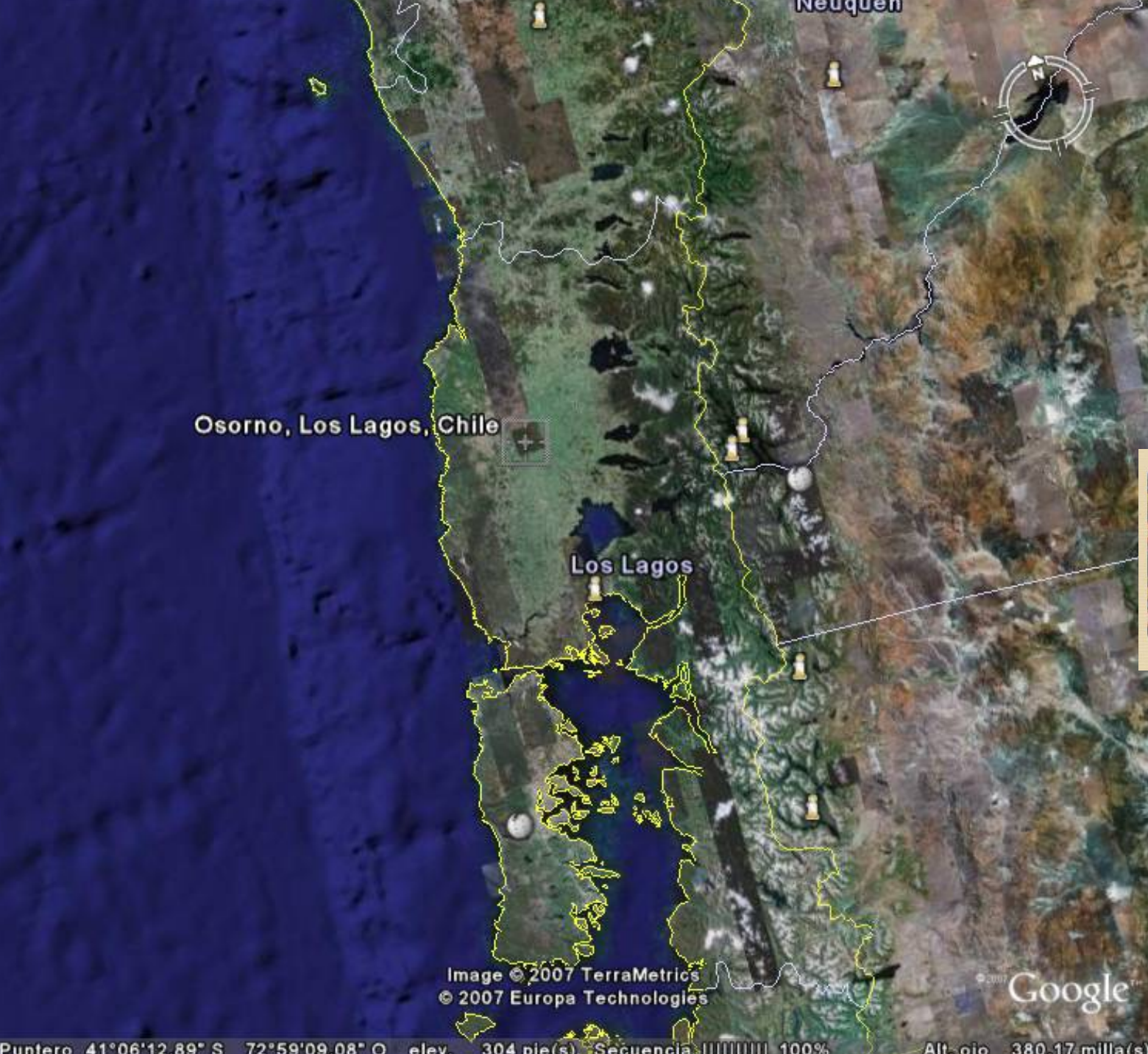




USE A FORECAST SYSTEM TO DEVELOP INTEGRATED PEST MANAGEMENT STRATEGIES FOR LATE BLIGHT IN SOUTHERN CHILE

I.Acuña, R. Bravo, B. Sagredo, M. Gutierrez, I. Maldonado,
N. Gaete, J. Inostroza, G. Secor and J. Kalazich

Finance by FIA-PI-C-2003-1-A-17.



CHILE

70.000 ha
25 t/ha
90.000 growers
60% in the southern

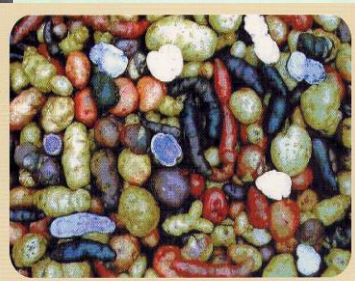


Foto: Profesor Andrés Contreras - UACH Valdivia

Situation of Late Blight in Chile

- **First Report: 1950's**
in tubers coming from Argentina
- **Incidence and severity is variable year to year** in the south, common in the north
- **Last years:**
Changes in potato production system



2006-07

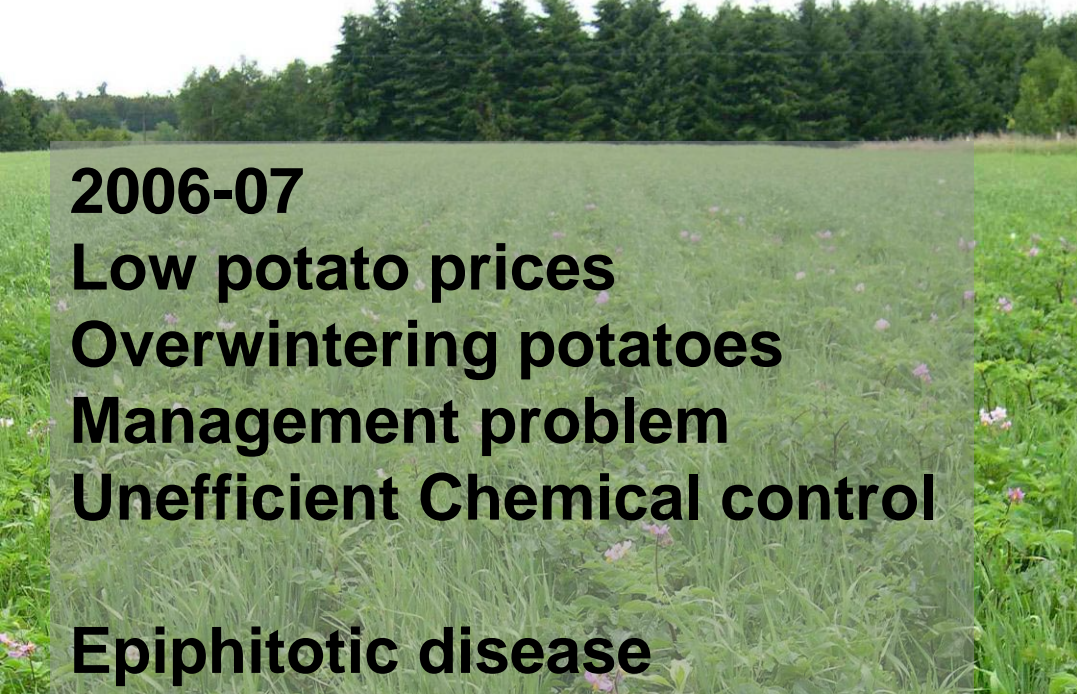
Low potato prices

Overwintering potatoes

Management problem

Unefficient Chemical control

Epiphytotic disease





Integrated Pest Management Considerations

Pathogen
P. infestans

Grower

¿?

Host
Potato

Weather
 T^a , RH, Pp



P. infestans collection

250 isolates were collected from the southern Chile: Los Lagos and Araucanía regions.

Season	N°
2003/04	99
2004/05	151

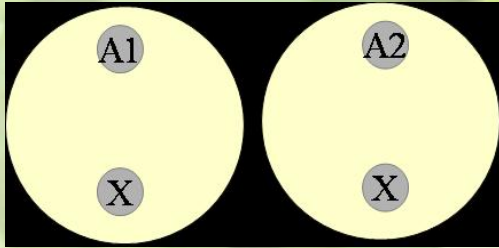


PLANO GENERAL DE UBICACIÓN
PROSPECCIÓN TIZÓN TARDÍO
EN LA NOVENA Y DÉCIMA
REGIÓN DE CHILE PERÍODO ENERO- ABRIL 2004

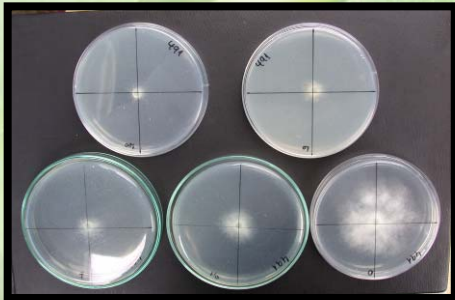


Studies on Characteristic of *P. infestans* Population in Chile

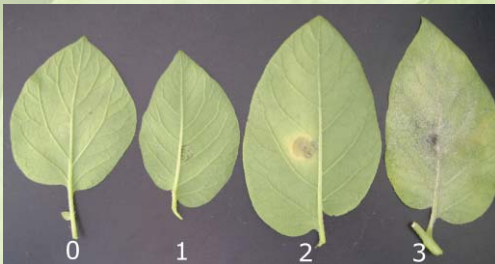
Mating type



Metalaxyl resistance

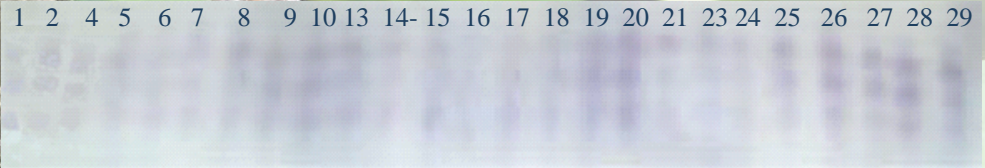


Virulence

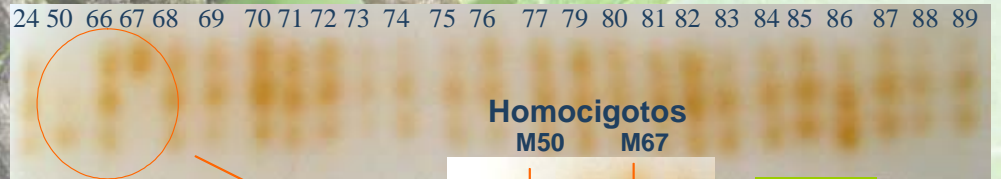


Isoenzimas

GPI → Monomórficos



PEP → Tres genotipos



Alelo

Homocigotos
M50 M67

Alelo

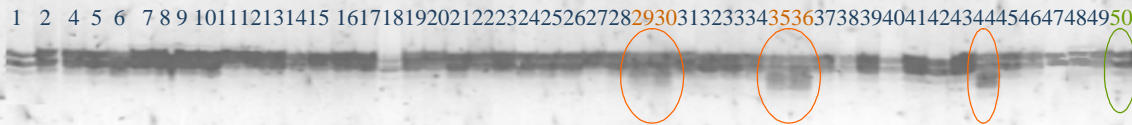
Heterocigoto

SSR DNA polymorphism: primers Pi02, Pi04, Pi56, Pi66, Pi33, Pi70, Pi16 and Pi26, plus DNA controls.

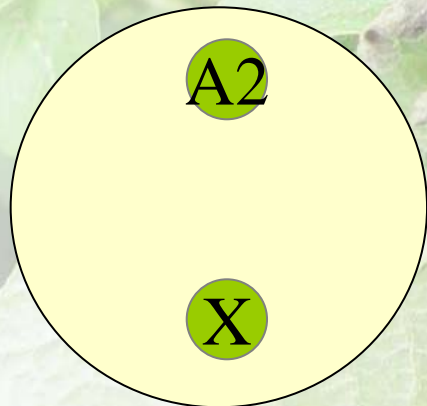
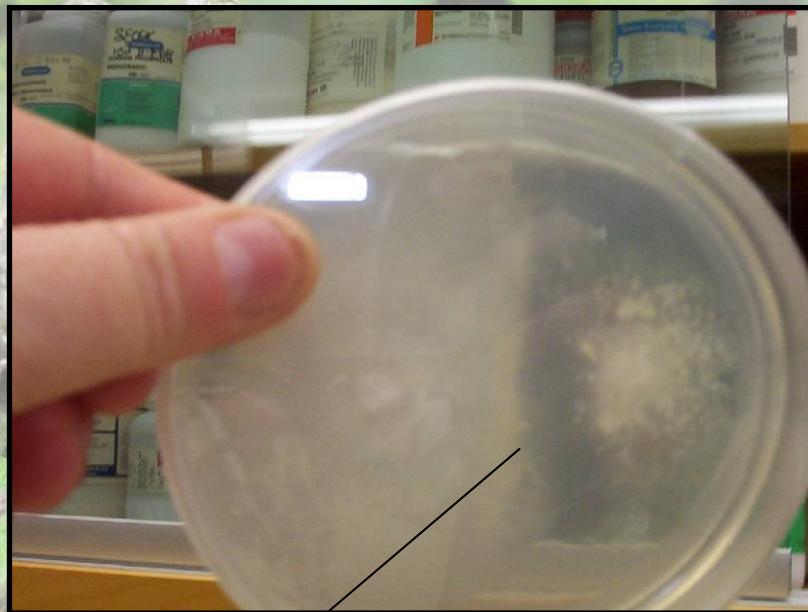
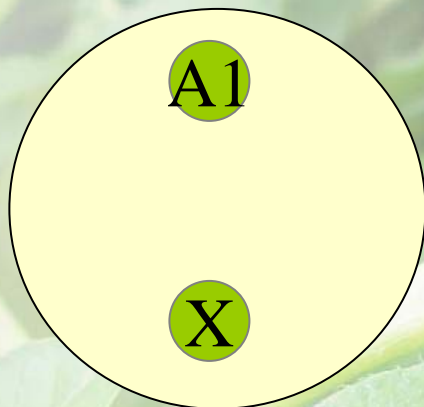
Pi02

200pb

150pb



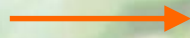
Mating type determination at North Dakota State University, Fargo, ND, USA. Dr. Gary Secor.



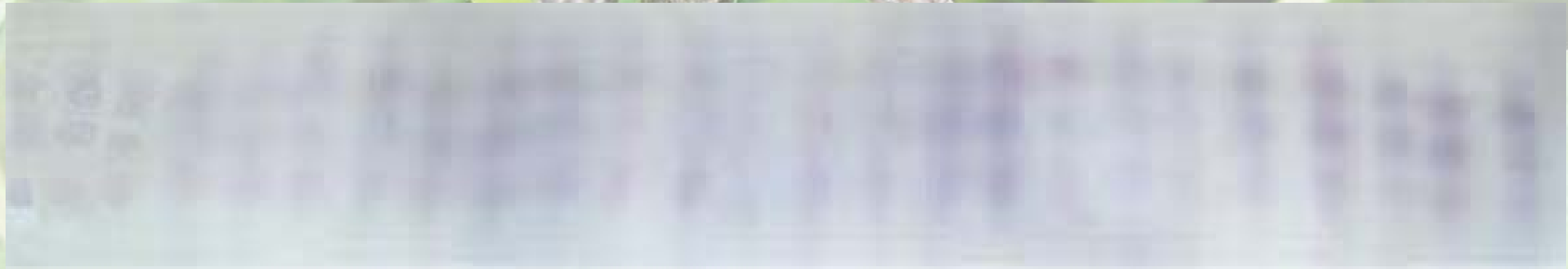
**150 isolates from
collection 2003-
04 and 2004-05:
A1 Mating type**

Allozymes GPI and PEP

GPI

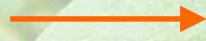


Monomorphic



Allele a
Diallelic
Allele b

PEP



Three genotypes

24 50 66 67 68 69 70 71 72 73 74 75 76 77 79 80 81 82 83 84 85 86 87 88 89



Simple Sequence Repeat (SSR) DNA

200pb

Pi04

505152 53 5455 5657 58 59 60 6162 63 6465 66 67 68 69 7071727374 75 76 77 78 79 80 8182 83 84 8586 8788 89 90

150pb

Monomorphic primers: Pi04, Pi33, Pi66 Pi70

200pb

Pi02

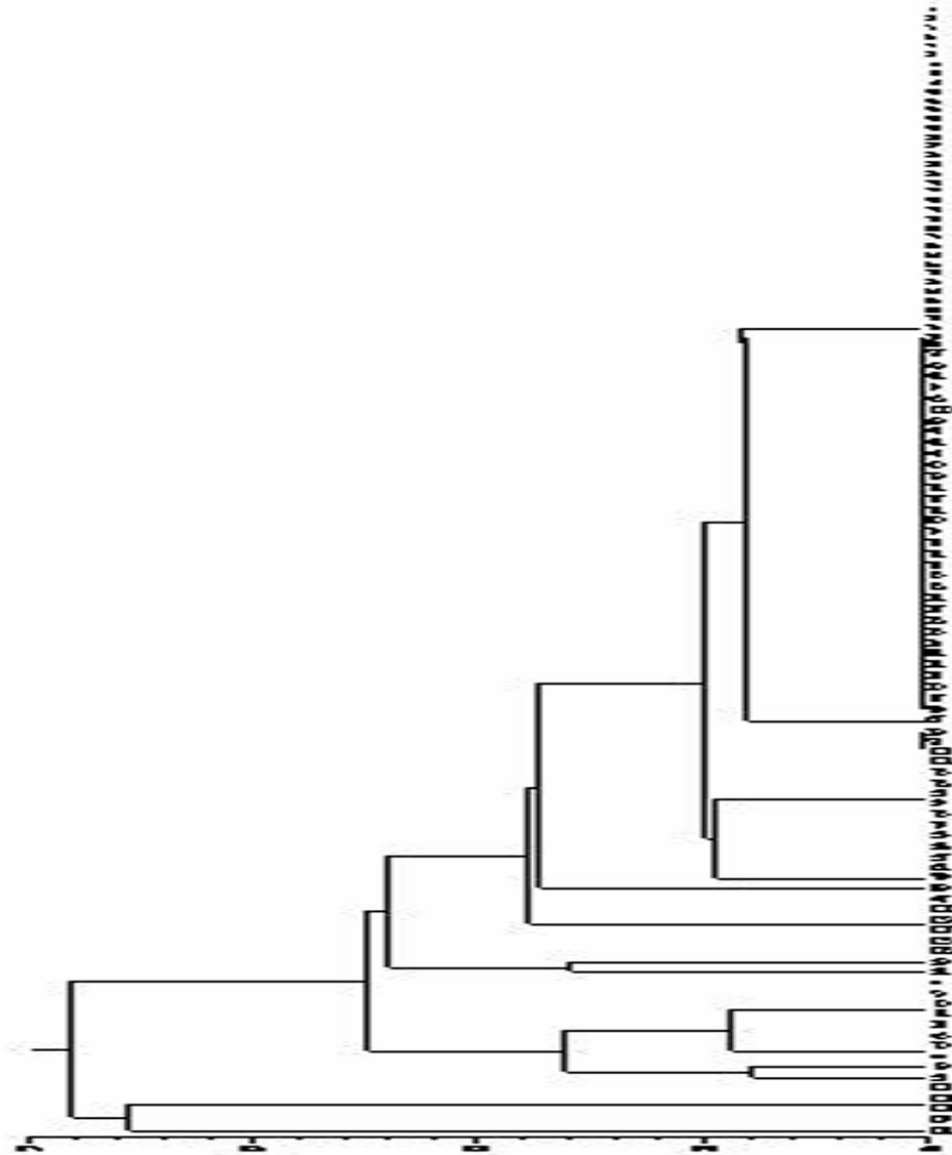
1 2 4 5 6 7 8 9 101112131415 1617181920212223242526272829303132333435363738394041424344454647484950

150pb



Marcadores polimórficos: Pi02, Pi16

DENDROGRAM



SM Coefficient

Group with 72
plates

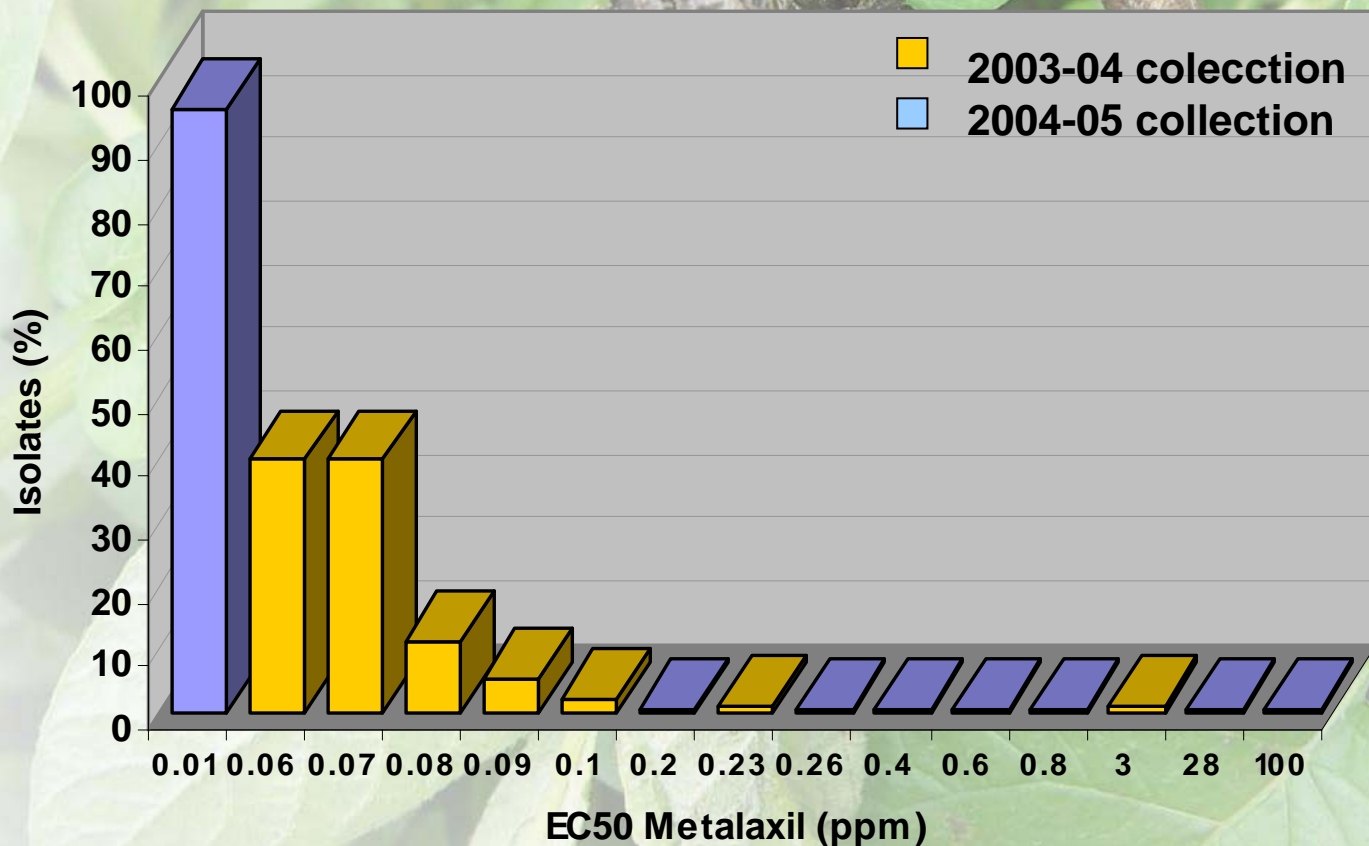
Group with 12
plates

Group with 6
plates

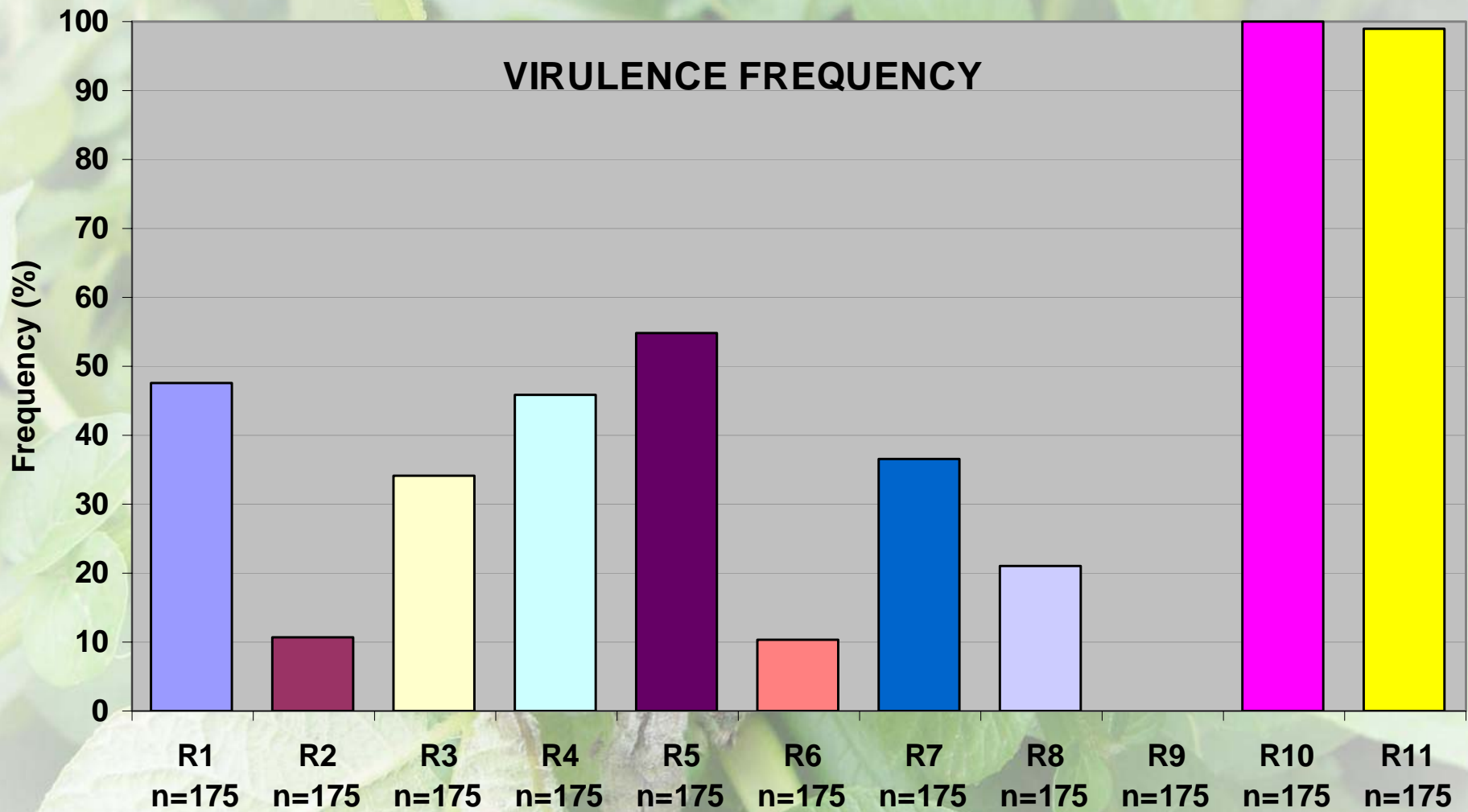
Metalaxil Resistance *in vitro* Test

Growth on 10 ug/l media relative to unamended media	Isolates (%)		Metalaxil resistance
	Season 2003-04 (n=98)	Season 2004-05 (n=152)	
0-10	23.4	43.4	Sensitive
10 to 60	76.5	55.9	Intermediate
>60	0	0.7	Resistente

Low resistance to Metalaxil, Less than 1%.



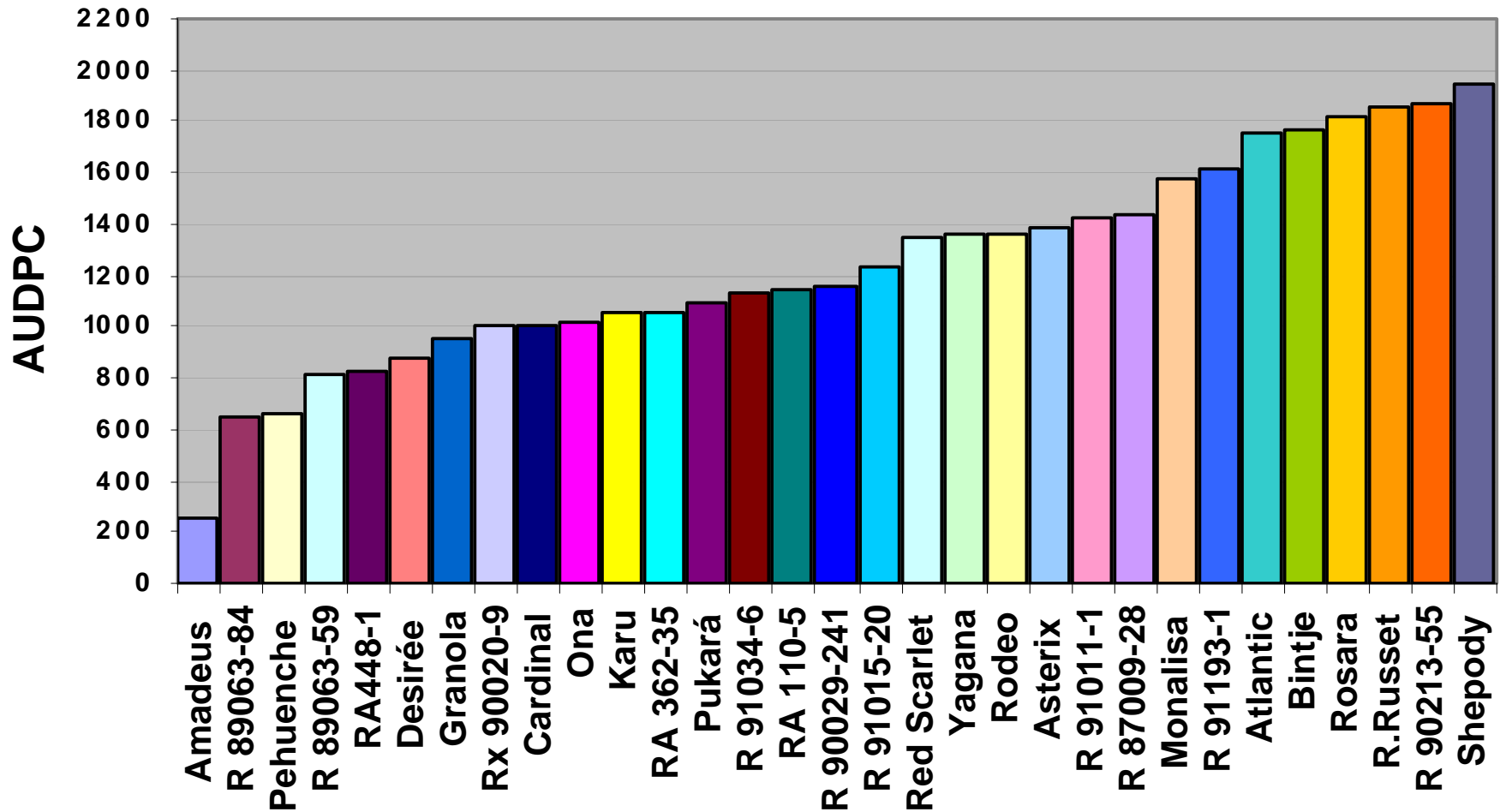
**EC50 < 3 ppm.
 Only 2 isolate show 27.7 and 100 ppm
 (0,0.1,1,10,100ppm)**





Host: Potato Cultivars

POTATO CULTIVARS RELATIVE RESISTANCE TO LATE BLIGHT INIA-REMEHUE



Evaluation replicated at 3 locations during 3 years

A close-up photograph of a plant stem showing late blight symptoms. The stem is dark brown and shriveled, with some small, dark, irregular lesions. The surrounding leaves are green and healthy. A semi-transparent text box is overlaid on the image, containing the text "Forecasting Late Blight".

Forecasting Late Blight

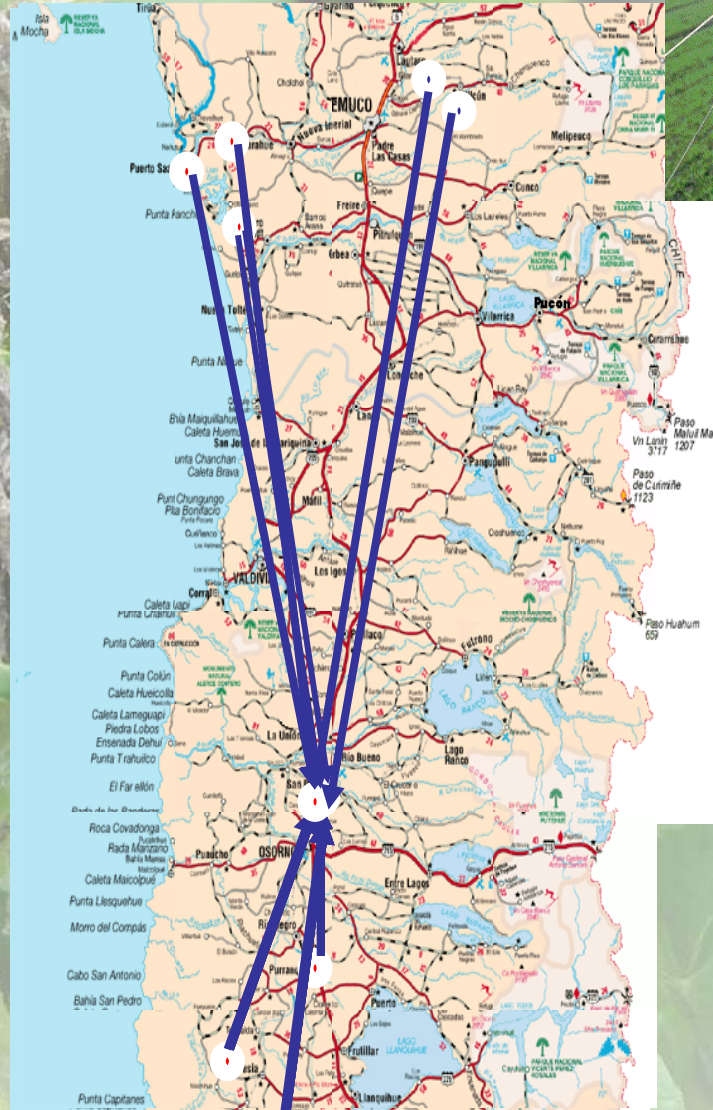
Weather Network at the Araucania and Los Lagos regions

Araucania region

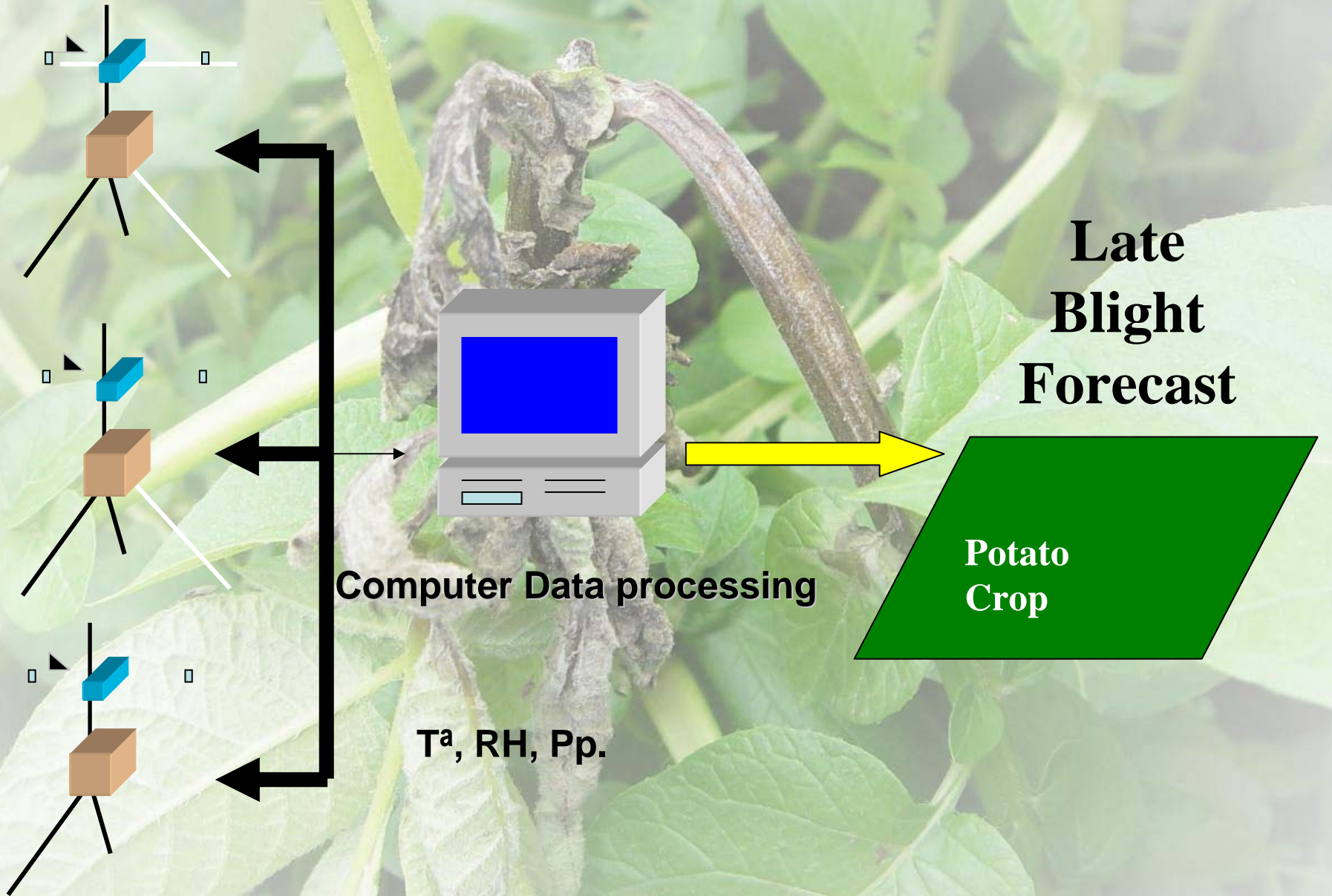
- Carahue
- Puerto Saavedra
- Teodoro Schmidt
- Pillanlelbun
- Vilcún

Los Lagos region

- Rapaco
- Osorno
- Purrانque
- Los Muermos
- Castro



Weather Data Record and Processing



Forecast Models: During the seasons 2004-07, Three models were evaluated, calibrated and validated with farmers:

NEGFY (Hansen et al., 1995): Based in two models:

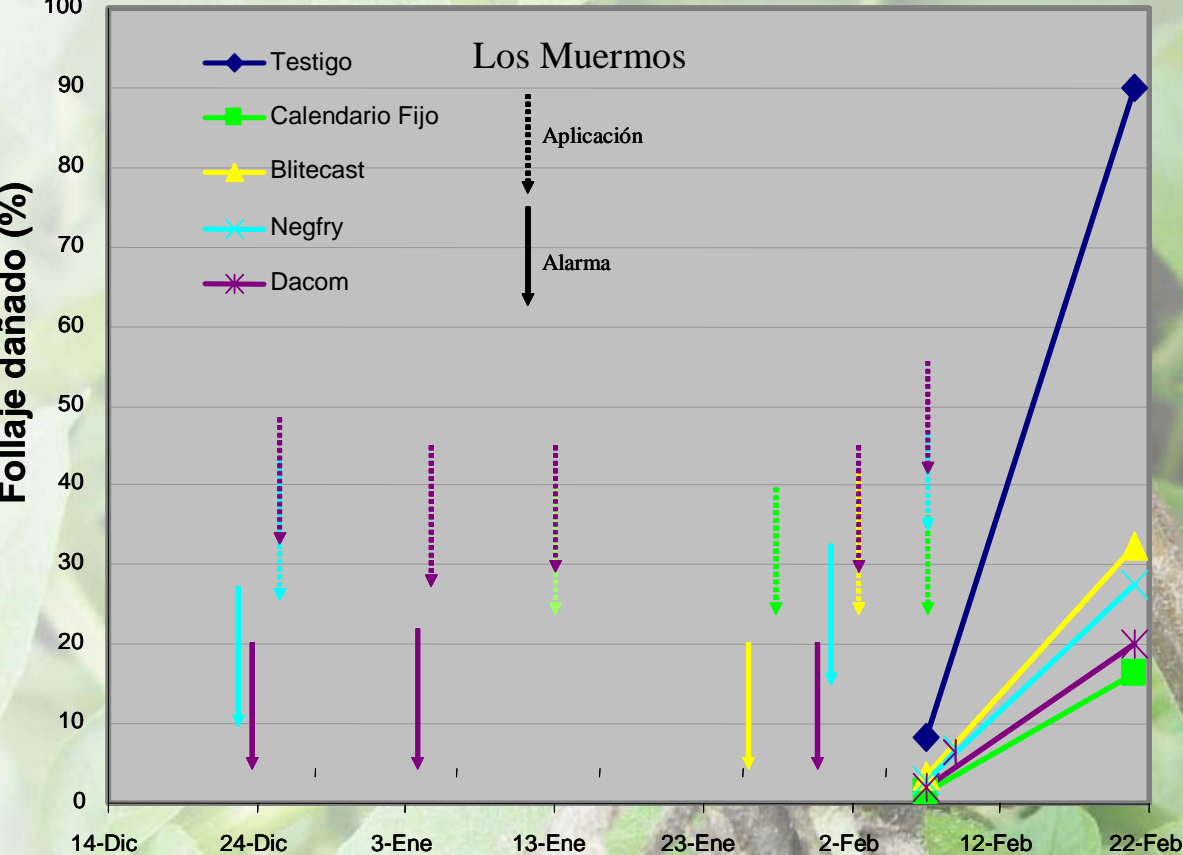
- Phytoprog (Schrodter y Ulrich, 1966): Negative prognosis, used T^a , RH and Pp.
- Simcast (Fry et al., 1983; Grunwald et al., 2000): Simulation on weather, fungicide and cultivar resistance.

DACOM Plant Plus Online:

- Wheather data (in the future).
- Uses infection periods, fungicide wear off, unprotected canopy, and sporulation:

BLITECAST (Krause et al., 1975):

- Combines severity values model of Wallin (1962) and the favorable day model of Hyre (1954)
- Uses RH and temp to calculate **severity values** (when **18** severity values are accumulated, late blight is predicted to occur in 7-14 days and the first protectant fungicide is recommended)



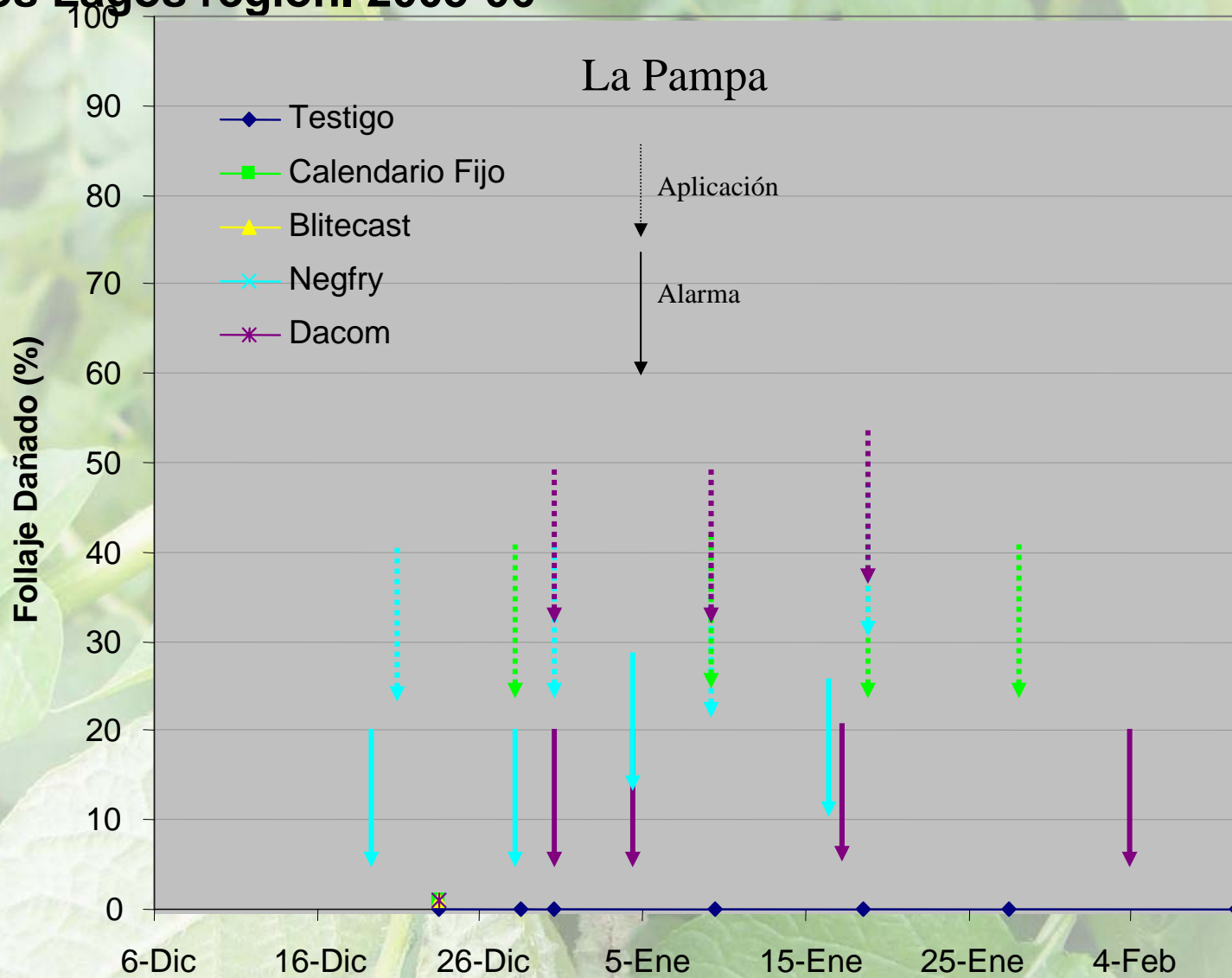
Late blight damage, forecast and fungicide application. Los Muermos, Los Lagos region. 2005-06

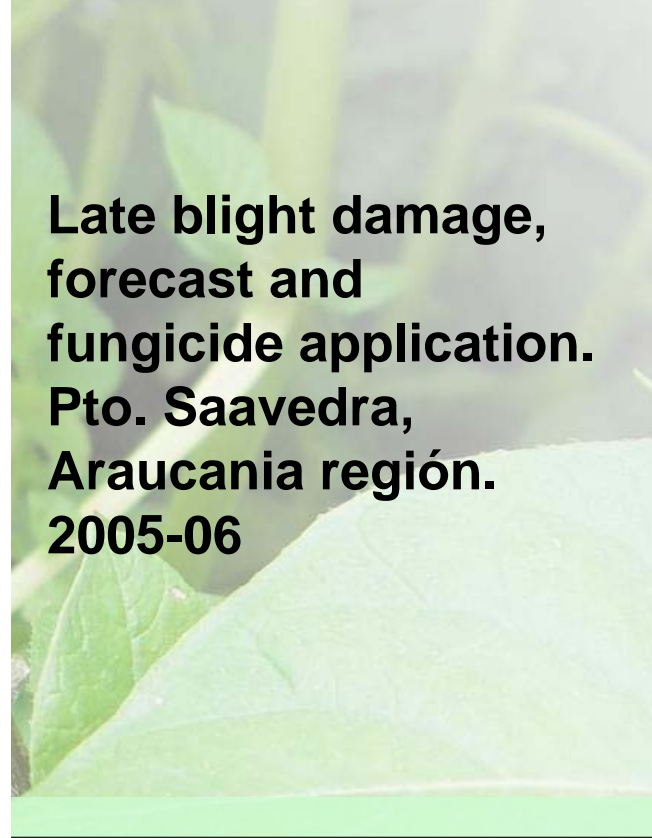
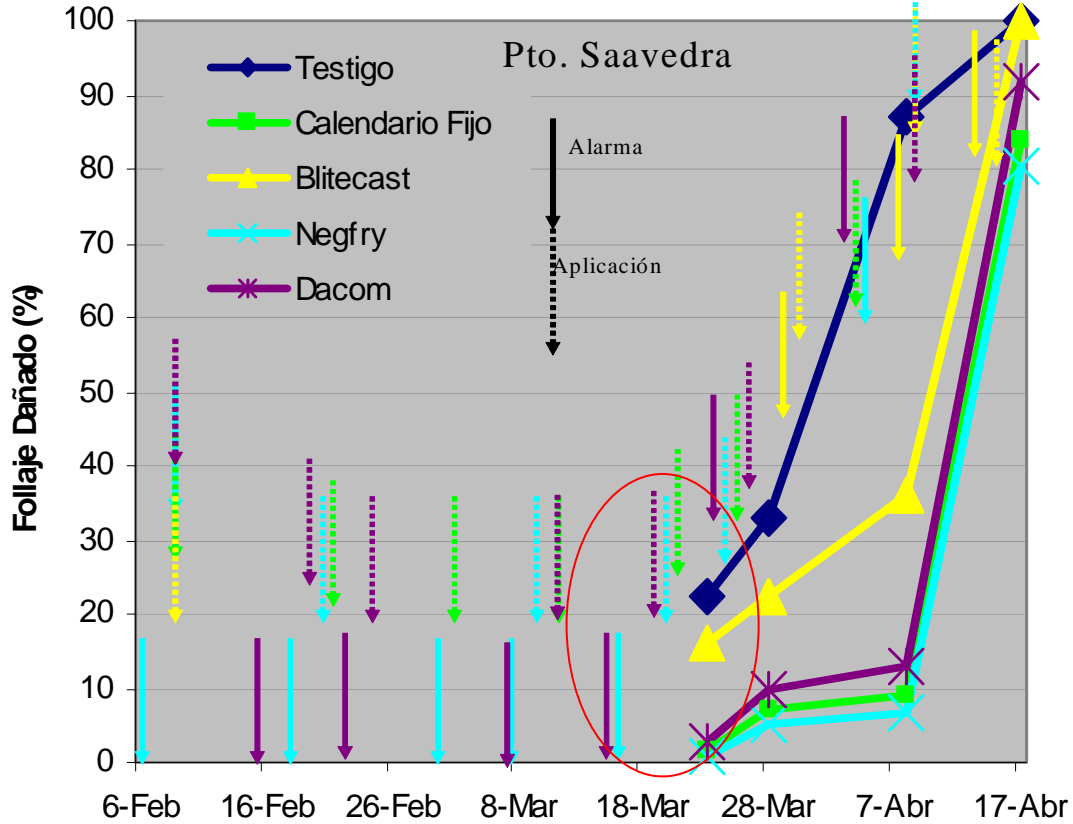
Percentage of foliar damage and AUDPC in potato cv Desireé.

(Mancozeb-clorotalonil)

Tratamiento	Follaje Dañado (%)		AUDPC
	Fecha de Evaluación		
	07-Feb-06	21-Feb-06	
1 Testigo	8.6 d	90.0 d	982.9 a
2 Calendario Fijo	0.2 a	16.2 a	177.8 d
3 Pronosticador Blitecast	4.4 c	32.5 c	358.2 b
4 Pronosticador Negfry	1.3 b	27.5 bc	302.4 bc
5 Pronosticador Dacom	0.1 a	20.0 ab	220.9 cd
<i>Cv</i>	1.94	6.49	14.24
<i>Prueba de F</i>	72.00	130.95	127.7
<i>Probabilidad</i>	0.0001	0.0001	0.0001

Late blight damage, forecast and fungicide application. INIA-La Pampa, Los Lagos region. 2005-06





Late blight damage, forecast and fungicide application. Pto. Saavedra, Araucania región. 2005-06

Percentage of foliar damage and AUDPC in potato cv Karu.

Tratamiento	Follaje Dañado (%)				AUDPC
	Fecha de Evaluación				
	23-Mar-06	28-Mar-06	08-Abr-06	17-Abr-06	
1 Testigo	22.4 b	33.0 b	87.2 c	100.0 c	1642.8 a
2 Calendario Fijo	1.5 a	7.1 a	9.1 a	84.0 a	530.0 c
3 Pronosticador Blitecast	16.0 b	22.3 b	35.9 b	100.0 c	1028.2 b
4 Pronosticador Negfry	0.6 a	5.2 a	6.5 a	80.4 a	470.6 c
5 Pronosticador Dacom	2.7 a	9.8 a	13.1 a	91.7 b	629.2 c
Cv	6.44	7.23	13.67	48.82	18.54
<i>Prueba de F</i>	<i>18.23</i>	<i>13.55</i>	<i>34.6</i>	<i>16.17</i>	<i>36.31</i>
<i>Probabilidad</i>	<i>0.0001</i>	<i>0.0002</i>	<i>0.0001</i>	<i>0.0001</i>	<i>0.0001</i>

Late blight forecast at Castro, Chiloé

Green: No spray

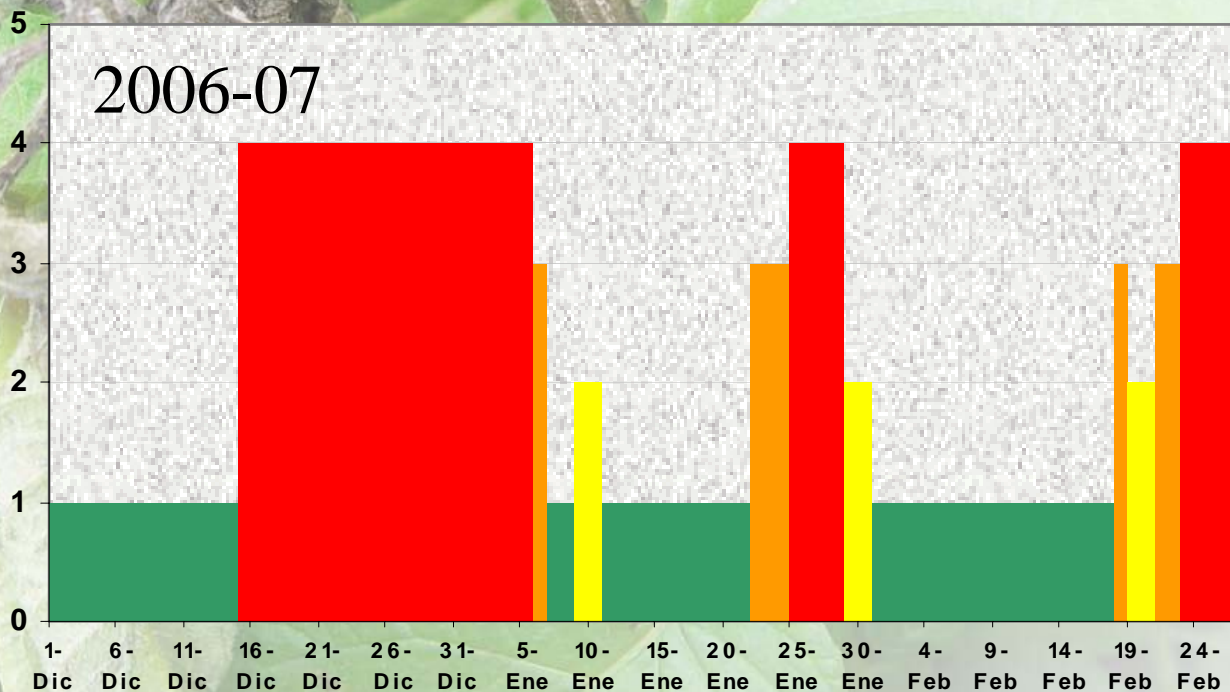
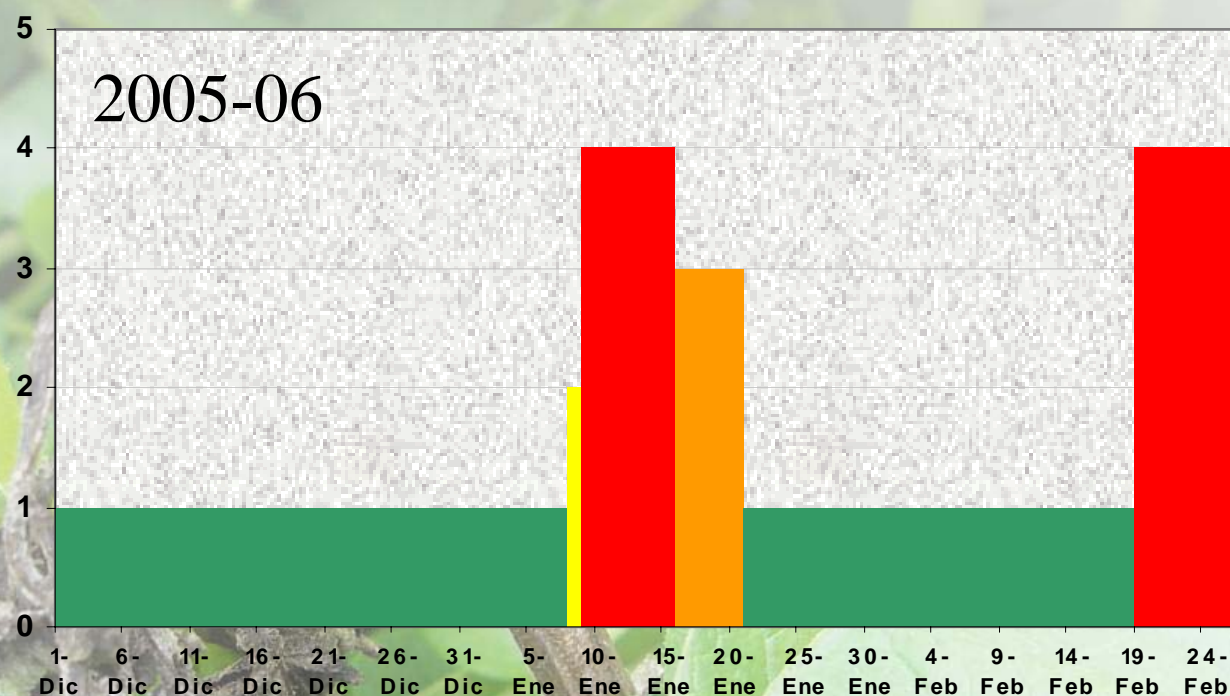
Yellow: Warning

Orange: 7 day spray

Red: 5 day spray

2006-07

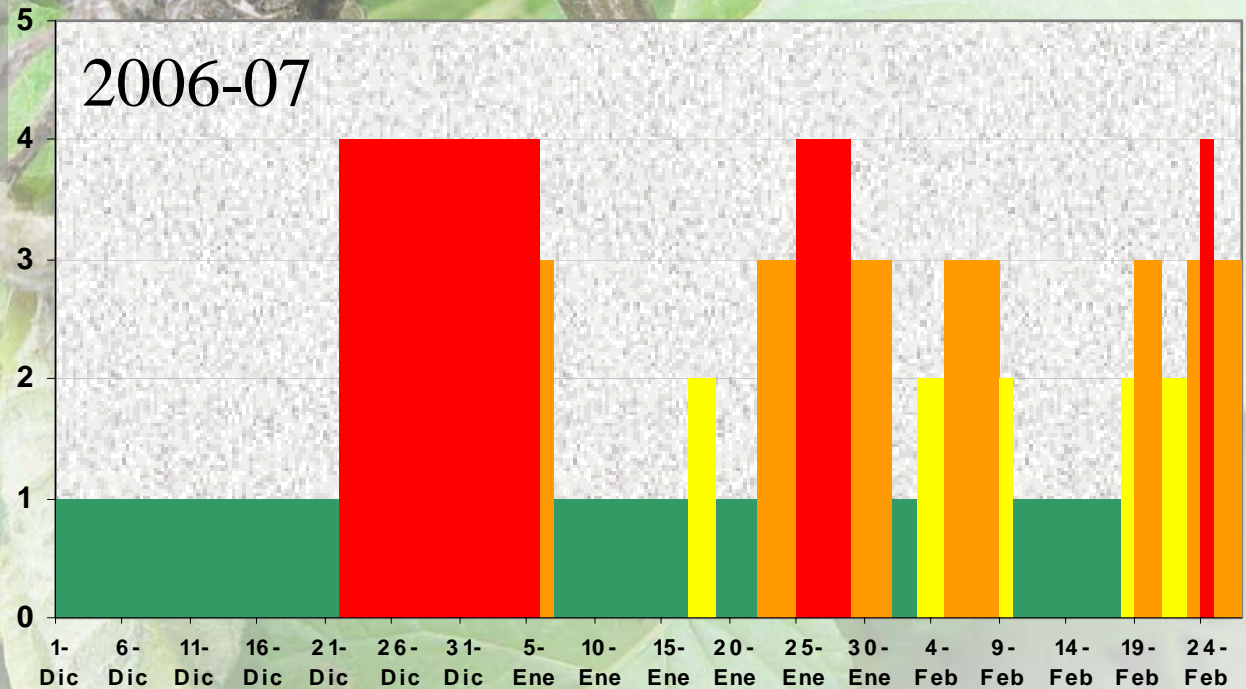
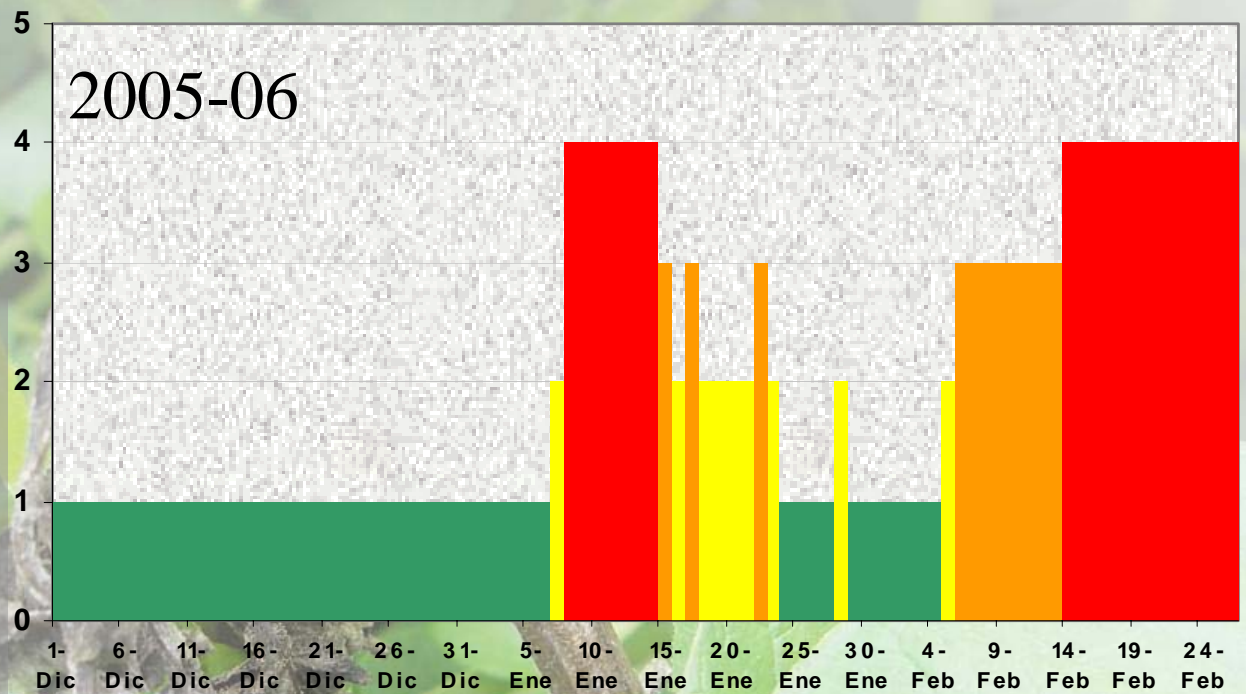
**BliteCast Model:
18 severity values
and 80% RH**



Late blight forecast at Los Muermos

Green: No spray
 Yellow: Warning
 Orange: 7 day spray
 Red: 5 day spray

2006-07
 BliteCast Model:
 18 severity values
 and 80% RH

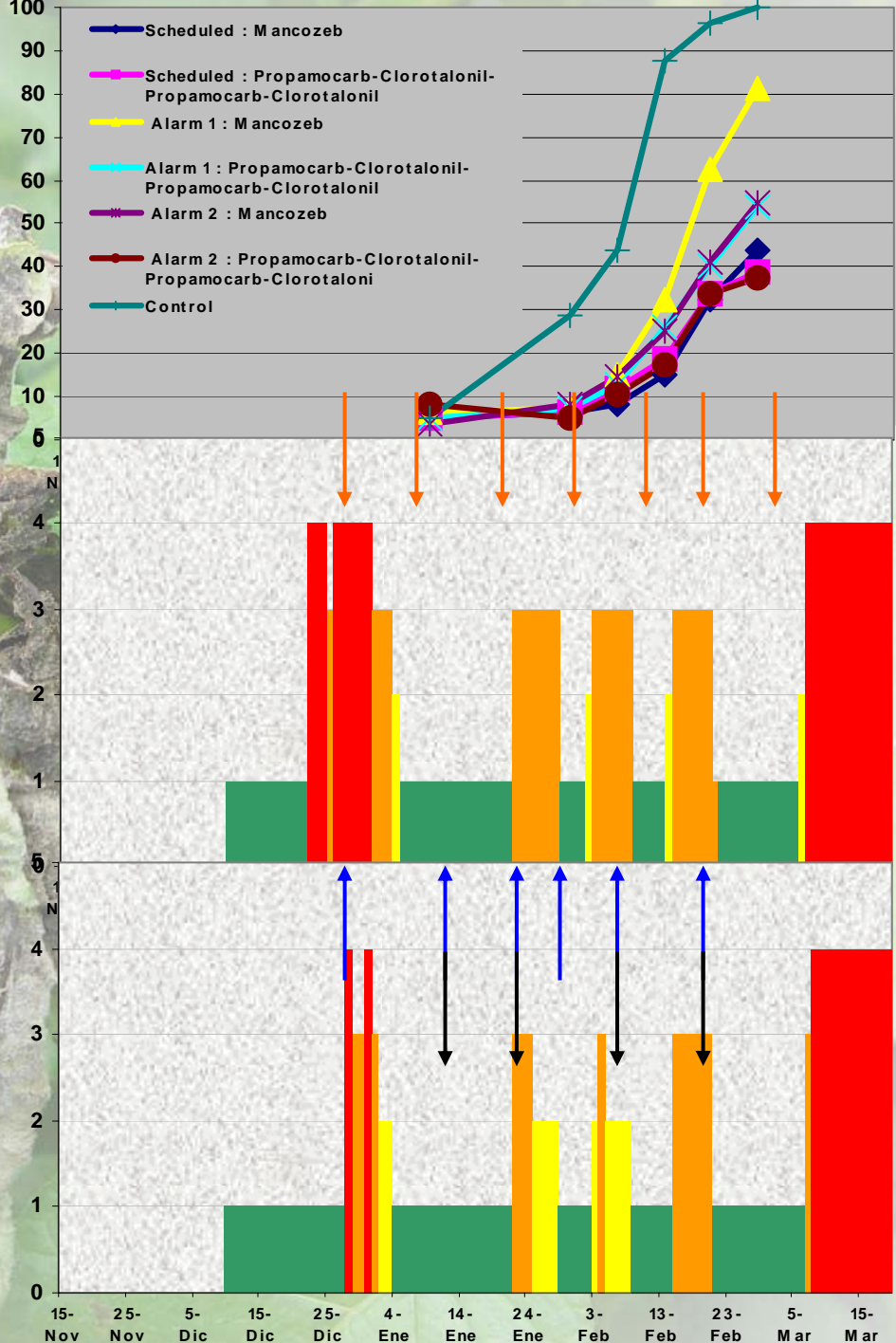


Late blight damage and chemical treatments according to forecast on potato cv Yagana(susceptible), under irrigation. 2006-07

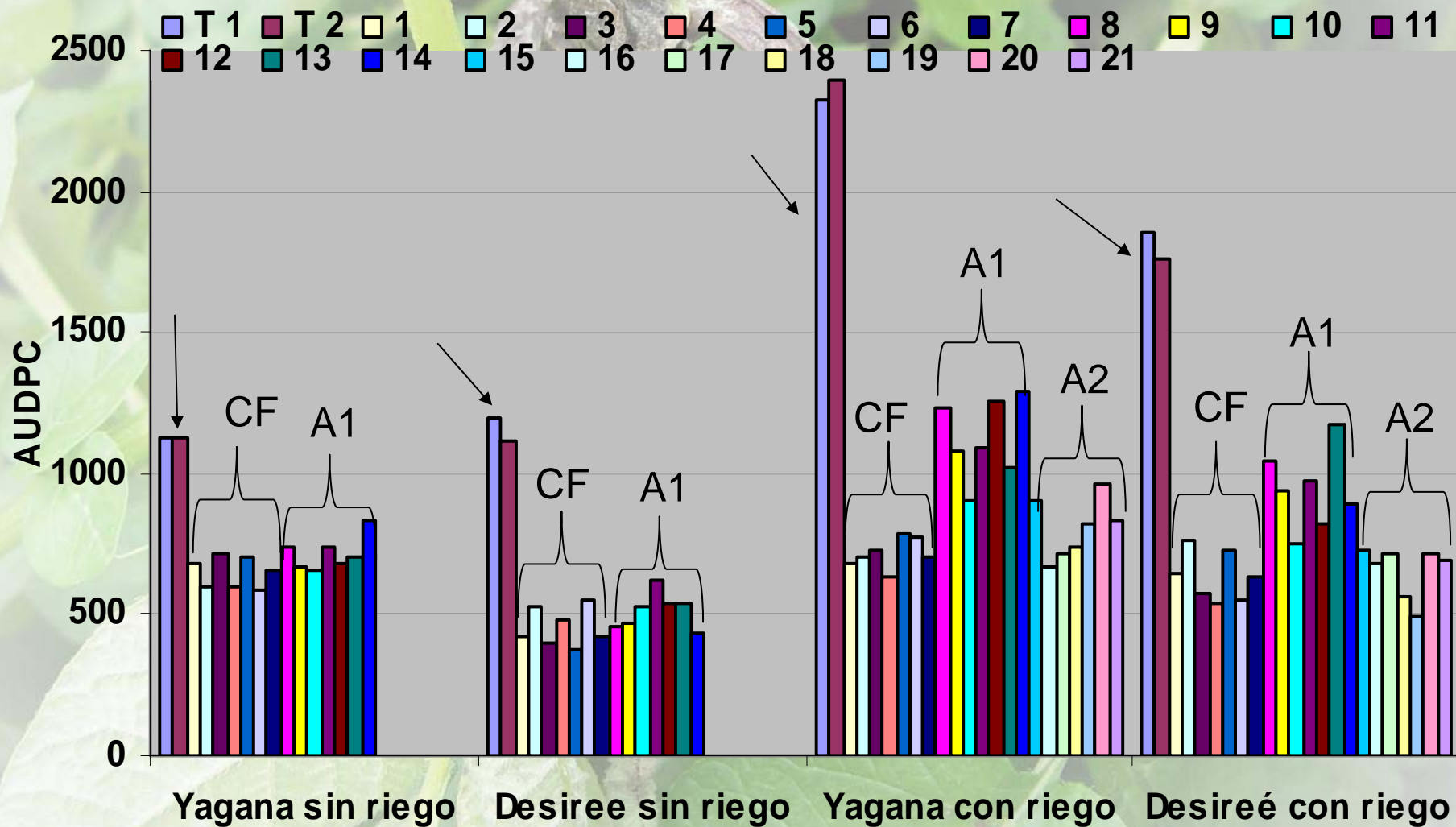
Alarm 2:
BliteCast Model:
 15 severity values and
 80% RH and modifications
 for Hyre model.

Alarm 1:
BliteCast Model:
 18 severity values and
 80% RH

- ↓ Spray Scheduled
- ↓ Spray on alarm 2
- ↓ Spray on alarm 1



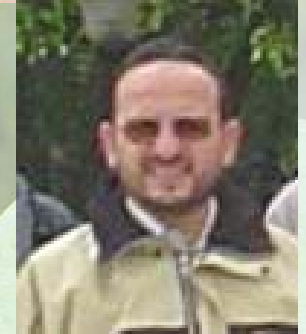
Severidad de daño por tizón tardío en plantas de papa cv Yagana y Desireé, bajo diferentes estrategias de manejo con uso de pronosticadores



Flecha: Testigo, CF: Calendario Fijo: 7 aplicaciones, A1: 4 aplicaciones, A2: 6 aplicaciones









¡Muchas Gracias!