MAGIC wheat

Multi-parent populations for the genetic dissection of agronomic traits

Alison Bentley, R Horsnell, P Howell, N Gosman, R Howells, G Rose, T Barber, J Cockram, A Greenland and I Mackay

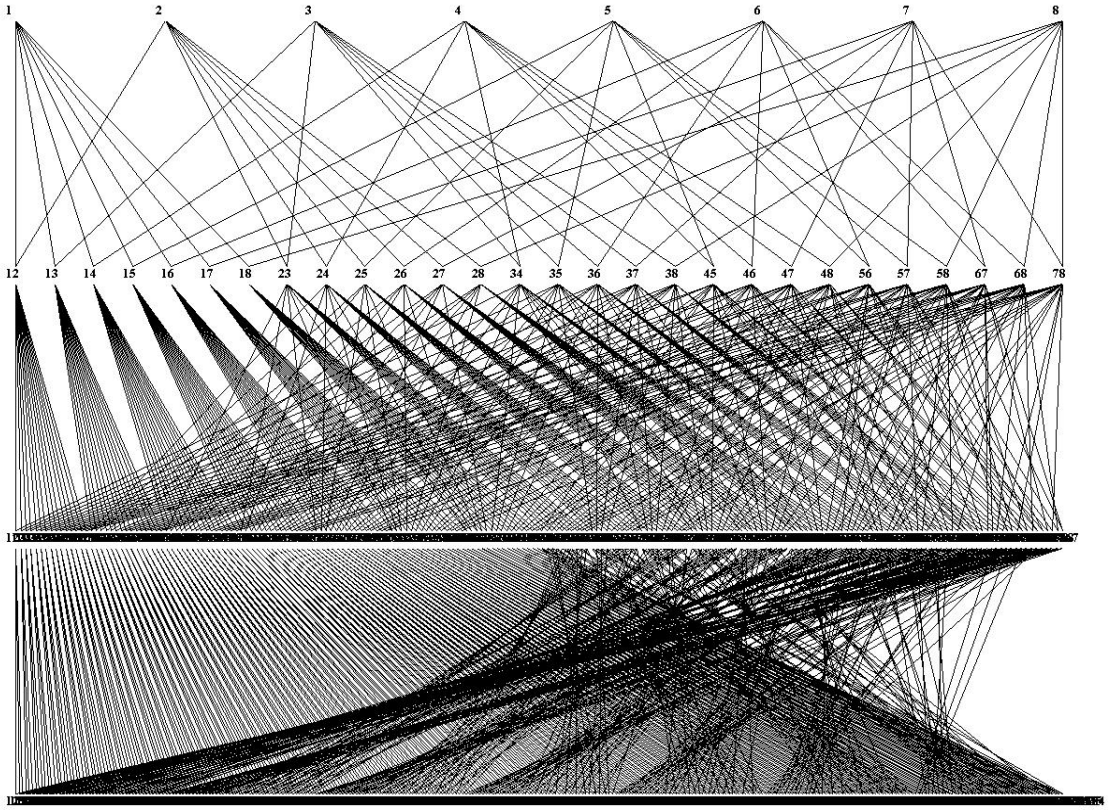
The John Bingham Laboratory
NIAB, Cambridge

@NIABTAG

Mapping in multi-founder experimental populations

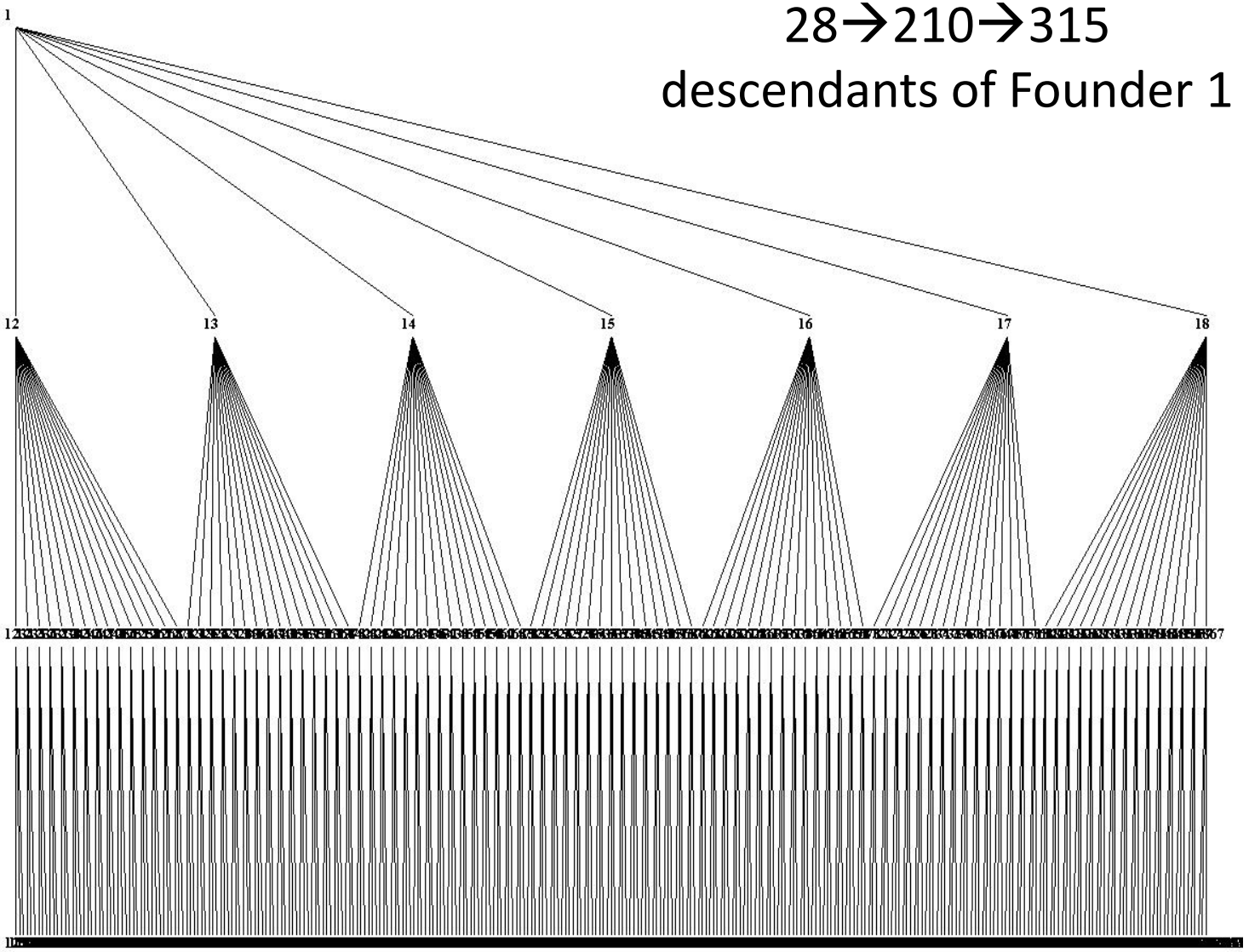
MAGIC

Multi-parent Advanced Generation InterCross



@NIABTAG

28→210→315
descendants of Founder 1



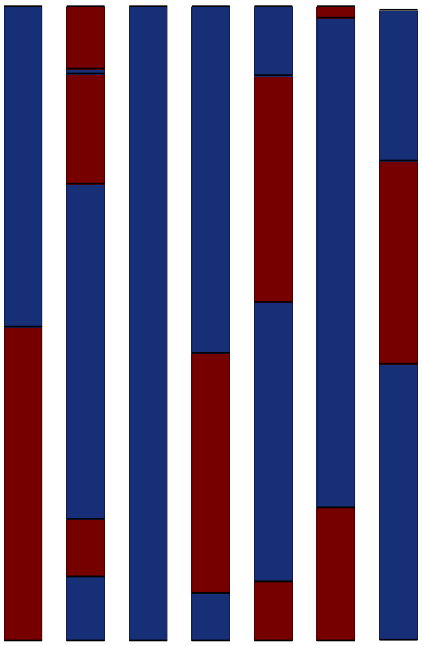
@NIABTAG

Customising MAGIC for mapping

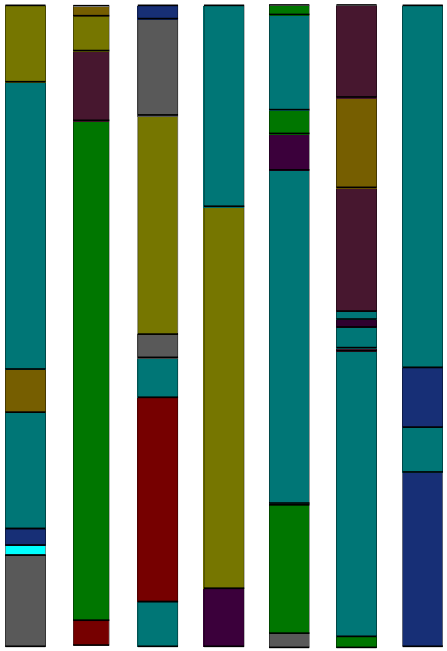
Variety	Reason for inclusion
Alchemy	Yield, disease resistance, soft feed type, breeding parent
Brompton	1BL/1RS, hard feed type, OWBM resistance
Claire	Slow apical development, soft biscuit/distilling type
Hereward	High quality benchmark Gp1 bread making type
Rialto	1BL/1RS, Gp2 moderate bread making type
Robigus	High yielding, soft biscuit/distilling type, OWBM resistance
Soissons	Early flowering French Gp2 bread making type
Xi19	Facultative, high quality Gp1 bread making type

@NIABTAG

F_2 derived

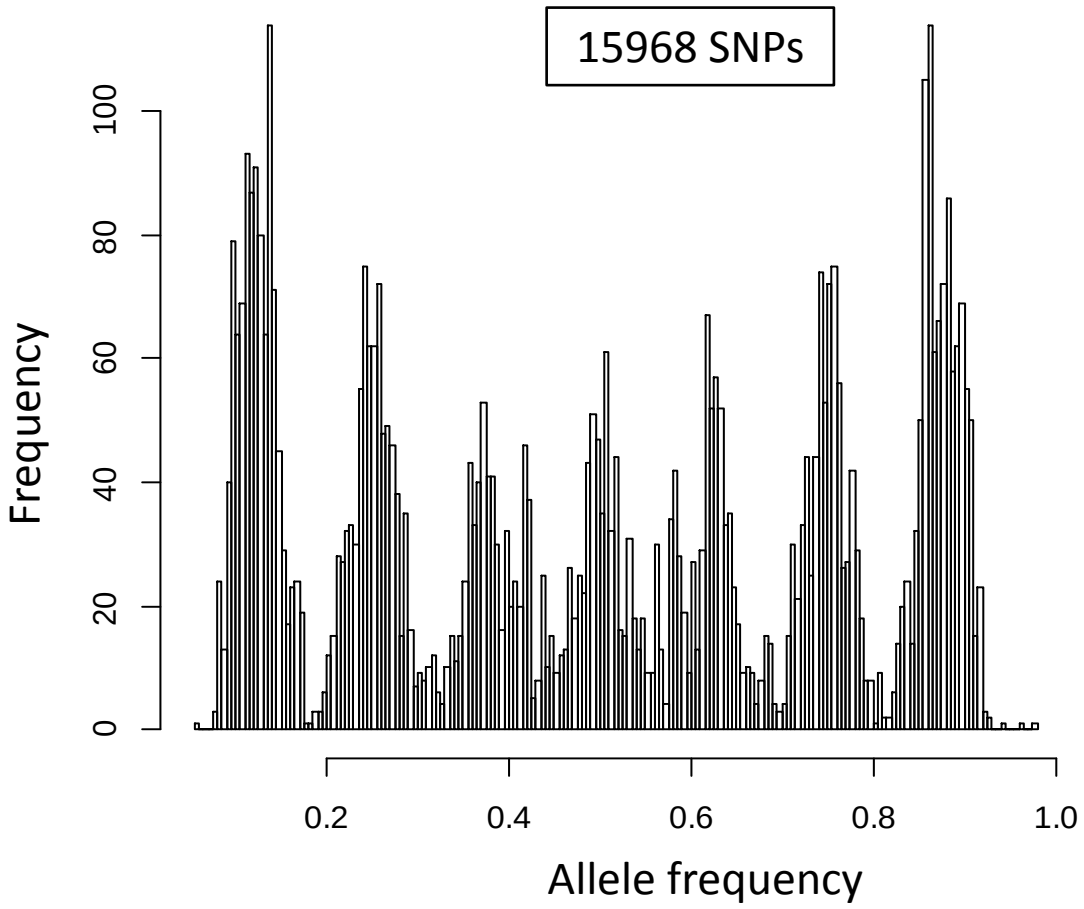


MAGIC

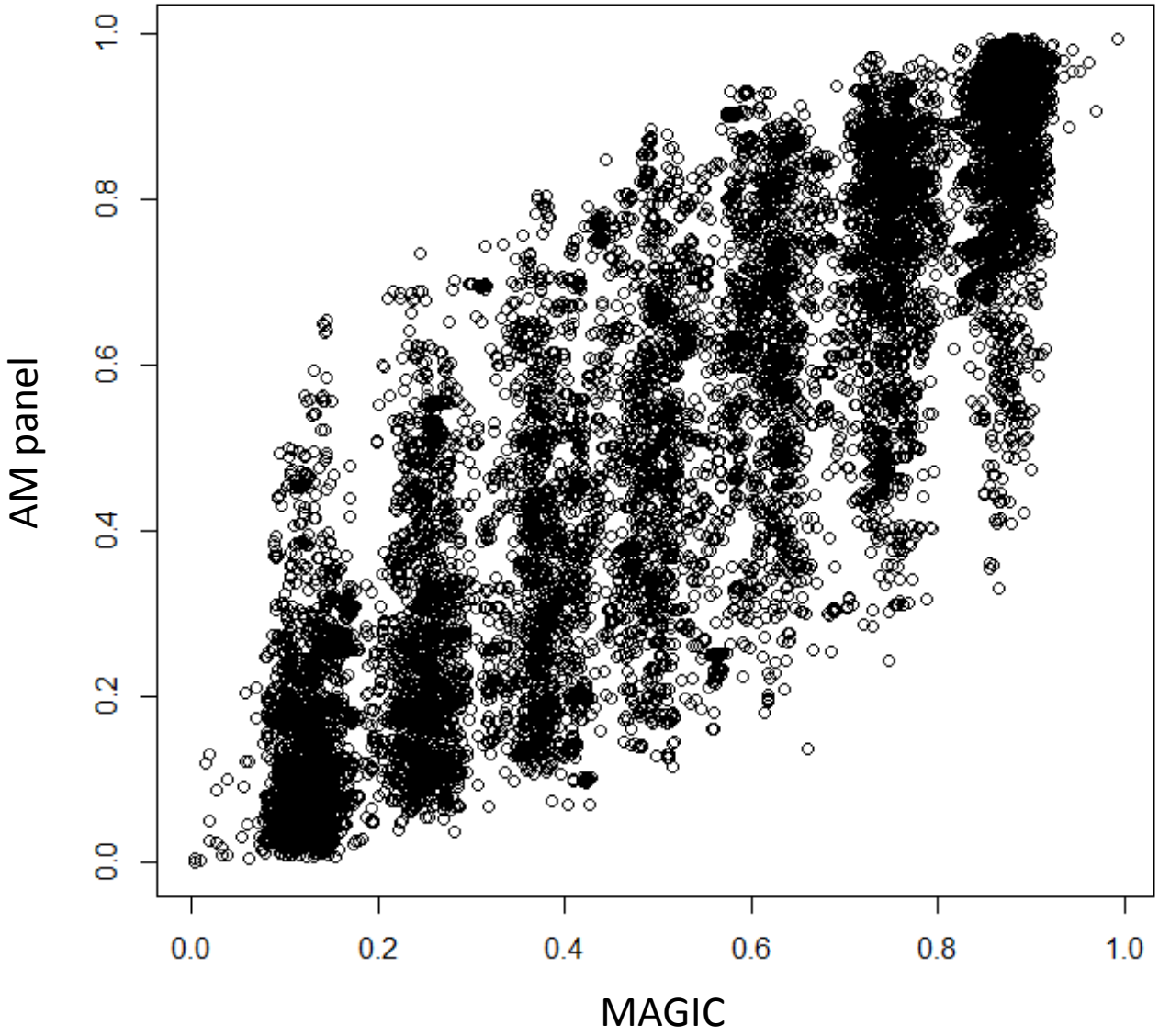


	F2 & self	Elite MAGIC & self
P (no recomb)	0.241	0.036
# tracts	2.6	4.7
# founders	2	3.5

90K iSelect genotypes



@NIABTAG



@NIABTAG

22nd August 2011 'Warrior' *Pst* race

New wheat yellow rust race confirmed

Mike Abram
Monday 22 August 2011 16:00

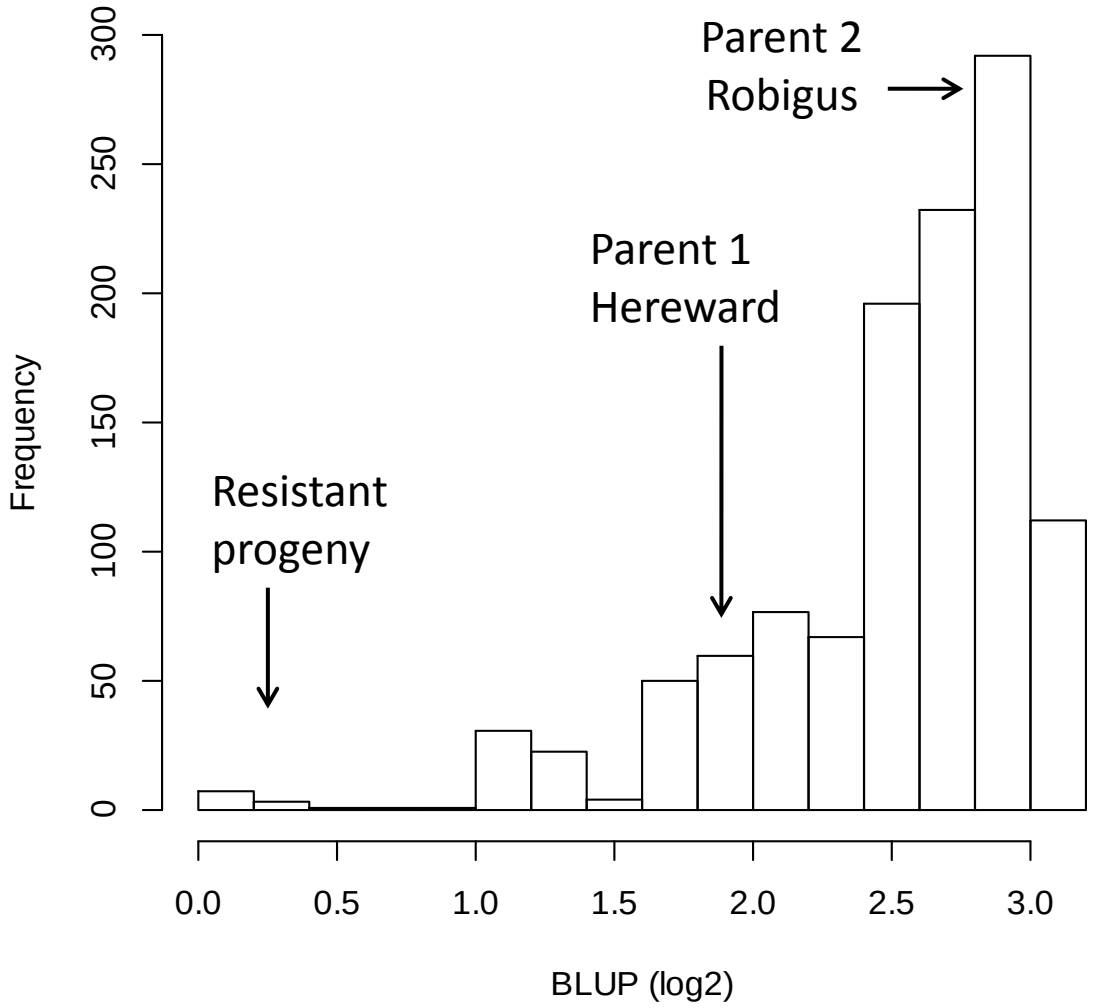
A new race of yellow rust in winter wheat has been confirmed by the UK Cereal Pathogen Virulence Survey (UKCPVS).

Yellow rust samples collected from three farm crops of Warrior winter wheat earlier this summer have re-infected the variety in the first round of testing by NIAB TAG.

"Warrior had been previously resistant to all yellow rust disease isolates at seedling and adult plant stages. The new isolates have been shown to infect the seedlings of the variety, which is evidence that we are dealing with a new race," explains Rosemary Bayles, principal cereal pathologist at NIAB

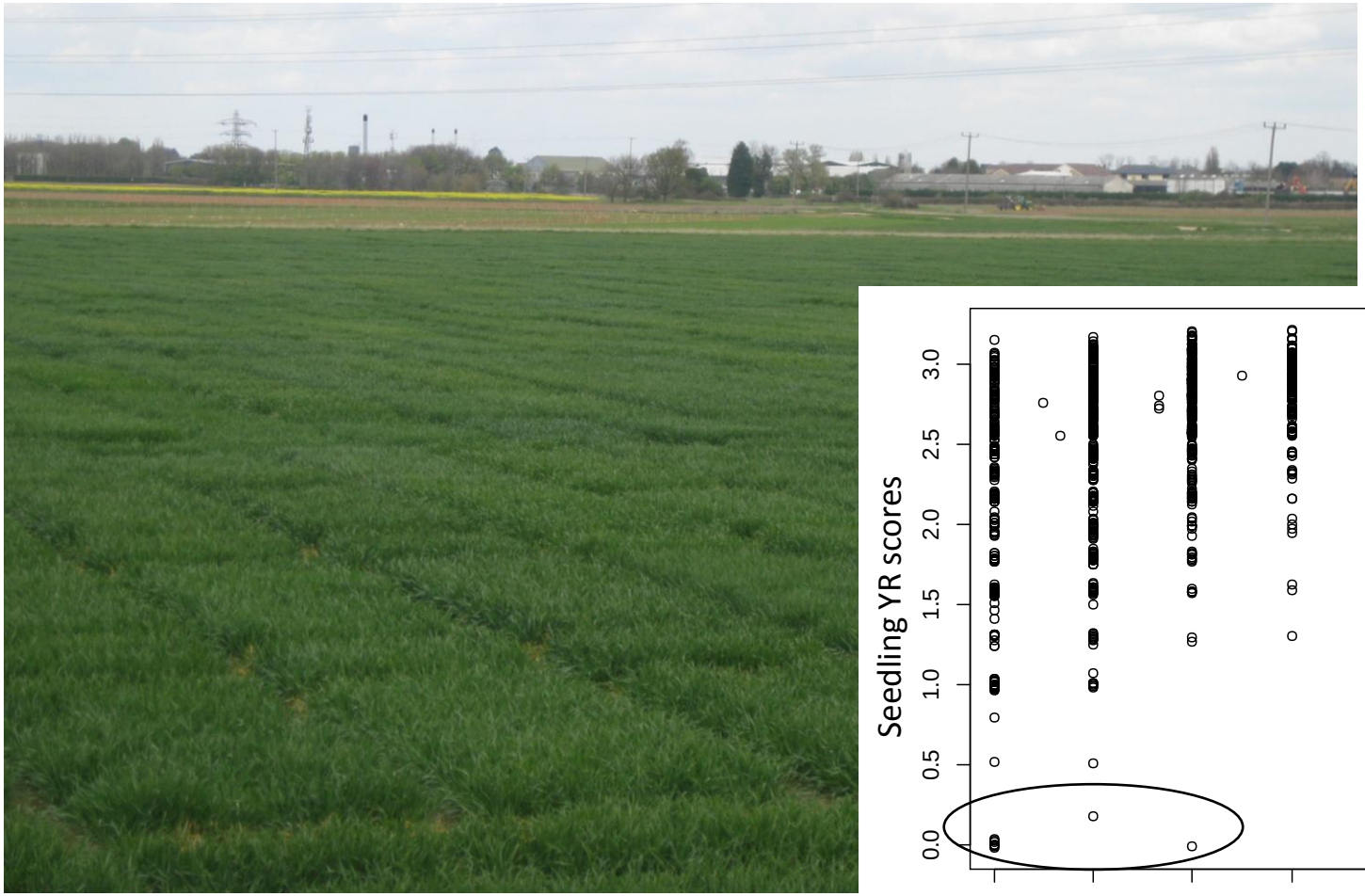
@NIABTAG

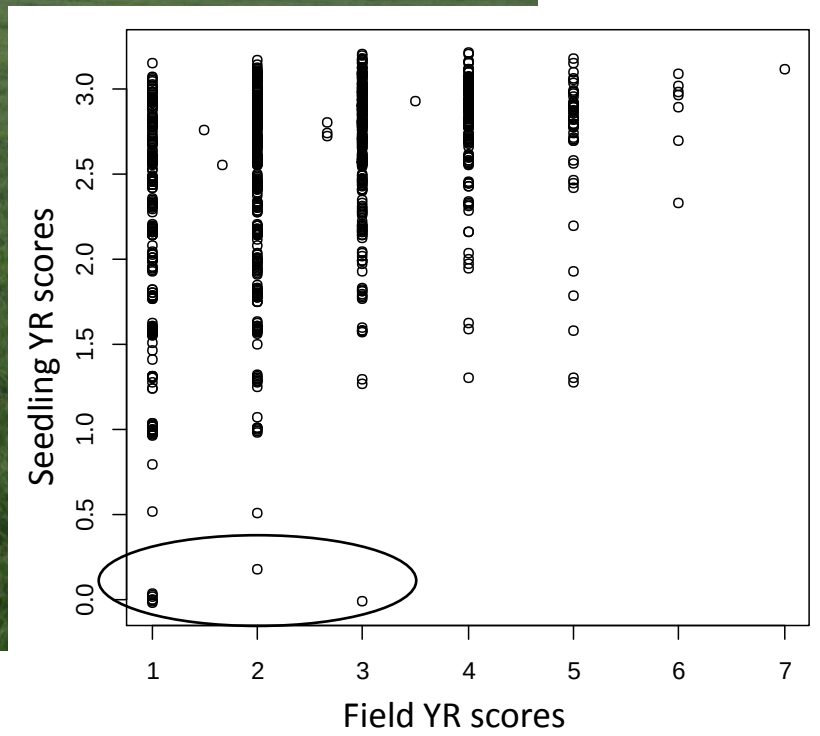
Glasshouse YR resistance



@NIABTAG

Field YR resistance

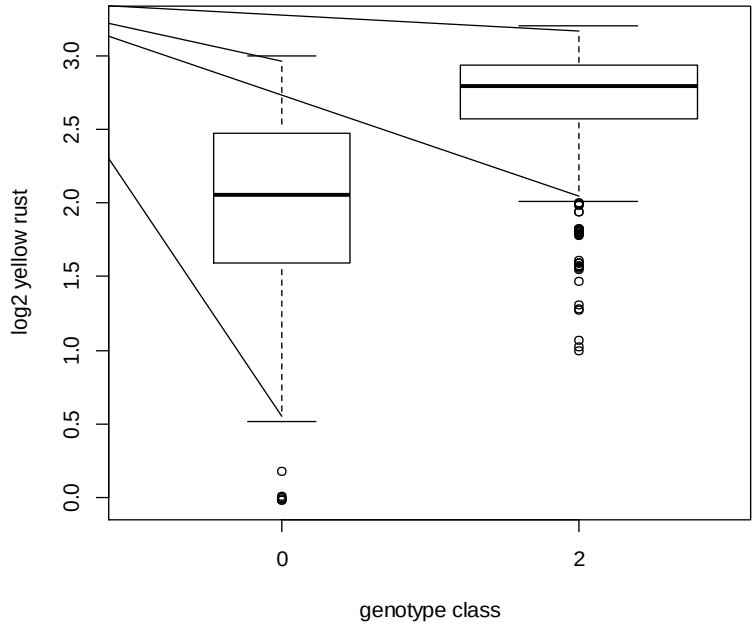




@NIABTAG

YR resistance - NIAB Elite MAGIC population

Marker	Estimated effect
2D	0.6476
3A	0.4223
1A	0.4069

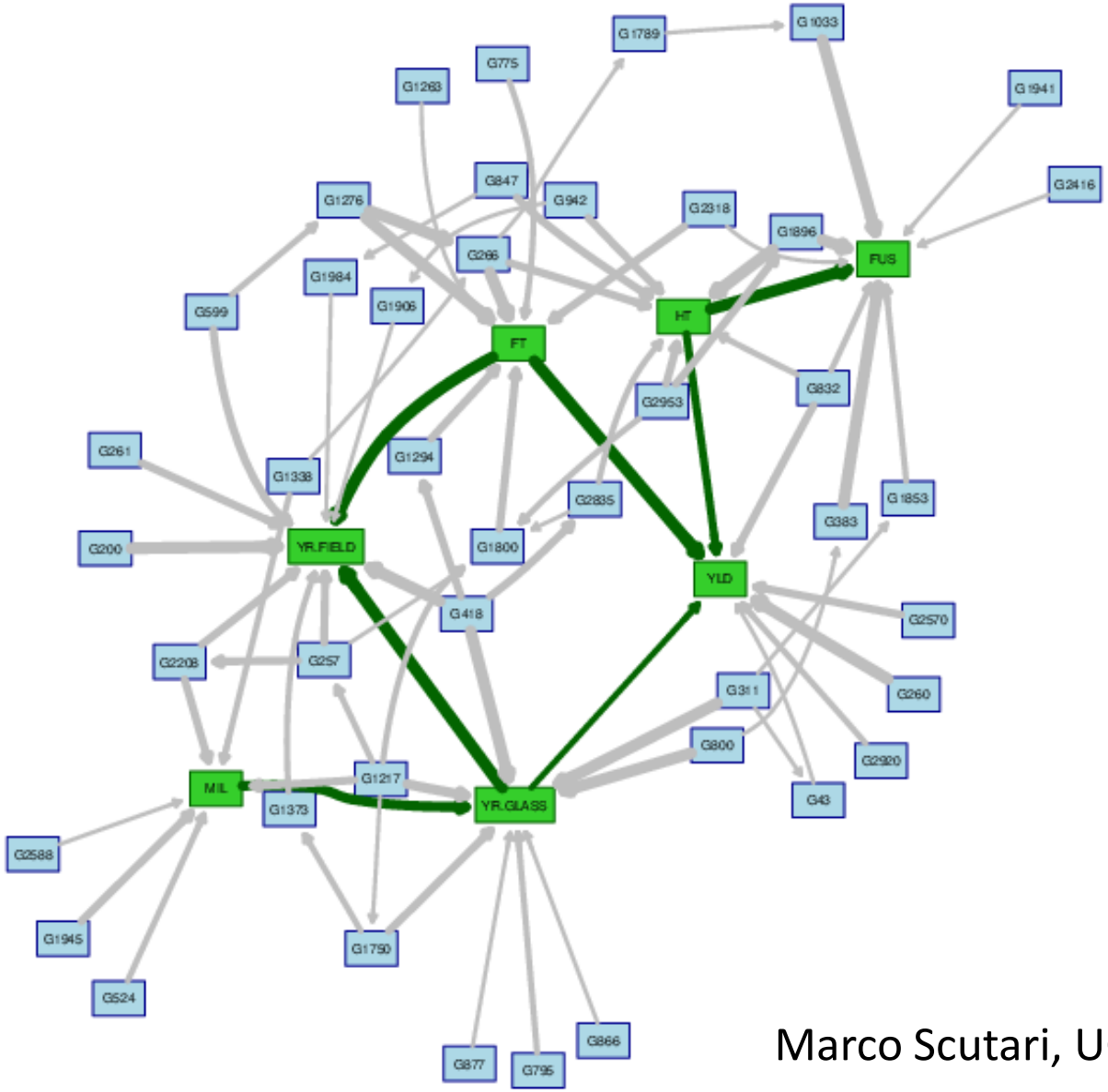


@NIABTAG

Favourable alleles are dispersed

Line/SNP	2A_SNP	3A_SNP	1A_SNP
Alchemy	R	S	S
Brompton	S	S	S
Claire	R	S	S
Hereward	S	S	R
Rialto	S	R	S
Robigus	S	S	S
Soissons	S	S	R
Xi19	S	R	S
MEL_1	R	R	R
MEL_2	R	R	R
MEL_3	R	R	S
MEL_4	R	R	S
MEL_5	R	R	S
MEL_6	R	S	R
MEL_7	R	S	S

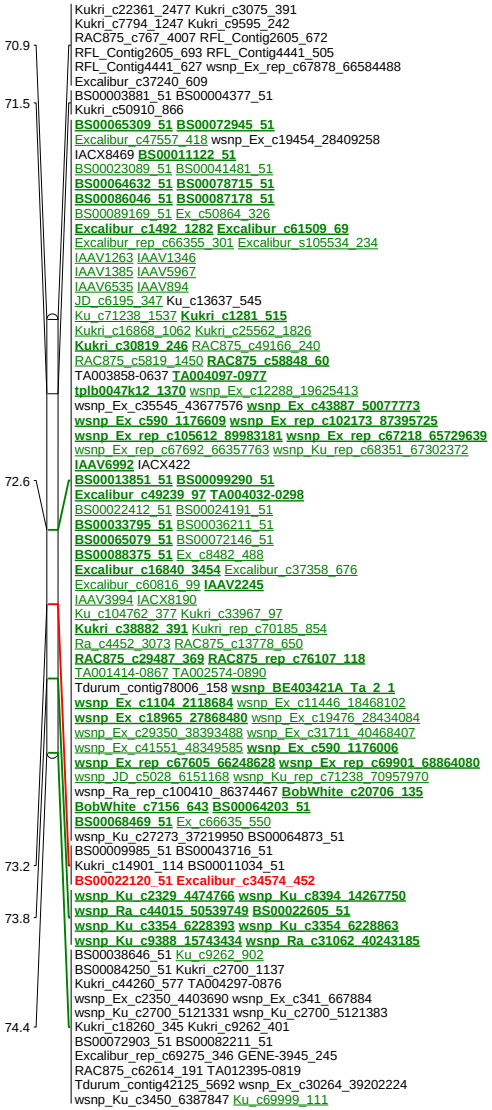
@NIABTAG

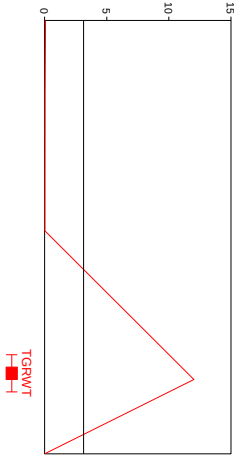


Marco Scutari, UCL

@NIABTAG

Mapping TGW QTL





Avalon x Cadenza

5 chromosomes

7 QTL

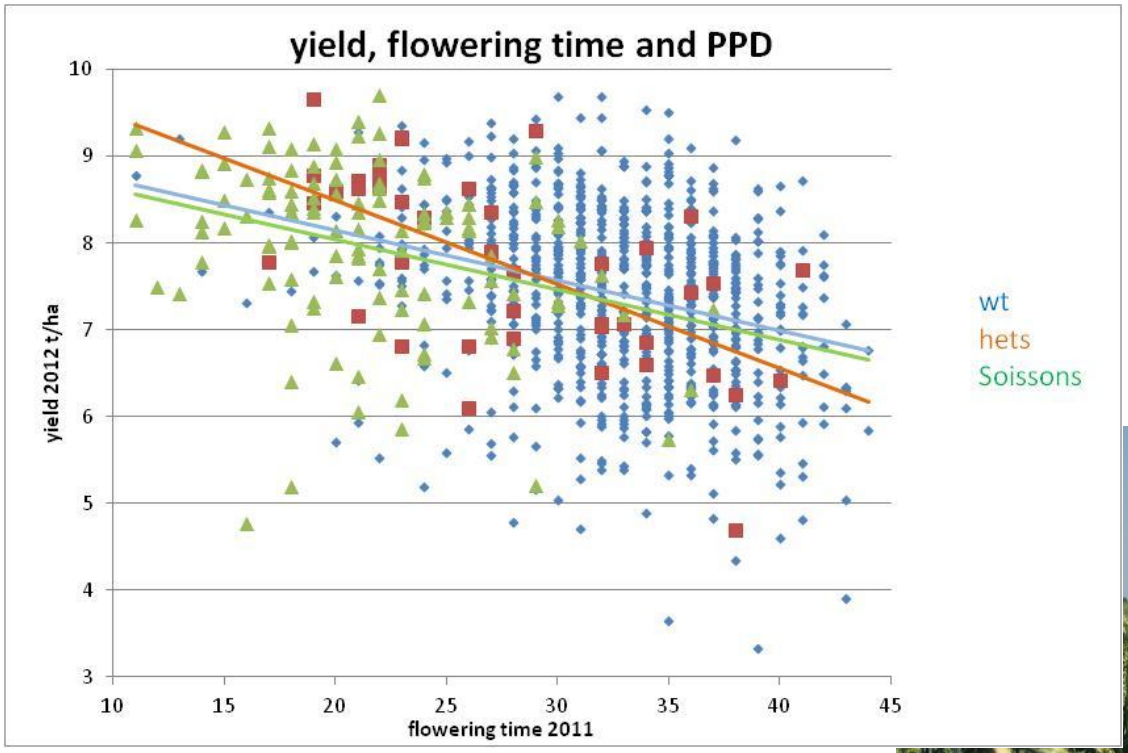
MAGIC

24 linkage groups

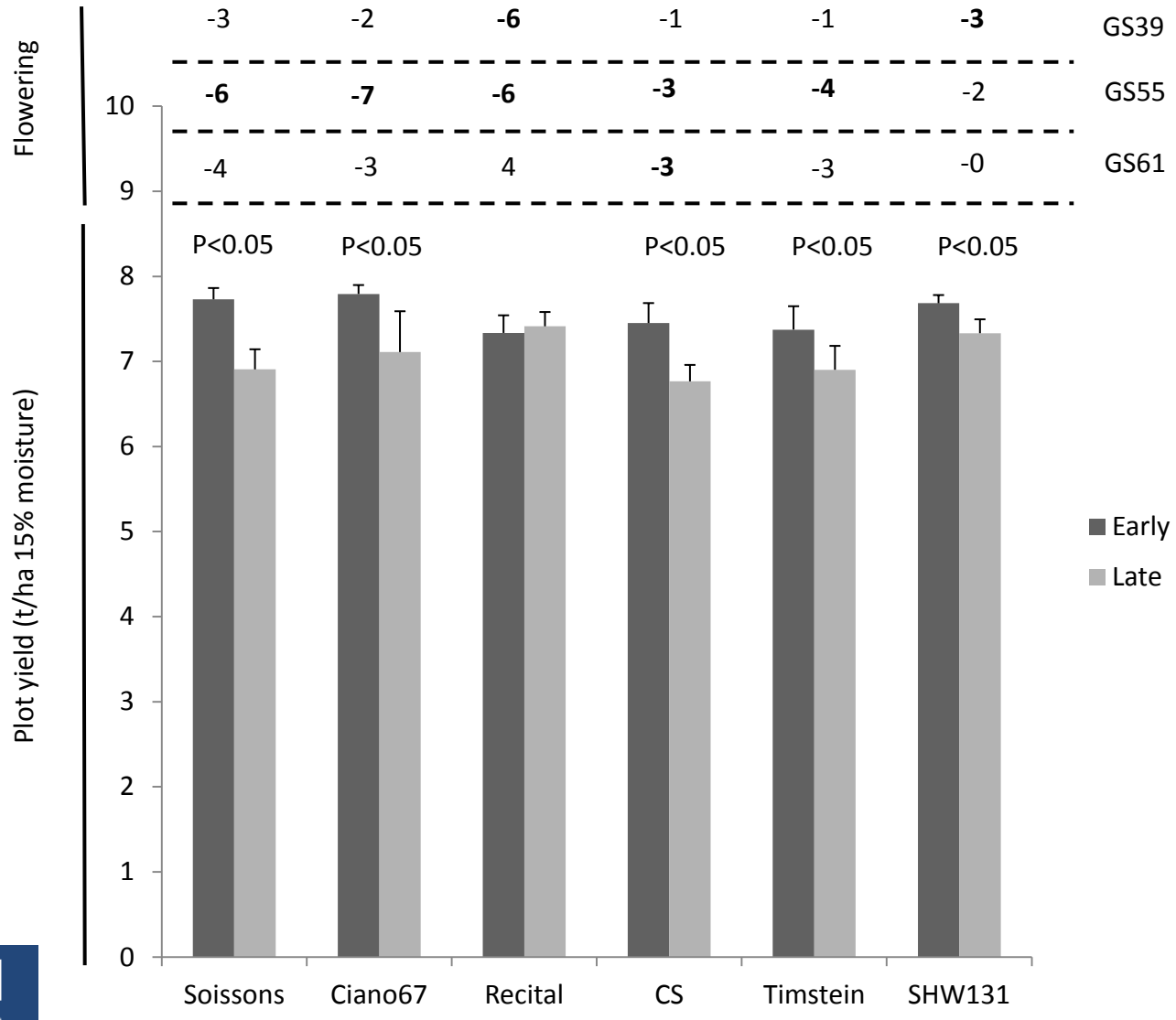
124 SNPs

Harriet Benbow University of Bristol

Adaptive traits e.g. flowering time

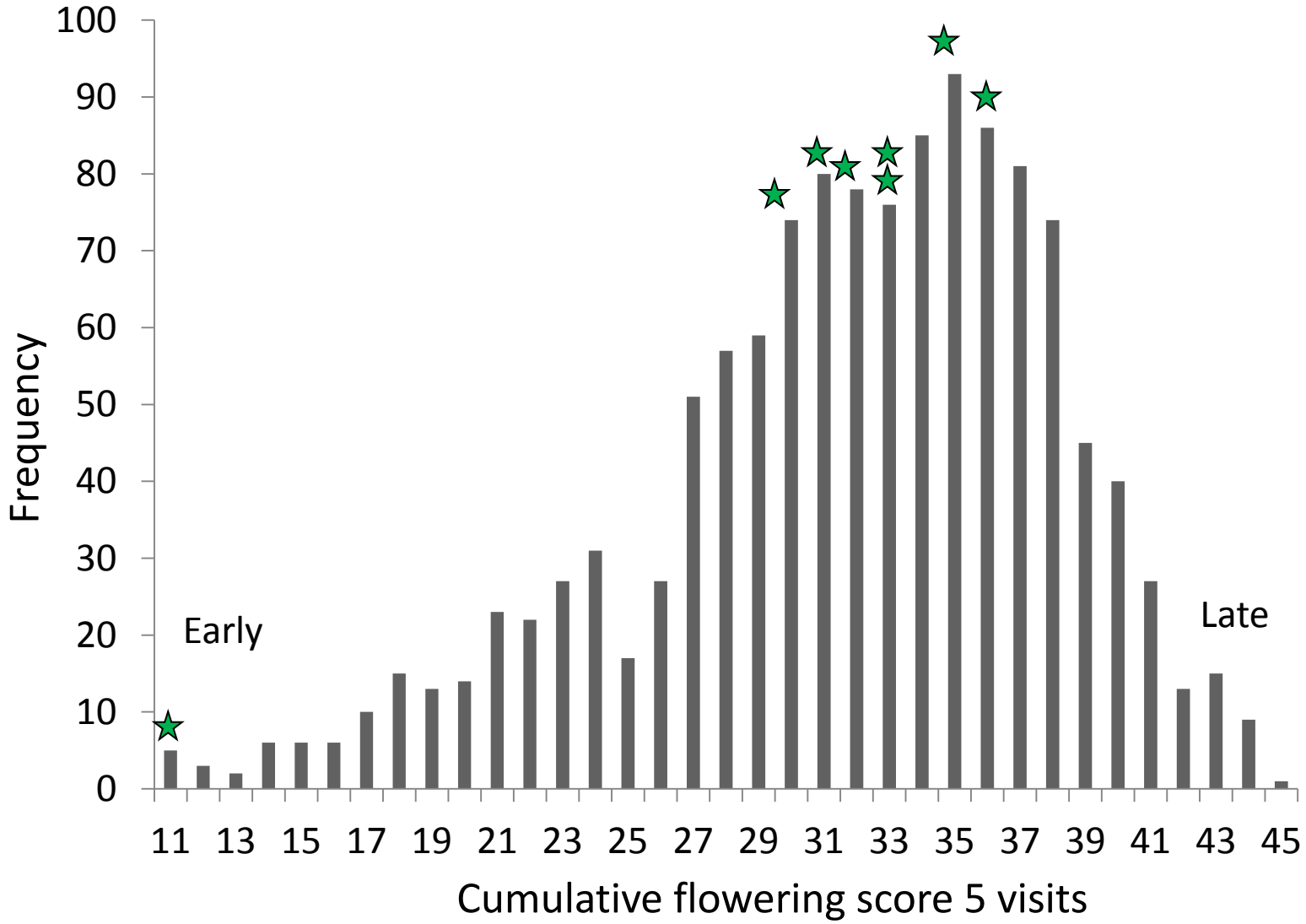


@NIABTAG



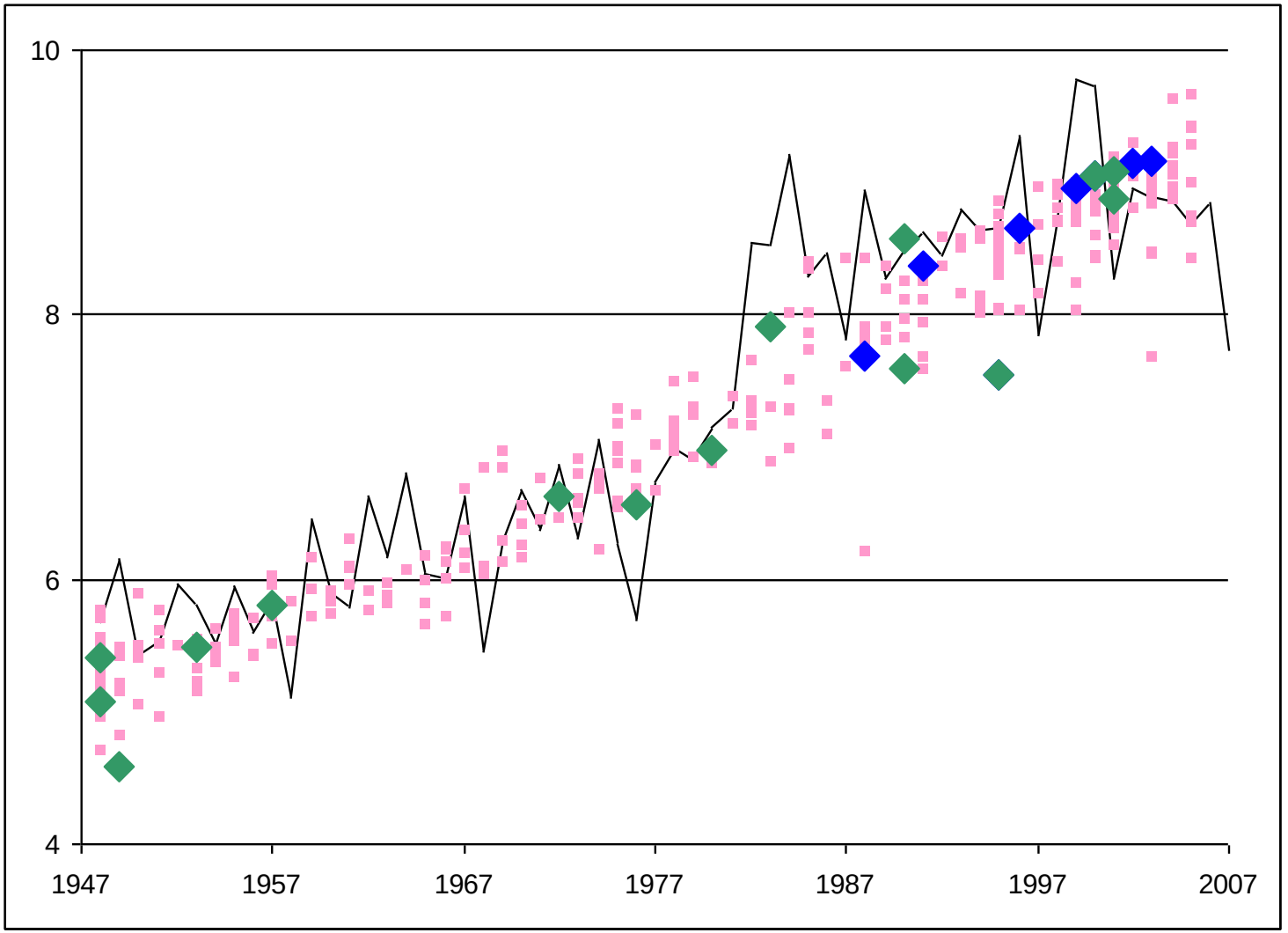
John Innes Centre

@NIABTAG

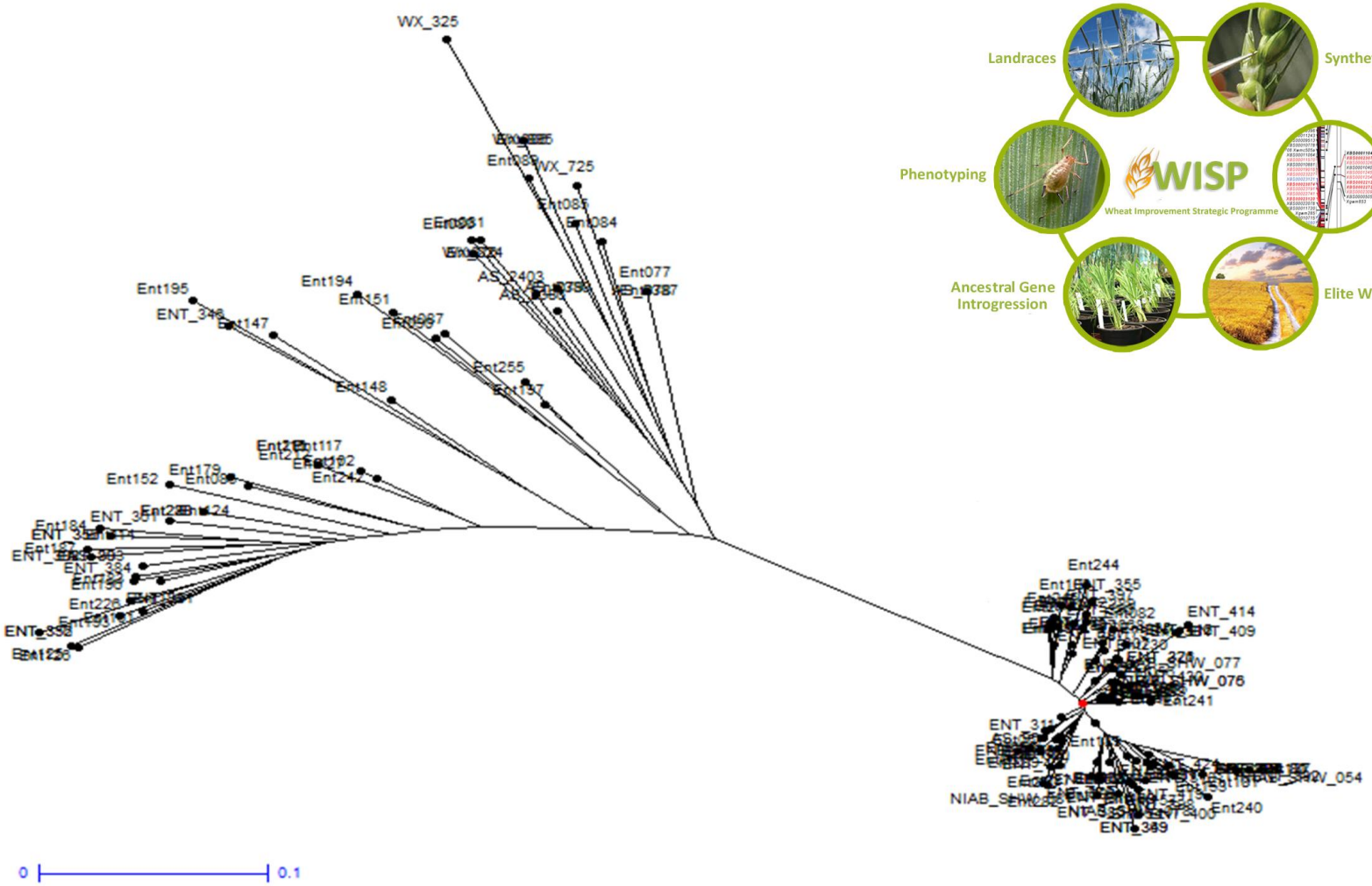

100
90
80
70
60
50
40
30
20
10
0
Frequency
Early
Late
11 13 15 17 19 21 23 25 27 29 31 33 35 37 39 41 43 45
Cumulative flowering score 5 visits

@NIABTAG

NIAB Diverse MAGIC population



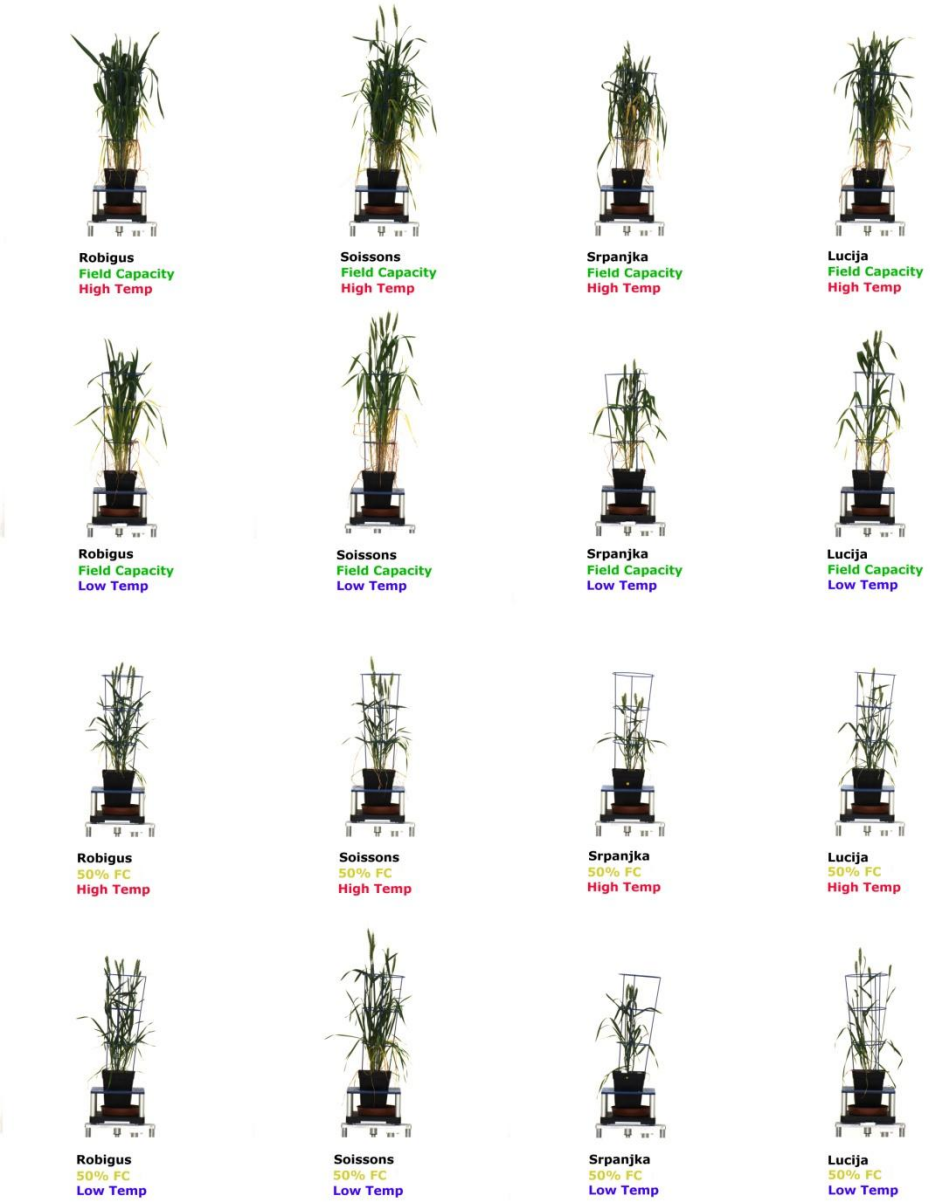
@NIABTAG


WX_325
WX_725
Ent084
Ent077
Ent195
Ent194
Ent151
Ent255
Ent148
Ent152
Ent179
Ent244
ENT_414
ENT_409
Ent241
Ent240
0
0.1

Landraces
Synthetics
Phenotyping
WISP
Wheat Improvement Strategic Programme
Genotyping
Ancestral Gene Introgression
Elite Wheats

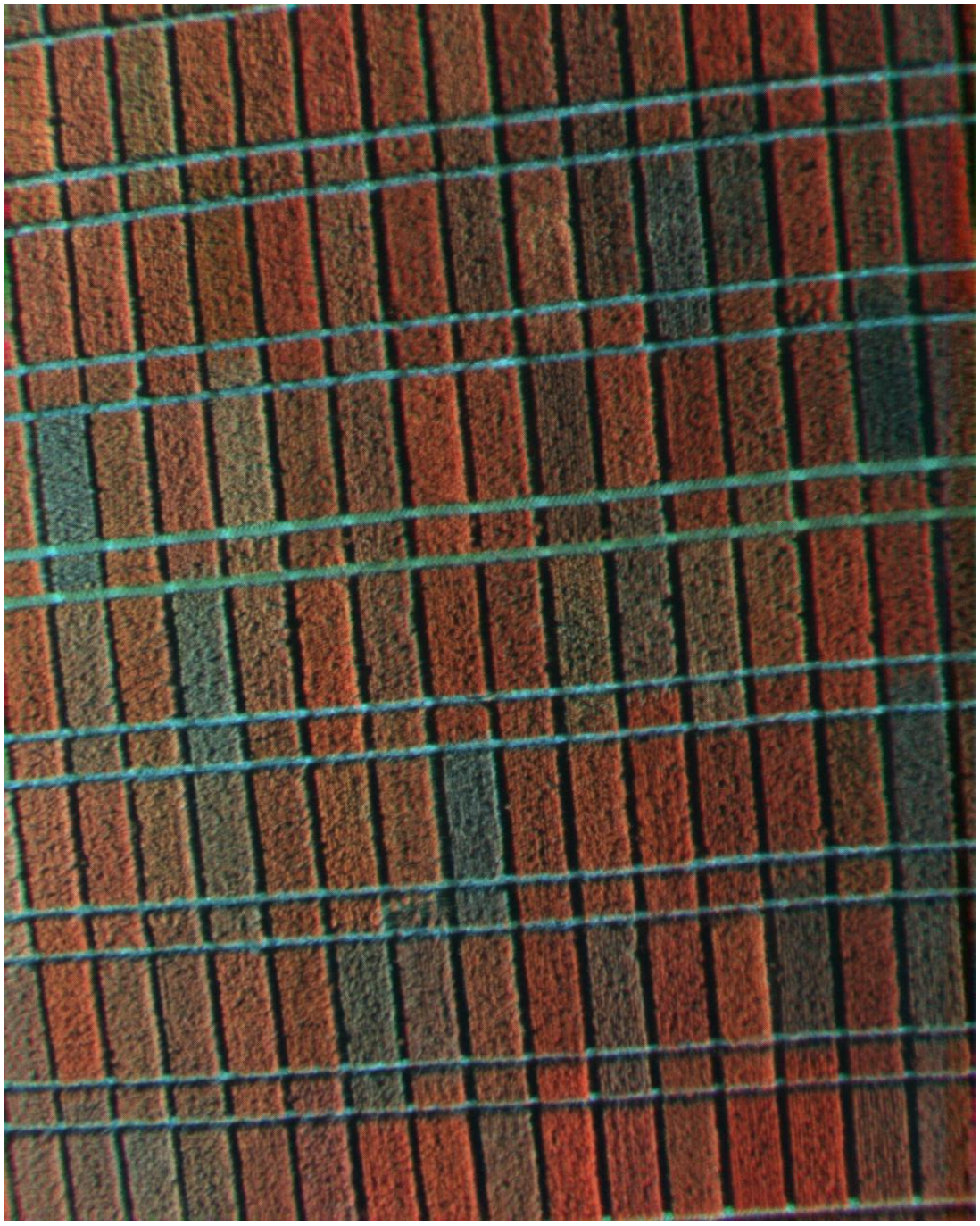
@NIABTAG

The National Plant Phenomics Centre, IBERS



@NIABTAG

Multi-spectral field imaging of MAGIC, Ursula Ag



Acknowledgements

NIAB Trust
NIAB pre-breeding team
BBSRC
Lesley Boyd
Wayne Powell
Colin Cavanagh & Emma Huang
Harriet Benbow, Keith Edwards, Sacha Allen
Donal O'Sullivan
KWS, RAGT, Limagrain

Dave Laurie, Adrian Turner (*Ppd-1*)
WISP partners

@NIABTAG