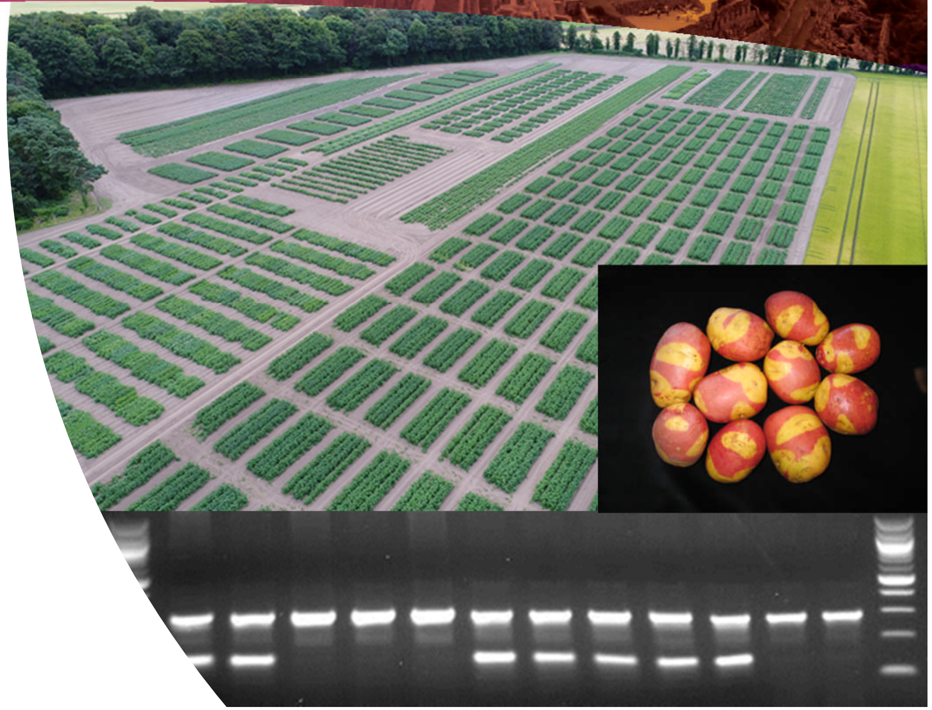
CUSCO - PERU | MAY 27-31, 2018
10th World Potato Congress
www.worldpotatocongress2018-alap.org
XXVIII CONGRESO DE LA ASOCIACIÓN LATINOAMERICANA DE LA PAPA

WPC | ALAP | CUSCO, PERU | 2018

Practical genome based approaches to augment potato breeding



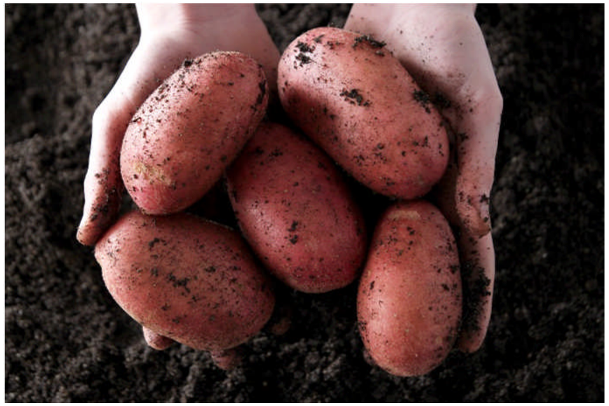
Denis Griffin

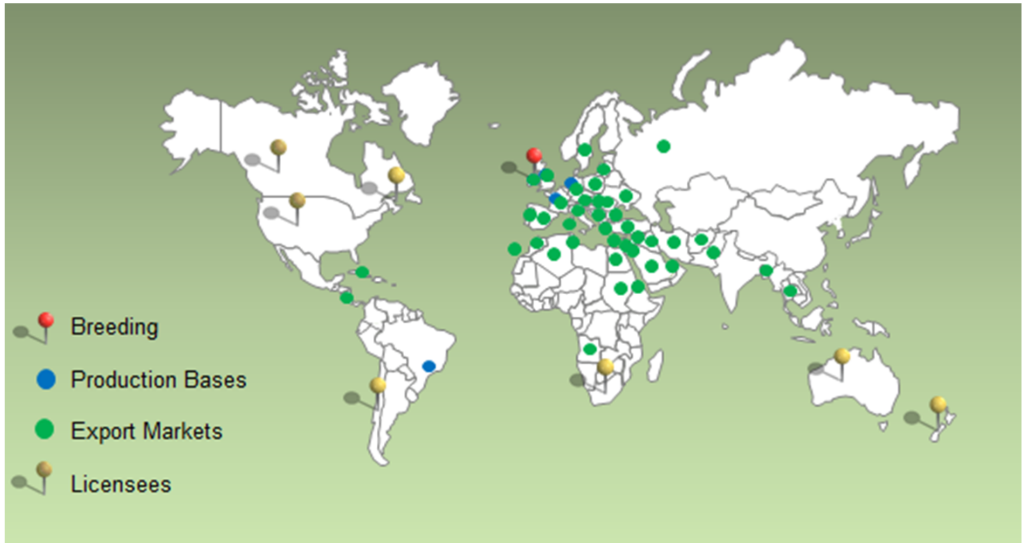
Crop Science Dept.
Teagasc Crops, Environment and Land Use Programme
Oak Park Crops Research Centre,
Carlow, Ireland
Denis.griffin@teagasc.ie

Teagasc
Agriculture and Food Development Authority
IPM POTATO GROUP
QUALITY IN THE BREED | QUALITY IN THE SEED
VICCI
MARIE CURIE ACTIONS
Department of Agriculture, Food and the Marine

Potato Breeding Programme

- Began in 1962
- Public private partnership with IPM Potato Group since 1970s
- Over 40 varieties released
- Global focus
- Disease resistance
- Processing

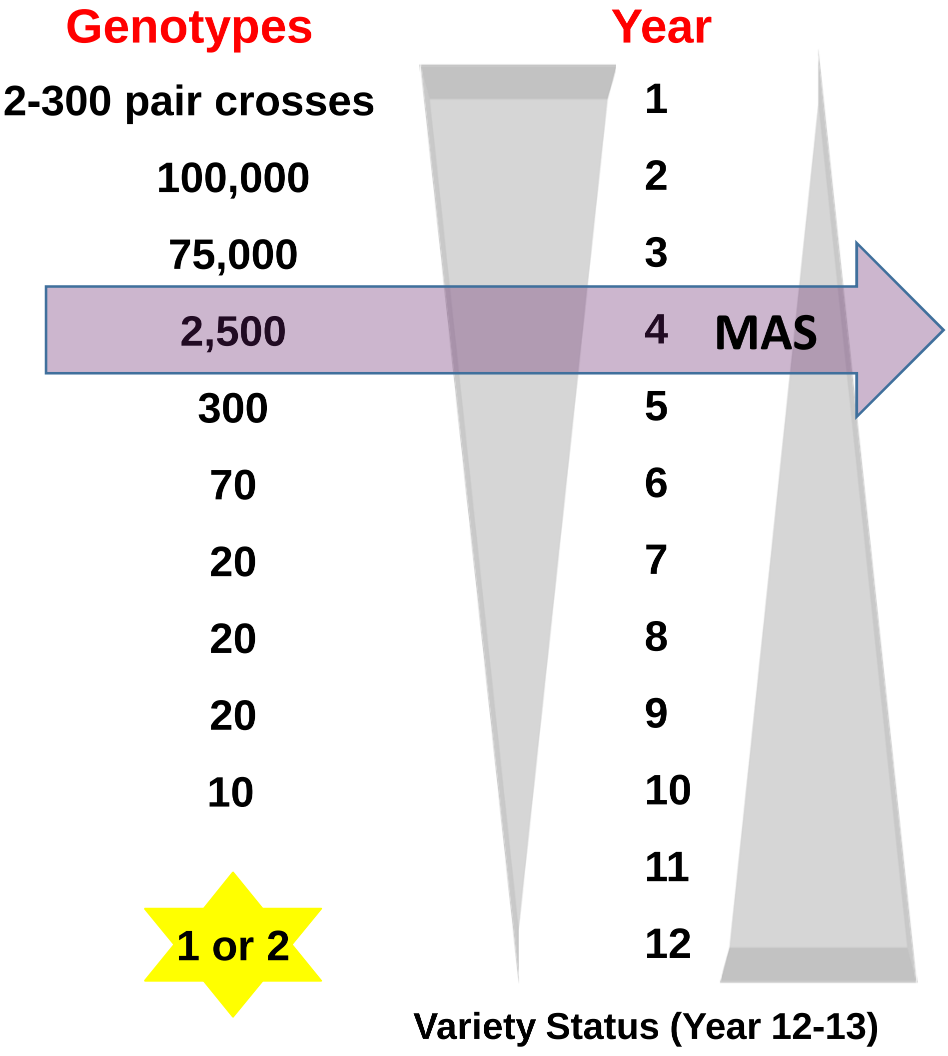




teagasc
AGRICULTURE AND FOOD DEVELOPMENT AUTHORITY

IPM POTATO GROUP
QUALITY IN THE BREED | QUALITY IN THE SEED

Conventional breeding scheme: from crossing to varieties



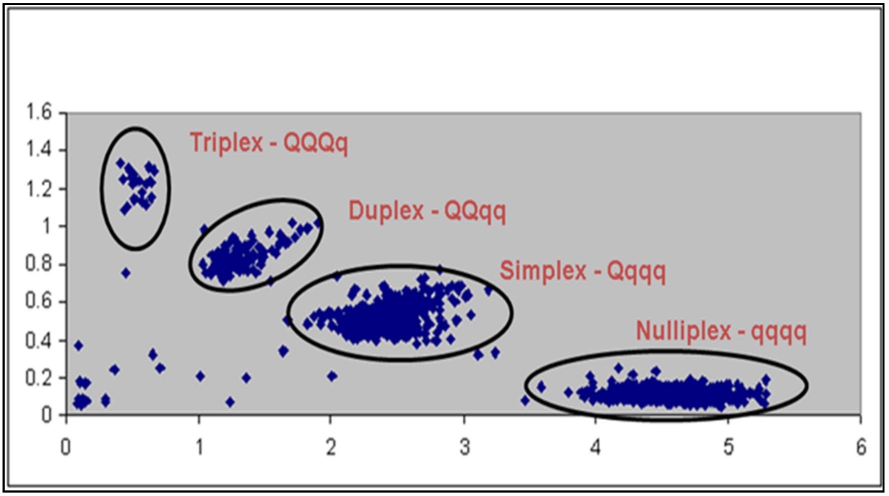
Genotypes	Year
2-300 pair crosses	1
100,000	2
75,000	3
2,500	4
300	5
70	6
20	7
20	8
20	9
10	10
	11
1 or 2	12

MAS

Variety Status (Year 12-13)

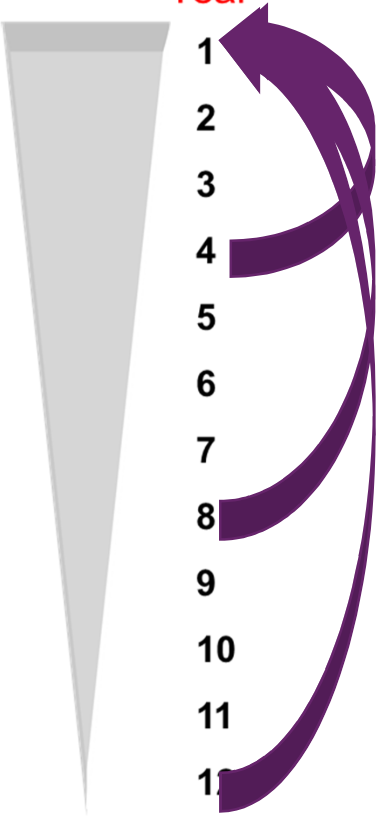
Genotypic Selection

Phenotypic Selection



MAS Stacking Strategies

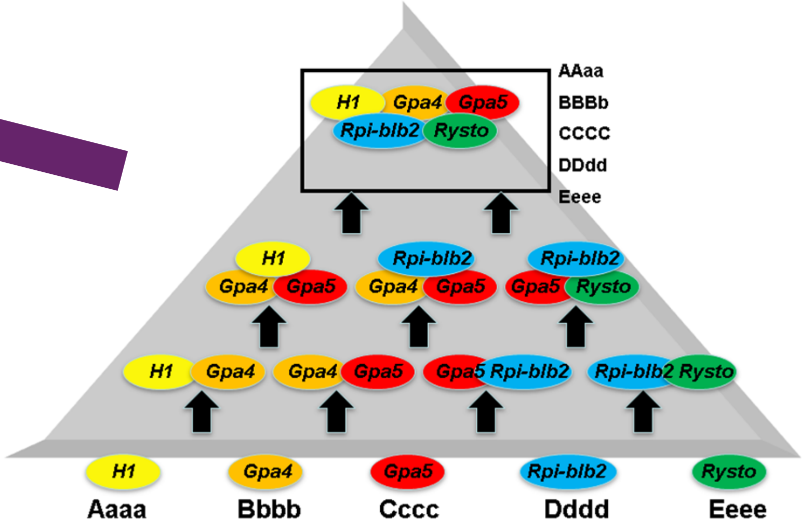
Multitrait parents

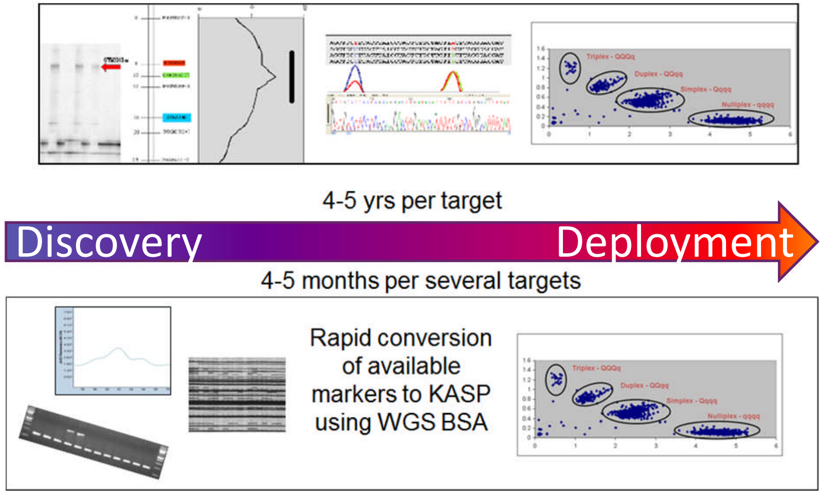


Genotypes	Year
2-300 pair crosses	1
100,000	2
75,000	3
2,500	4
300	5
70	6
20	7
20	8
20	9
10	10
	11
1 or 2	1

MAS-based recurrent selection

More resistant donors = more resistant varieties





4-5 yrs per target

4-5 months per several targets

Rapid conversion of available markers to KASP using WGS BSA

Benefit of MAS for stacking QTLs to *Globodera pallida*

C1992/31
GpaIV_{adg}

x

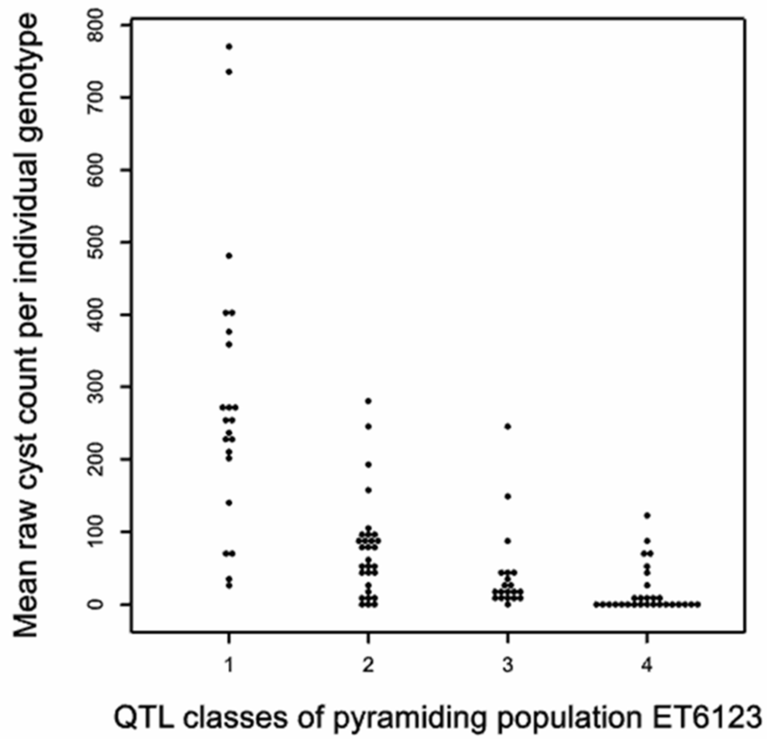
Innovator
GpaV_{vrn}

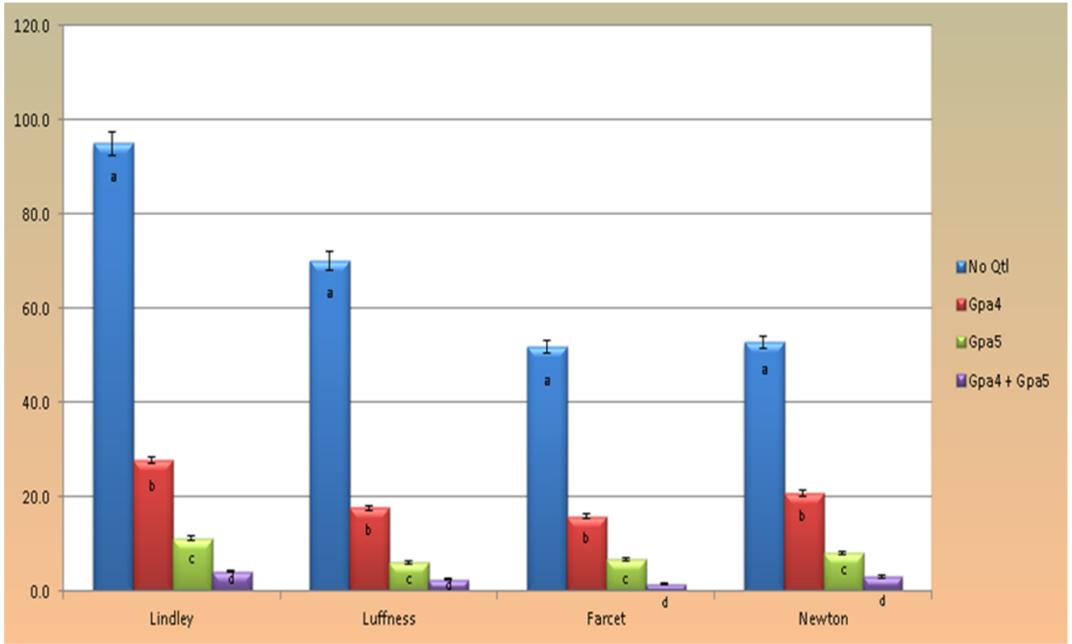
1 No QTL

2 GpaIV_{adg}

3 GpaV_{vrn}

4 GpaIV_{adg} GpaV_{vrn}

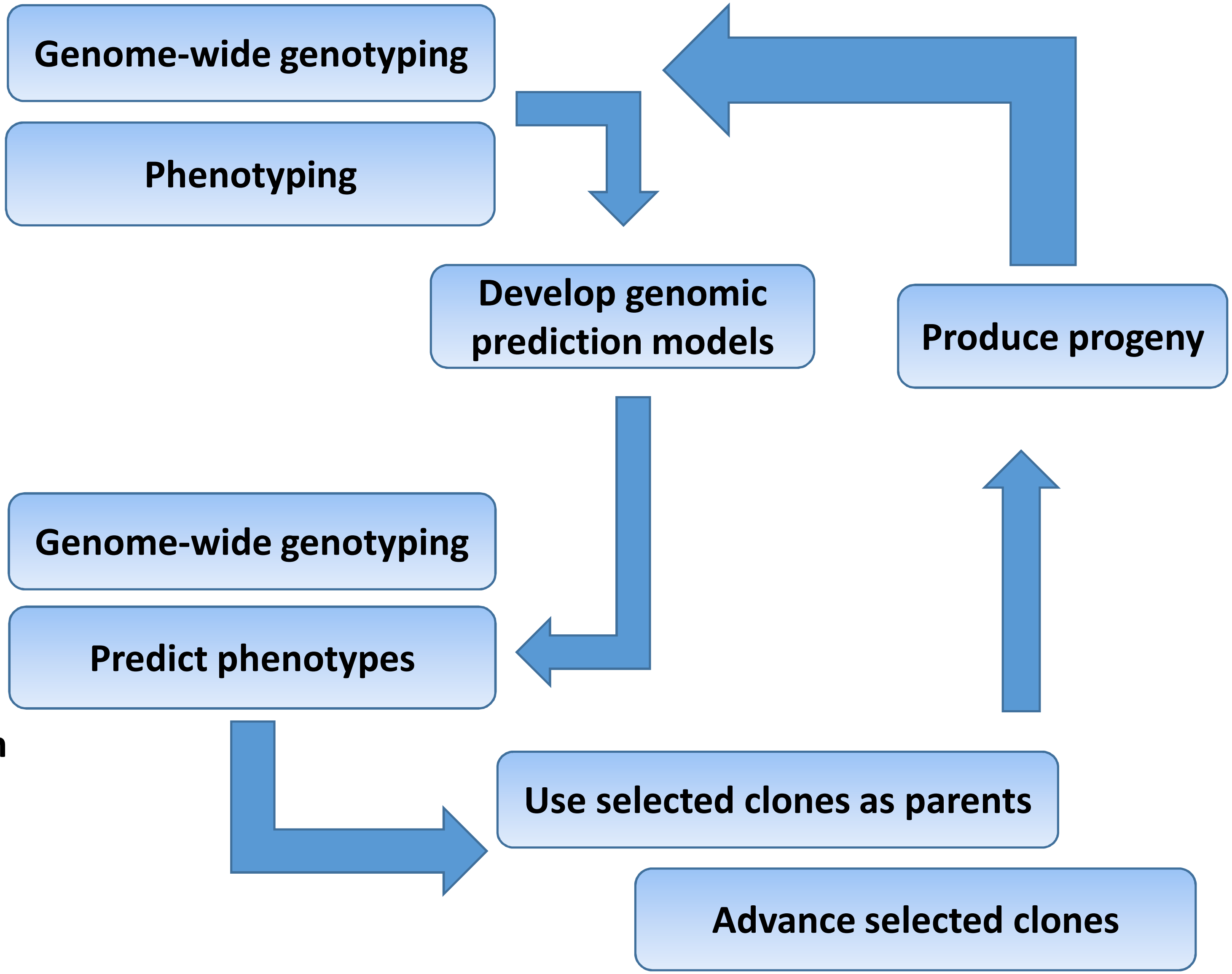




MAS doesn’t work for polygenic traits – genomic selection

Training Population

Breeding population



Genome-wide genotyping

Phenotyping

Develop genomic prediction models

Genome-wide genotyping

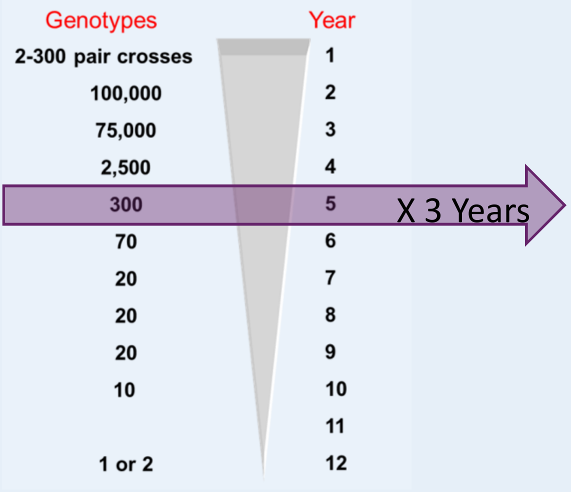
Predict phenotypes

Use selected clones as parents

Advance selected clones

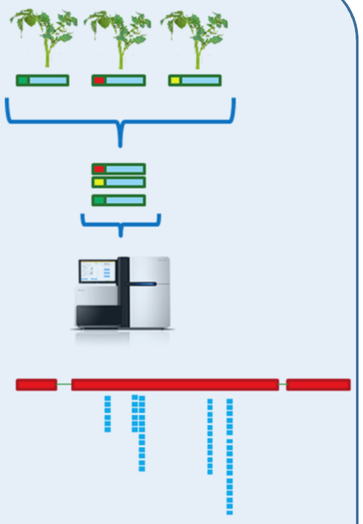
Produce progeny

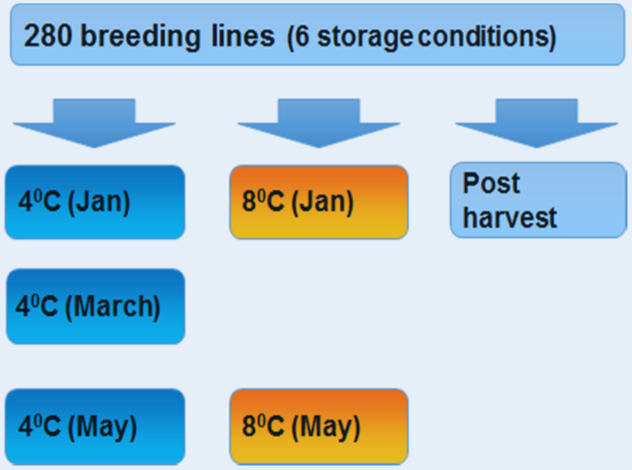
Genomic selection for - fry colour



Genotypes	Year
2-300 pair crosses	1
100,000	2
75,000	3
2,500	4
300	5
70	6
20	7
20	8
20	9
10	10
	11
1 or 2	12

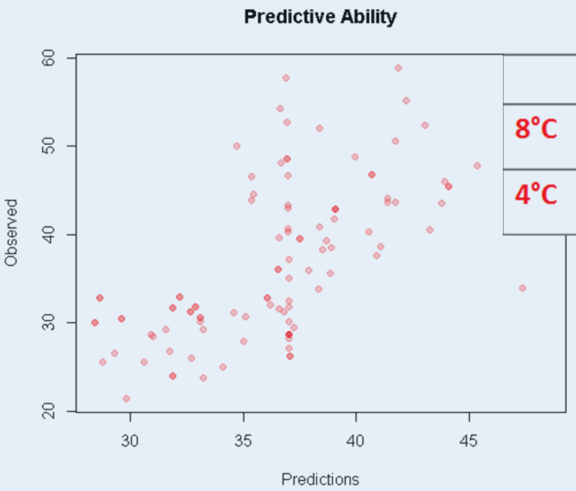
X 3 Years





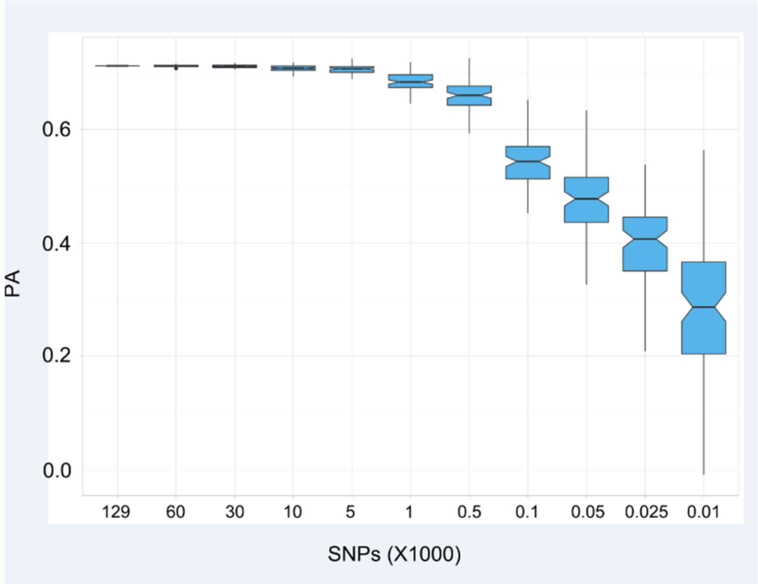
280 breeding lines (6 storage conditions)

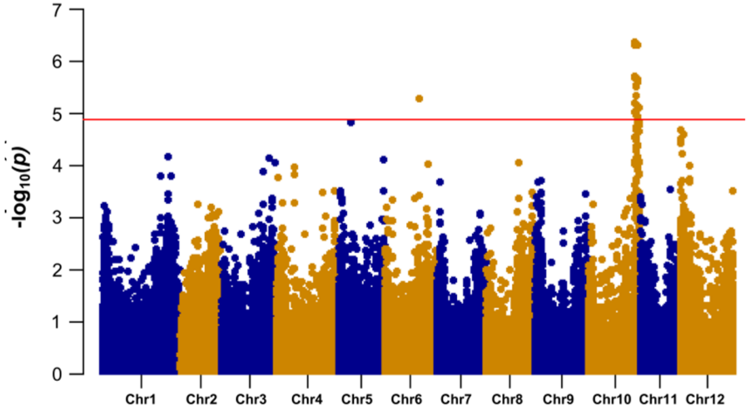
4⁰C (Jan)
8⁰C (Jan)
Post harvest
4⁰C (March)
4⁰C (May)
8⁰C (May)

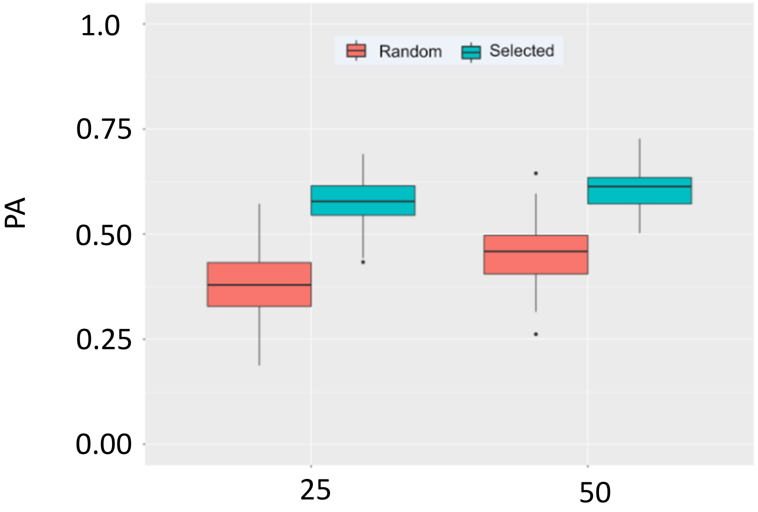


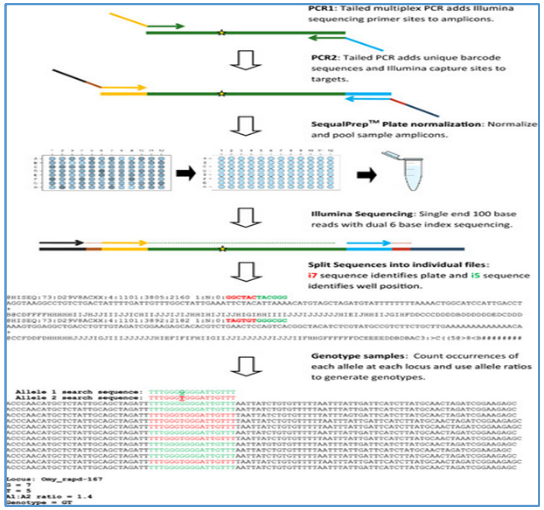
	JAN	MAY
8°C	0.72	0.62
4°C	0.68	0.64

Cost effective deployment of genomic selection?



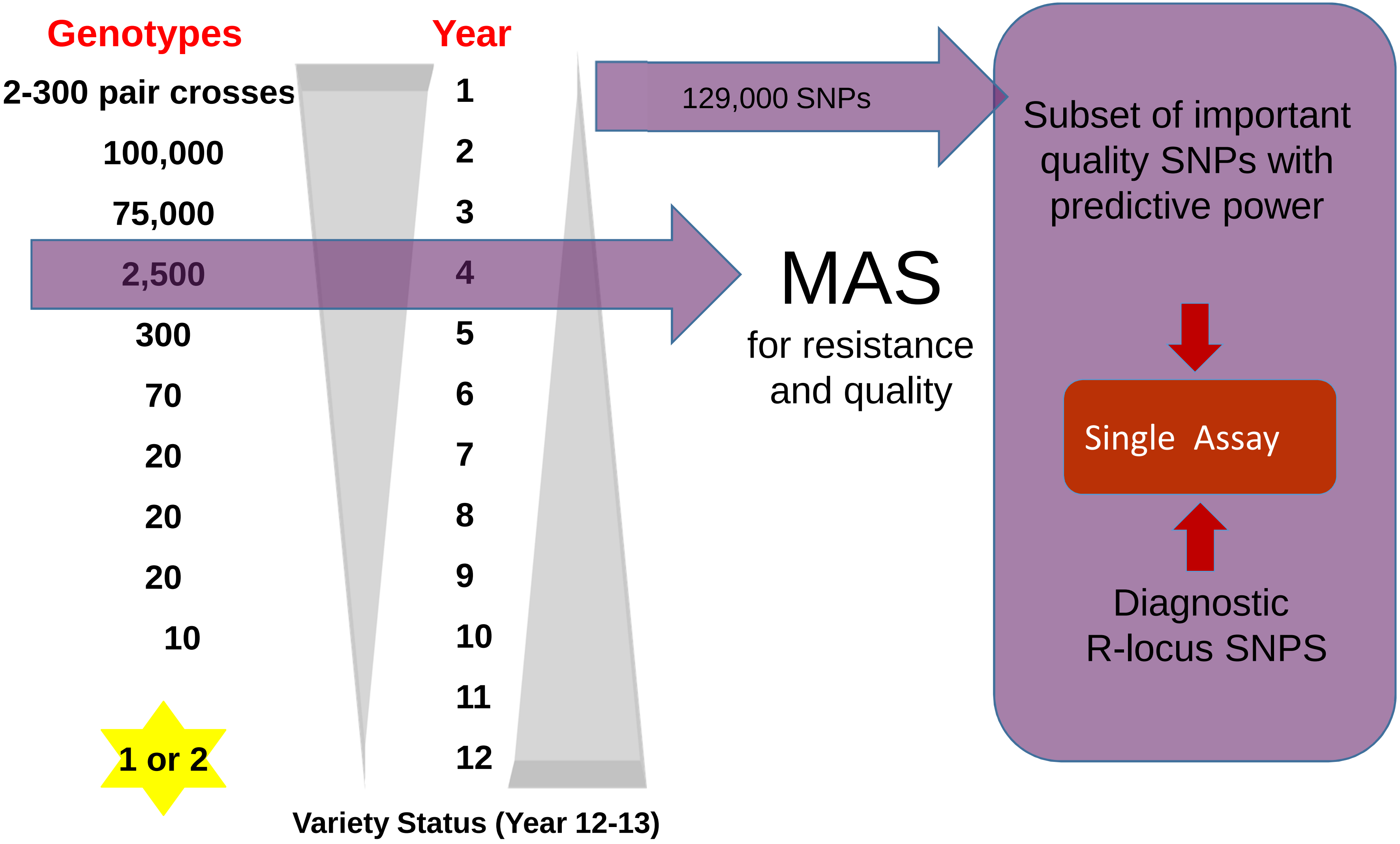






Campbell *et al*. (2015) Mol Ecol Resources 15(4):855-67

Can we do MAS for complex traits



Genotypes	Year
2-300 pair crosses	1
100,000	2
75,000	3
2,500	4
300	5
70	6
20	7
20	8
20	9
10	10
	11
1 or 2	12

Variety Status (Year 12-13)

129,000 SNPs

Subset of important quality SNPs with predictive power

MAS
for resistance and quality

Single Assay

Diagnostic
R-locus SNPS

Acknowledgements

Dan Milbourne (Co-PI)
Stephen Byrne
Fergus Meade
Francesca Mesiti
Colum Kennedy
Potato Breeding Field Team

Brian Rigney
Marialaura Destefanis
Emmet Dalton

teagasc
AGRICULTURE AND FOOD DEVELOPMENT AUTHORITY

IPM POTATO GROUP
QUALITY IN THE BREED | QUALITY IN THE SEED

VICCI

Web: http://www.vicci.ie/

DAFM Project No.14/S/819

Department of Agriculture, Food and the Marine

MARIE CURIE ACTIONS

GenSPI:
Marie Sklodowska-Curie grant agreement No. 658031.