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

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CHILE

70,000 ha
25 t/ha
90,000 growers
60% in the southern
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

Epiphitotic 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.

<table>
<thead>
<tr>
<th>Season</th>
<th>N°</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003/04</td>
<td>99</td>
</tr>
<tr>
<td>2004/05</td>
<td>151</td>
</tr>
</tbody>
</table>
Studies on Characteristic of *P. infestans* Population in Chile

**Mating type**

- **A1**
- **A2**
- **X**

**Metalaxyl resistance**

**Virulence**

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

PEP  Three genotypes

Allele a
Diallelic
Allele b
Simple Sequence Repeat (SSR) DNA

Monomorphic primers: Pi04, Pi33, Pi66, Pi70

Marcadores polimórficos: Pi02, Pi16
DENDOGRAM

SM Coefficient

- Group with 72 isolates
- Group with 12 isolates
- Group with 6 isolates

- Three groups with the same genotypes
- 100% of isolates with SM = 1
- SM = 0.84
## Metalaxil Resistance *in vitro* Test

<table>
<thead>
<tr>
<th>Growth on 10 μg/l media relative to unamended media</th>
<th>Season 2003-04 (n=98)</th>
<th>Season 2004-05 (n=152)</th>
<th>Metalaxil resistance</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-10</td>
<td>23.4</td>
<td>43.4</td>
<td>Sensitive</td>
</tr>
<tr>
<td>10 to 60</td>
<td>76.5</td>
<td>55.9</td>
<td>Intermediate</td>
</tr>
<tr>
<td>&gt;60</td>
<td>0</td>
<td>0.7</td>
<td>Resistante</td>
</tr>
</tbody>
</table>

**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)**
• 0= No symptoms.(-)
• 1= Hypersensitivity.(-)
• 2= Lesion < 1 cm, no sporulation.(+)
• 3= Lesión > 1 cm, with sporulation.(+)
Host: Potato Cultivars
POTATO CULTIVARS RELATIVE RESISTANCE TO LATE BLIGHT INIA-REMEHUE

Evaluation replicated at 3 locations during 3 years
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
- Purranque
- Los Muermos
- Castro
Weather Data Record and Processing

Late Blight Forecast

Computer Data processing

\( T^a, RH, Pp. \)
Forecast Models: During the seasons 2004-07, Three models were evaluated, calibrated and validated with farmers:

**NEGFRY** (Hansen et al., 1995): Based in two models:
- Simcast (Fry et al., 1983; Grunwald et al., 2000): Simulation on weather, fungicide and cultivar resistance.

**DACOM Plant Plus Online:**
- Weather 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)
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.

<table>
<thead>
<tr>
<th>Tratamiento</th>
<th>23-Mar-06</th>
<th>28-Mar-06</th>
<th>08-Abr-06</th>
<th>17-Abr-06</th>
<th>AUDPC</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Testigo</td>
<td>22.4 b</td>
<td>33.0 b</td>
<td>87.2 c</td>
<td>100.0 c</td>
<td>1642.8 a</td>
</tr>
<tr>
<td>2 Calendario Fijo</td>
<td>1.5 a</td>
<td>7.1 a</td>
<td>9.1 a</td>
<td>84.0 a</td>
<td>530.0 c</td>
</tr>
<tr>
<td>3 Pronosticador Blitecast</td>
<td>16.0 b</td>
<td>22.3 b</td>
<td>35.9 b</td>
<td>100.0 c</td>
<td>1028.2 b</td>
</tr>
<tr>
<td>4 Pronosticador Negfry</td>
<td>0.6 a</td>
<td>5.2 a</td>
<td>6.5 a</td>
<td>80.4 a</td>
<td>470.6 c</td>
</tr>
<tr>
<td>5 Pronosticador Dacom</td>
<td>2.7 a</td>
<td>9.8 a</td>
<td>13.1 a</td>
<td>91.7 b</td>
<td>629.2 c</td>
</tr>
</tbody>
</table>

Cv 6.44 Prueba de F 18.23 Probabilidad 0.0001
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

¡Muchas Gracias!