4-39 T4-47 T9-27
trait genes

Trait gene	MYbaits	% coverage	Promoter (bp)	5' UTR (bp)	Combined length (bp)	Exons/ Introns
T2-8	4	18.4	0	122	122	Ex1 -> Ex3 (20%)
T4-40	10	50.1	917	78	995	Ex 1 (60%)
T8-1	17	73.4	1872	131	2003	Ex1, In1 (50%)
T9-27	21	94.8	0	3133	3133	Ex1 (25%)

Table 8: MYbaits are specific to each homoeologue **only** if the below coverage pattern is observed. KR = Kronos (AABB), ENT = *A.tauschii* (D)

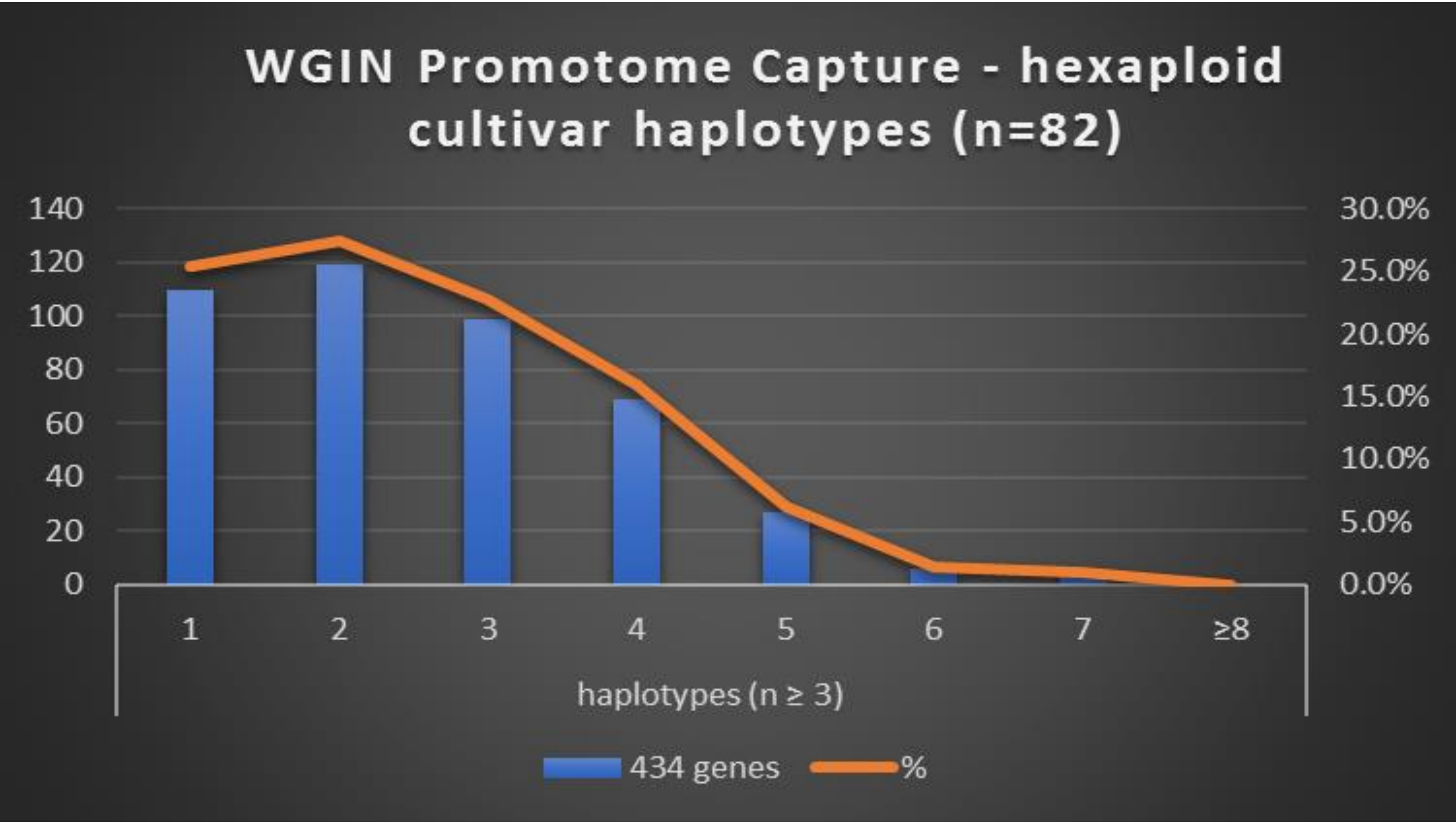
homoeologue	**A**		**B**		**D**	
cultivar	KR	ENT	KR	ENT	KR	ENT
Sequencing coverage	**+**	**-**	**+**	**-**	**-**	**+**


WGIN Promotome Capture - Homoeologue Specificity
100.0%
90.0%
80.0%
70.0%
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
0.0%
A
B
D
AABB
DD
AA
BB
AABB? NO !
AADD /
BBDD or
ABDD
Kronos
Ae. tauschii
T. monococcum
Ae. speltoides
Ae. peregrina
n = 515

ID	cultivar
1	A. speltoides 2140022
2	Abbot
3	Aegilops peregrina (variabilis)
4	Alcedo
5	Ambrosia
6	Avalon
7	Badger
8	Bobwhite
9	Brompton
10	Buster
11	Cadenza
12	Cellule
13	Charger
14	Chinese Spring
15	Claire
16	Coppadra
17	Cordiale
18	Cougar
19	Crusoe
20	Dickens
21	Einstein
22	ENT-228
23	Fielder
24	Flanders
25	Gallant
26	Garcia
27	Gatsby
28	Gladiator
29	Graham
30	Hereford
31	Hereward
32	Hobbit

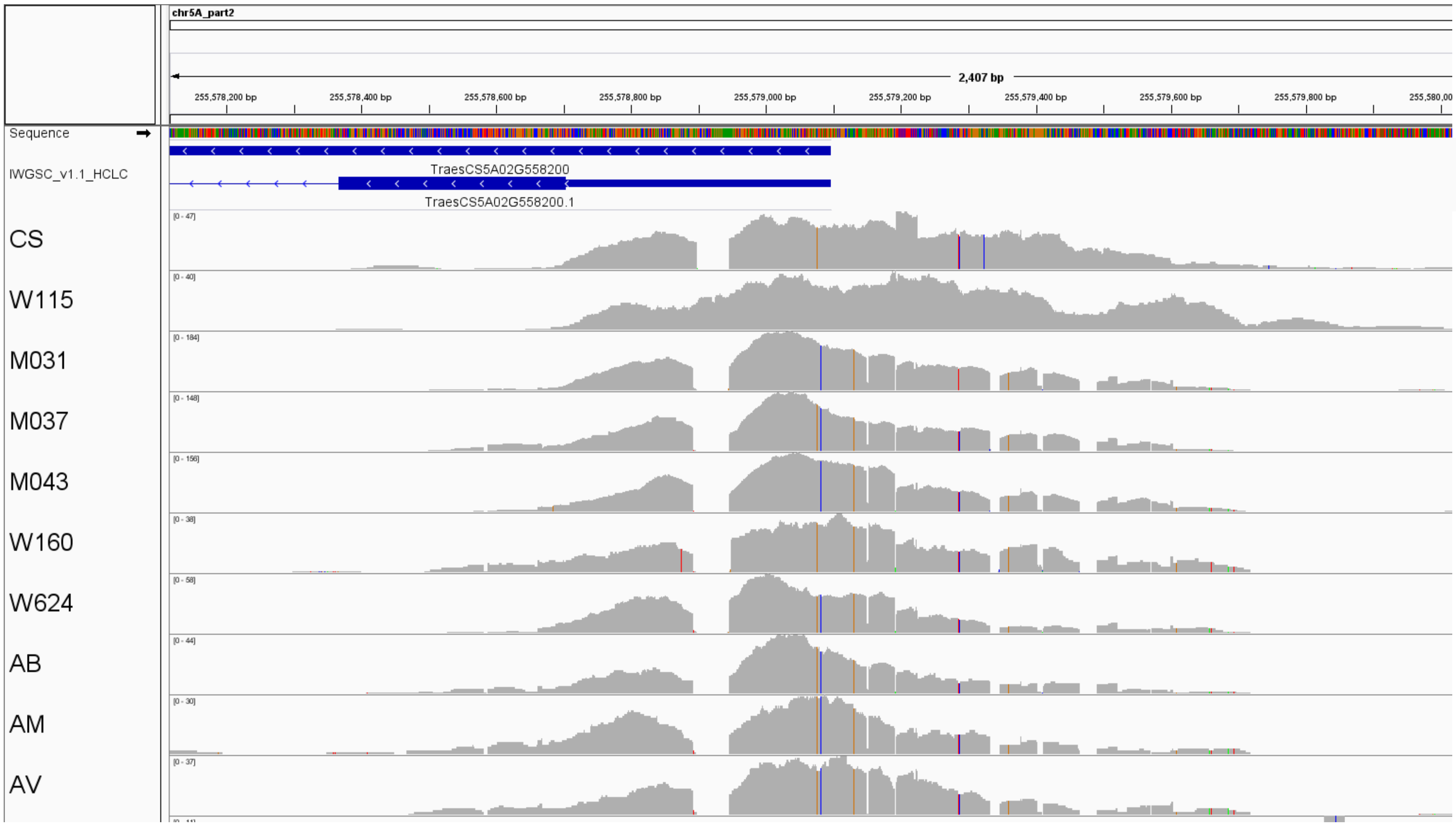
ID	cultivar
33	Hustler
34	Isengrain
35	Istabraq
36	JB Diego
37	Kronos
38	KWS Santiago
39	KWS Silverstone
40	KWS Siskin
41	KWS Trinity
42	Malacca
43	Maris Huntsman
44	Maris Widgeon
45	Marksman
46	Mercia
47	Napier
48	Oakley
49	Paragon
50	Piko
51	Reflection
52	Relay
53	Revelation
54	Rialto
55	Riband
56	Robigus
57	Savannah
58	Scout
59	Sear Synthetic
60	Skyfall
61	Soisson
62	Solstice
63	Spark
64	Stigg

ID	cultivar
65	Sumai 3
66	*T. monococcum* MDR031
67	*T. monococcum* MDR037
68	*T. monococcum* MDR043
69	*T. monococcum* MDR045
70	*T. monococcum* MDR046
71	*T. monococcum* MDR049
72	*T. monococcum* MDR308
73	*T. monococcum* MDR657
74	Taichung 29
75	Ukrainka
76	USU-Apogee
77	Valoris
78	Veranopolis
79	Watkins 115
80	Watkins 141
81	Watkins 160
82	Watkins 199
83	Watkins 203
84	Watkins 239
85	Watkins 209
86	Watkins 246
87	Watkins 292
88	Watkins 387
89	Watkins 579
90	Watkins 624
91	Watkins 733
92	Watkins 777
93	Watkins 786
94	Xi19
95	Yumai 34
96	Zebedee


WGIN Promotome Capture - hexaploid cultivar haplotypes (n=82)
140
120
100
80
60
40
20
0
30.0%
25.0%
20.0%
15.0%
10.0%
5.0%
0.0%
1
2
3
4
5
6
7
≥8
haplotypes (n ≥ 3)
434 genes
%

Tm-Introgression into Landraces & commercial hexaploid wheat?

TaGT2L2 (T5-10) A homoeologue; drought tolerance



Update on *Triticum monococcum* Introgression

Michael Hammond-Kosack (WGIN PA)

WGIN MM June 28th 2018 @ JIC

Latest crossing strategy using tetraploid wheat as a bridging species

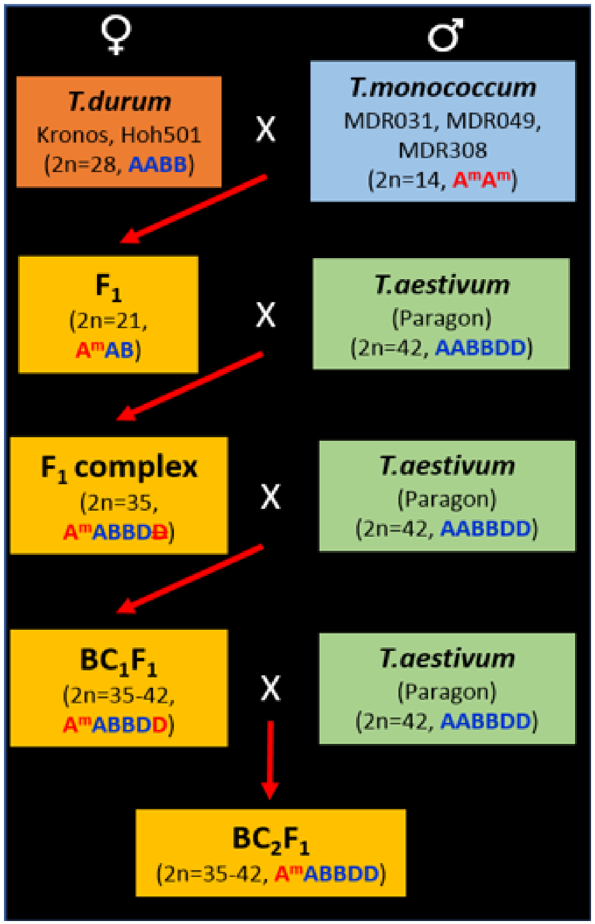


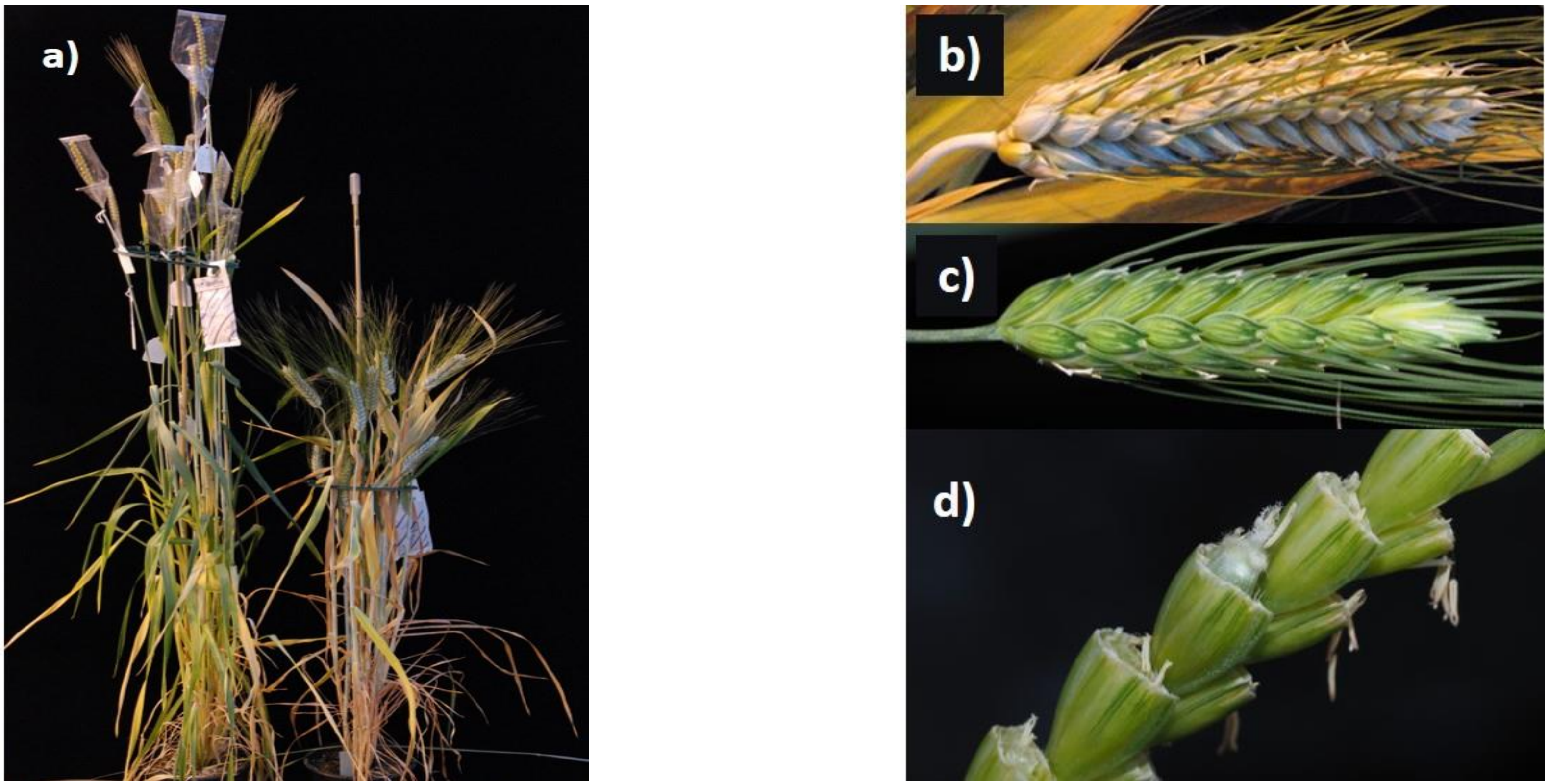
Figure 18: Crossing strategy for Introgression of *T. monococcum* into Hexaploid Wheat. Please note that all germplasms shown on the left are used as the females, to be pollinated with the fertile anthers of the male germplasms on the right (as indicated by the gender signs).

Table 4: 1st round of hybrid crosses between tetraploid *Triticum durum* and diploid *Triticum monococcum* (MDRs)

cross	Grains (F_1)	Ears
Kronos x MDR031	7	7
Kronos x MDR049	4	3
Kronos x MDR308	12	6
Hoh501 x MDR031	8	4
Hoh501 x MDR049	3	3
Hoh501 x MDR308	0	0

Table 5: No of F_1 stigmas pollinated with Paragon and 'F_1 complex' grains obtained

	MDR031	**MDR049**	**MDR308**
Kronos	960 stigmas	120 stigmas	120 stigmas
Grains (% of stigmas)	**7** (0.73%)	**0**	**1** (0.83%)
Hoh501	1920 stigmas	400 stigmas	none
Grains (% of stigmas)	**9** (0.47%)	**0**	**n/a**



a) Comparison of heights of triploid F_1 plant (left) and Hoh501 parent **b)** selfed Hoh501 grain-filled ear **c)** 'selfed' Hoh501 x MDR031 F_1 sterile ear (empty) **d)** ripening 'F_1 complex' grain. Note extruded anthers in c) and d) which never contained any pollen**.**

Germination of F_1 Complex Grains

#	cross	germinated	vernalisation
24	[Kronos x MDR**031**]x[Paragon]	YES	YES
25	[Kronos x MDR**031**]x[Paragon]	NO	YES
27	[Kronos x MDR**031**]x[Paragon]		YES
34	[Kronos x MDR**031**]x[Paragon]		YES
40	[Kronos x MDR**308**]x[Paragon]		YES
46-1	[Kronos x MDR**031**]x[Paragon]		YES
46-2	[Kronos x MDR**031**]x[Paragon]		YES
47	[Kronos x MDR**031**]x[Paragon]		YES
66	[Hoh501 x MDR**031**]x[Paragon]		YES
77	[Hoh501 x MDR**031**]x[Paragon]		YES
82	[Hoh501 x MDR**031**]x[Paragon]		YES
84	[Hoh501 x MDR**031**]x[Paragon]		YES
86-1	[Hoh501 x MDR**031**]x[Paragon]		YES
86-2	[Hoh501 x MDR**031**]x[Paragon]		YES
94	[Hoh501 x MDR**031**]x[Paragon]		YES
108	[Hoh501 x MDR**031**]x[Paragon]		YES
112	[Hoh501 x MDR**031**]x[Paragon]		YES

Table 6: 2nd round of crosses between tetraploid *Triticum durum* and diploid *Triticum monococcum*

cross	Grains (F_1)
Kronos x MDR049	0
Hoh501 x MDR049	13
Kronos x MDR308	11
Hoh501 x MDR308	79

7. Dissecting wheat-Septoria interactions

kostya.kanyuka@rothamsted.ac.uk

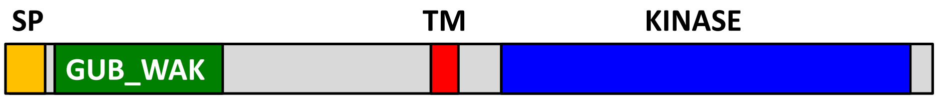
WGIN3/4 Management Meeting, 28th June 2018

ROTHAMSTED RESEARCH

BBSRC bioscience for the future

Lawes Agricultural Trust

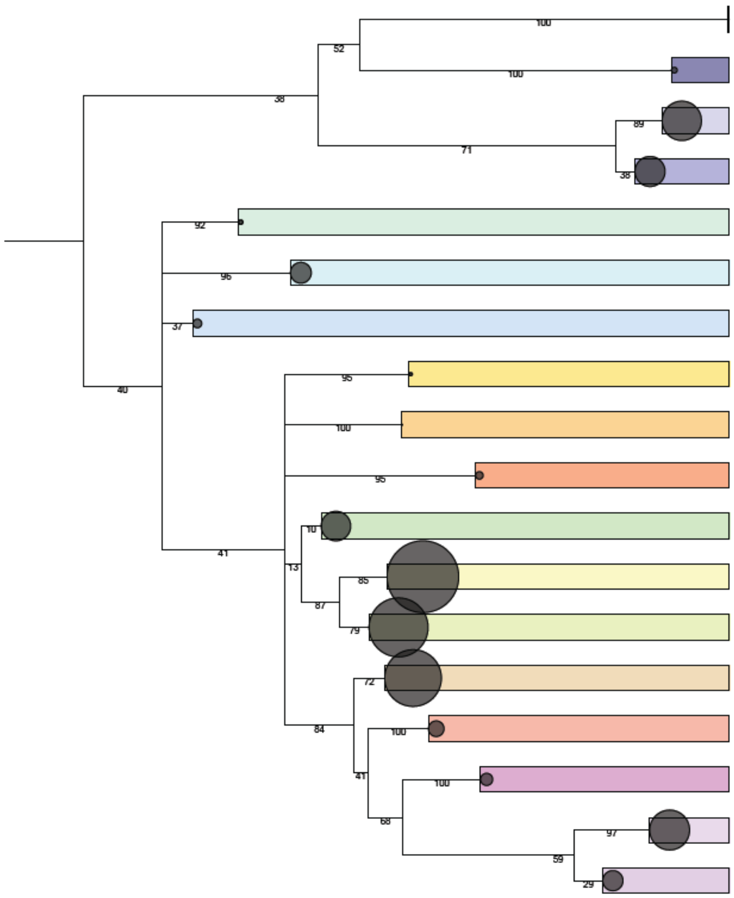
WAKs - new players in plant innate immunity against extracellular pathogens such as Septoria

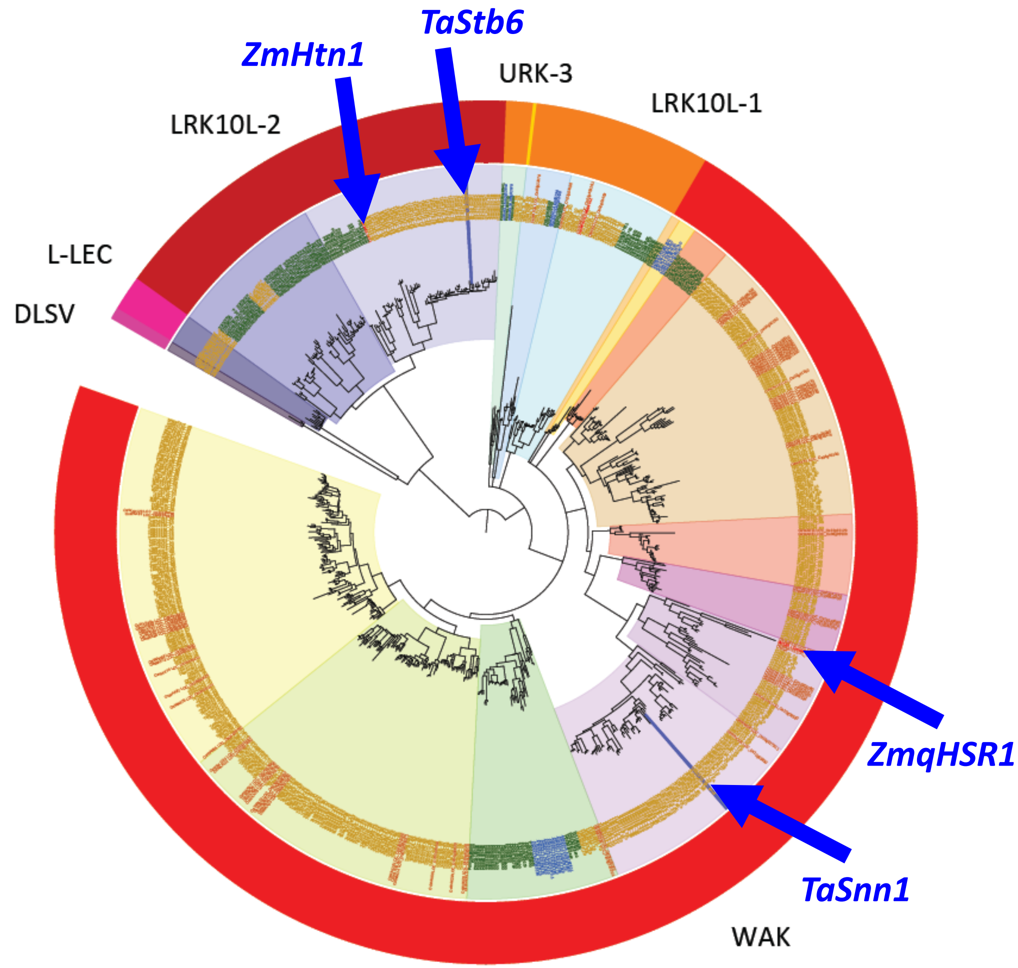


Stb6 / Wall-associated kinase (WAK)

- We isolated the first gene for resistance to Septoria in the DFW project
- We show that Stb6 encodes an extracellular WAK-like receptor protein, which represents a new class of resistance proteins in plants
- WAKs can control qualitative pathogen resistance/or susceptibility in a gene-for-gene manner through recognition of apoplastic Avr effectors (major *R* genes e.g. wheat *Stb6* and *Snn1*)
- WAKs can also control broad-spectrum, but partial, quantitative resistance (QTLs e.g. maize *Htn1* and *qHSR1*)

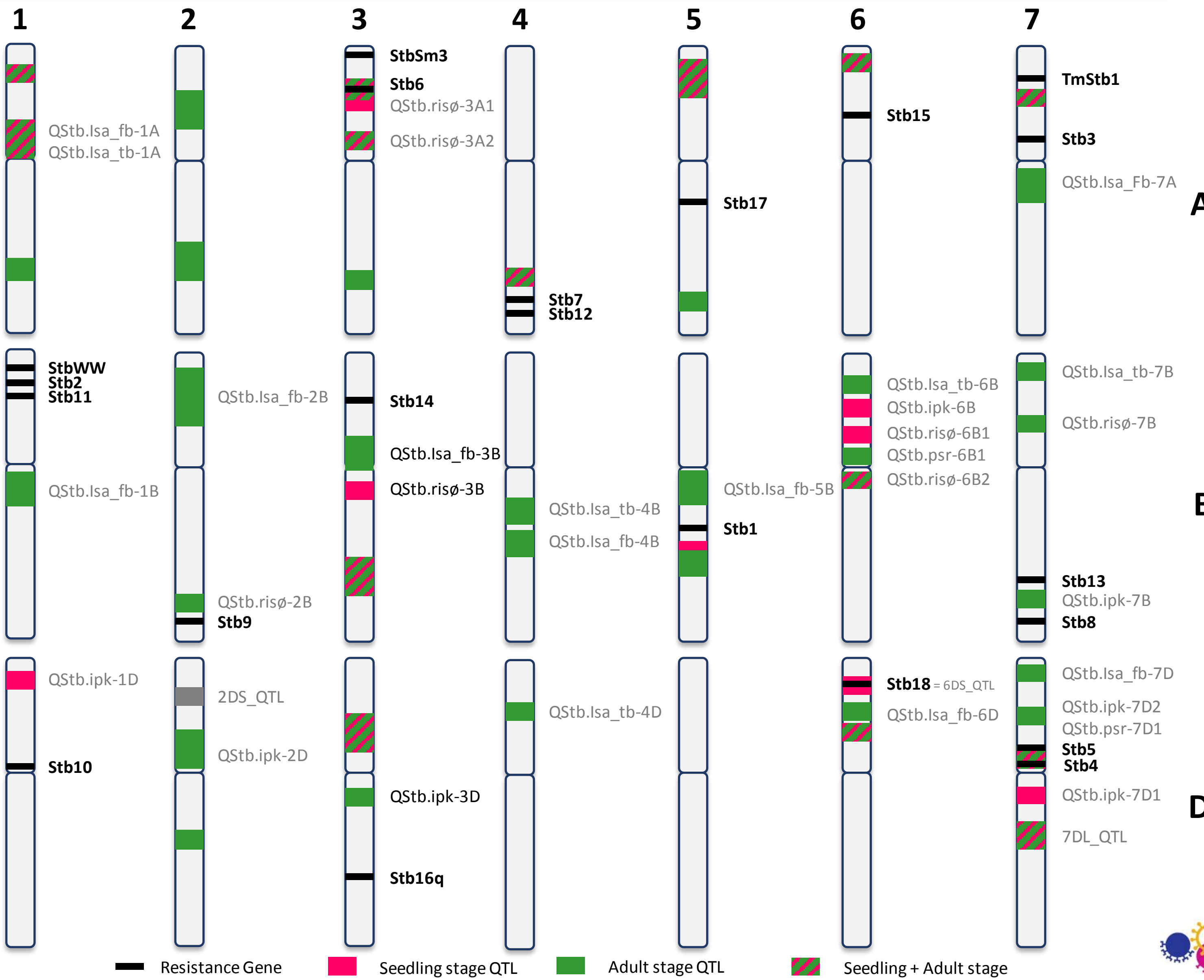
Wheat genome contains 601 WAK genes that can be grouped in 15 phylogenetic clades





Major genes and QTLs for resistance to Septoria

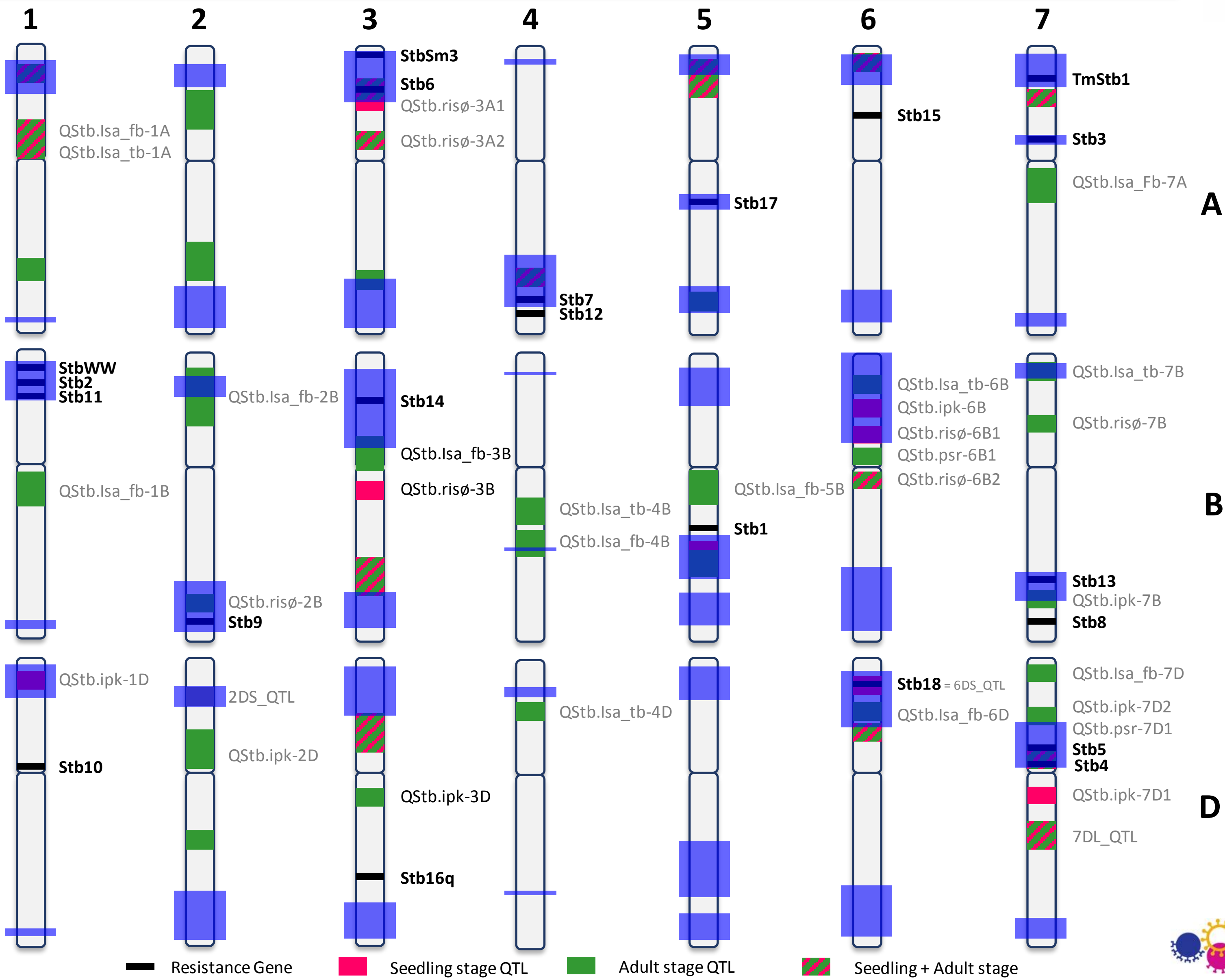
ROTHAMSTED RESEARCH



BBSRC
bioscience for the future

Several WAK gene clusters co-localise with major genes and QTLs for resistance to Septoria

ROTHAMSTED RESEARCH



BBSRC bioscience for the future

Sequence characterisation of the WAK gene family in wheat

Wheat Genetic Improvement Network

defra
Department for Environment Food and Rural Affairs

Aim:
To explore the association between known STB resistance loci and sequence polymorphism in specific WAK genes. This will provide new genetic markers and STB disease resistance genes for use in breeding.

How:

- develop a myBaits array for capturing coding and promoter sequences of all 601 wheat WAK genes in wheat **– done!**
- capture and sequence WAK sequences from **96 wheat lines** with known differential responses to Septoria
- identify WAK genes that may be associated with STB resistance

DNA capture and sequencing is planned for early September 2018.

Therefore, **breeders,** you are welcome to nominate your promising cultivars/breeding materials/exotic wheat or other wheat genotypes showing good levels of resistance to Septoria and send us 10-20 grains of each as soon as possible!

ROTHAMSTED RESEARCH

8.

AHDB

Dhan Bhandari

AHDB Arable KE

WGIN Management Meeting,
JIC, 28th June 2018

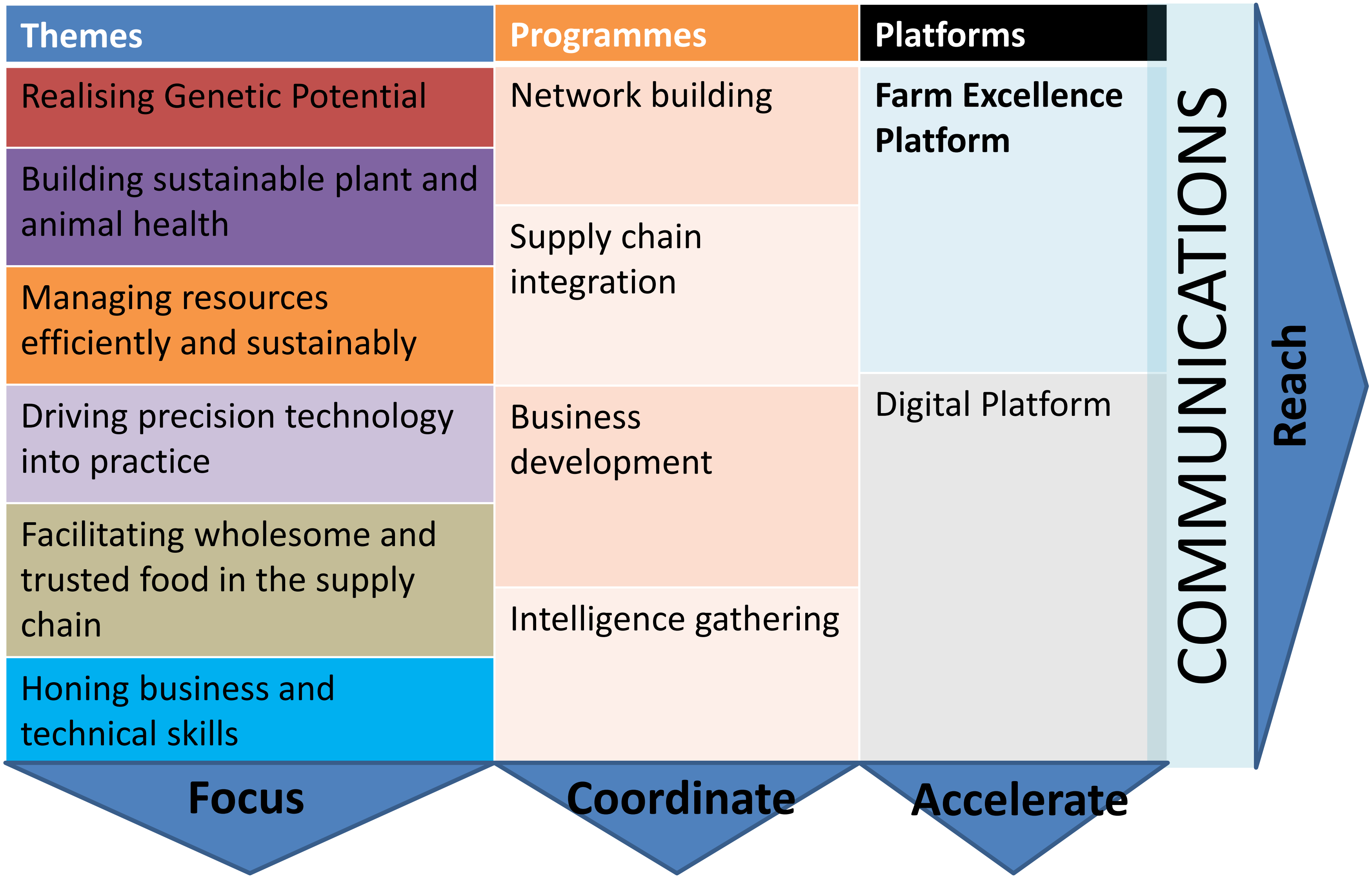
CEREALS & OILSEEDS

AHDB Strategic objectives 2017 - 2020

1. Inspire farming to be competitive & resilient
2. Accelerate innovation & productivity growth
3. Help industry deliver what consumers will buy
4. Deliver leadership & horizon scanning

Needs coordinated research & knowledge exchange

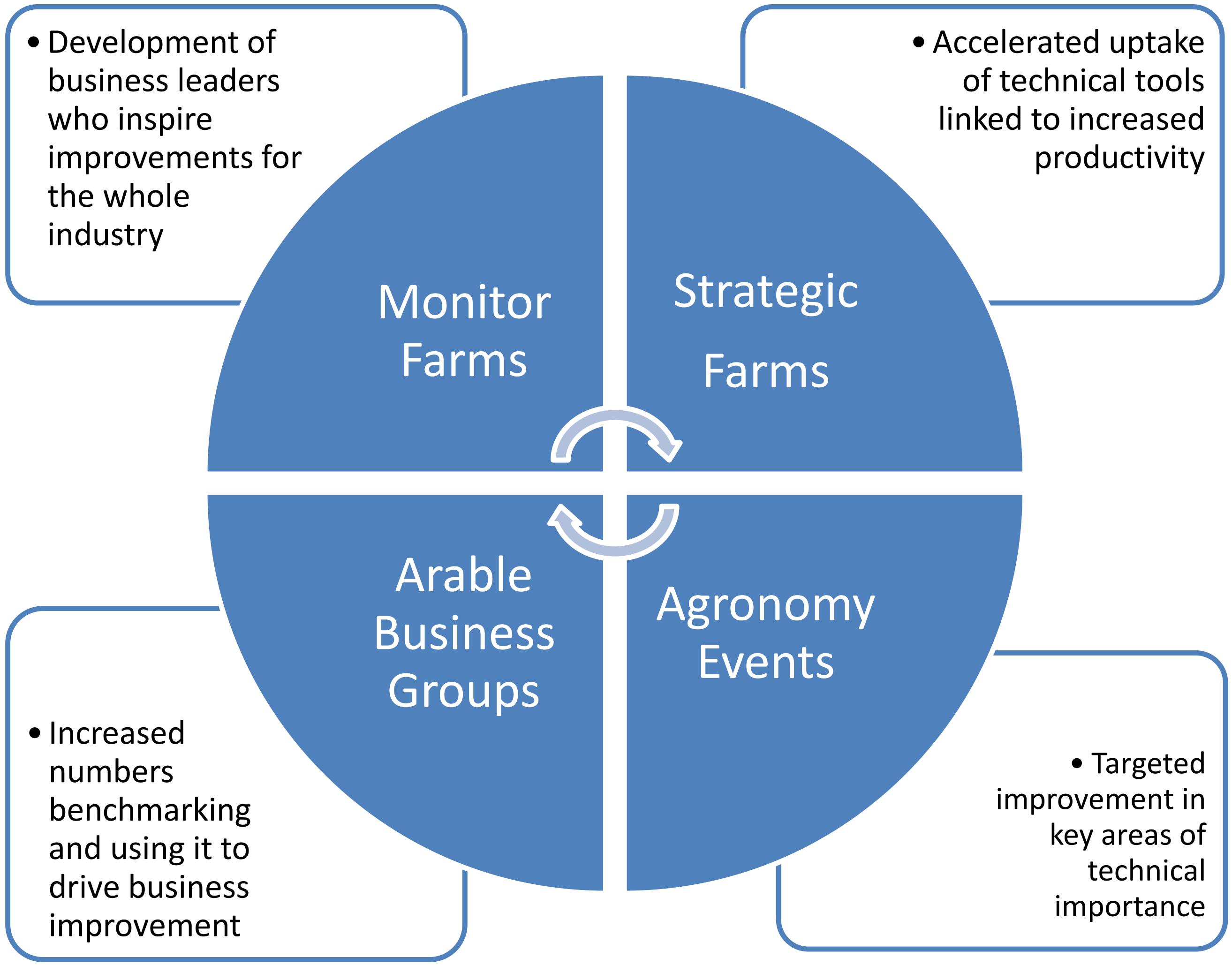
AHDB KE Excellence Programme



Arable Farm Excellence Platform

Harnessing the proven benefits of "farmer to farmer" learning

for growers of Cereals, Oilseeds & Potatoes



Arable Farm Excellence programme

- 7 **Strategic Farms** (5 meetings/year) – rolling 6-year cycle
- 23 **Monitor Farms** (5 meetings/year) – rolling 3-year cycle
- 50+ Arable Business Groups (1-3 meetings / year)
- 12 regional Agronomy Updates
- 50+ joint events
- Programme of locally relevant meetings = ~300/year

A significant, innovative knowledge exchange initiative

Arable Farm Excellence Network

- Phase Three MFs
- Phase Four MFs
- Scottish MFs with QMS
- Phase Five MFs
- Strategic C&O Farms
- Strategic Potato Farms

Monitor Farm Concept

What is it?

- An established model
- Not a demonstration farm
- Typical commercial business
- Real issues in real time
- Topical & interactive meetings
- Whole Farm Approach
- Benchmarking throughout

Unique underlying philosophy:

Farmer-led and Farmer-c

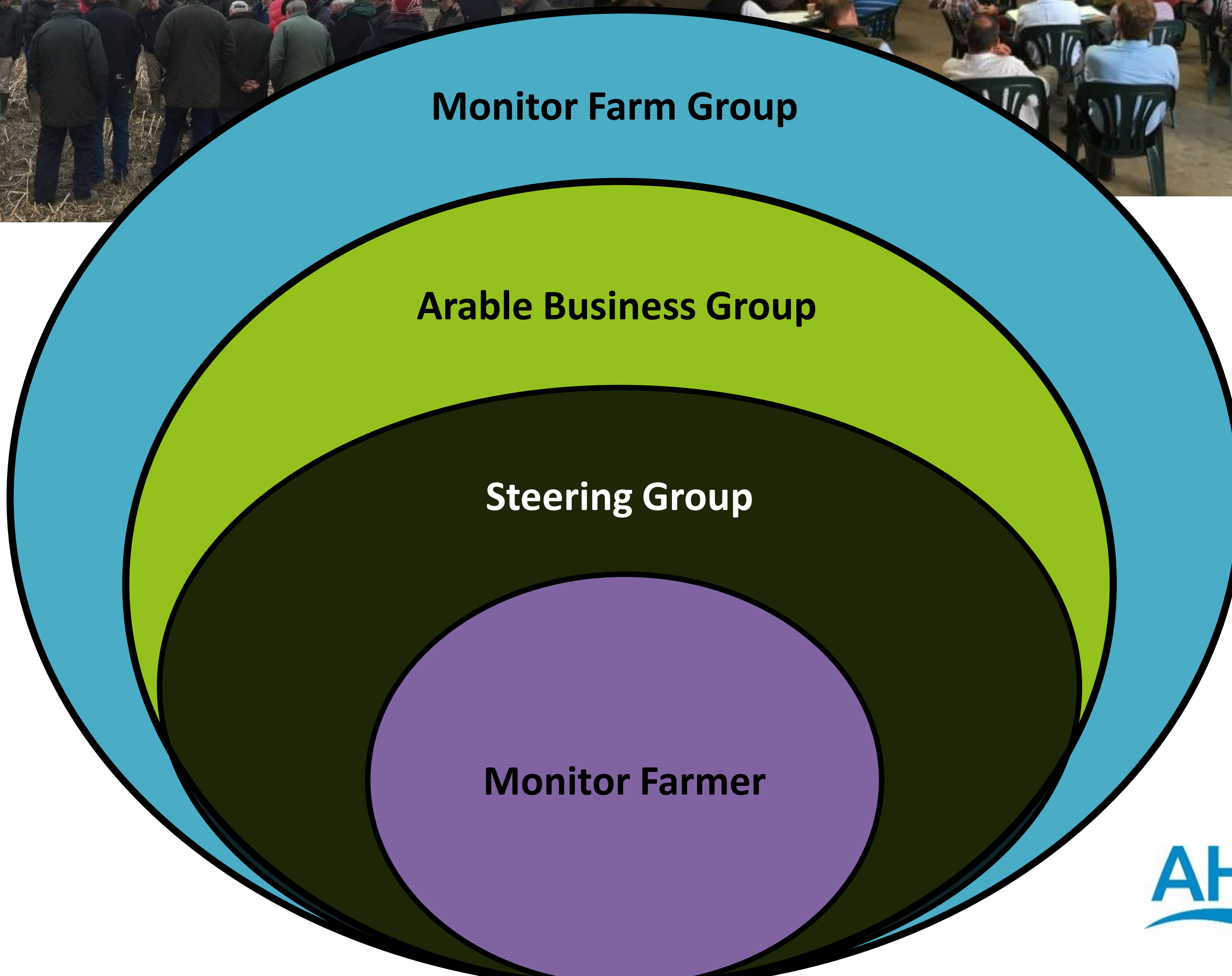
Why benchmark?

- How do you know how good you are?
- How have you done compared with last year?
- How have you done compared to other similar farms?
- Which is your most profitable crop / rotation?
- Where could cost savings be made?
- Is every pound you spend reflected by higher yields?
- At what selling price do you make a profit?

Benchmarking gives you the answers:

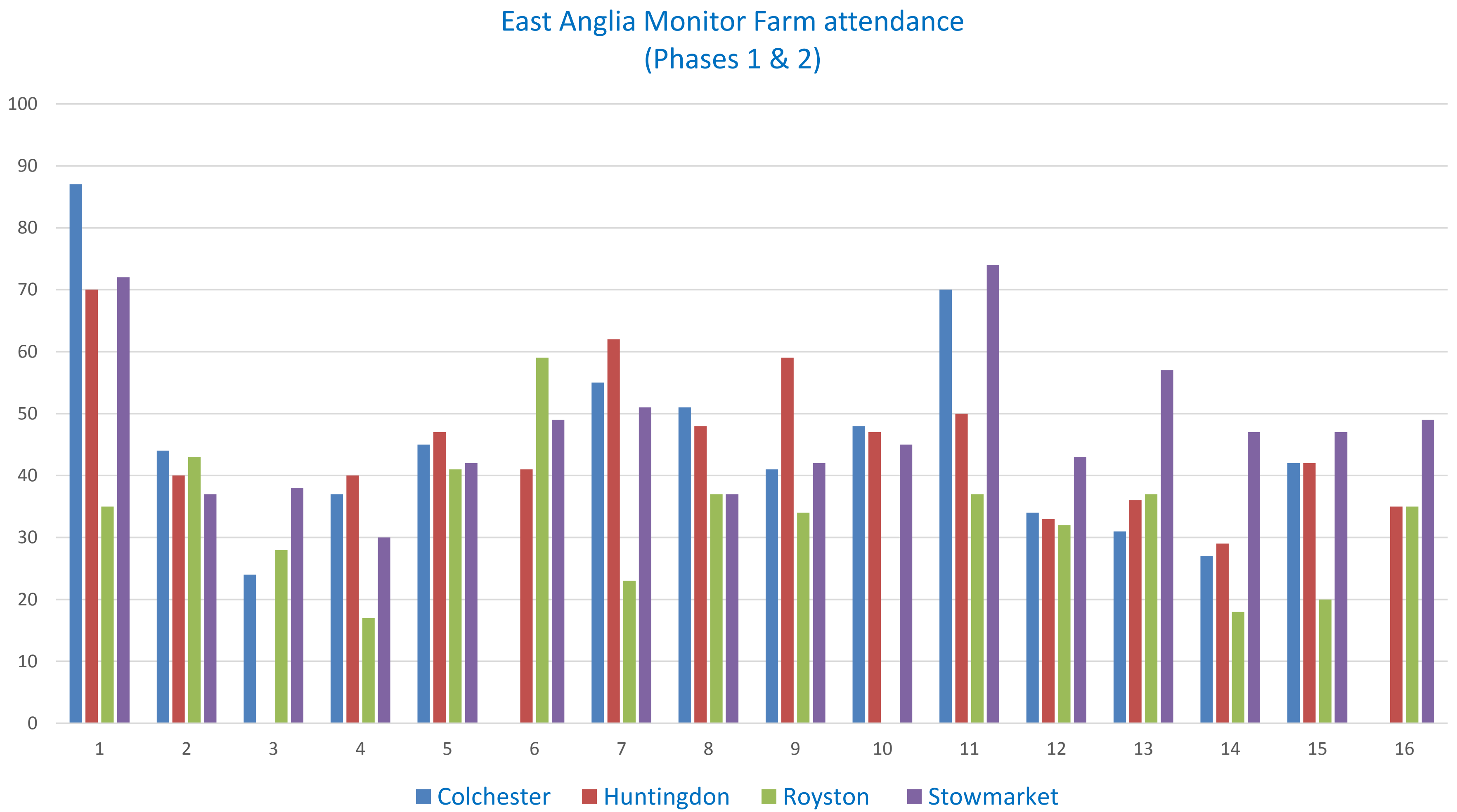
“the search for best practice that leads to superior performance”

Monitor Farm Model



AHDB

Monitor Farm attendance trends



MF meeting topics – the top ten…

	2016/17	2017/18
1	Soils	Cover crops
2	Fixed costs	Weeds
3	Yields	Precision farming
4	Cultivations	Soils
5	Weeds	Marketing
6	Rotations	Machinery
7	Marketing	Risk management
8	Fungicides & pests	Fixed costs
9	Precision farming	Yields
10	Business resilience	Rotations

AHDB – What’s our role?

- Facilitate overall process
- Assist with development of core programme
- Arrange technical input (in-house and third-party)
- Coordinate benchmarking activity
- Manage promotion and communications
- Prepare meeting reports & publish lessons learnt
- Cover direct costs

Monitor Farm summer meeting dates 2018

Farm	Date	Farm	Date
Saltburn Monitor Farm	24 May	Hereford Monitor Farm	21 June
Dereham Monitor Farm	**05 Jun**	Petworth Monitor Farm	21 Jun
Newark Monitor Farm	05 Jun	**Chelmsford Monitor Farm**	**22 Jun**
Bridgnorth Monitor Farm	05 June	Brigg Monitor Farm	26 Jun
Basingstoke Monitor Farm	06 Jun	Warrington Monitor Farm	26 Jun
Cereals Event	**13/14 Jun**	Malmesbury Monitor Farm	26 Jun
Leicester Monitor Farm	19 Jun	Pembroke Monitor Farm	27 Jun
Sittingbourne Monitor Farm	19 Jun	Taunton Monitor Farm	03 Jul
Truro Monitor Farm	19 Jun	Northampton Monitor Farm	04 July
Downpatrick Monitor Farm	19 Jun	Blandford Monitor Farm	05 Jul
Duxford Monitor Farm	**19 Jun**		

Strategic Farms

- Each SF for arable farmers runs for 6 years to allow independent demonstration of research to be conducted across a full rotation.
- Demonstrate new ways of working in a commercial setting and, as approaches are subject to full cost-benefit analyses, can help farmers assess the possibility of changing approaches on their own farms.
- SFs focus on the broader strategic needs of the industry and use trials-based approaches and sound economic data to fulfil those needs.
- Selected research findings and technical developments from AHDB and non-AHDB activity will be identified, tested and demonstrated at the SFs. Short- and long-term field and farm-scale trials will be exploited to generate evidence-based results.

	Monitor Farms	Strategic Farms
Core principle	Farmer led, farmer driven - focus on business, technical and personal development	Research into practice - focus on improving arable productivity through the structured testing and demonstrating innovative practices on field- or farm-scale.
Aim	Encourage and facilitate business improvement through the adoption of new technology and practices.	Accelerate uptake of arable innovation through the testing and demonstrating novel practices
Objectives	1. To bring together groups of like-minded farmers, who wish to develop their enterprise, in an environment which encourages them to share critical performance data. 2. To provide a case study and focus for meetings. 3. To discuss issues and solutions being relevant to, and delivered in a format understood by the local farmers. 4. To develop local/ regional farmer champions proficient in business management.	1. To provide a range of KE and KT opportunities where growers can view, interpret and consider innovative technologies and key research findings that have potential for commercial integration. 2. To provide an accessible platform to test and showcase cutting edge research funded by AHDB and others, with potential innovations identified on-farm, via a structured combination of short and long term field and farm scale trials. 3. To provide a dynamic vehicle for improving productivity, profitability and competitiveness in the UK arable sector.

	Monitor Farms	Strategic Farms
Duration of programme (years)	3 (4-6 open meetings per year).	6 (3 open meetings per year, plus closed group visits).
Steering group	Yes (3-5 including host farmer, local farmers, agronomist & KEM).	Yes (8-10 including host farmer, local farmers, agronomist, Knowledge Exchange Manager, Knowledge Transfer Manager & relevant AHDB Researcher).
Strategic fit	Priority 1: Inspiring British farming and growing to be more competitive and resilient. Activity 2.1: Build growers business profitability and resilience through good business planning Activity 2.5: Collect more financial and yield information on rotational crops and communicate in ways to support grower choice	Priority 2: Accelerating innovation and productivity through coordinate R&D and KE. Activity 2.2: Introducing on-farm/farm scale trialling as part of the KE programme to be able to demonstrate to growers the value of changes proposed Activity 4.1: Drive KE through coordination of national delivery and fast implementation of R&D outputs

Strategic Farms

Strategic Farm East - Stowmarket (started in 2017)

E.J. Barker & Sons is, a family farm partnership and contracting business which dates back to 1957. 513ha arable farm business uses a traditional 12-year rotation, incorporating winter wheat for feed, herbage grass seed and break crops of spring barley, beans, oilseed rape and linseed.

Strategic Farm West (2018-

Robert Fox - Squab Hall farm, based just outside Leamington Spa. Robert farms 400ha of owned and rented land, with a rotation of winter wheat, winter barley, winter OSR, spring beans and spring barley. His challenges include black-grass control, improving soil quality and introducing controlled traffic farming.


‘Inspiring our farmers, growers
and industry to succeed in a
rapidly changing world’

9.

Breeders priority traits – overall outcome of the 2017 questionnaire completed by the individual companies + new GINs Research Advisory Group (RAG) – ***Kim Hammond-Kosack*** *(RRes)*

WGIN MM 28th June 2018 @ JIC

WGIN Breeders Priority Traits Questionnaire (August – November 2017)

- Based around the 10 traits used for the promotome capture experiment plus additional traits identified by the WGIN team
  107 sub-traits

- Eight breeding companies contacted individually

- Outcome: high level of consistency between companies but also notable differences

- Summary of the top results. Max score 30

Wheat
Genetic
Improvement
Network

Department for Environment Food & Rural Affairs

WGIN Breeders Priority Traits Questionnaire (August – November 2017)

Presented to all the breeders at WGIN MM 1st Feb 2018

Resilience	Sustainability	Quality	Resource efficiency
29* Septoria leaf blotch	24* Lodging	**25* Specific weight**	23* Nitrogen
29 BYDV	24 Deep rooting	23 Grain protein deviation	
28 Loss of chemistry	24 Early root establishment	22 Pre harvest sprouting	
25 Yellow Rust	24 Floret fertility	22 Grain size	
24 Floral health - ergot	23 Yield stability	22 Grain filling rate	
24 Floral health - fusarium	23 Season independent yield QTLs	22 Grain filling duration	
23 Aphids	22 Context independent yield QTLs		
22 Bulb Fly	22 Sterility		
	22 Staygreen - canopy senescence		
	22 Stem Height		
	22 Spikelet fertility		
*** max value 30**	22 Ear size		

Wheat Genetic Improvement Network

Department for Environment Food & Rural Affairs

WGIN Breeders Priority Traits Questionnaire (August – November 2017)

➡ included in WGIN 4

Resilience	Sustainability	Quality	Resource efficiency
➡ **29* Septoria leaf blotch**	24* Lodging ⬅	**25* Specific weight** ⬅	23* Nitrogen ⬅
➡ **29 BYDV**	24 Deep rooting	23 Grain protein deviation ⬅	
➡ **28 Loss of chemistry**	24 Early root establishment	22 Pre harvest sprouting	
➡ **25 Yellow Rust**	24 Floret fertility	22 Grain size	
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22 Bulb Fly	22 Sterility		
	22 Staygreen - canopy senescence		
	22 Stem Height		
	22 Spikelet fertility		
* max value 30	22 Ear size		

Wheat Genetic Improvement Network

Department for Environment Food & Rural Affairs

Joint GINs Research Advisory Group
to meet at 6 month intervals

12th June @ RRes

DEFRA
Andy Cuthbertson
Martin Cannell
Luke Spadavecchia

Research Advisory Group members
David Cooper (independent)
Dhan Bhandari (AHDB)
Harriet Trewin (BBSRC)
Sean Mayes (Nottingham University)
Bill Thomas (James Hutton)

GINS – Leaders
Ian Bancroft (OREGIN) University of York
Guy Barker (VEGIN) University of Warwick
Claire Domoney (PCGIN) John Innes Centre
Kim Hammond-Kosack (WGIN) Rothamsted Research