Bundesanstalt für
Landwirtschaft und Ernährung

BÖLN

Bundesprogramm Ökologischer Landbau
und andere Formen nachhaltiger
Landwirtschaft

BLE-Projekt
2810OE071 (LfL), 2810OE121 (JKI), 2810OE122 (IPK)

Assessment of genetic hotspots for *Phytophthora* resistance and their use as molecular markers in potato breeding

K. Sieber, G. Forster, A. Berger, A. Schwarzfischer und A. Kellermann

Development of Late Blight (*Phytophthora infestans*) Resistant Potato Breeding Material for Organic Farming

LfL Pflanzenbau · JKI Julius Kühn-Institut · IPK Gatersleben · GFP · Bioland Ökologischer Landbau · Naturland · ÖKORING

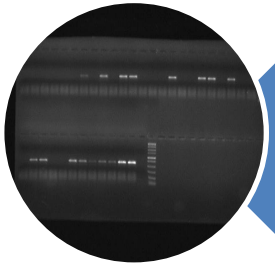
Aims and objectives

Field Trial:

150 cultivars and breeding clones have been grown and examined under organic farming conditions.

Potato Breeding:

We aim at combining late blight resistance with quality traits. For the selection of breeding material we use a participative approach on organic farms



Molecular Analyses:

Examination of resistance hotspots and evaluation of genetic markers for resistance breeding

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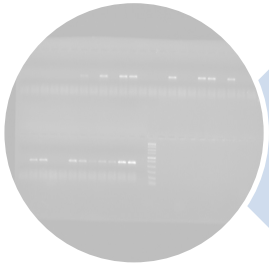

Molecular Analyses:

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Field trial

Varieties for field trials 2014

Total: 153 cultivars

- JKI (28)
- LfL (26)
- IPK (10)
- German potato breeders (58)
- others (26)
- reference (5)

Field trial

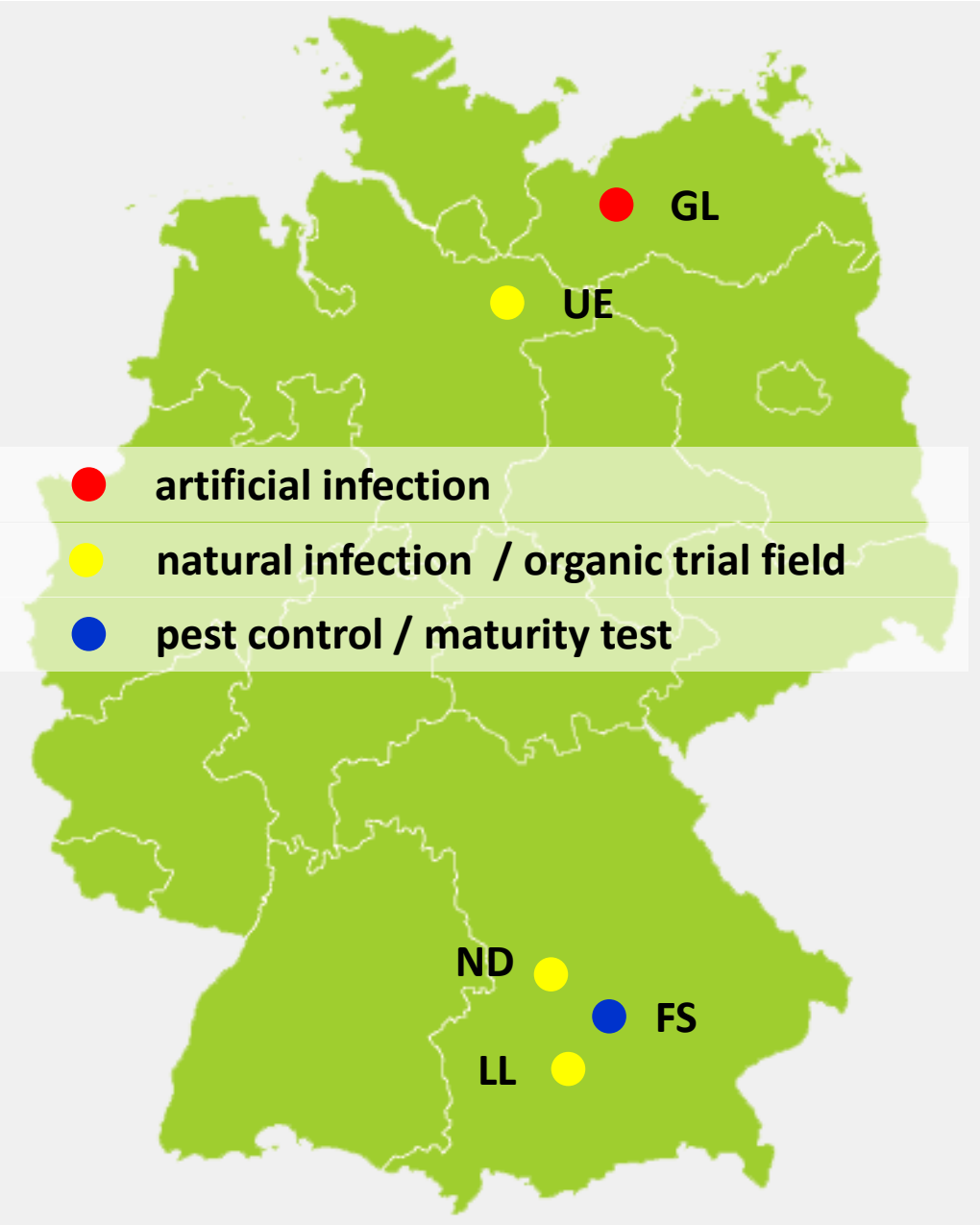
GL: Groß Lüsewitz

UE: Uelzen

ND: Neuburg a.d. Donau)

FS: Freising

LL: Landsberg am Lech



Field trial

year	number of varieties	environments	trials per environment	individuals per plot
2012	117	3 (LL, ND, UE)	2	10
2013	149	1 (FS)+ 3 (ND, LL, UE)	2	10
2014	153	1 (FS) + 3 (LL, ND, UE)	2	10

Parameter

Sprouting time	development	growth form	maturity	late blight	yield
tuber shape	**tubers per plant**	**starch content**	**tuber size**	**quality**	**frying quality**

Field trial

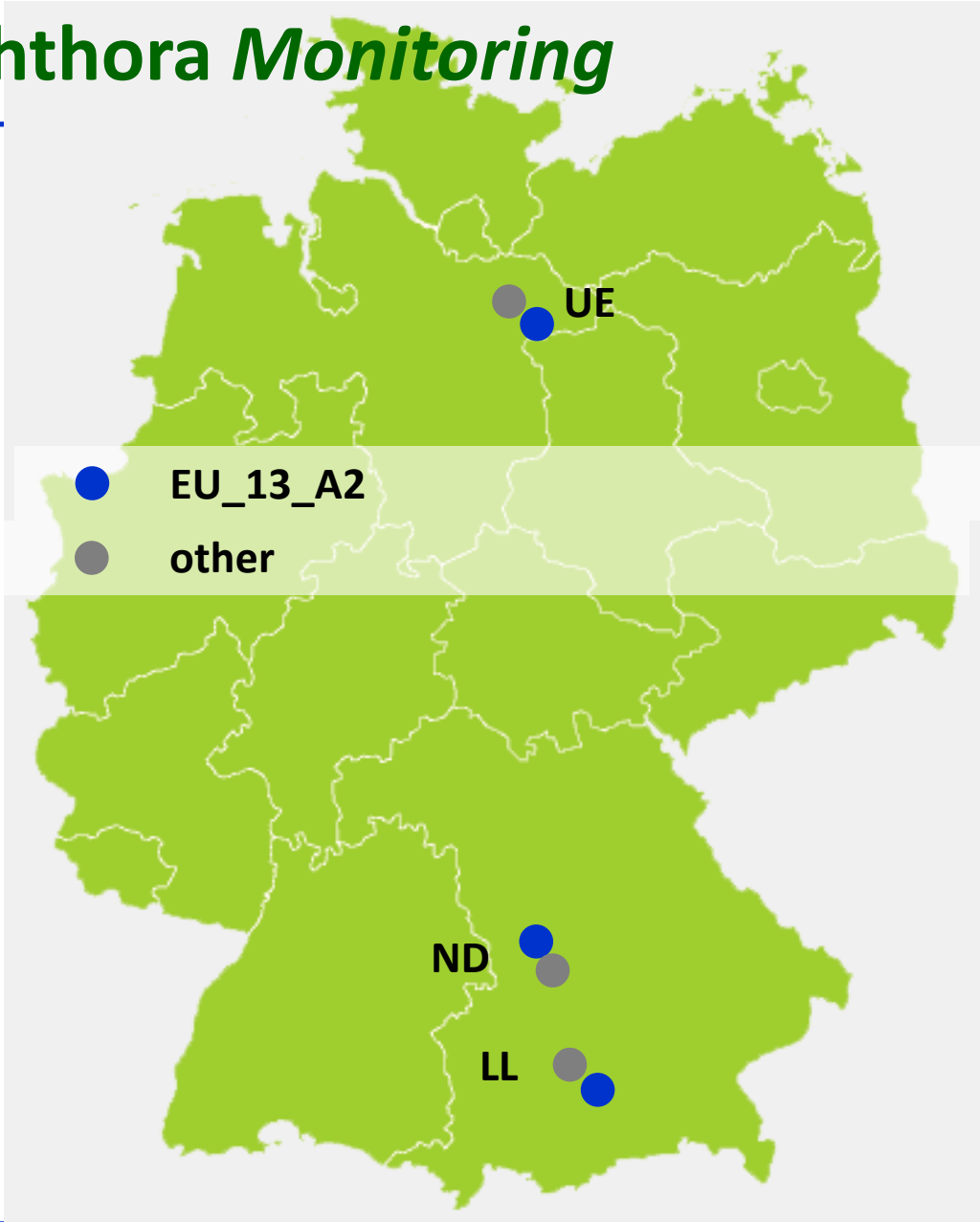
Trial field in Schrobenhausen 2012

Field trial: Phytophthora *Monitoring*

UE: Uelzen

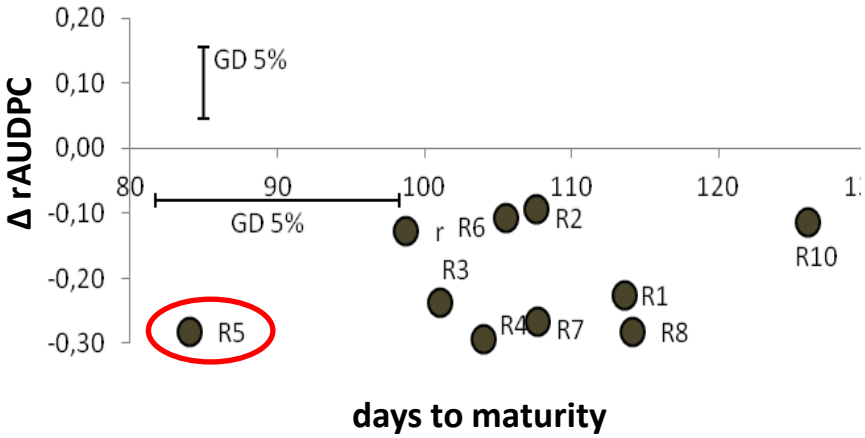
ND: Neuburg a.d. Donau)

LL: Landsberg am Lech

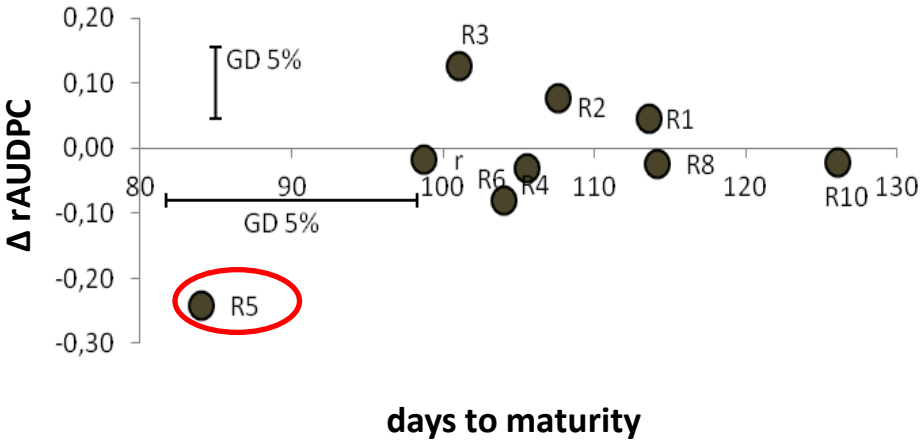


Field trial

Corrected Late Blight Resistance and Maturity for Black's Differential Set

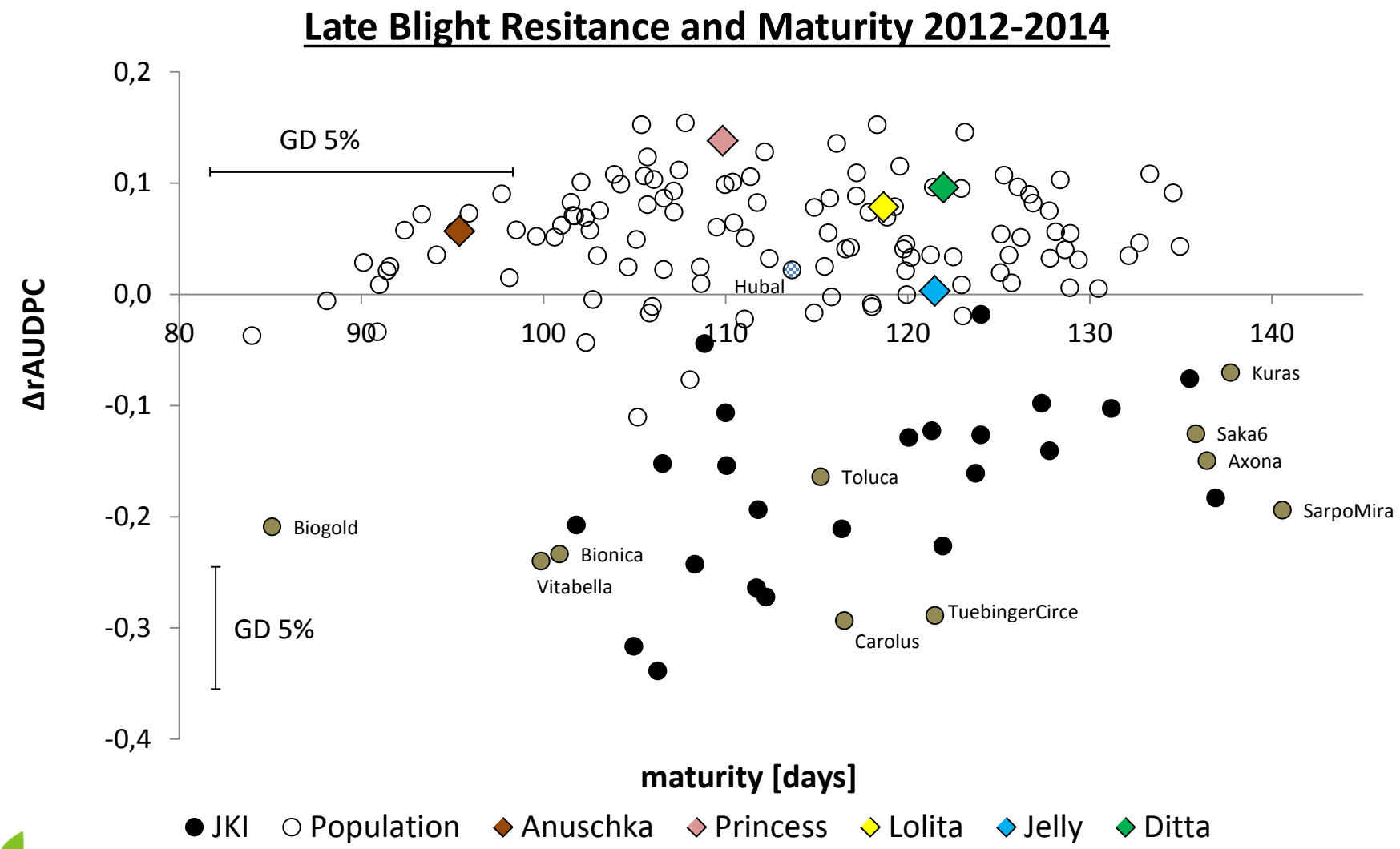


LL 2014
Walleshausen LK Landsberg

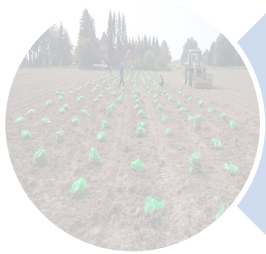


UE 2014
Natendorf LK Uelzen

Field trial


Late Blight Resitance and Maturity 2012-2014
ΔrAUDPC
0,2
0,1
0,0
-0,1
-0,2
-0,3
-0,4
80
90
100
110
120
130
140
GD 5%
GD 5%
Hubal
Kuras
Saka6
Axona
SarpoMira
Toluca
Biogold
Bionica
Vitabella
TuebingerCirce
Carolus
maturity [days]
JKI
Population
Anuschka
Princess
Lolita
Jelly
Ditta

Aims and objectives



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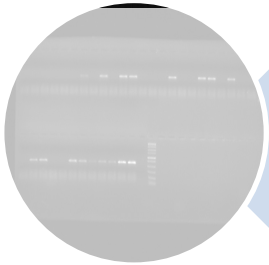


Molecular Analyses:

Examination of resistance hotspots and evaluation of genetic markers for resistance breeding

Potato breeding

Seedling potatoes in Landsberg 2014

Potato breeding

Participative selection of breeding clones in Landsberg 2014

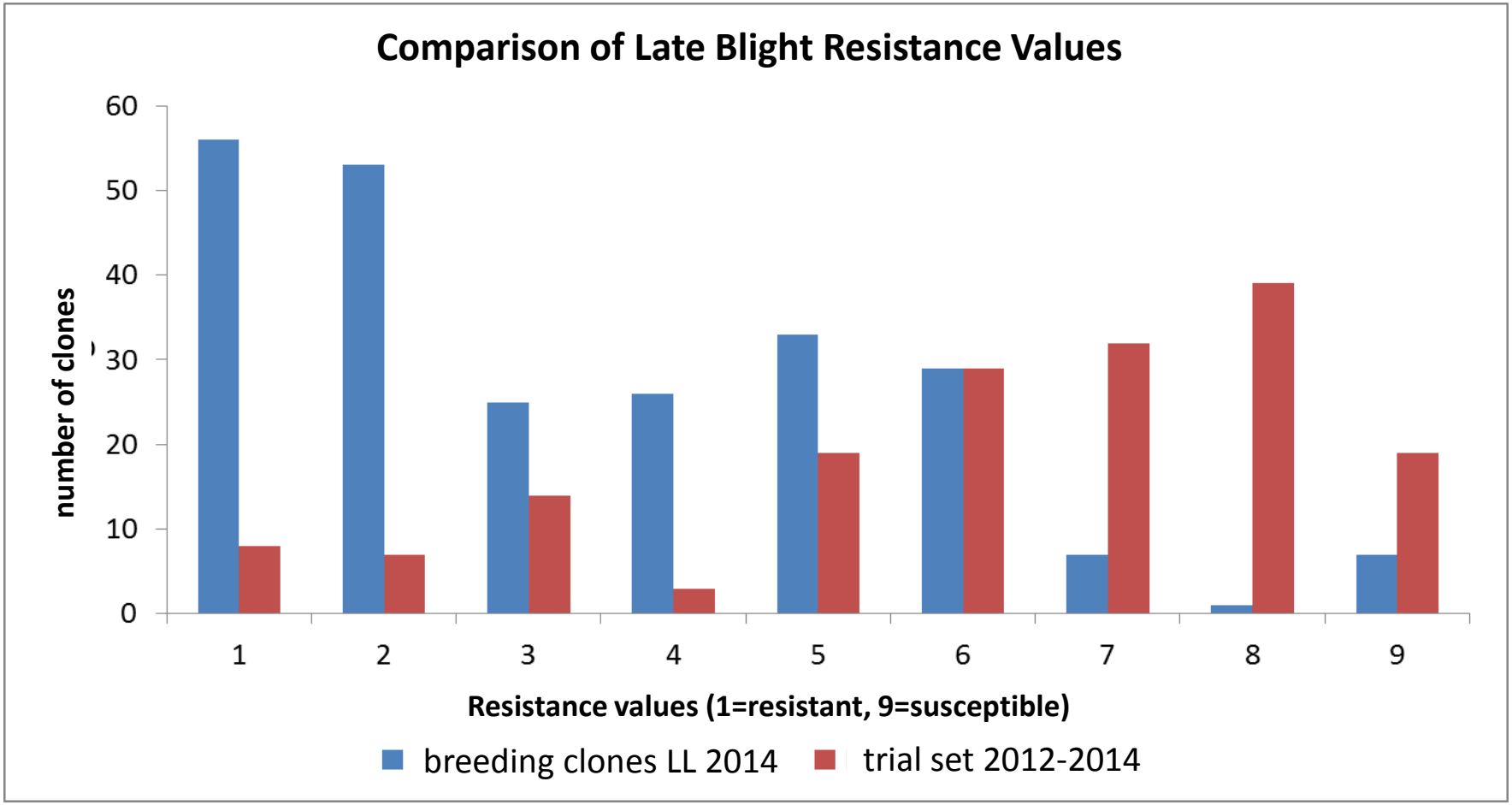
Potato breeding

Susceptible plants will be sorted out

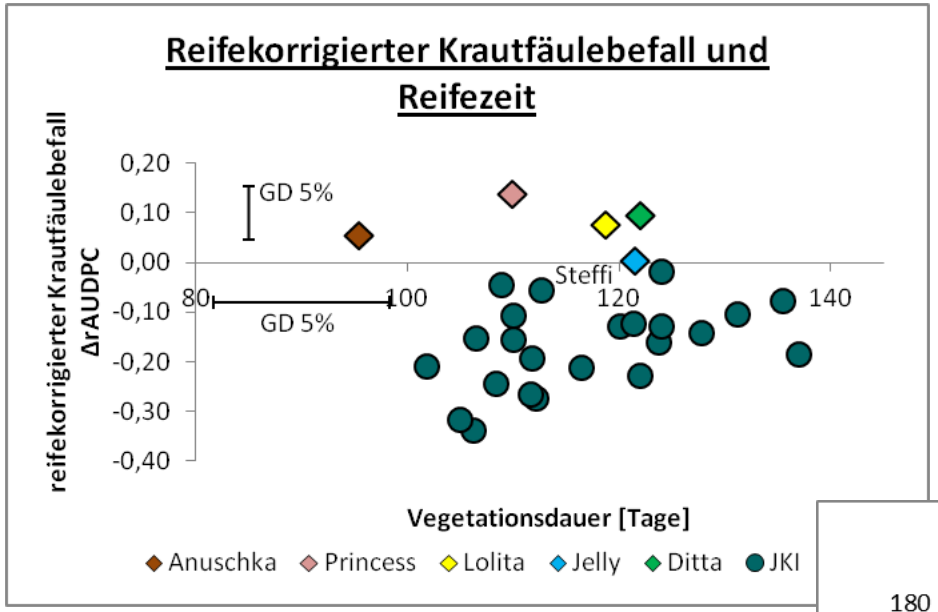
Potato breeding

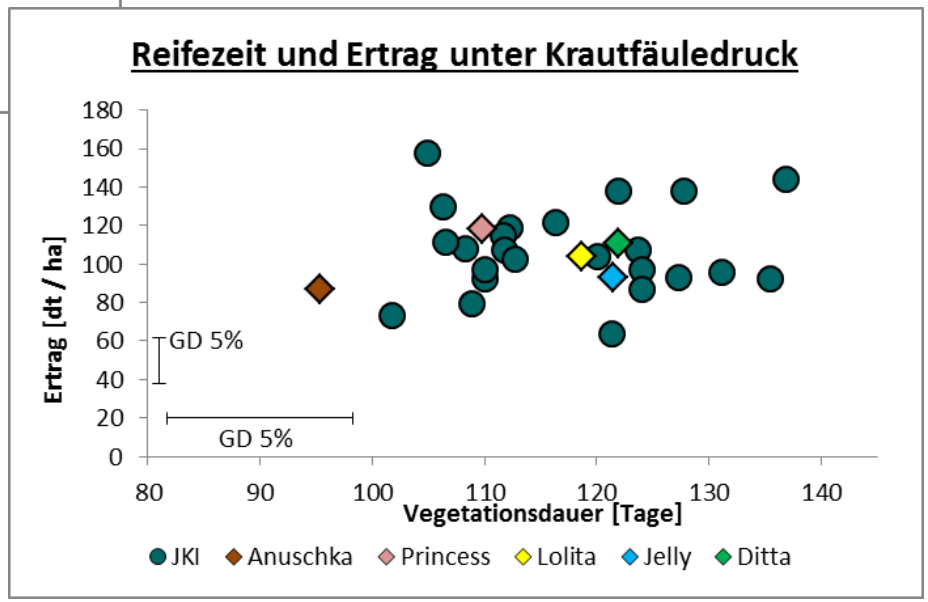
Harvest of preselected clones in Landsberg n 2014

Potato breeding



Potato breeding: resistance vs yield





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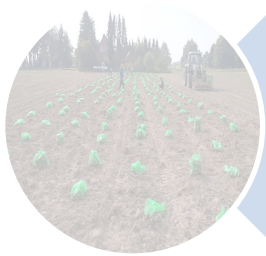

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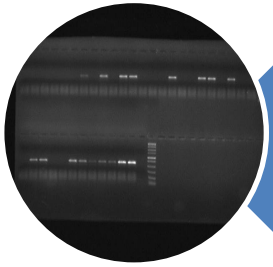


Molecular Analyses:

Examination of resistance hotspots and evaluation of genetic markers for potato breeding

Molecular Analyses: Wild Resistance Donors

S. demissum

S. acaule

S. bulbocastanum

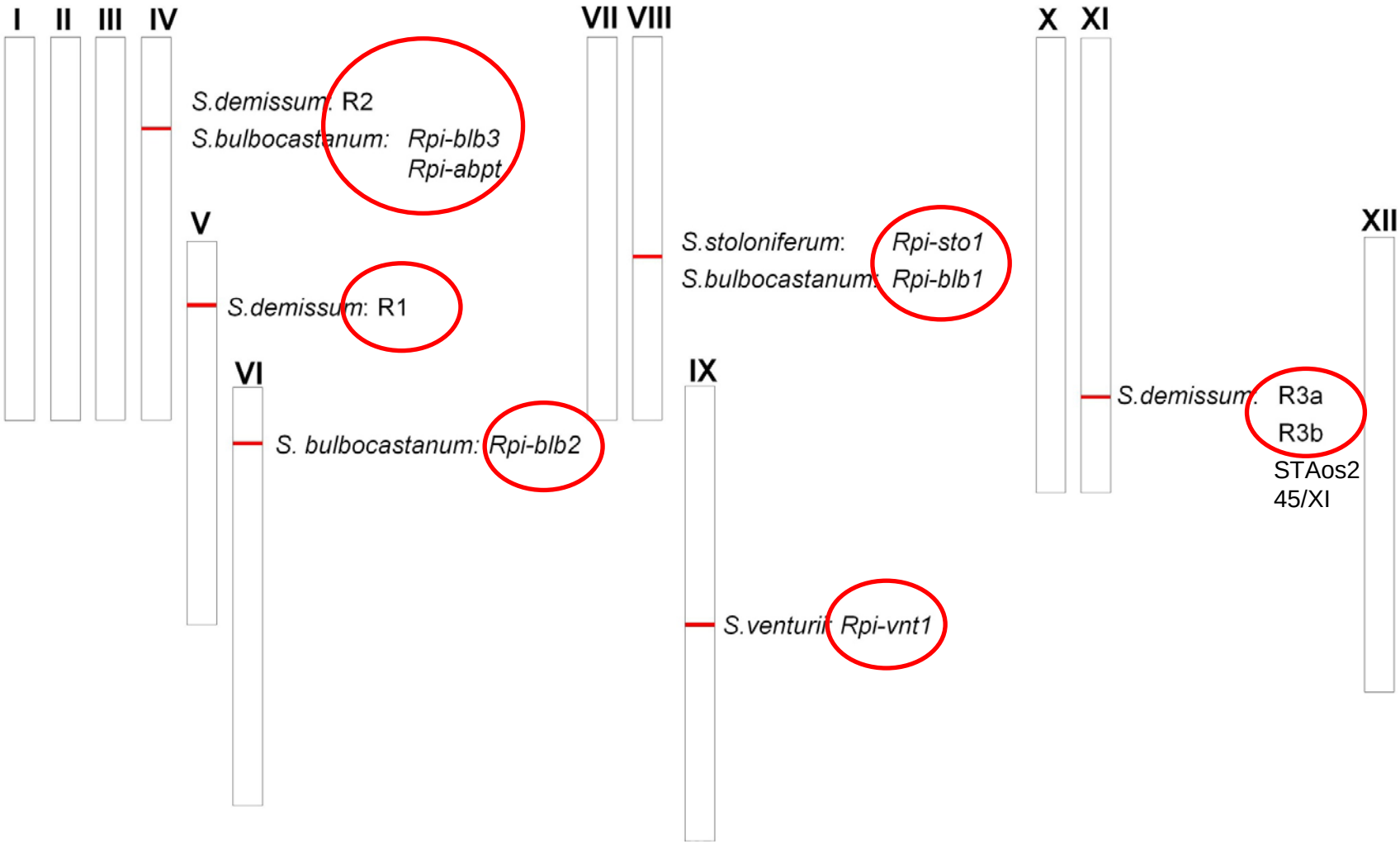
S. pinnatisectum

S. phureja

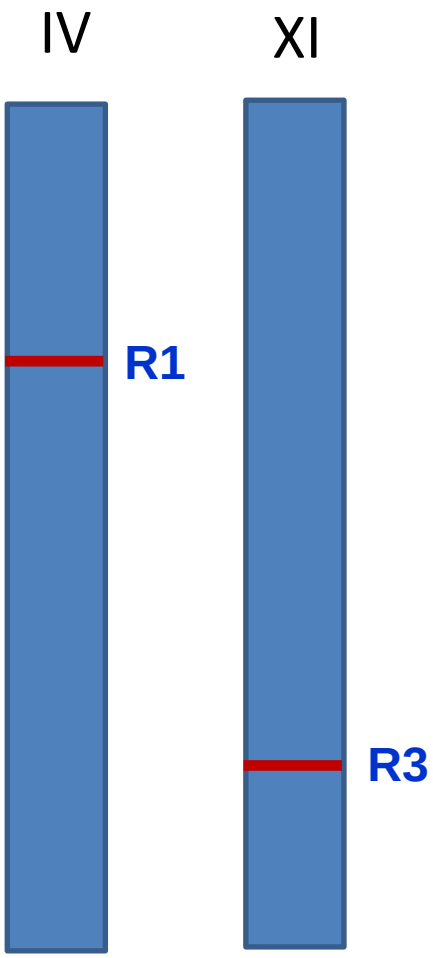
S. stoloniferum

LfL Pflanzenbau

Molecular Analyses: Resistance Loci



Molecular Analyses: Markers for S. demissum

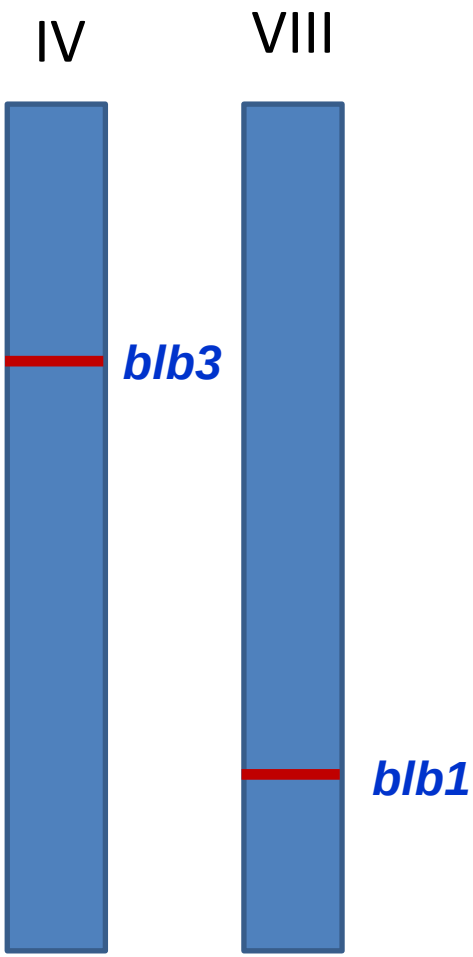


- We applied regions from *R1* and *R3b* as molecular markers.
- Sequences are identical for all investigated cultivars.
- ***R1*** appears in ca. **12%** of all trial samples
- ***R3b*** appears in ca. **35%** of all trial samples

S. demissum

Products: R1, R3a, R3b
References: Huang *et al.* 2005, Rietman 2011, Lokossou *et al*. 2009; Kim *et al.* 2012

Molecular Analyses: Markers for S. bulbocastanum



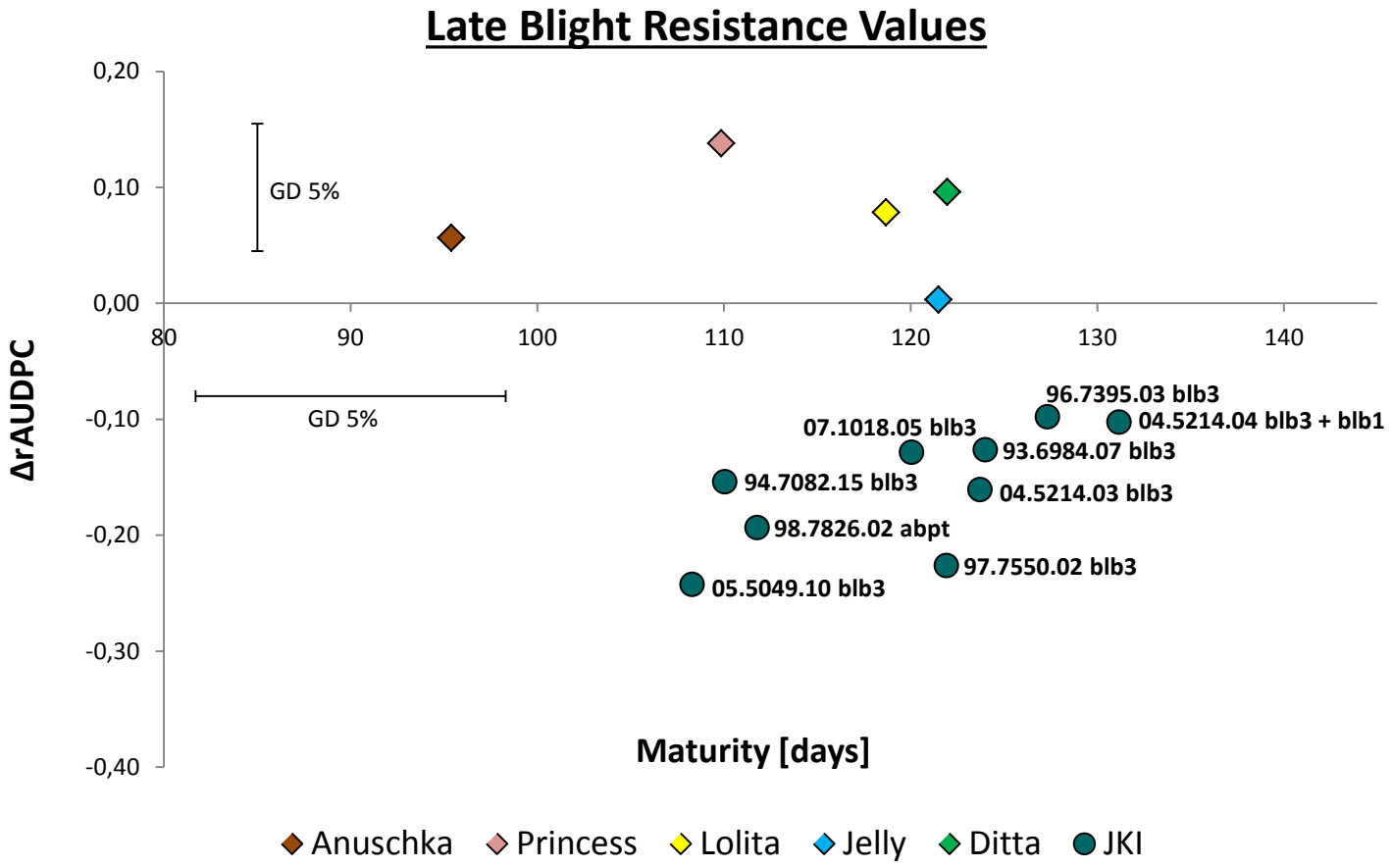
- Markers Blb3 and Abpt were established for the *blb3* region
- Blb1-820 was used for the blb1 region
- **9%** of all samples were positive at the ***blb3*** locus
- **1 sample** was positive at the ***blb1*** locus.

S. bulbocastanum

Products:
- Blb3, Abpt,
- RB-629, Blb1-820, RB-226, Sto1

References:
- Lokossou *et al*. 2009; Kim *et al.* 2012;
- Fadina *et al*. 2009; Zhu *et al*. 2012

Molecular Analyses: Markers for S. bulbocastanum



Molecular Analyses: Wild Resistance Donors

S. bulbocastanum

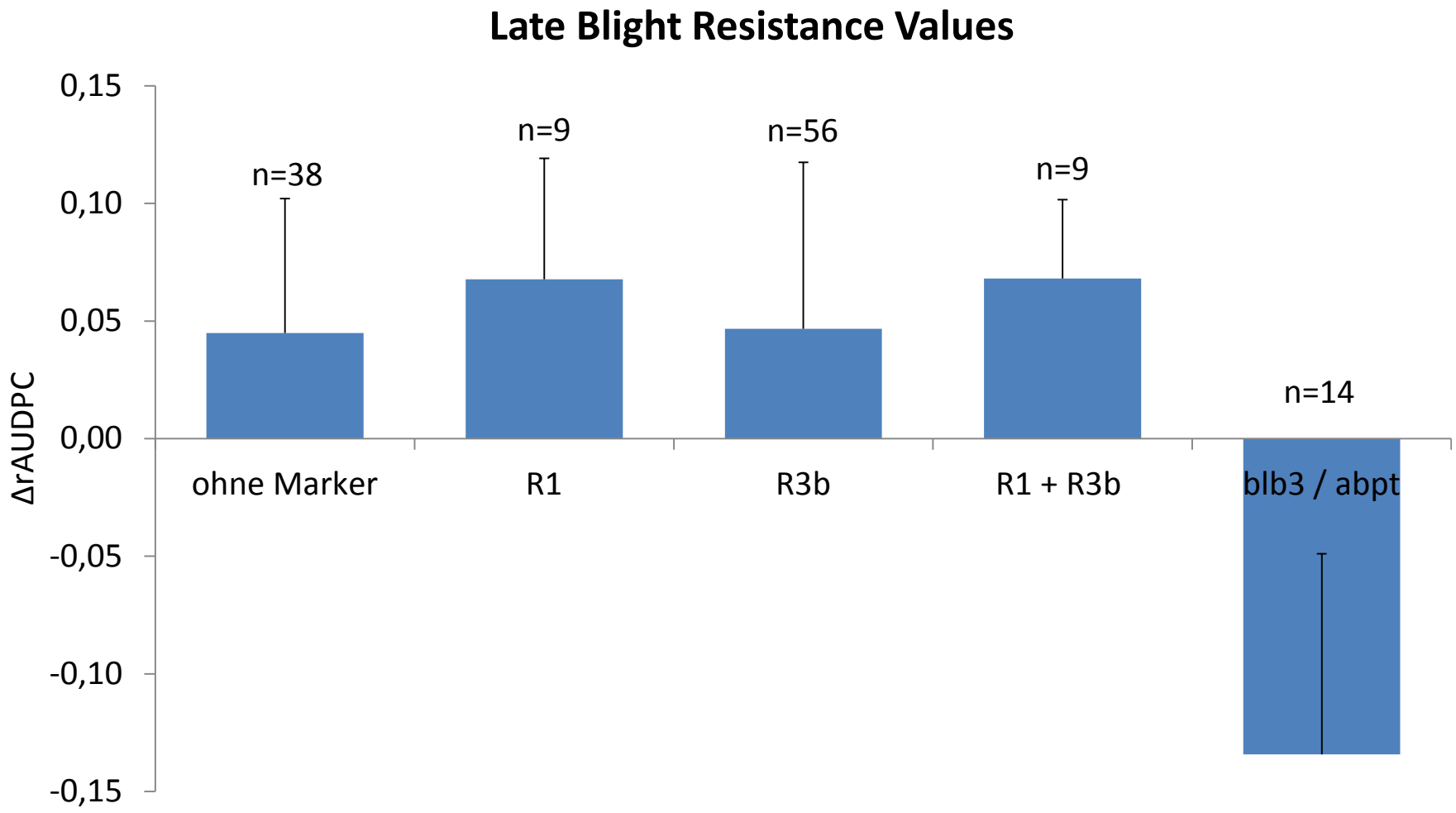
??

S. andigena

??

S. stoloniferum

Molecular Analyses

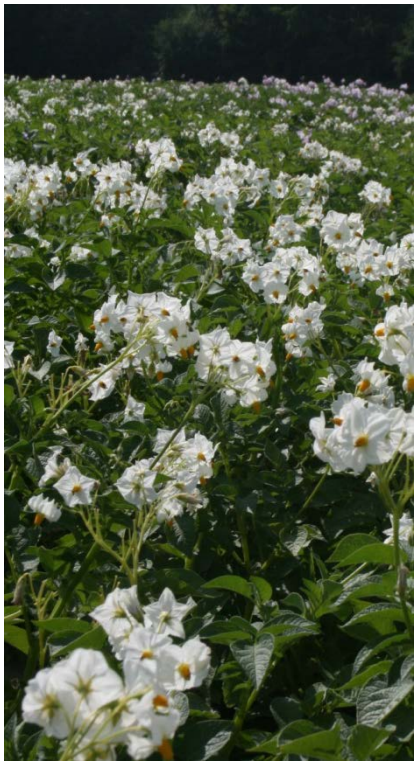


Perspectives

IX

- **Continue breeding efforts and selection of breeding clones**
- **Analyse of SNP results**
- **Find molecular markers for other *Solanum* species that were used as resistance donors**
- **Develop markers that allow to distinguish between resistance genes and their inactive homologues**

- *S. venturii*
- *S. phureja*



Thank You!

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Gefördert durch:

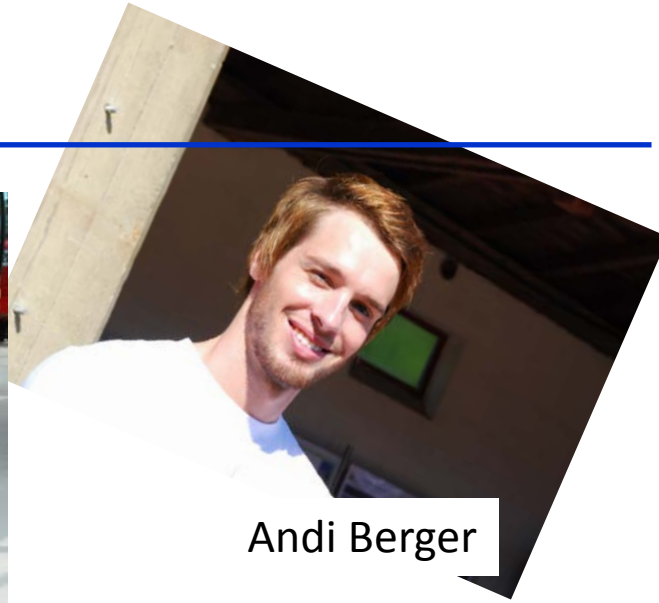
Bundesministerium
für Ernährung
und Landwirtschaft

aufgrund eines Beschlusses
des Deutschen Bundestages

GFP

Gemeinschaft zur Förderung der privaten
deutschen Pflanzenzüchtung e.V.

Georg Forster



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