Breeding for host resistance: the key to sustainable potato production

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Phytophthora infestans continues to be a major limiting factor to potato production worldwide

Fungicide application is highly effective at controlling late blight but may not always be possible or desirable

How can host resistance be employed as a tool in fighting this costly disease?

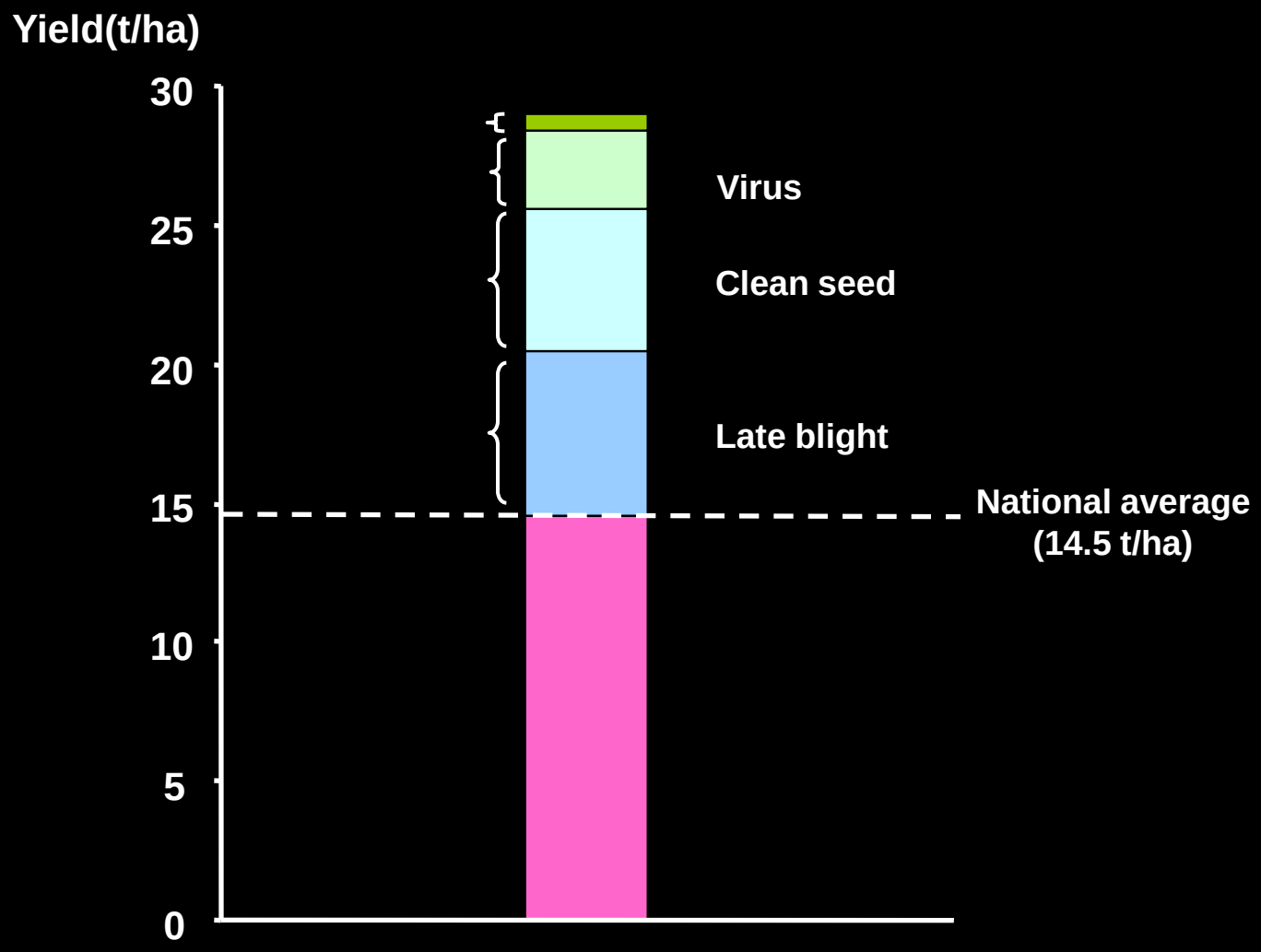
The need for resistance

- Need to reduce inputs – public concern over chemical residues in food and desire to reduce carbon footprint
- New *P.infestans* genotypes resistant to metalaxyl
- Threat of withdrawal of a number of fungicides under EU directive

The need for resistance (cont.)

- Difficulty of application in very wet seasons eg 2007/08
- Cost of fungicide and its application – often quoted as >£20m in UK
- Resource poor farmers may have no access to suitable fungicides or to advice on how to apply them effectively and safely

Potato yield, China



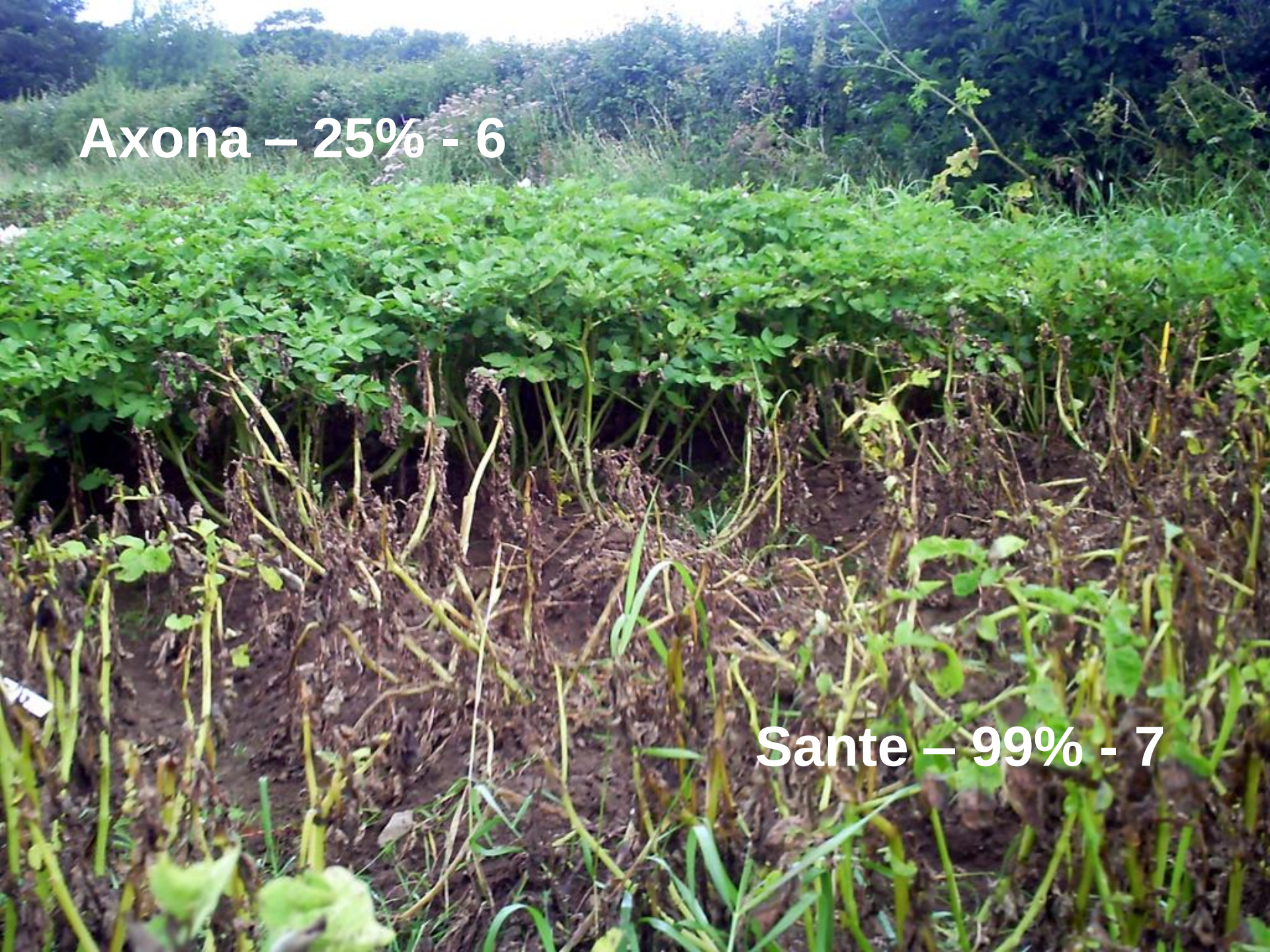
Slide supplied by Pamela Anderson, DG, International Potato Centre, Peru

Sources of resistant material

- Early breeding programmes relied heavily on Black's R-Genes from *S. demissum*, primarily R1, R3 and R10
- Many recent cultivars contain genes from *S. bulbocastanum* eg cv. Toluca
- Diverse wild *Solanum* spp. that confer resistance continue to be found eg *S. venturii*

Sustainable = durable

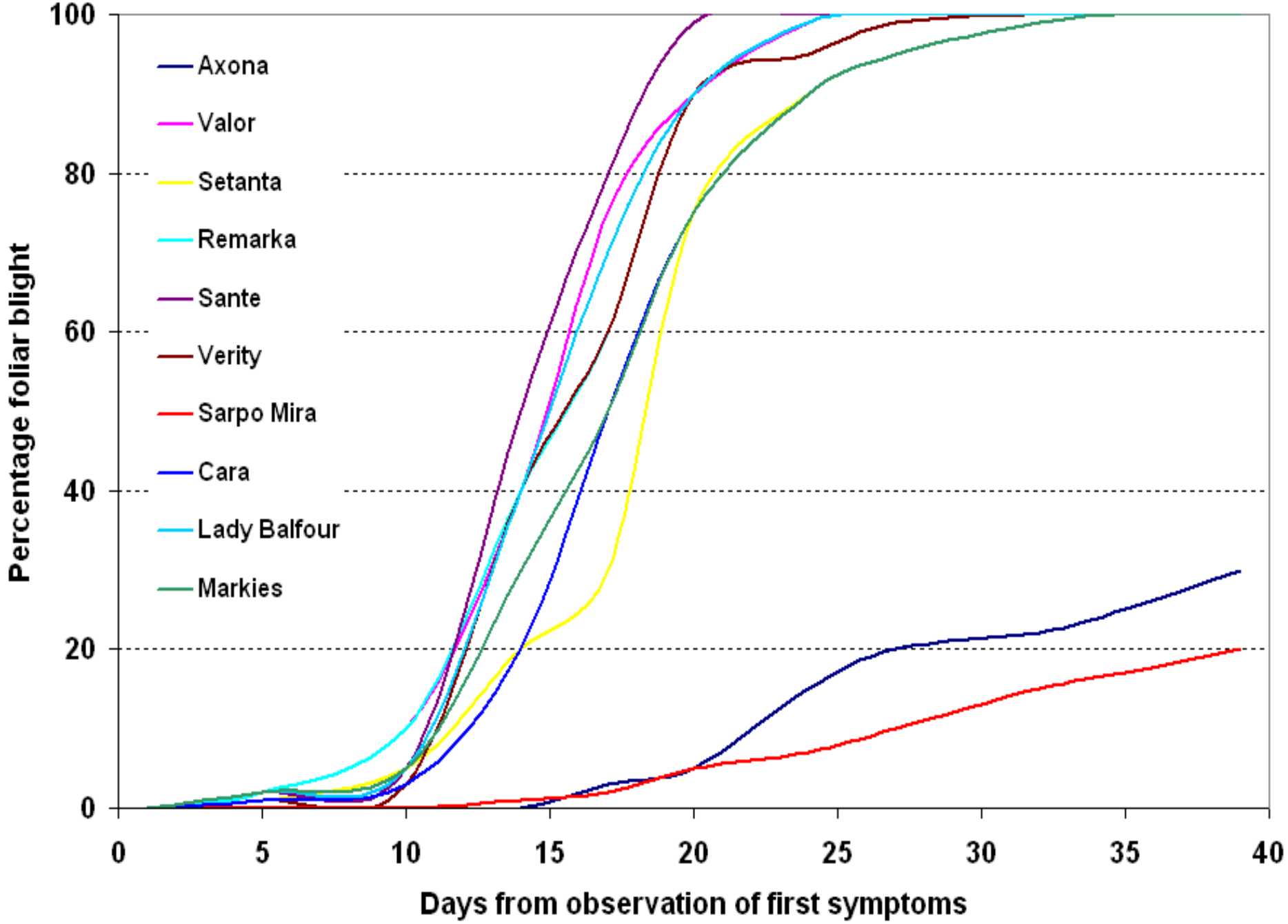
- Introgressed R-genes conferring immunity have generally been overcome
- Evidence that field/partial resistance is more durable
- Recent changes in pathogen population have overcome many previously resistant cultivars, even those thought to have polygenic resistance


Axona – 25% - 6
Sante – 99% - 7


Sarpo Mira - 10% - 9
Verity – 99% - 8

Resistance in Sárpo clones

- Partial resistance/slow-blighting phenotype to all *P.infestans* tested, including new populations with increased virulence
- Clones show a range of resistance: Sárpo Mira/Axona – Sárpo Shona/Will – Blue Danube/Kifli
- All varieties show high tuber blight resistance


100
80
60
40
20
0
Percentage foliar blight
Axona
Valor
Setanta
Remarka
Sante
Verity
Sarpo Mira
Cara
Lady Balfour
Markies
0
5
10
15
20
25
30
35
40
Days from observation of first symptoms

rAUDPC - maincrop

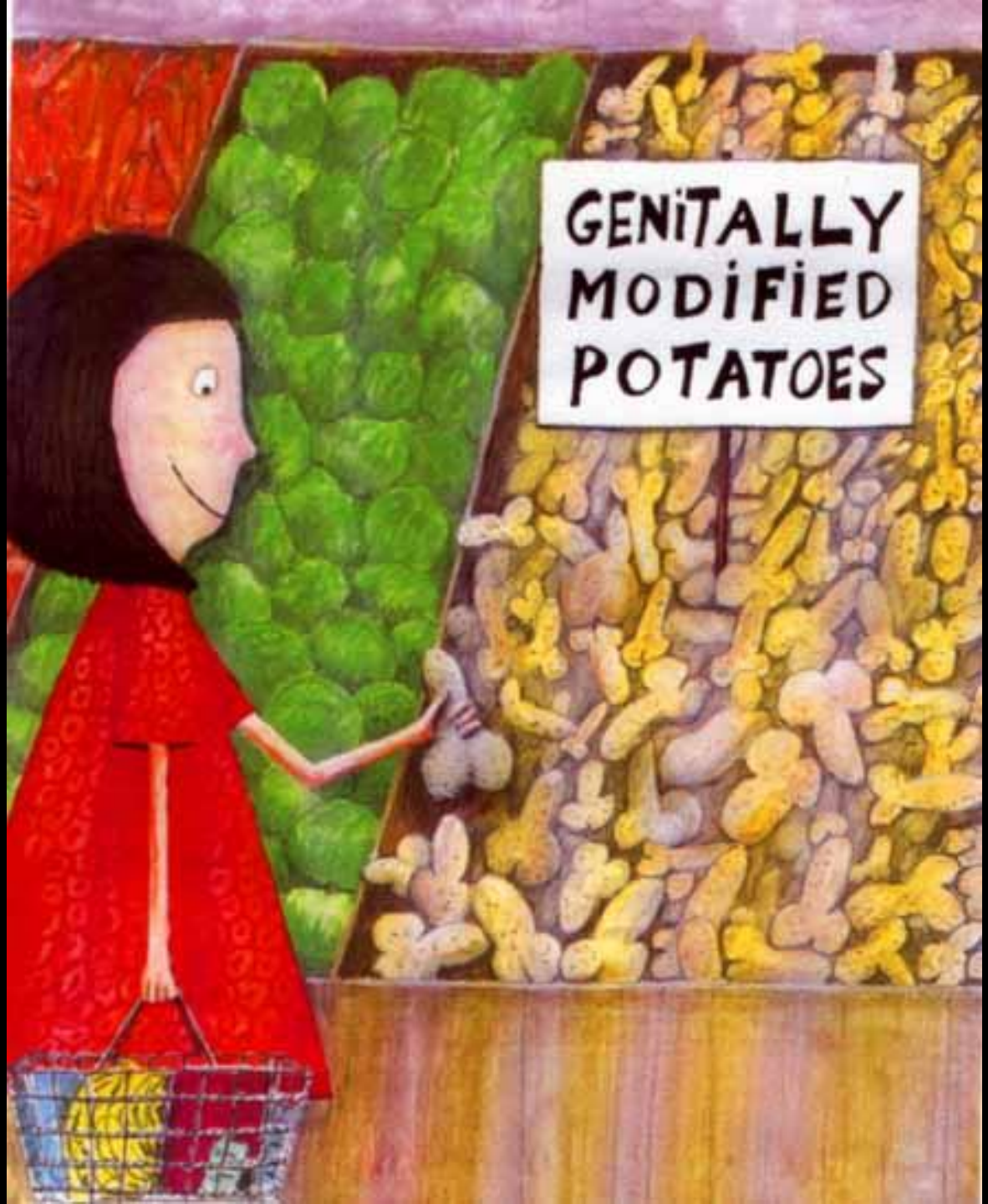
	Mira	Axona	Will	Robijn	L.Balfour	Bintje
2005	0	0	0.05	0.3	0.27	0.81
2006	0	0.02	0.12	0.26	0.39	0.56
2007	0.06	0.14	0.21	0.66	0.76	0.88
2008	0.25	0.53	0.5	0.75	0.81	0.88
2009	0.31	0.37	0.56	0.68	0.74	0.88

rAUDPC - earlies

	Val	Una	Orla	Escort	Gloria 1972	Eersteling
2005	0.01	0	0.54	0.3	0.75	0.75
2006	0	0	0.54	0.4	~	~
2007	0.1	0.74	0.84	~	~	~
2008	0.48	0.78	0.79	0.8	0.85	0.84
2009	~	0.69	0.76	~	0.87	0.86

New directions

- Genome sequence has enabled the mapping of R-genes and QTL's
- BASF transgenic cv. Amflora recently granted EU approval
- Genes involved in resistance in many *Solanum* spp. being mapped and identified within the genome sequence
- Cisgenic transfer of selected genes into favourite cvs


GENITALLY
MODIFIED
POTATOES

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