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## Screening for resistance in wild species and landraces in Peru, and the strategy and resistant materials from CIP's breeding program

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Third AsiaBlight International Meeting, Beijing



RESEARCH  
PROGRAM ON  
Roots, Tubers  
and Bananas

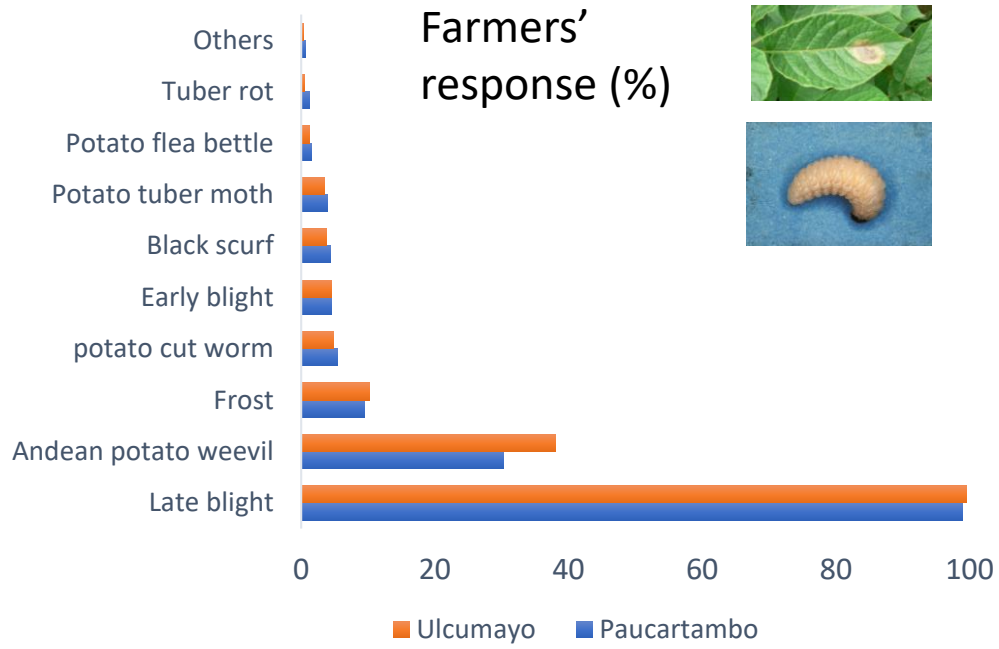


# Outline

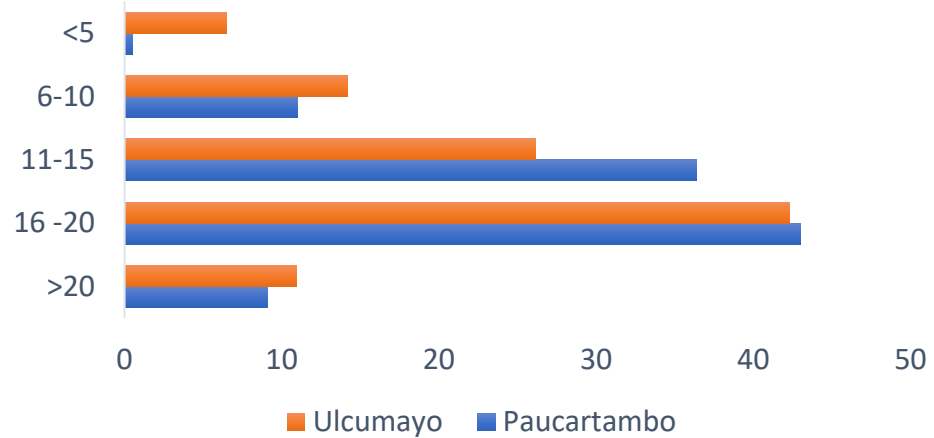
- LB in developing countries
- The cornerstone: Host resistance
- Knowing the pathogen: pathogen population studies
- Helping farmers to use fungicides: Decision support systems
- It is all about the farmers: Training
- Perspectives

# Top ten priorities for CIP's partners

No.	Topic	Mean	LAC	SSA	ESEA	SWCA
1	Late blight management	4.71	4.63	4.77	4.85	4.06
2	Late blight breeding	4.60	4.56	4.52	4.76	3.82
3	Breeding for drought tolerance	4.51	4.56	4.34	4.59	4.88
4	Breeding for earliness	4.49	4.48	4.66	4.48	4.88
5	Production and dist. of planting materials (formal)	4.45	4.31	4.42	4.67	4.76
6	Improving soil fertility	4.44	4.33	4.68	4.53	4.53
7	Germplasm enhancement and pre-breeding	4.41	4.42	4.43	4.39	4.69
8	Breeding for high yield	4.38	4.13	4.59	4.54	4.83
9	Development of farmer organizations	4.34	4.23	4.56	4.41	4.65
10	Improving potato cropping systems	4.32	4.46	4.60	4.26	4.06



## Sprays in rainy season





W. Pérez



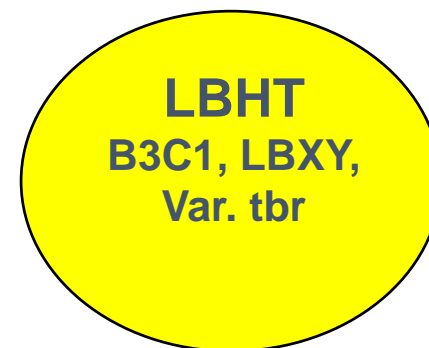
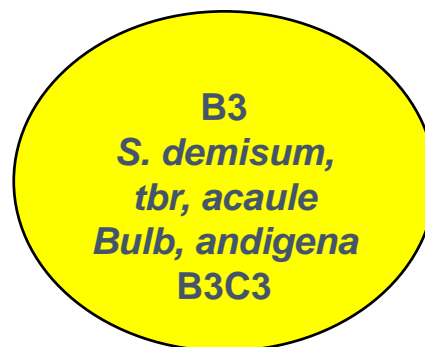
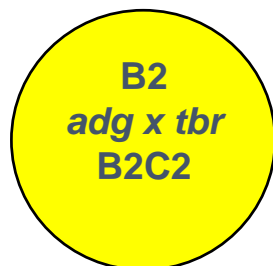
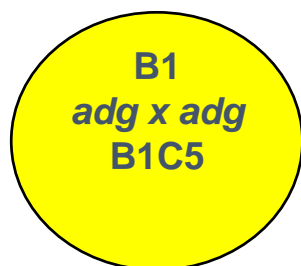
R. Harari

## HOST RESISTANCE: Genetically engineered potato with 3 R genes stacked into farmer preferred varieties



- Confined field trial (CFT) in Uganda.
- Natural epidemic and no fungicide sprays
- *P. infestans* population has been monitored before and during the CFTs
- No virulent pathogen phenotypes found

## HOST RESISTANCE: Population B



Selection for:

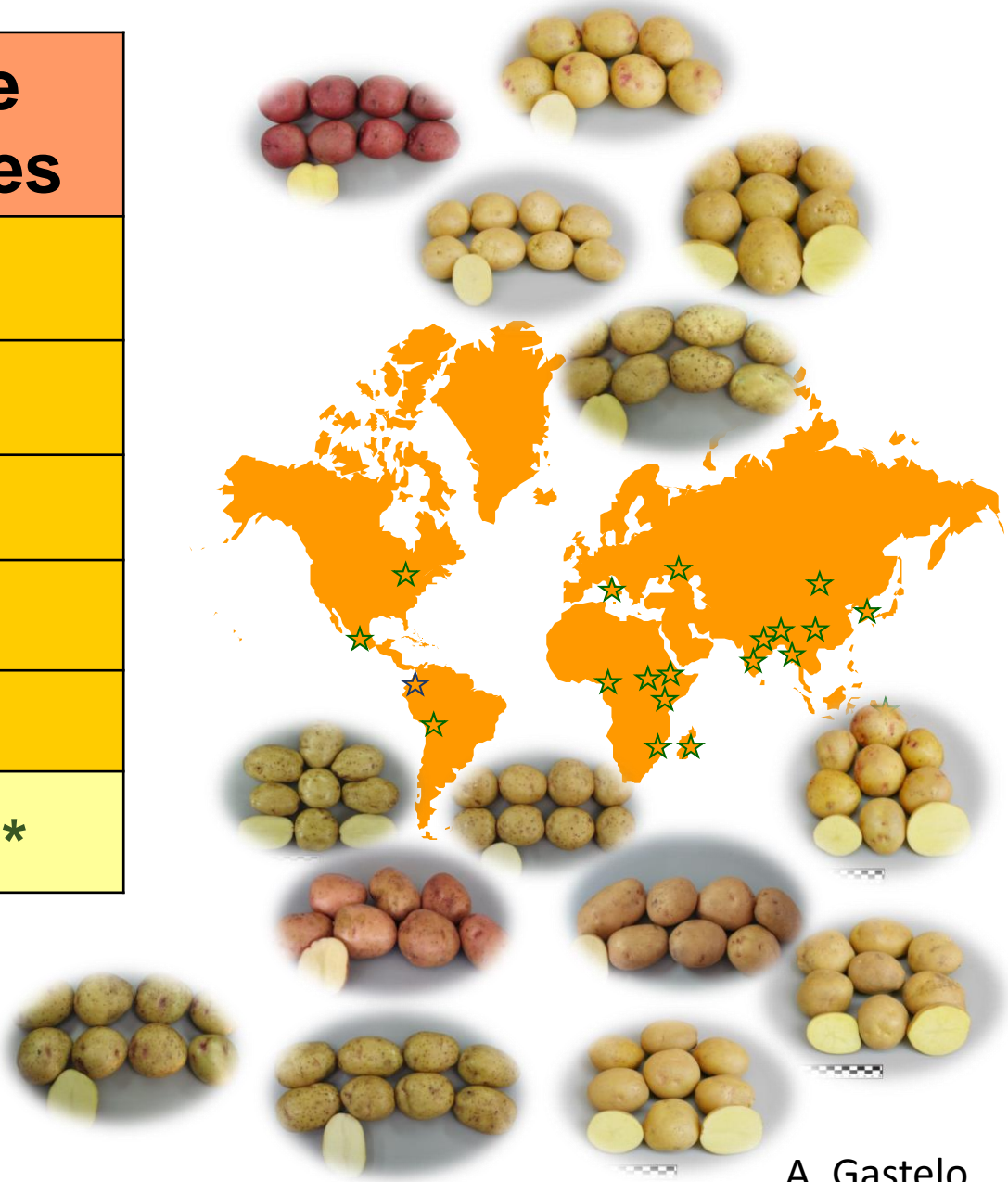
- Horizontal resistance to LB
- Agronomic and quality traits
- Tolerances to biotic and abiotic stresses  
– heat, drought tolerance
- Early maturity (early tuber initiation, fast bulking)
- Immunity to PVY, PVX
- Adaptation to wide environments (day length)





Population	Elite Clones
B3C1	56
B3C2	57
B3C3	50
B1C5	71
LBHT	44
Releas. Var.	$\pm 70^*$

~ 15 countries



A. Gastelo

**Kuelap, Peru  
500-1100 AD**



**Screening for resistance in potato landraces and wild Solanaceae**

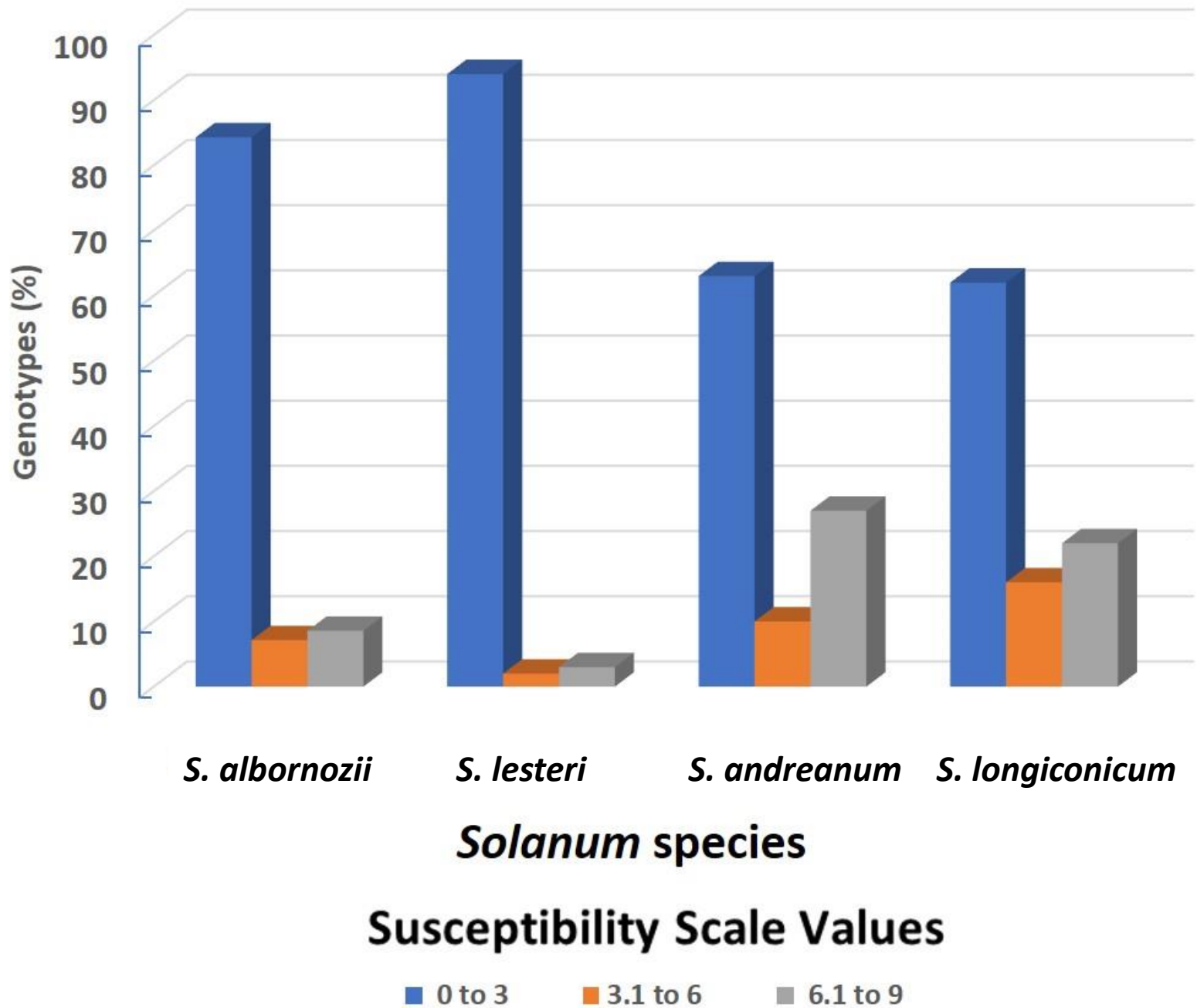
## Potato landraces and wild Solanaceae tested for resistance to late blight

	Number of Accessions*	Assays				Total
		2001	2014	2018	2019	
Landraces	4354		468	321	81	870
Wild	2337	133		57	15	205

*\*Accessions in CIP germplasm*

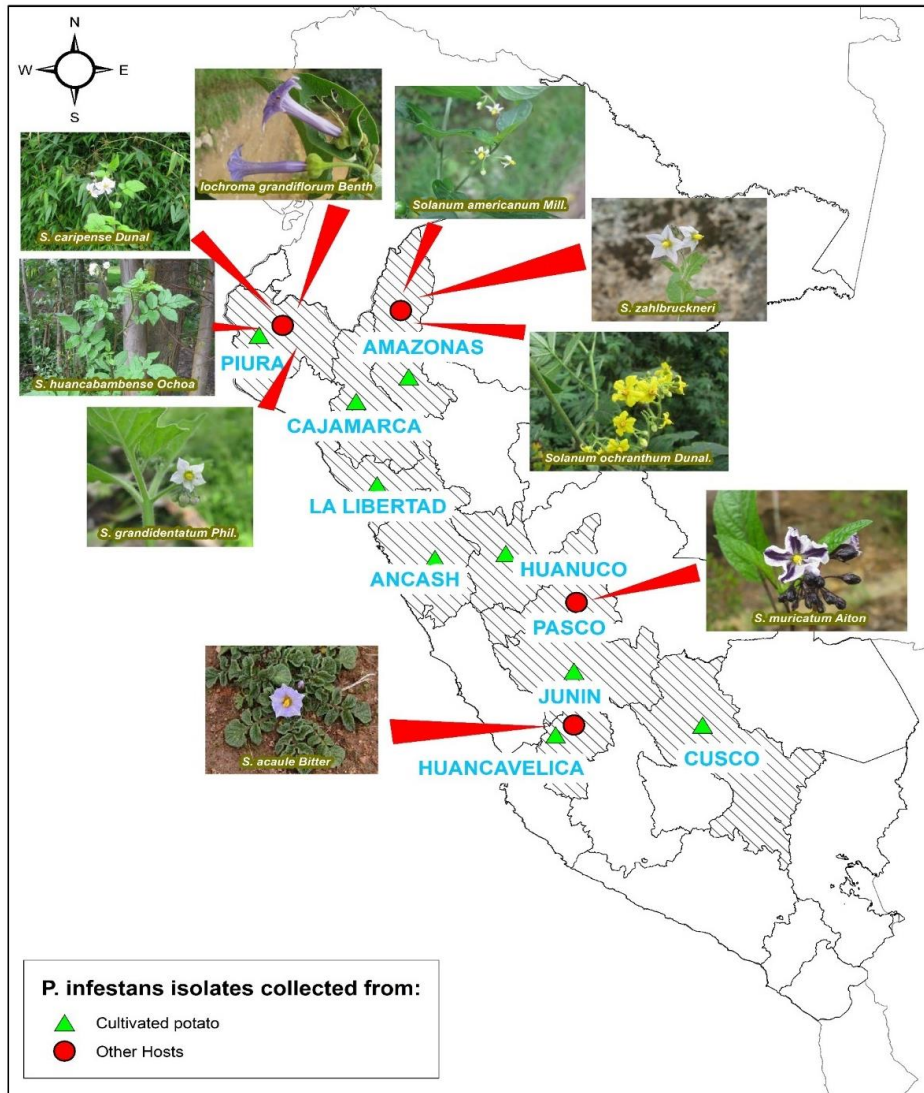


Yuen and Forbes  
(2009)





# PATHOGEN POPULATION STUDIES: Example from Peru

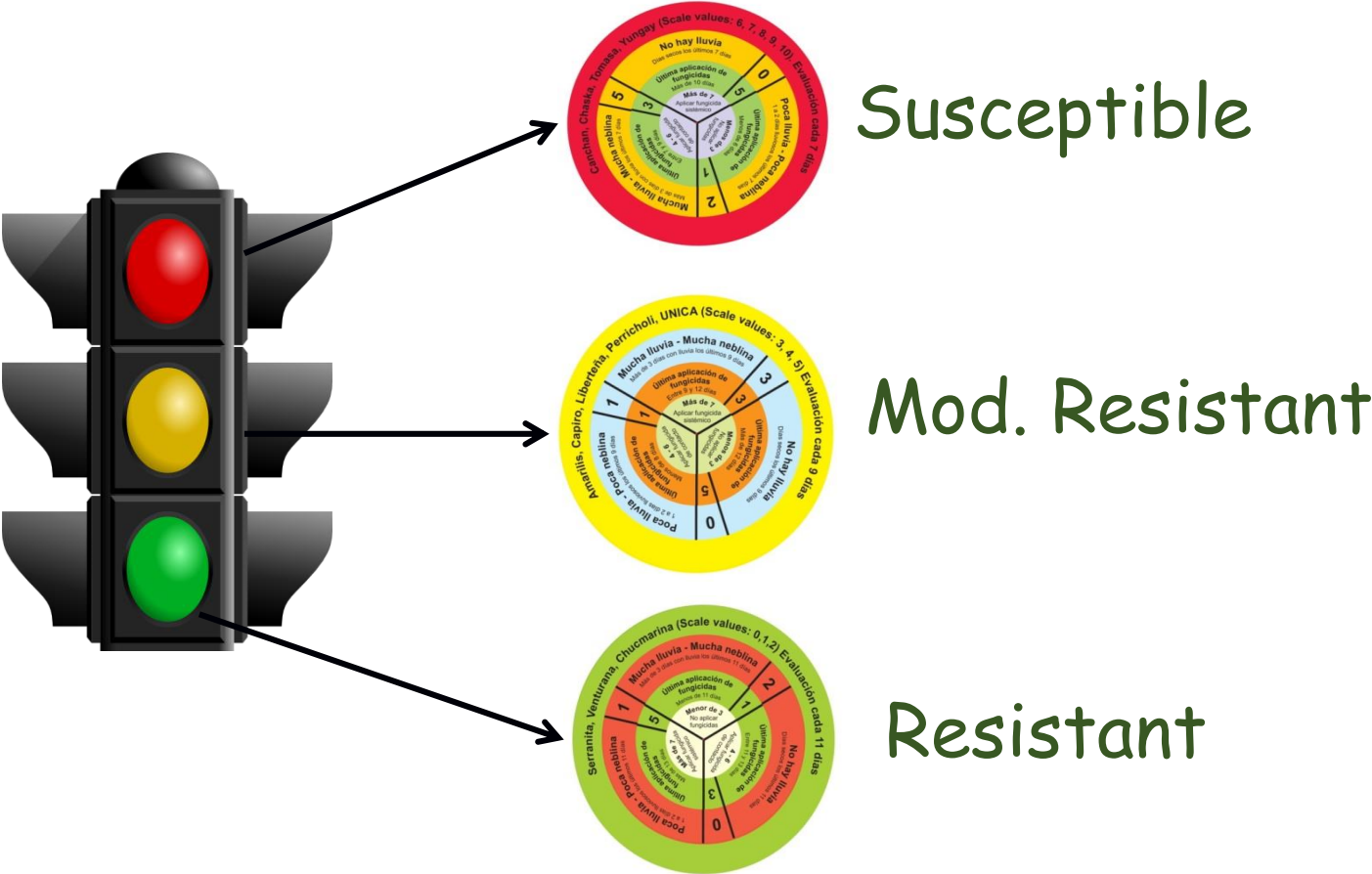


Wild Solanaceae's infected with *P. infestans*:

- S. americanum*
- S. zahlbruckneri*
- S. ochranthum*
- S. candolleianum*
- S. acaule*
- S. muricatum* (US-1)
- S. grandidentatum*
- S. caripense*
- S. huancabambense*
- Lochroma grandiflorum*

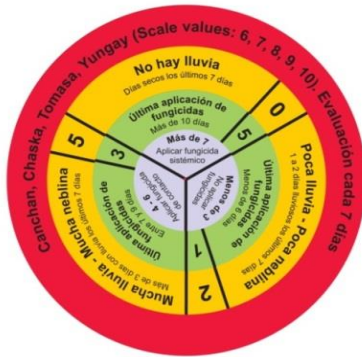
S. Gamboa and H. Linqvist-Kreuze

# DISEASE MANAGEMENT: Decision Support System (DSS)

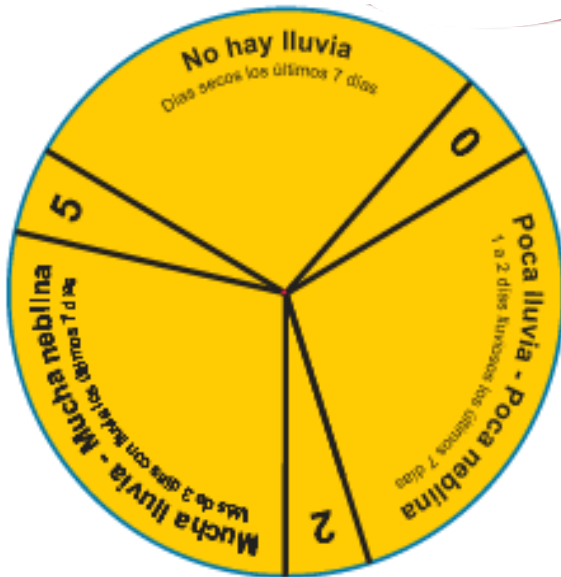




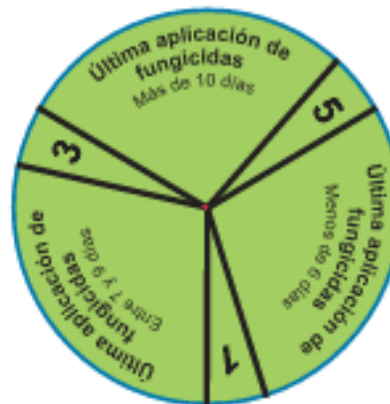
# DISEASE MANAGEMENT: Decision Support System (DSS)



Host



Weather conditions



Period since last spray application



Recommendation

# Development and validation of the DSS

- Perú and Ecuador
- 2011-2016
- 15 experiments
- 51 epidemics
- 13 varieties



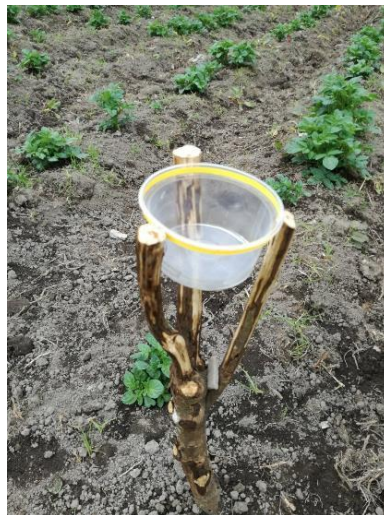
# DSS test in Ecuador: Randomized Control Trial

Group 1: 150 farmers using conventional LB management



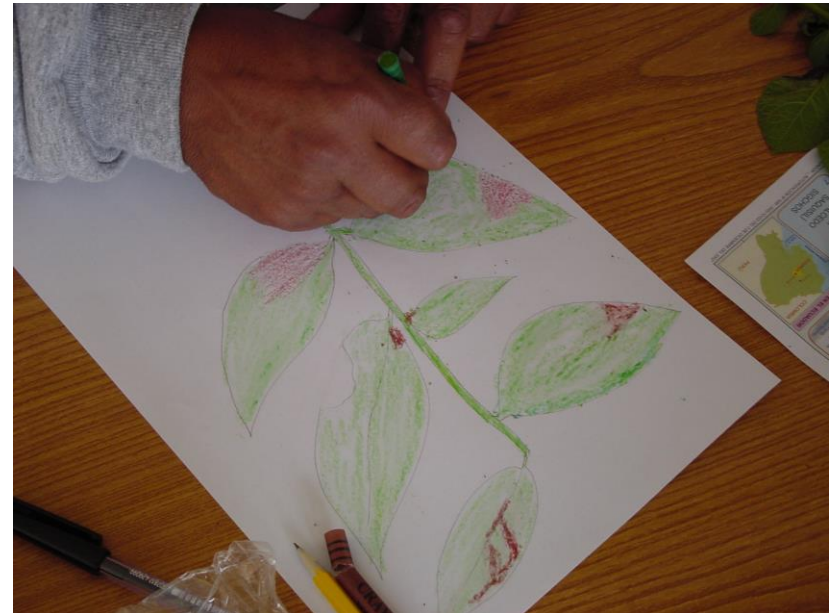
# DSS test in Ecuador: Randomized Control Trial

Group 2: Farmers using DSS, including training and backstopping



Variable	Control		DSS		<i>P</i>
	<i>n</i>	Mean	<i>n</i>	Mean	
rAUDPC	135	1.17	130	1.89	0.0175
Environmental impact	135	1180	130	497	< 0.0001
Yield (t/ha)	133	52.2	129	52.3	0.6080

# IT IS ALL ABOUT THE FARMER: Training



## CIP recognized with award of excellence at the International Pest Management Symposium (2018)



Oscar Ortiz and Modesto Olanya

# Perspectives

- Understanding and using host resistance from landraces and wild Solanaceae
- Artificial intelligence algorithms and apps to diagnose late blight and other diseases
- Decision support system adapted for developing countries using apps
- Alliances with private sector to develop Latin Blight, Asia Blight and Africa Blight





**The International Potato Center** (known by its Spanish acronym CIP) is a research-for-development organization with a focus on potato, sweetpotato, and Andean roots and tubers. CIP is dedicated to delivering sustainable science-based solutions to the pressing world issues of hunger, poverty, gender equity, climate change and the preservation of our Earth's fragile biodiversity and natural resources.

[www.cipotato.org](http://www.cipotato.org)



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