Effect of Climate Change on Potato Diseases and Pests in South Africa

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EAPR 2013, Jerusalem

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Potato Pathology
Programme @ UP

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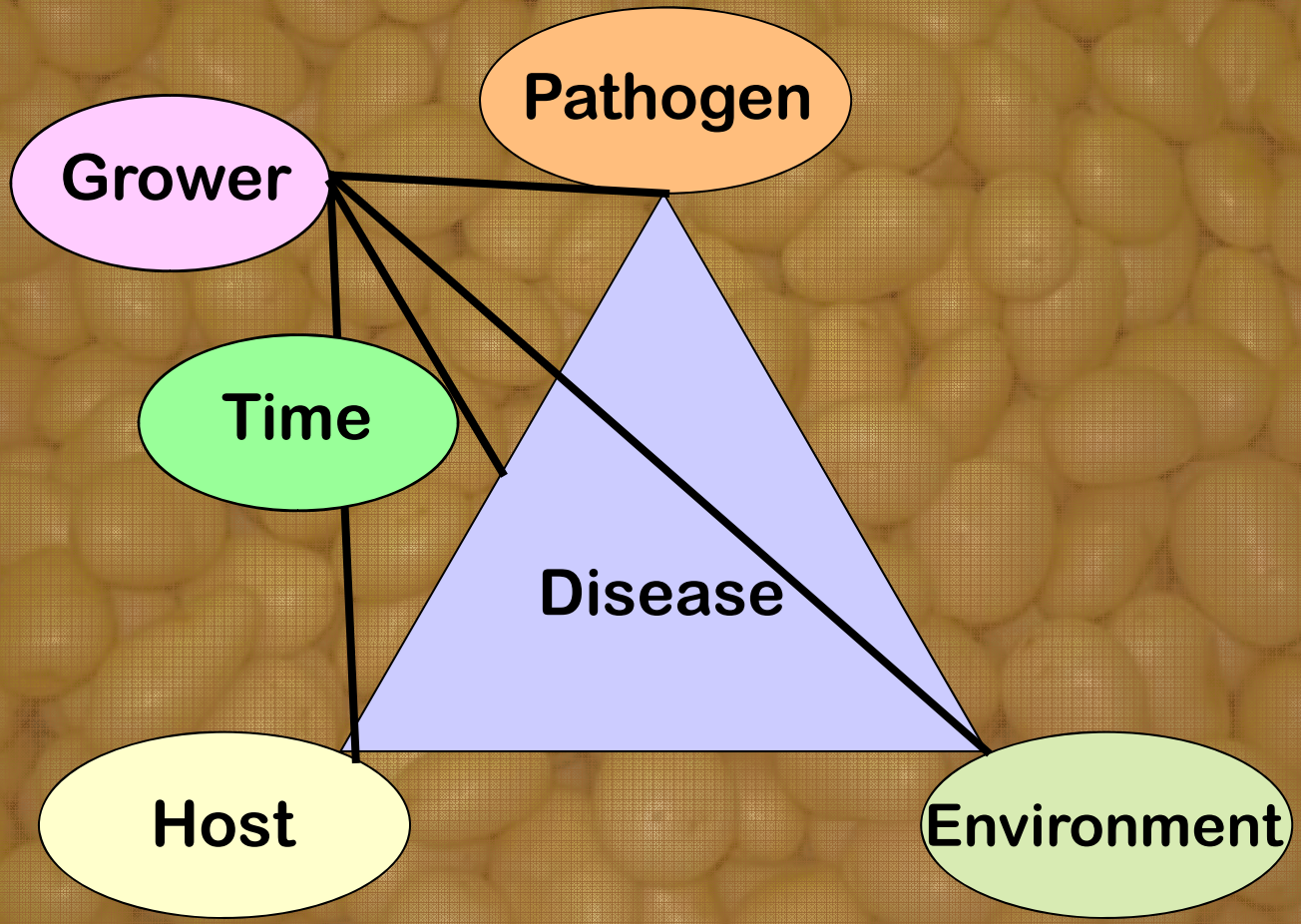
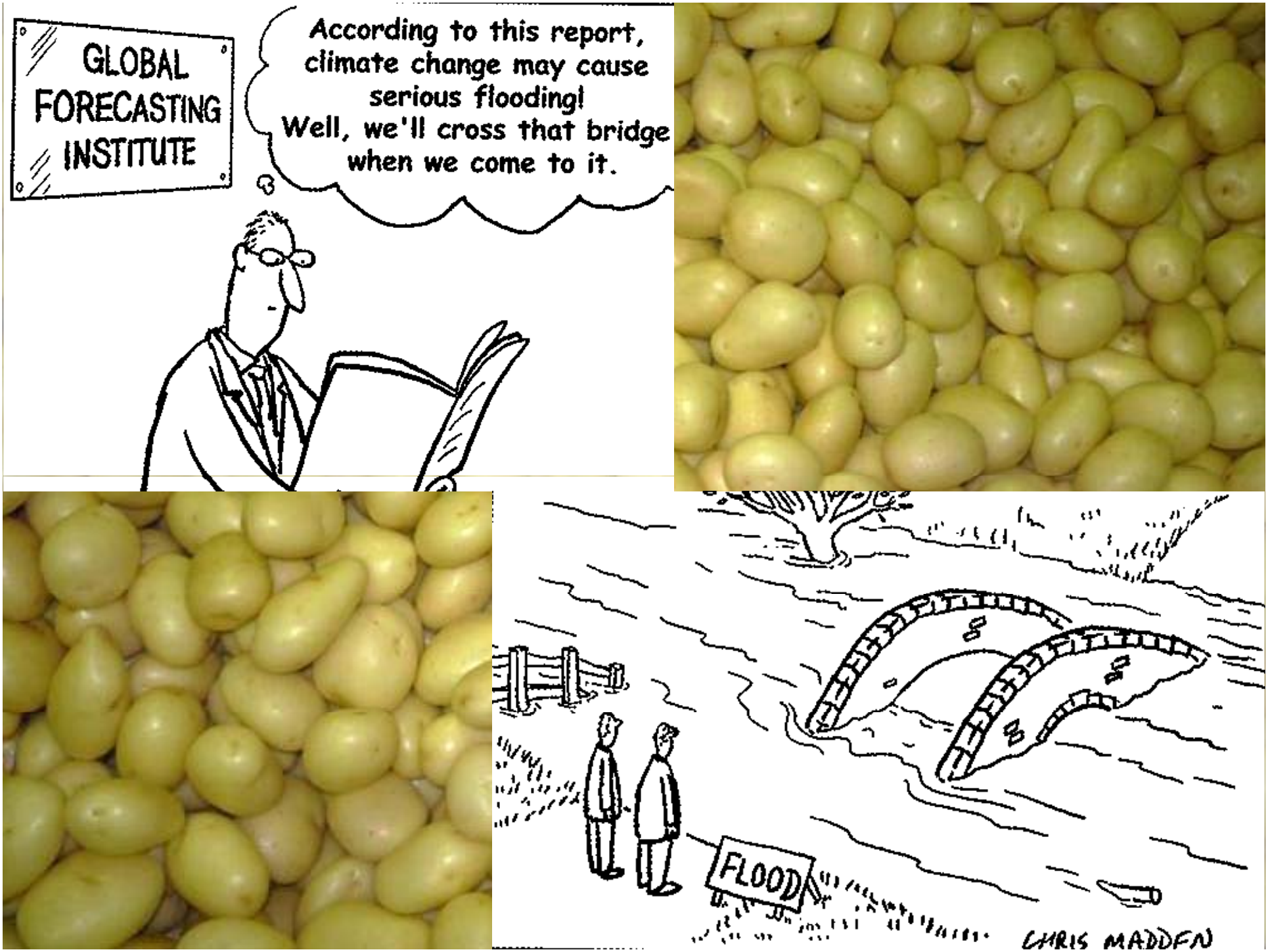
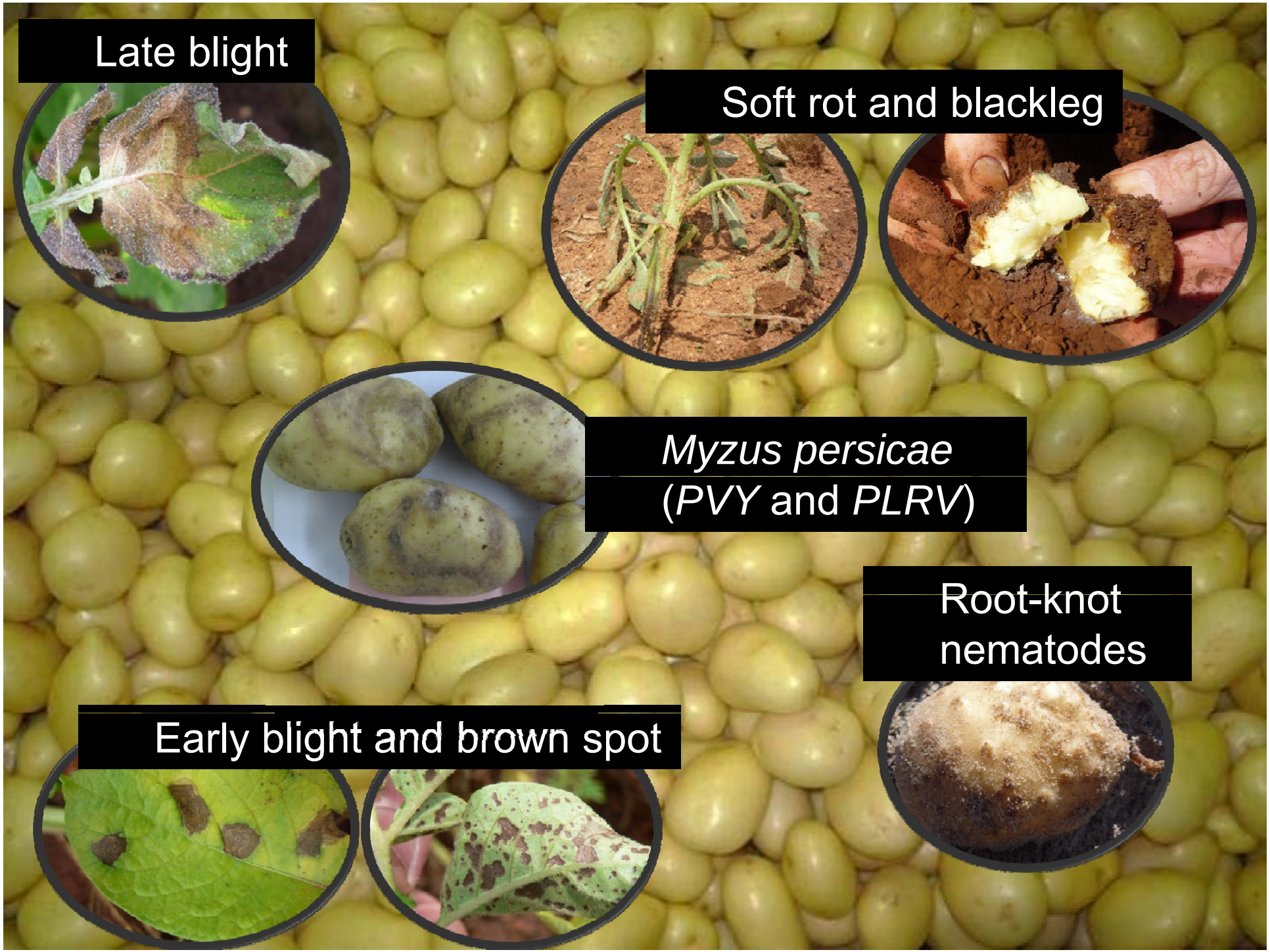
INTRODUCTION

Disease Pyramid



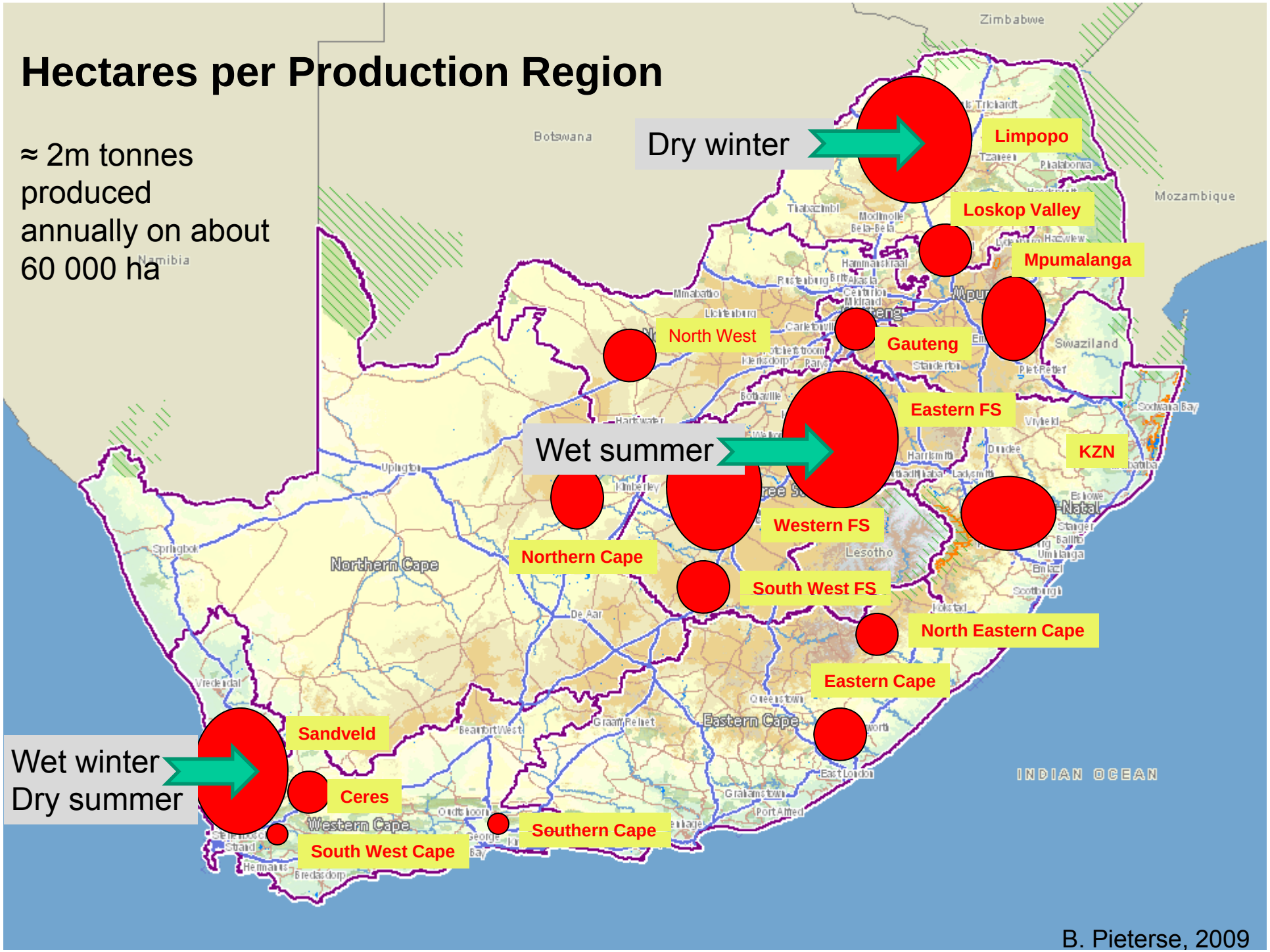

GLOBAL FORECASTING INSTITUTE
According to this report, climate change may cause serious flooding!
Well, we'll cross that bridge when we come to it.
FLOOD
CHRIS MADDEN


Late blight
Soft rot and blackleg
Myzus persicae
(*PVY* and *PLRV*)
Root-knot
nematodes
Early blight and brown spot


MATERIALS AND METHODS

Disease development rules

- For each organism a set of “rules” was drawn up using literature to describe conditions for disease development or population growth: defined as **cumulative relative development rate** (cRDR)
- Parameters used: min, opt, max **temperature**; **relative humidity**
- Indication of change in disease pressure over period 1961 - 2050
- High resolution climate models were used to calculate daily weather data (maximum and minimum temperatures, precipitation, wind speed and solar radiation) for the period 1961 – 2050

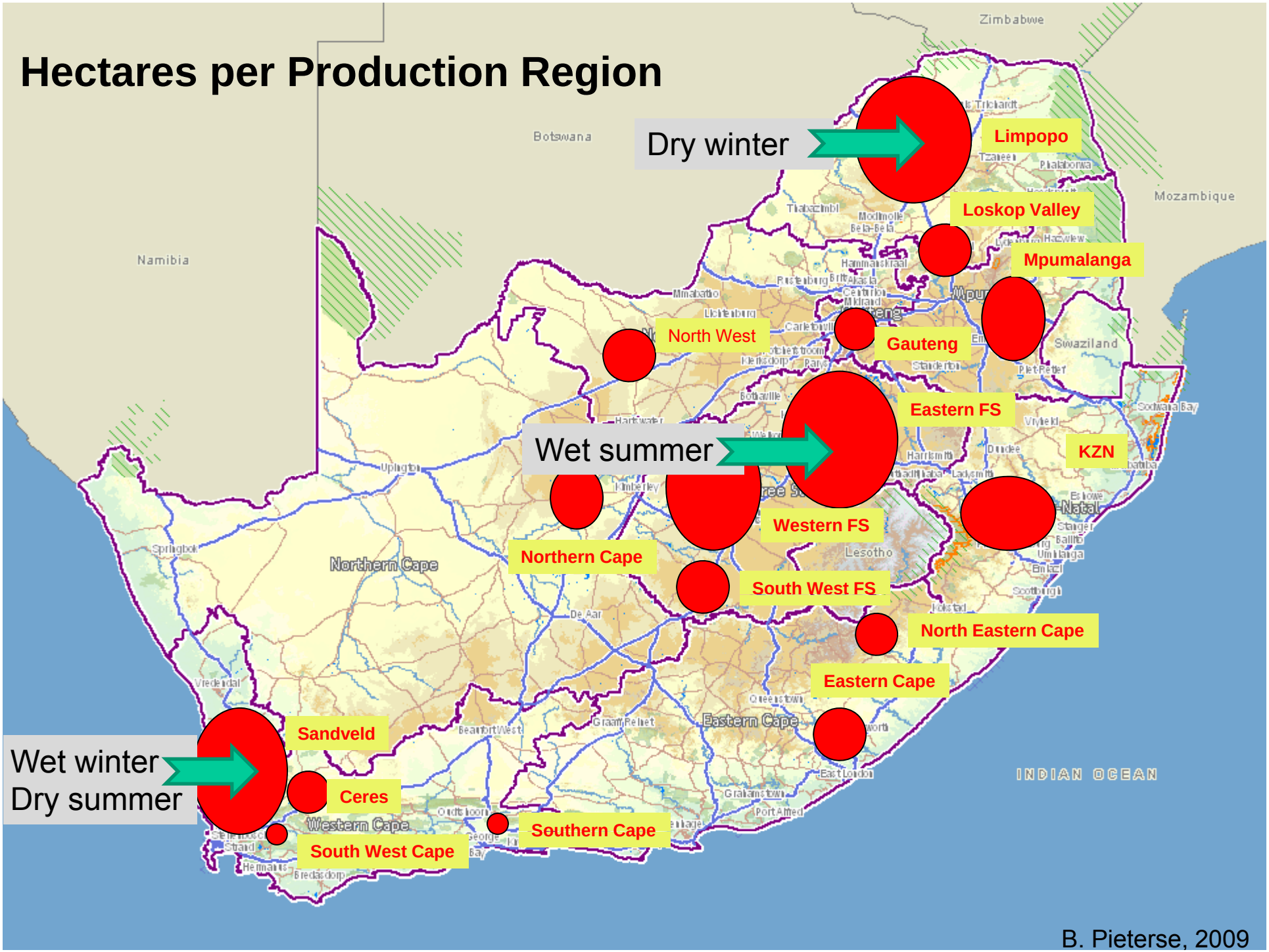

Hectares per Production Region
≈ 2m tonnes produced annually on about 60 000 ha
Dry winter
Limpopo
Loskop Valley
Mpumalanga
North West
Gauteng
Eastern FS
Wet summer
KZN
Western FS
Northern Cape
South West FS
North Eastern Cape
Eastern Cape
Wet winter
Dry summer
Sandveld
Ceres
Southern Cape
South West Cape
Zimbabwe
Botswana
Namibia
Mozambique
Swaziland
Lesotho
INDIAN OCEAN
B. Pieterse, 2009


RESULTS AND
DISCUSSION

Shifts in planting times

(Franke *et al*., 2013)

- **Sandveld**: Current peak plantings of August-September are likely to shift a month earlier to July-August; the autumn plantings remain unchanged
- **EFS**: October-November plantings will probably also move forward to September-October
- **Limpopo**: Main planting starts in May and continues through winter until July, with the peak planting period in June. By 2050 planting likely to start earlier in April-May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INDIAN OCEAN
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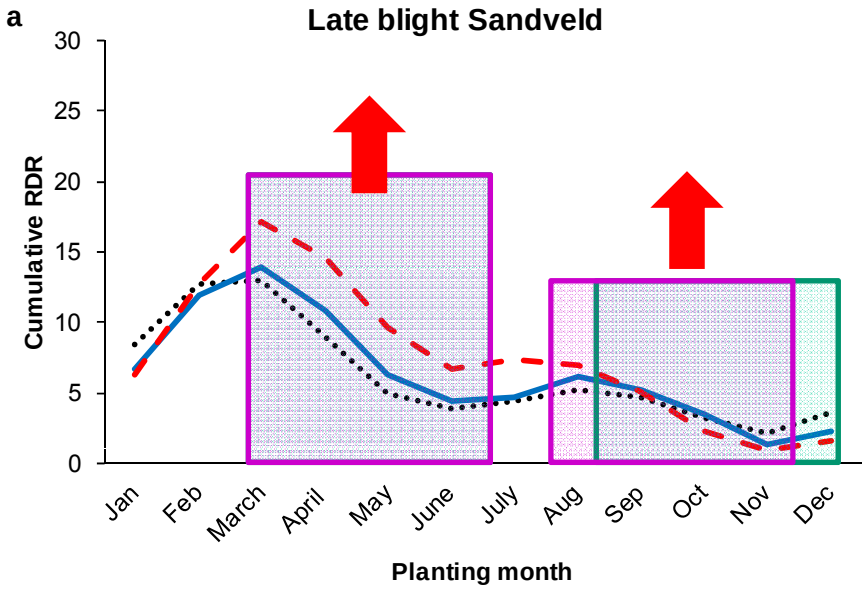
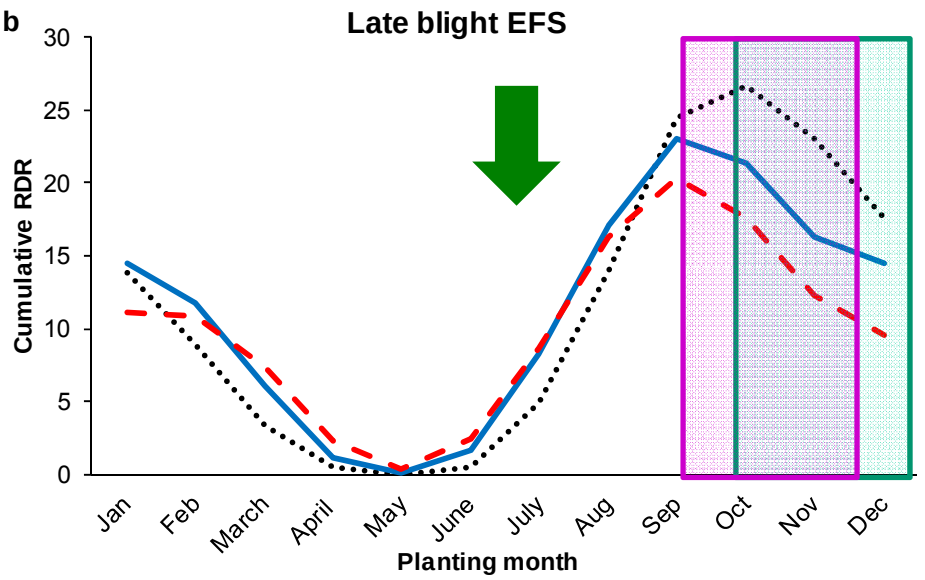
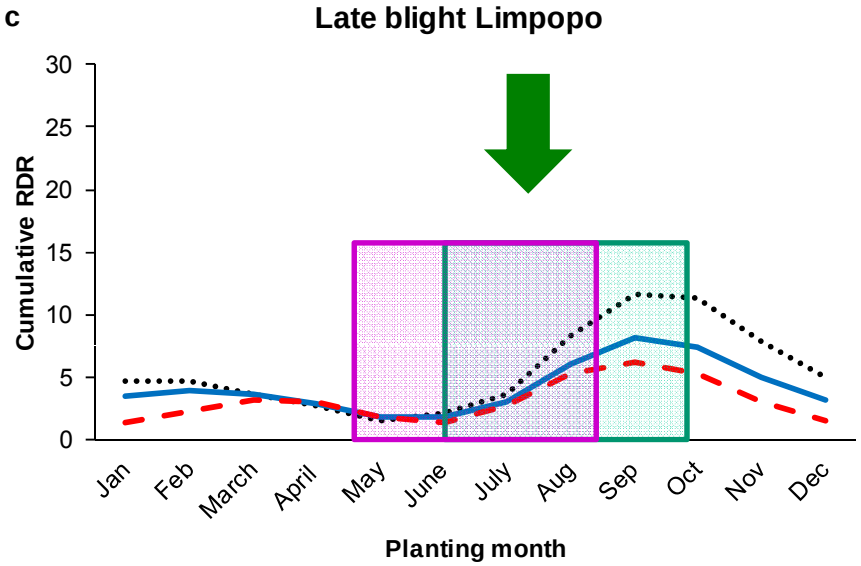
Late Blight

10˚C > Temp. < 26˚C
and RH >75% for two consecutive days
(Beaumont 1947; Krause et al. 1975; MacKenzie 1981; Zwankhuizen & Zadoks 2002)



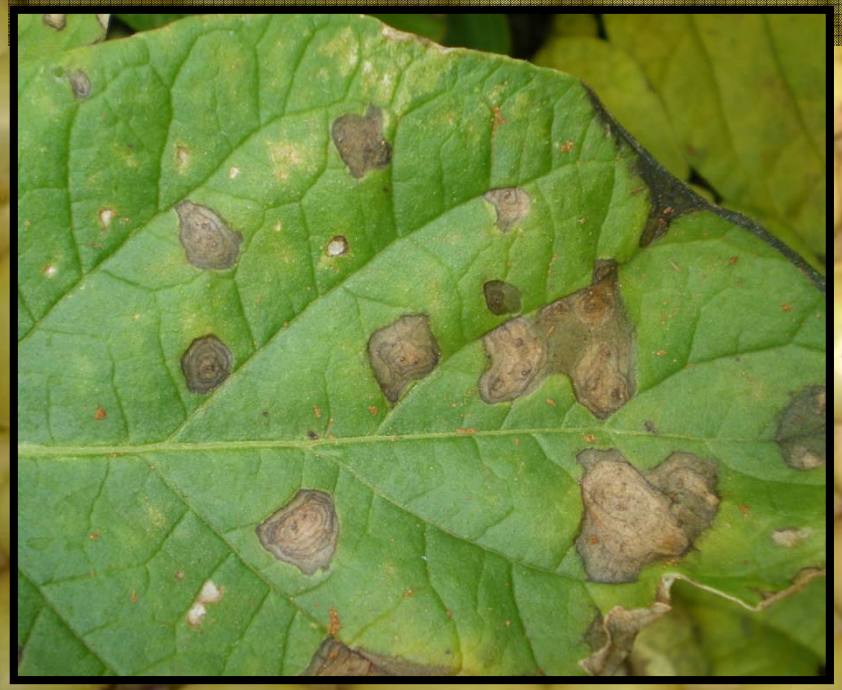




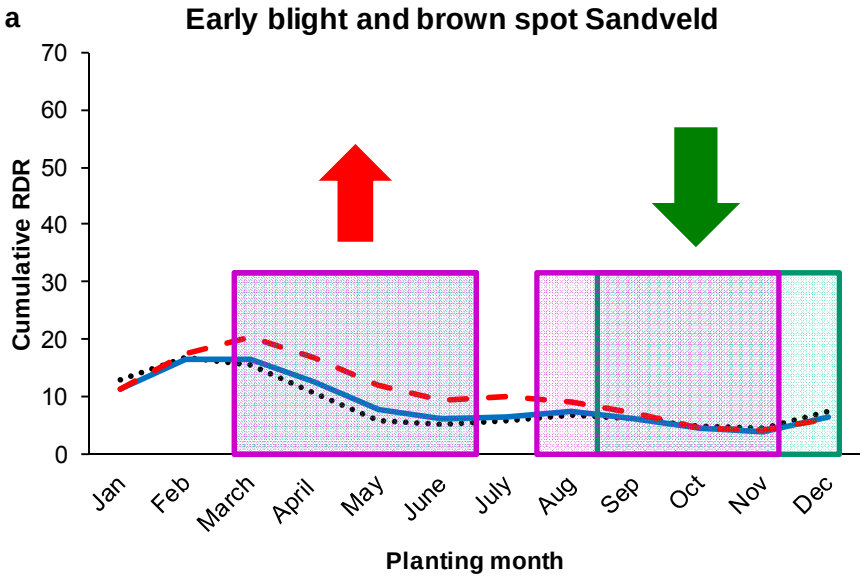
Cumulative relative development rates (cRDR) of **late blight** on potatoes for the periods 1961-1970 (·····), 2001-2010 (——) and 2041-2050 (----) in (a) the Sandveld, (b) the Eastern Free State and (c) Limpopo growing regions in SA

Early Blight and Brown Spot

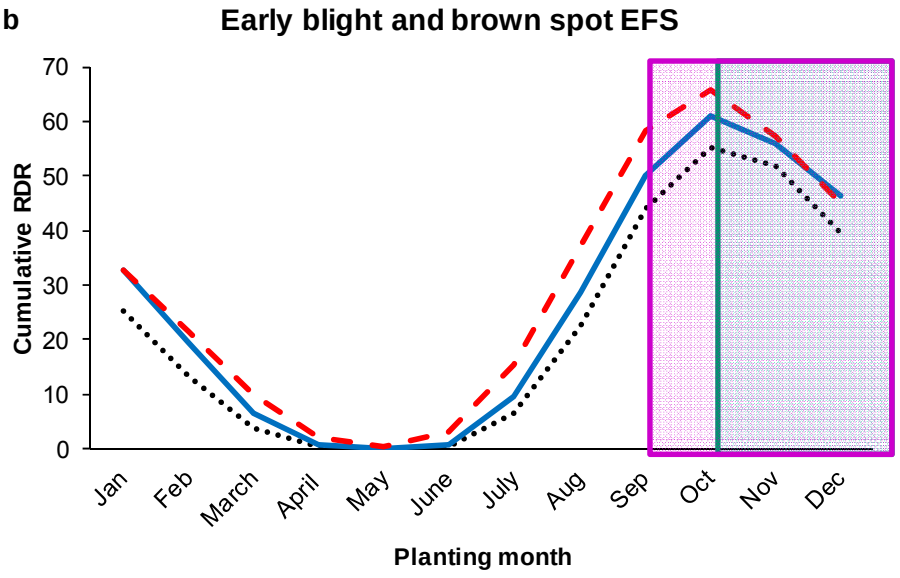
"Infection day" =
10˚C > Temp. < 35˚C
and RH >75%
(Rotem 1974)



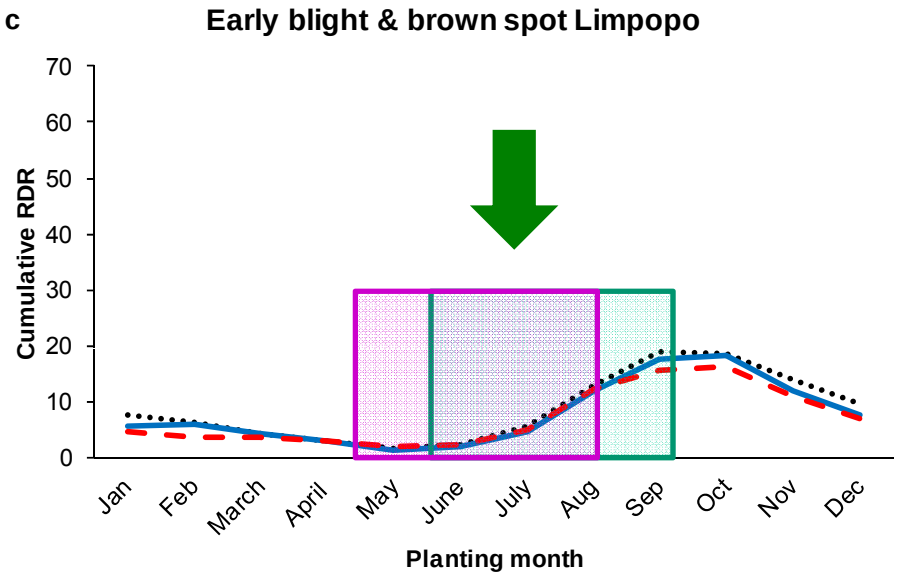
a



b



c



Cumulative relative development rates (cRDR) of **early blight and brown spot** on potatoes for the periods
1961-1970 (·····),
2001-2010 (——) and
2041-2050 (----) in
(a) the Sandveld,
(b) the Eastern Free State and
(c) Limpopo growing regions in SA

Soft Rot and Blackleg

RDR = 1 if Ave daily temp = 26˚C

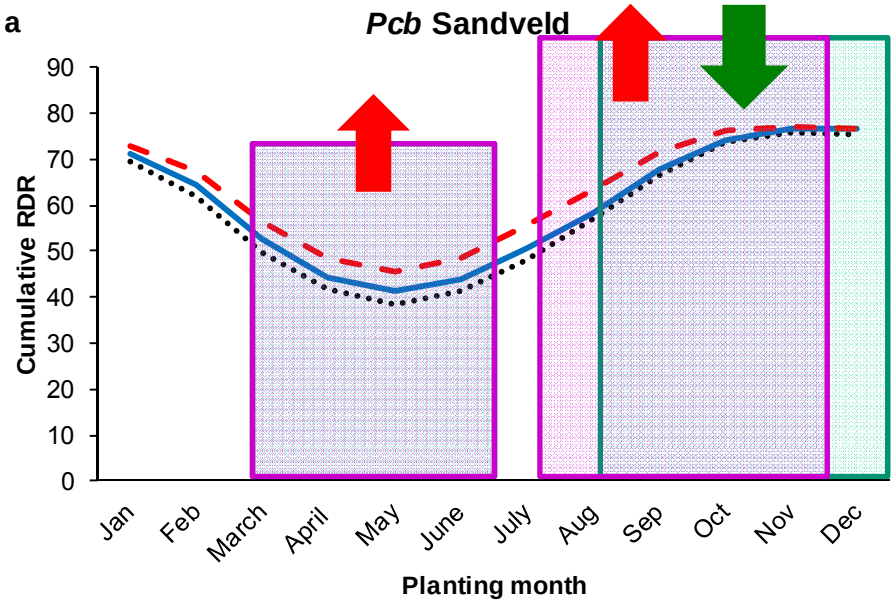
RDR = if Ave daily temp < 4˚C or > 37˚C

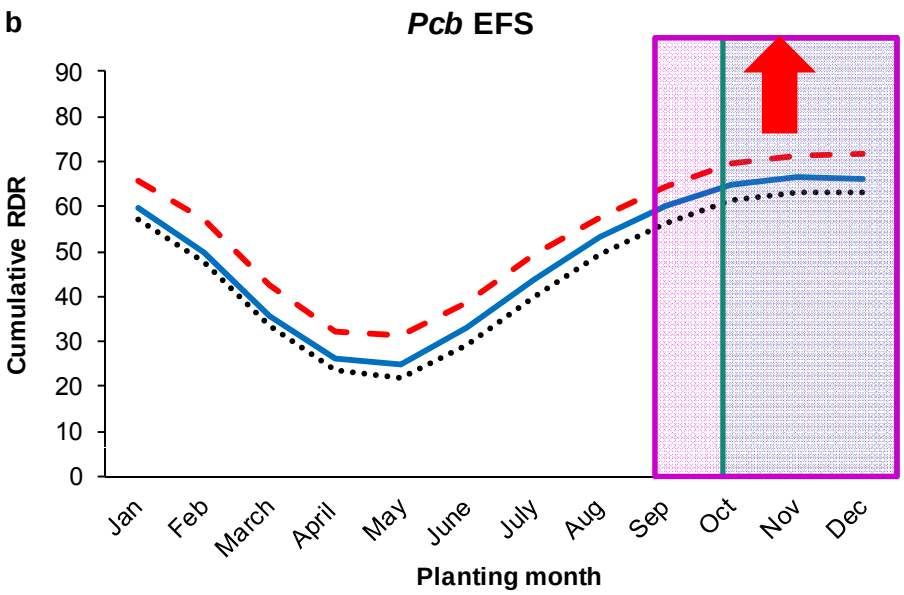
Intermediate RDR values obtained through linear interpolation of values from 4-37˚C

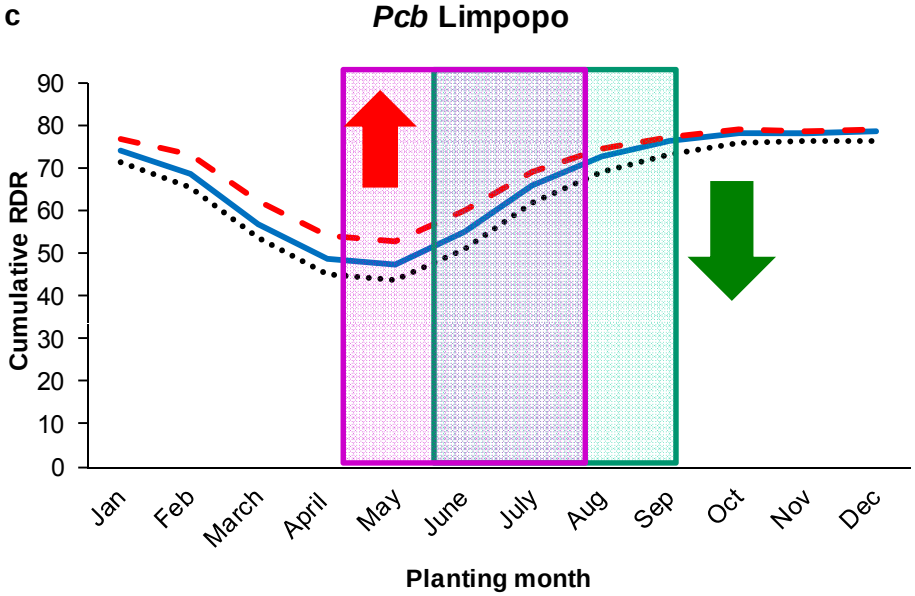
Air temp averages used as indication of prevalent soil temps: ($T_{soil} = (T_{max} + T_{min})/2$)

Soils are irrigated

(Duarte et al. 2004; du Raan *In Prep.*)







Cumulative relative development rates (cRDR) of **soft rot and blackleg** on potatoes for the periods 1961-1970 (·····), 2001-2010 (——) and 2041-2050 (----) in (a) the Sandveld, (b) the Eastern Free State and (c) Limpopo growing regions in SA

Root Knot Nematodes

RDR at ave daily temp of 26 °C=1/25=0.04

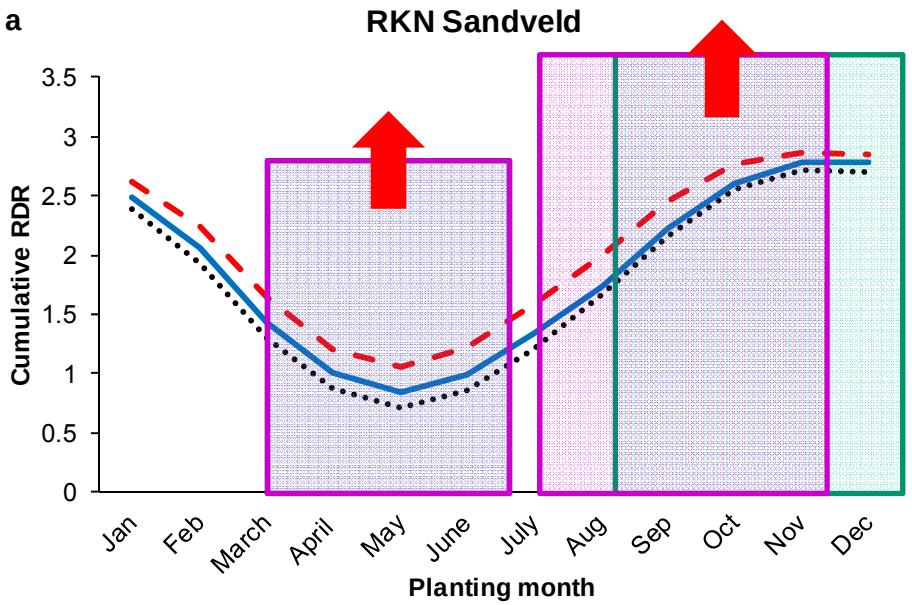
RDR = 0 if ave daily temp < 9.5˚C or > 34˚C

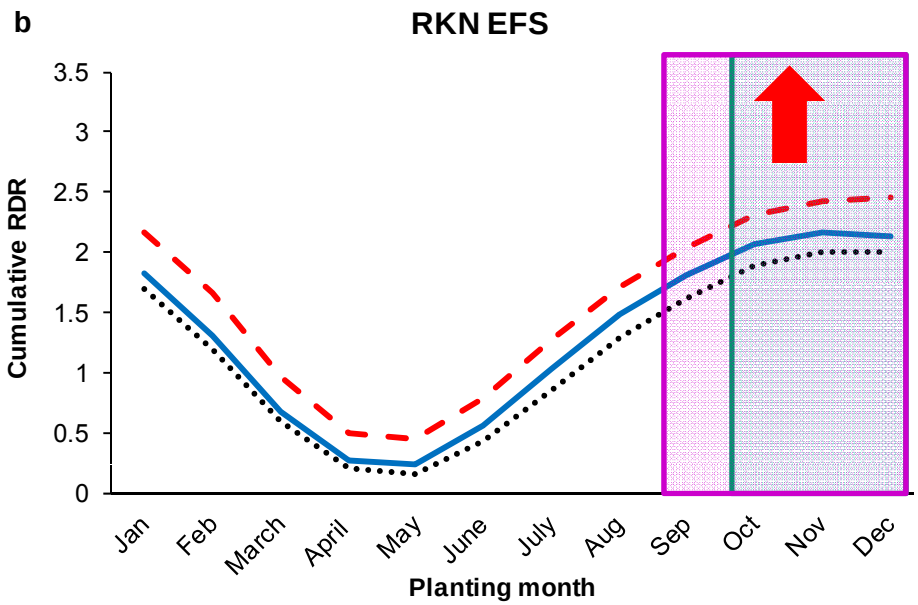
Intermediate RDR values obtained through linear interpolation of values from 9.5-34˚C

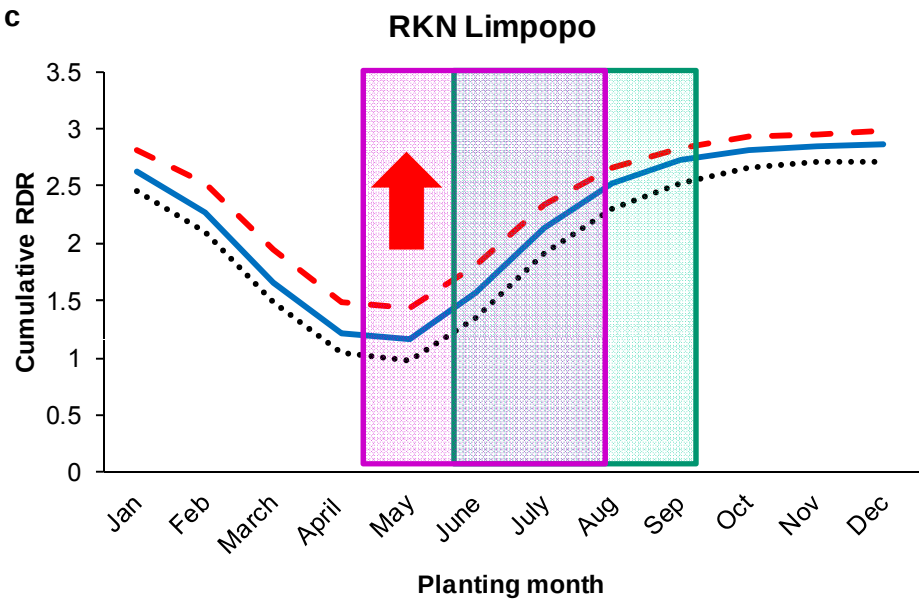
Air temp averages used as indication of prevalent soil temps: ($T_{soil} = (T_{max} + T_{min})/2$)

Soils are irrigated

(Vrain et al. 1978; Ploeg & Maris 1999)



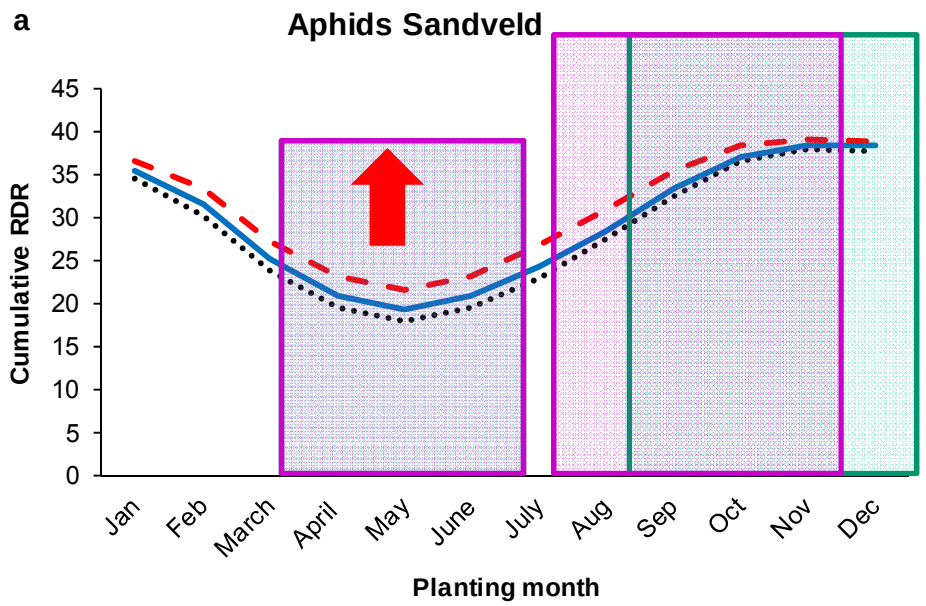


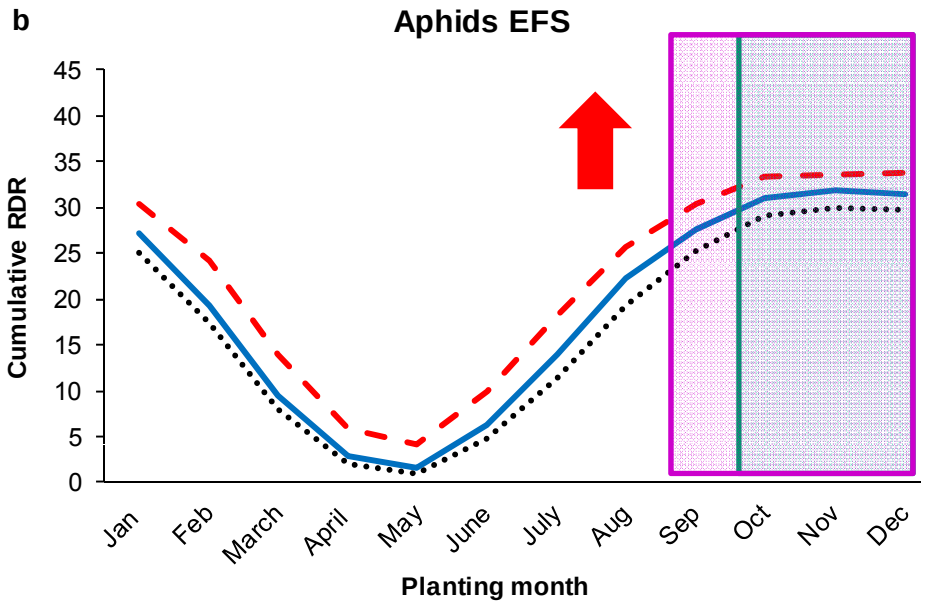


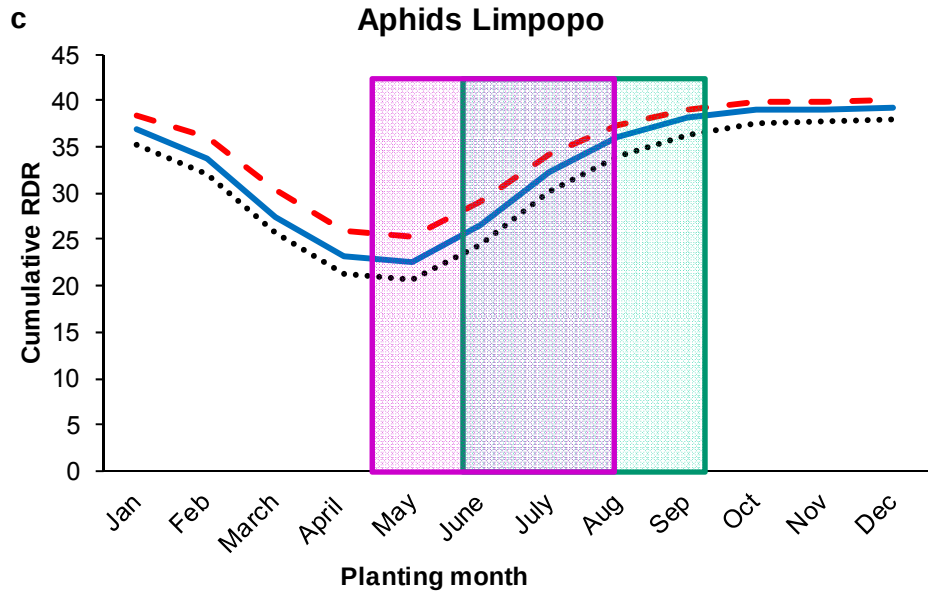
Cumulative relative development rates (cRDR) of **root-knot nematodes** for the periods 1961-1970 (·····), 2001-2010 (——) and 2041-2050 (----) in (a) the Sandveld, (b) the Eastern Free State and (c) Limpopo growing regions in SA

Aphids as Vectors of PVY

Optimal RDR is 1/1.95=0.51 at 26.7°C.
Linear interpolation used to determine doubling time
RDR = 0 if daily min temp < 6.5°C or max > 37.3°C
(Bale et al., 2002; Davis et al. 2006)







Cumulative relative development rates (cRDR) of **aphids** on potatoes for the periods 1961-1970 (·····), 2001-2010 (——) and 2041-2050 (----) in (a) the Sandveld, (b) the Eastern Free State and (c) Limpopo growing regions in SA

CONCLUSIONS

- **Predictions** can be made on how frequently particular weather patterns will occur until 2050
- Shifts in planting times **might allow escape** from pathogens or pests
- Changes in climate are **gradual** – enough time to alter management practices
- Published as: van der Waals *et al.* (2013) Potato Research 56:67-84

ACKNOWLEDGEMENTS

Funding:

- Netherlands Ministry of Economy, Agriculture and Innovation
- Potatoes South Africa
- THRIP

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Second announcement of the

2ND INTERNATIONAL POWDERY SCAB WORKSHOP

29 July – 1 August 2014

South Africa (Klein Kariba, Limpopo Province)

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