

epidemiology and disease management of rice brown spot

Research Priorities and Knowledge Gaps

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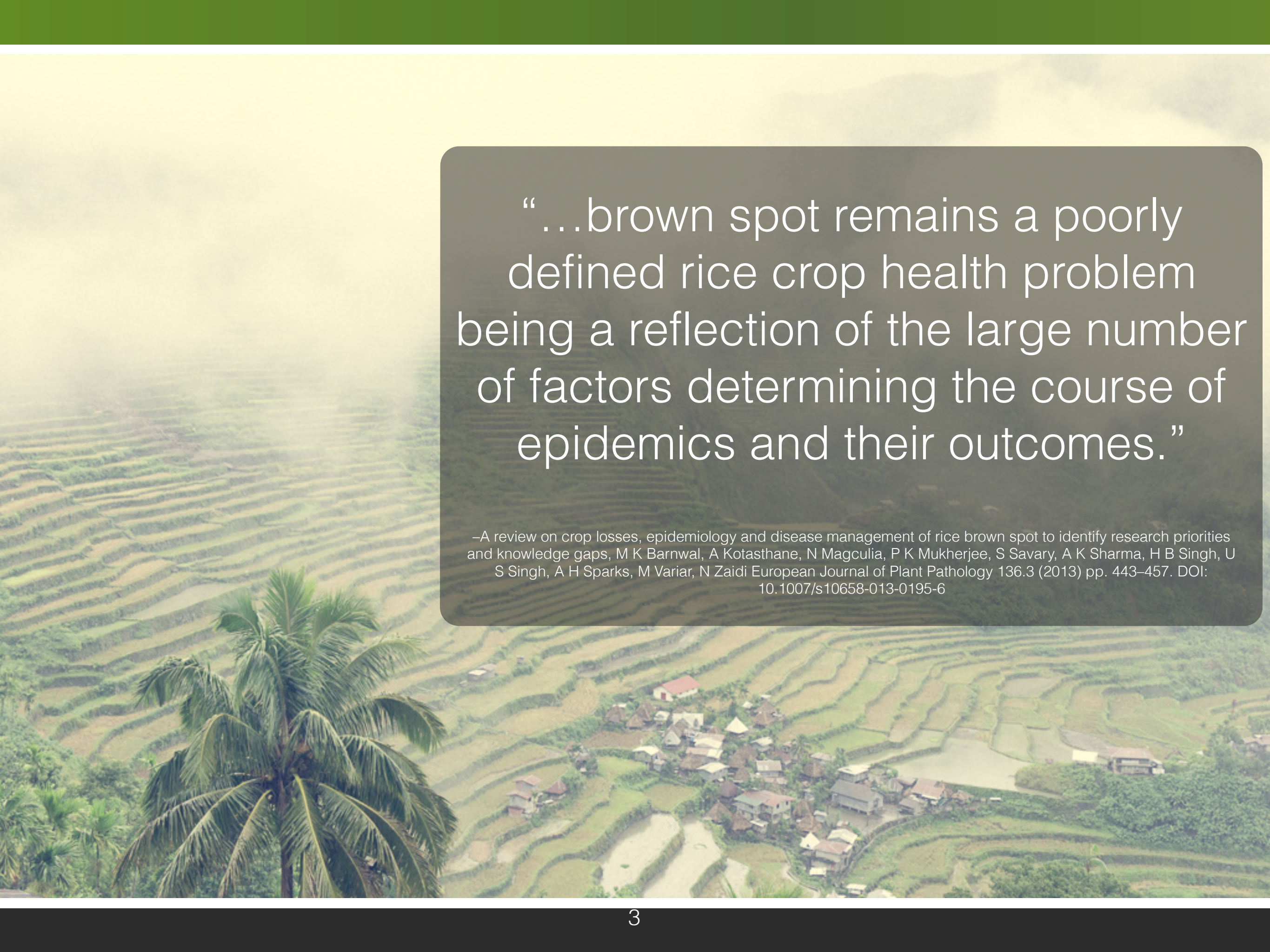
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With Special Thanks to

A review on crop losses, epidemiology and disease management of rice brown spot to identify research priorities and knowledge gaps. European Journal of Plant Pathology 136.3 (2013) pp. 443–457. DOI: 10.1007/s10658-013-0195-6

- M K Barnwal,
- A Kotasthane,
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- P K Mukherjee,
- S Savary,
- A K Sharma,
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- A H Sparks,
- M Variar,
- N Zaidi



“...brown spot remains a poorly defined rice crop health problem being a reflection of the large number of factors determining the course of epidemics and their outcomes.”

—A review on crop losses, epidemiology and disease management of rice brown spot to identify research priorities and knowledge gaps, M K Barnwal, A Kotasthane, N Magculia, P K Mukherjee, S Savary, A K Sharma, H B Singh, U S Singh, A H Sparks, M Variar, N Zaidi European Journal of Plant Pathology 136.3 (2013) pp. 443–457. DOI: 10.1007/s10658-013-0195-6

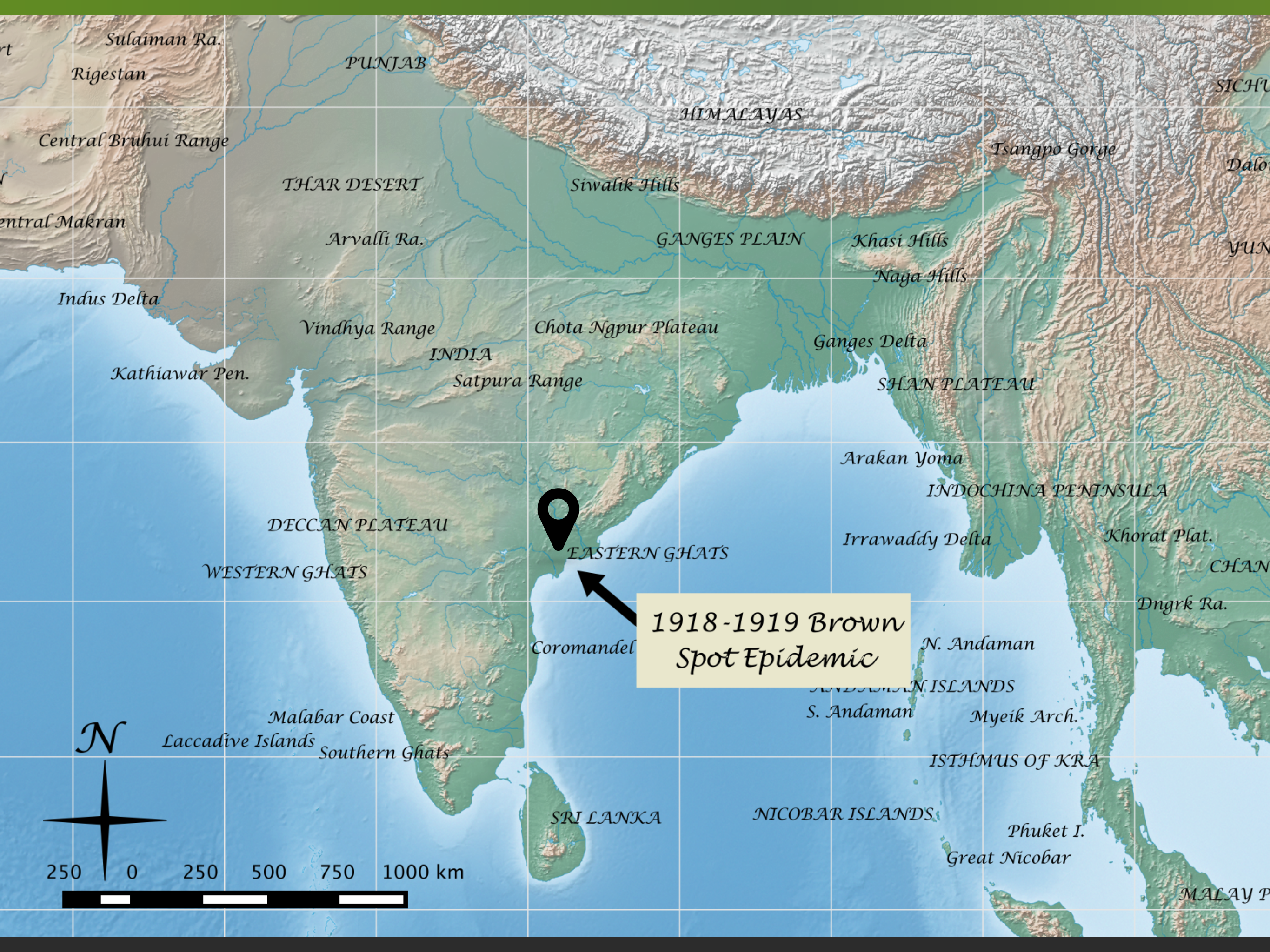


Yield Losses:

Range 4% - 52%

Average 10%
in affected areas

History



Great Bengal Famine (1943)

Yield losses were 50 -
90%

1.5 to 4 million people died of
starvation, malnutrition and
disease, out of Bengal's 60.3
million population





If Brown Spot is poorly defined...

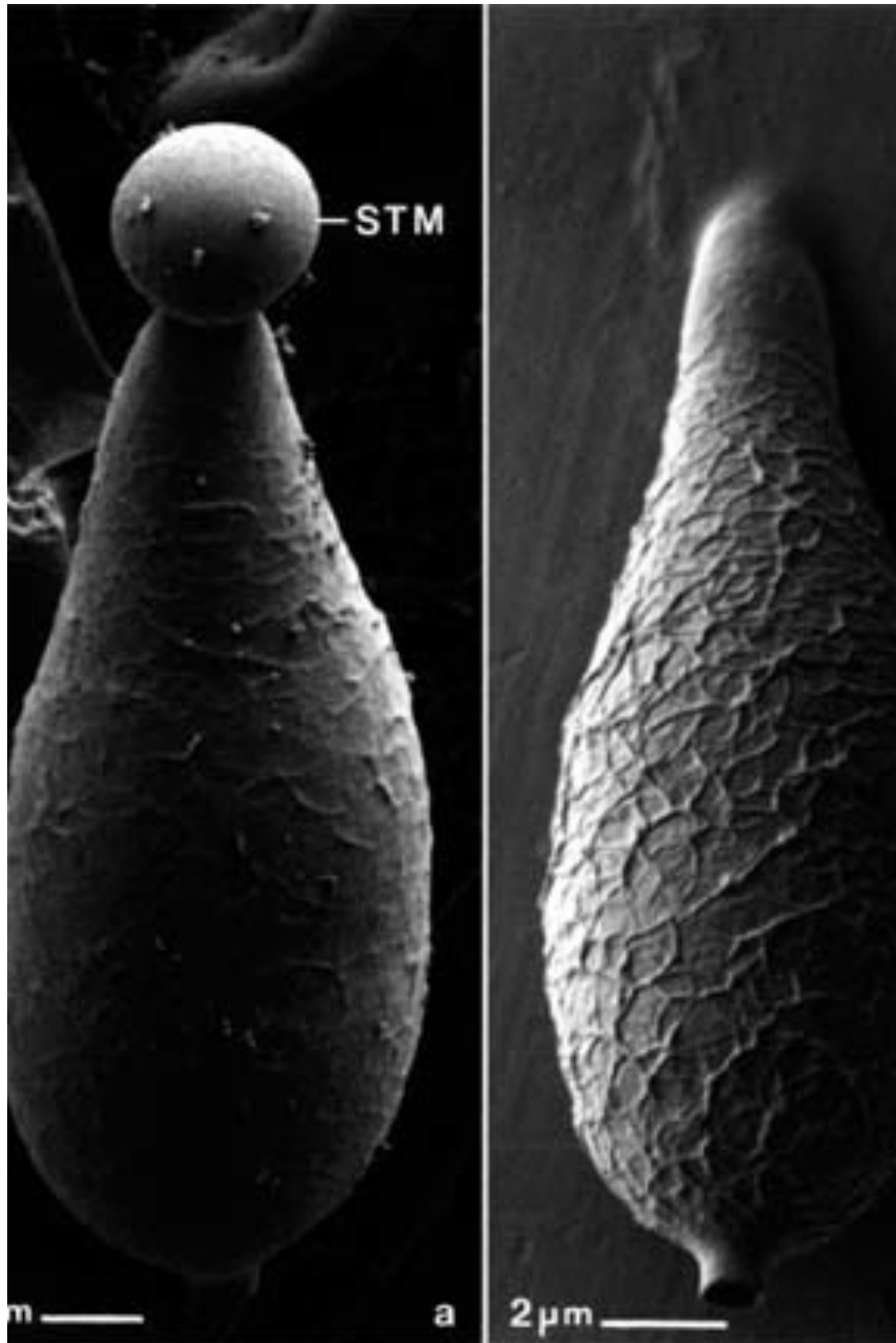
What is a well defined disease of rice?





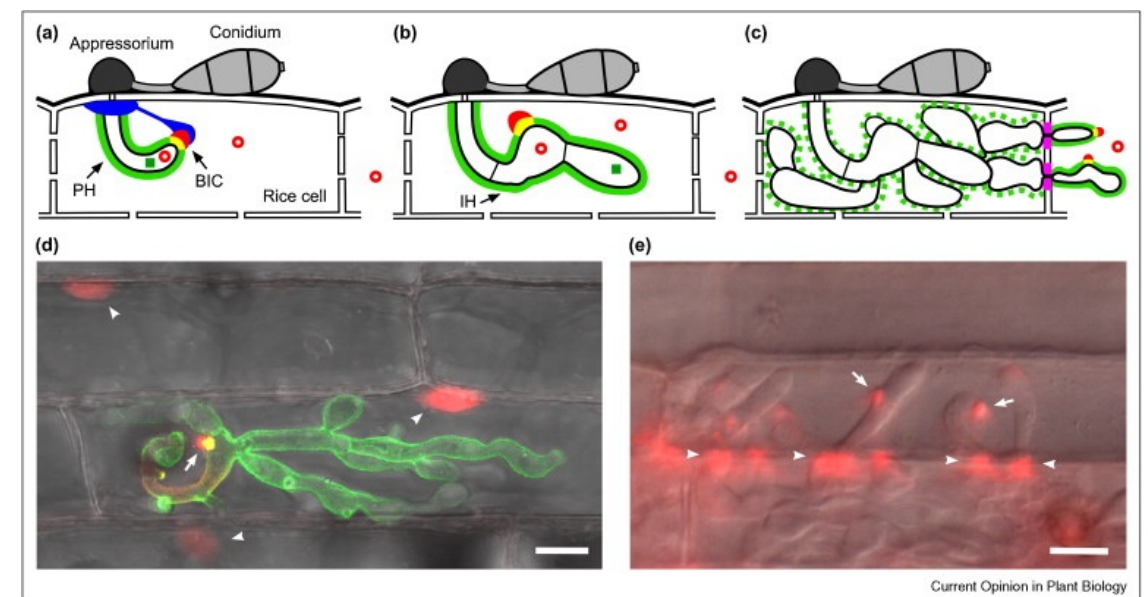
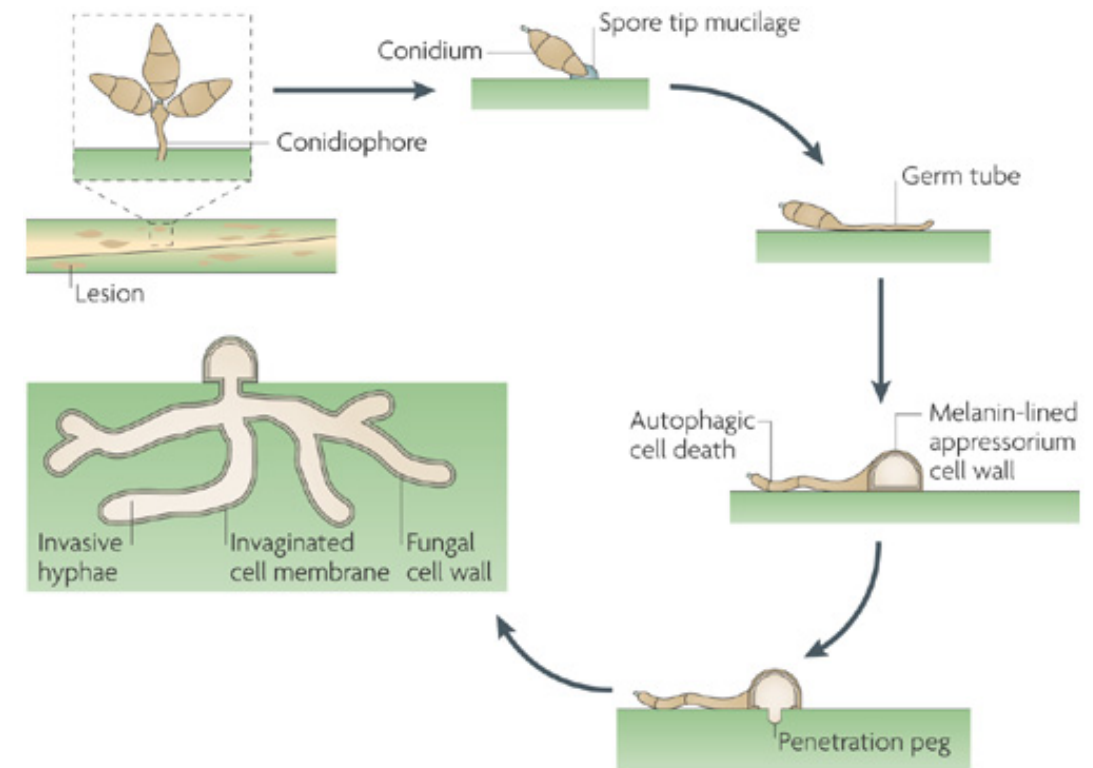
Rice Leaf Blast Life Cycle





Howard and Valent, "Breaking and Entering: Host Penetration by the Fungal Rice Blast Pathogen *Magnaporthe oryzae*." *Current Opinion in Plant Biology*, Volume 13, Issue 4, 1 August 2010, Pages 434–441


Richard A. Wilson & Nicholas J. Talbot, Under pressure: investigating the biology of plant infection by *Magnaporthe oryzae*, *Nature Reviews Microbiology* 7, 185–195 (March 2009)



Barbara Valent, Chang Hyun Khang, Recent advances in rice blast effector research, *Current Opinion in Plant Biology*, Volume 13, Issue 4, 1 August 2010, Pages 434–441



Rice Brown Spot Life Cycle 

A close-up photograph of a grass leaf, likely from a cereal crop, showing signs of brown spot disease. The leaf is covered in numerous small, dark brown, elongated lesions. Several clear dew drops are visible on the leaf's surface, particularly on the right side. The background is a dense field of similar grass blades, slightly out of focus.

Why do we not
yet have a good
understanding of
the brown spot
lifecycle?

Google

Rice Leaf Blast Disease





About 3,990,000 results

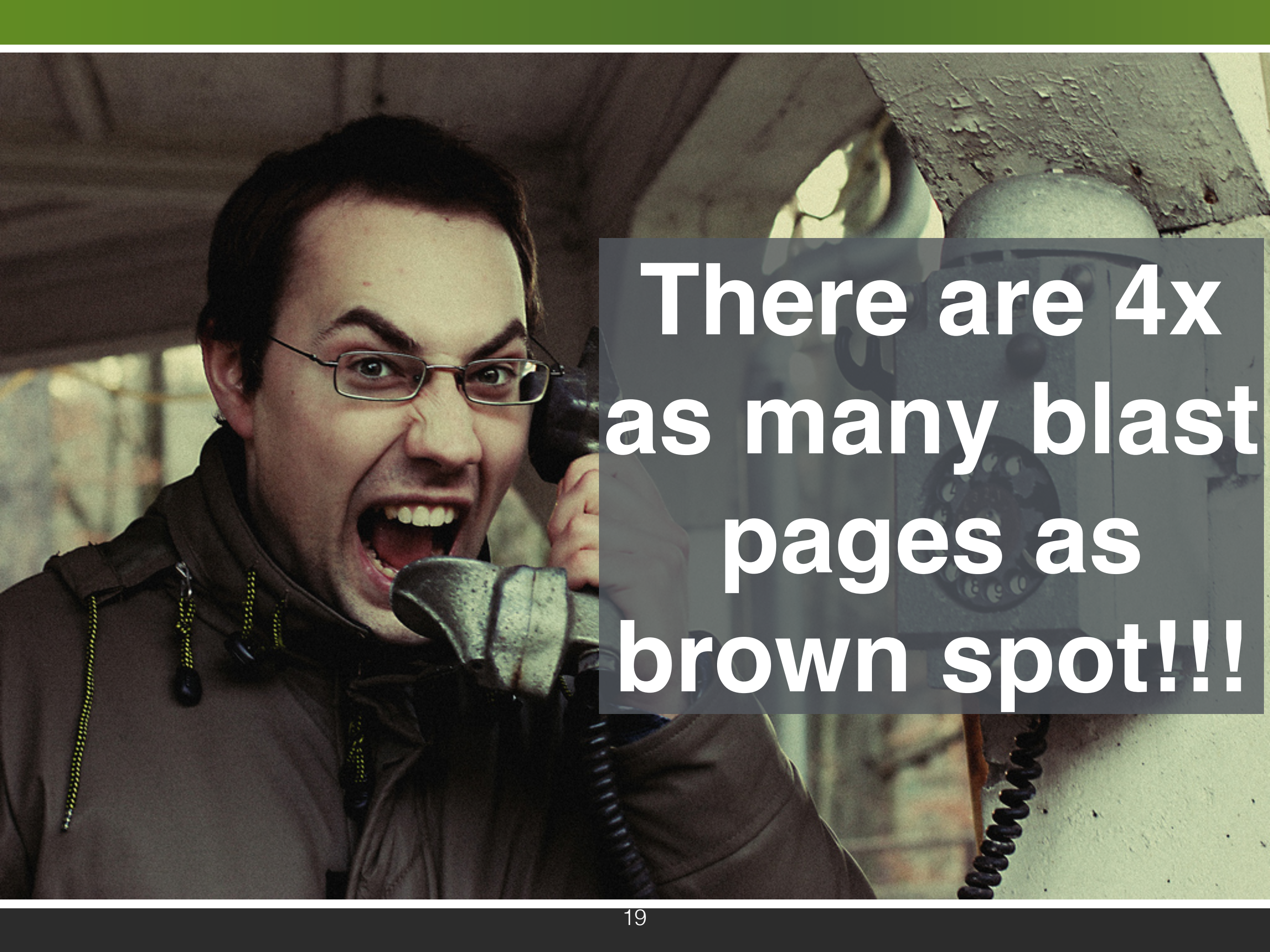
Google

Rice Brown Spot Disease



A photograph of a misty landscape. In the foreground, a hillside is covered with terraced fields, likely for agriculture. The terraces are filled with green crops. In the background, more hills and mountains are visible, shrouded in a thick mist or fog. The overall atmosphere is serene and somewhat ethereal. A dark grey rounded rectangle is positioned in the lower-left area of the image, containing white text.

About 1,050,000 results



**There are 4x
as many blast
pages as
brown spot!!!**

Why?



A photograph of a misty landscape. On the left, a hillside is covered with terraced fields, likely for agriculture. The terraces are filled with green crops. The background shows more hills and mountains shrouded in a thick, white mist or fog, creating a sense of depth and atmosphere. The overall color palette is muted, with greens, greys, and whites.

What do we know?



Water Stressed Rice = Brown Spot
Poor Plant Nutrition = Brown Spot



To be more specific

Nutrient-deficient soil: soil that is low in potassium, magnesium, silica, iron, and calcium

Akiochi: excessive concentration of hydrogen sulphide in the soil, reduced nutrient uptake, this mainly occurs in poorly drained soil with high organic matter

“Brown spot is generally not observed in years with regular rainfall (Singh *et al.* 2005) whereas seasons with limited rainfall but heavy dew are conducive to stronger epidemics (Sherf *et al.* 1947).”

–Barnwal *et al.* 2013



What do we NOT know?



Plenty!

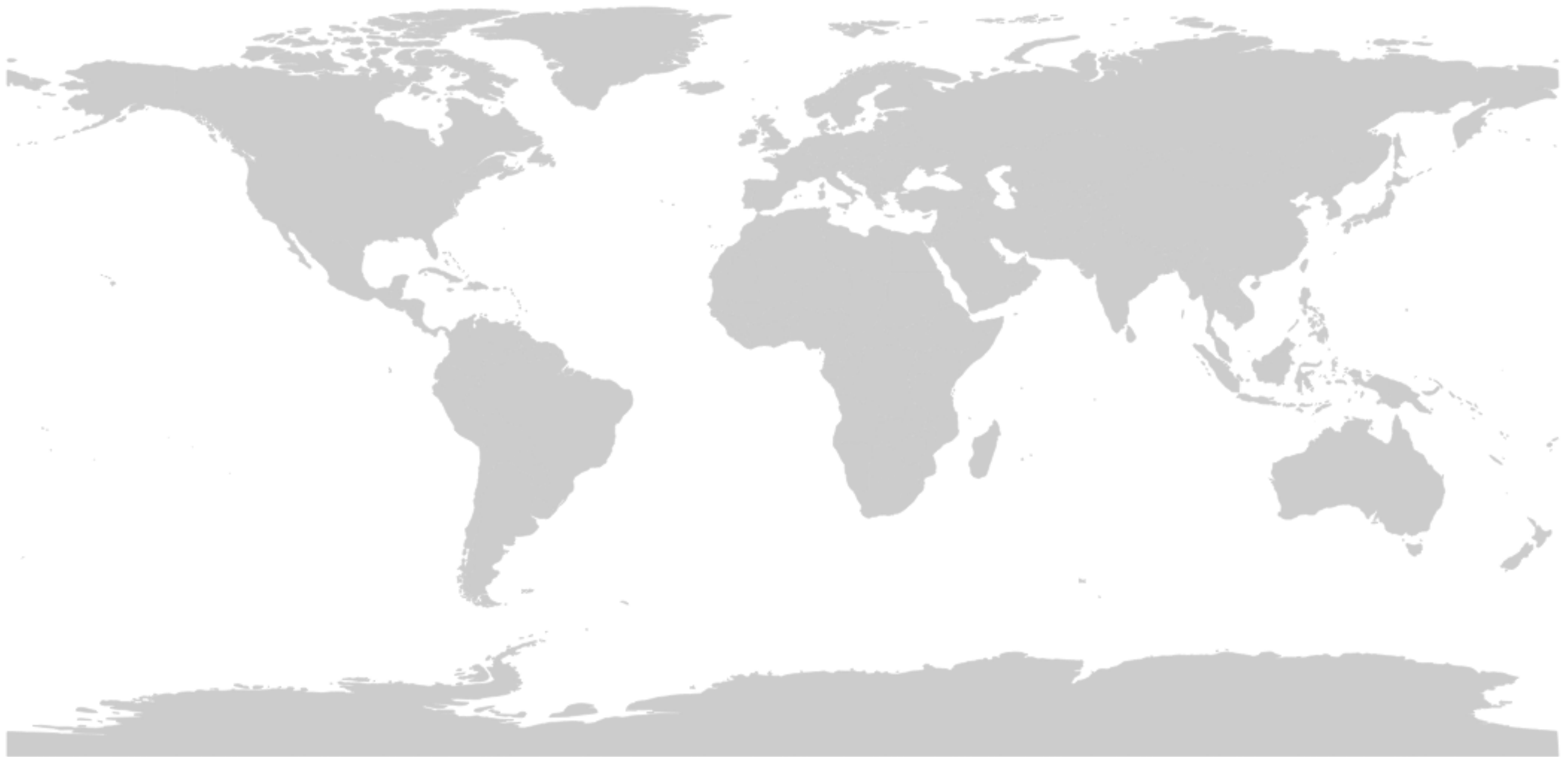
Host plant resistance
is not well understood

(Barnwal *et al.* 2013)

Host plant resistance **is not** well understood

Most efforts focus on blast or bacterial blight

(Barnwal *et al.* 2013)



(Barnwal *et al.* 2013)



Intensity

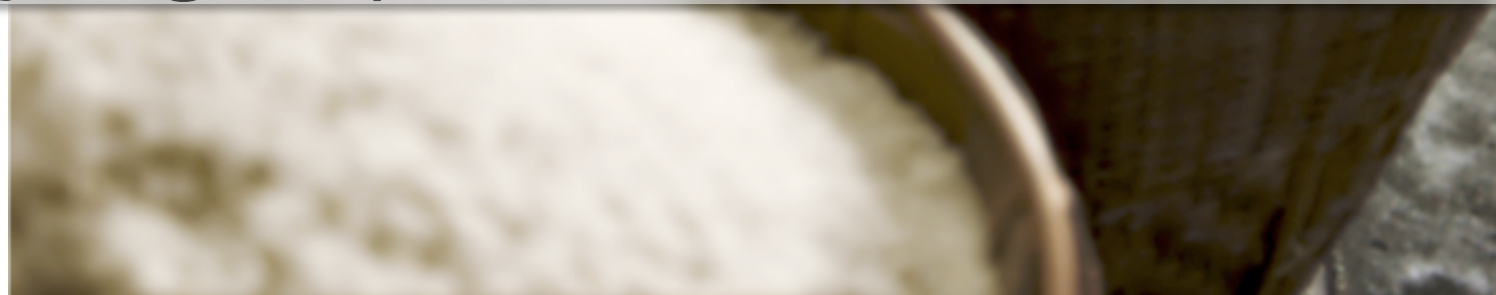
Frequency

Possible Changes

(Barnwal *et al.* 2013)



What are actual yield losses given the widely varying reported values?

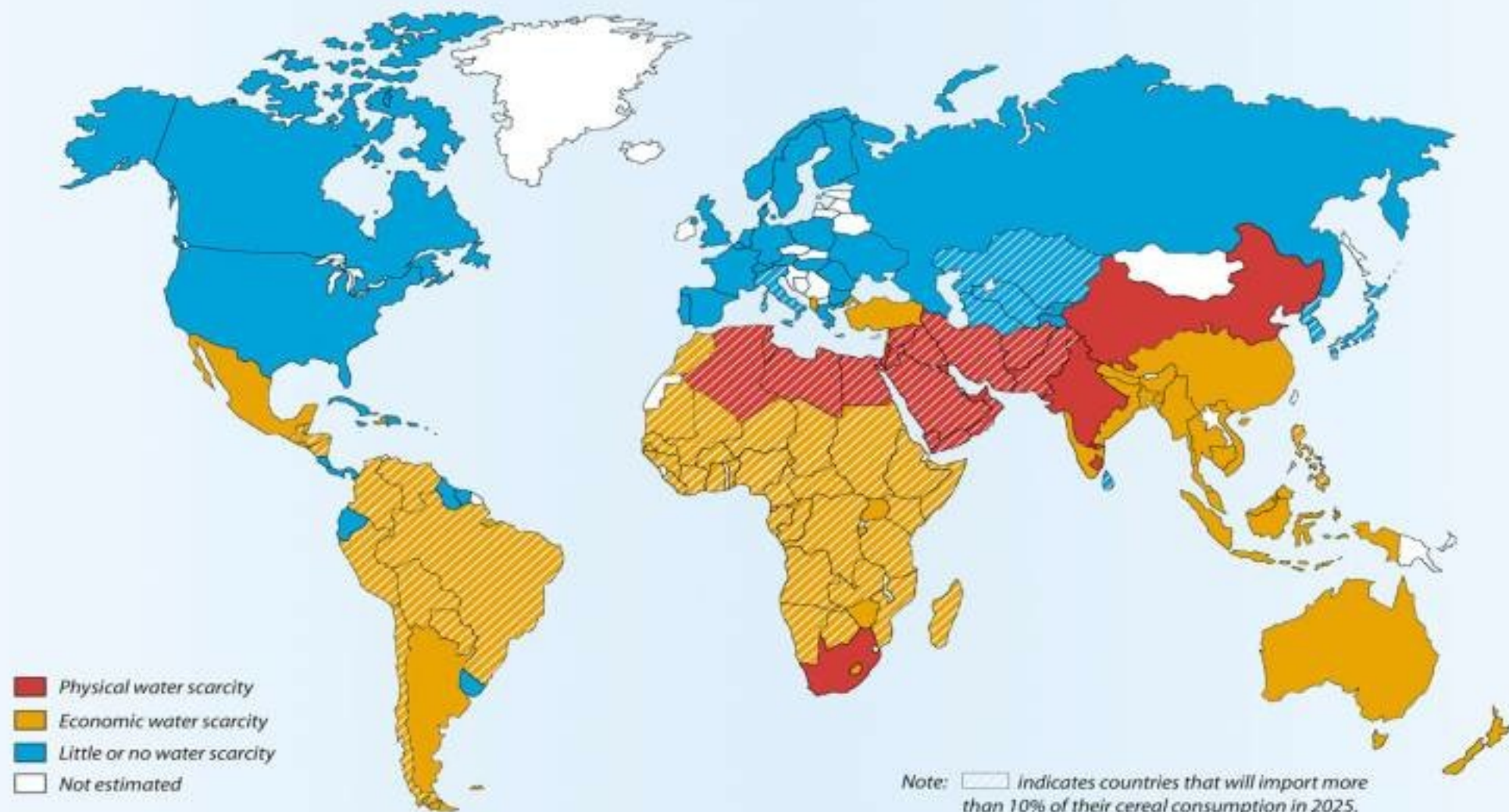


(Barnwal *et al.* 2013)

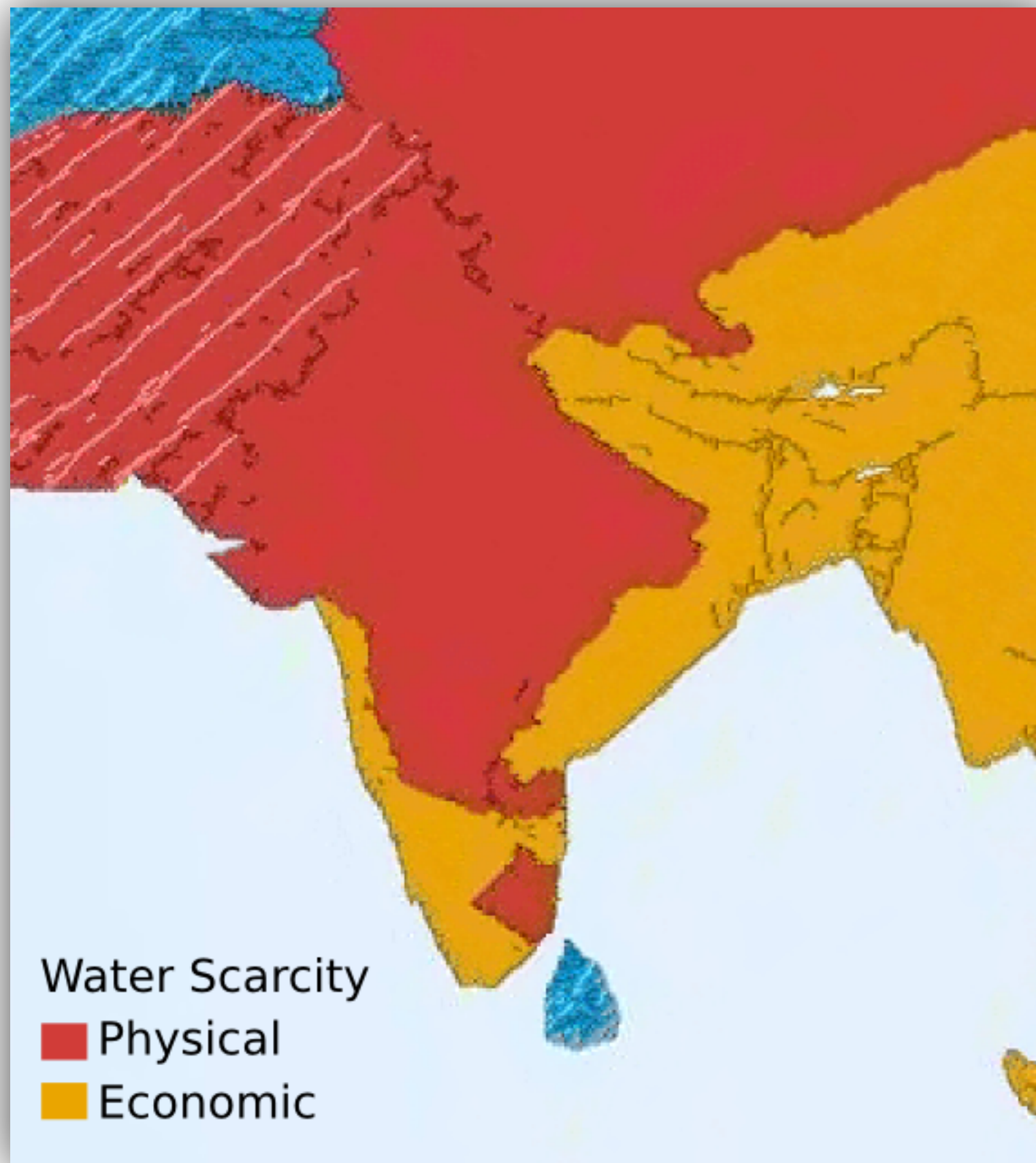


Climate Change...

Projected Water Scarcity in 2025



DTP Unit, IWMI - January, 2000



**Do you think this might affect Brown
Spot incidence and severity?**



El Niño



Indian Monsoon

Shifts of just 10% can cause drought



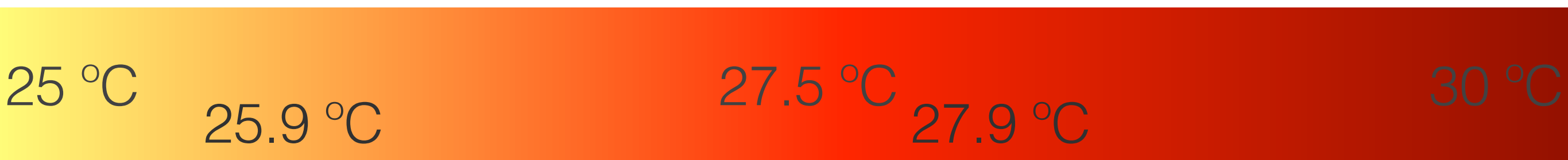
Indian Monsoon

Shifts of just 10% can cause drought

El Niño is predicted to become stronger...



What other implications might climate change have for brown spot?



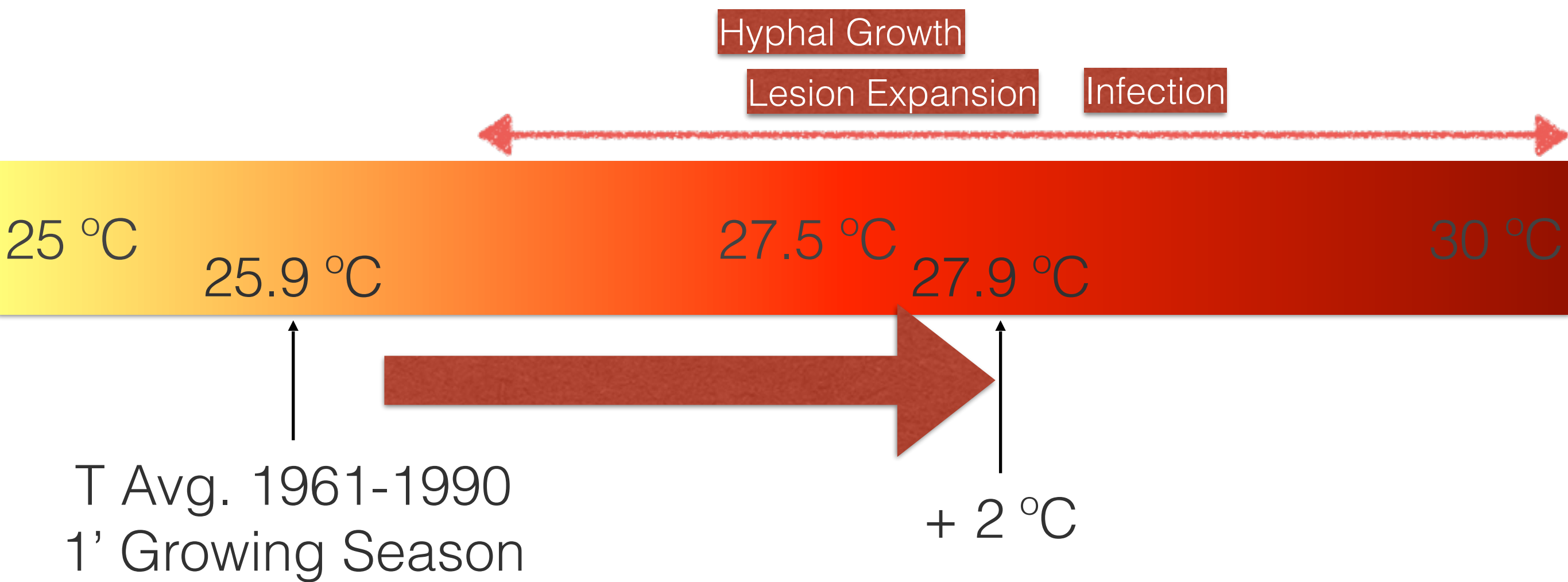
↑
T Avg. 1961-1990
1' Growing Season

New *et al.* 2000



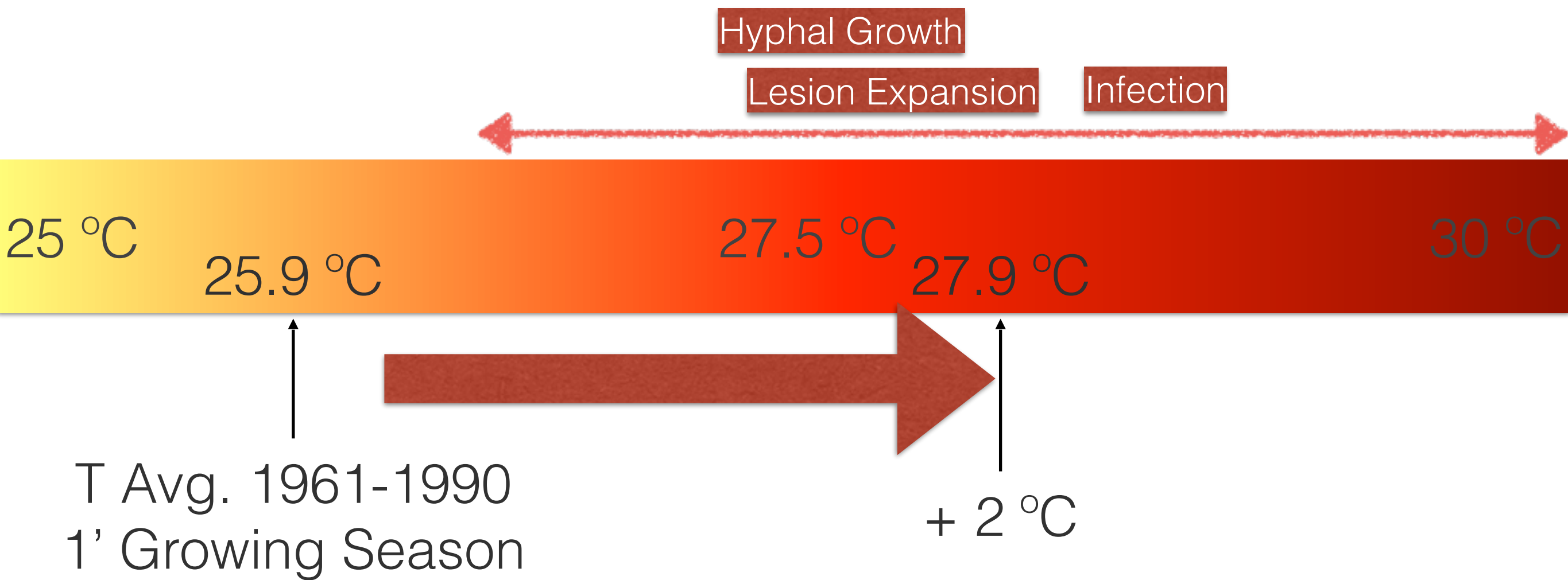
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New *et al.* 2000

PERHAPS



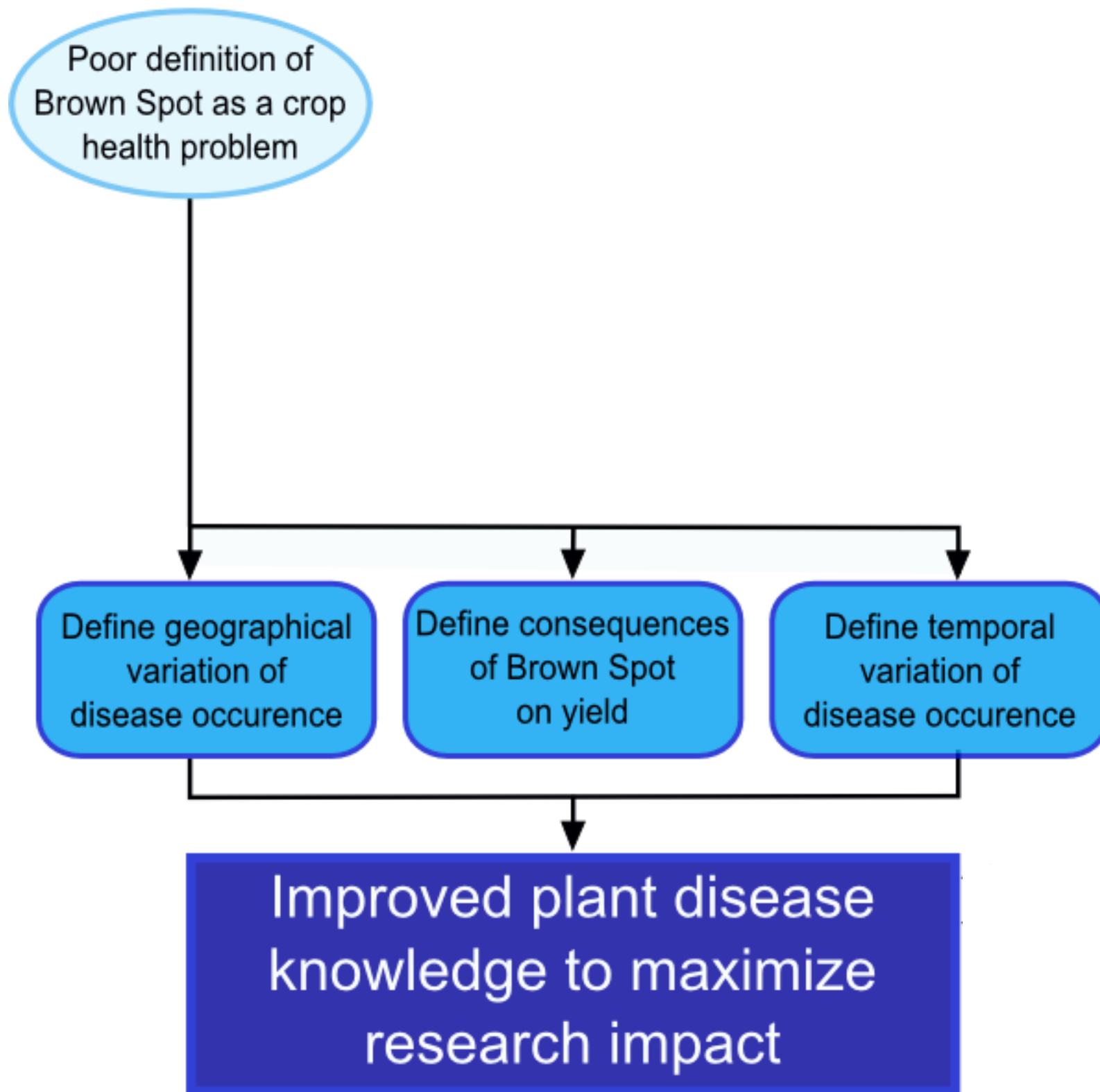
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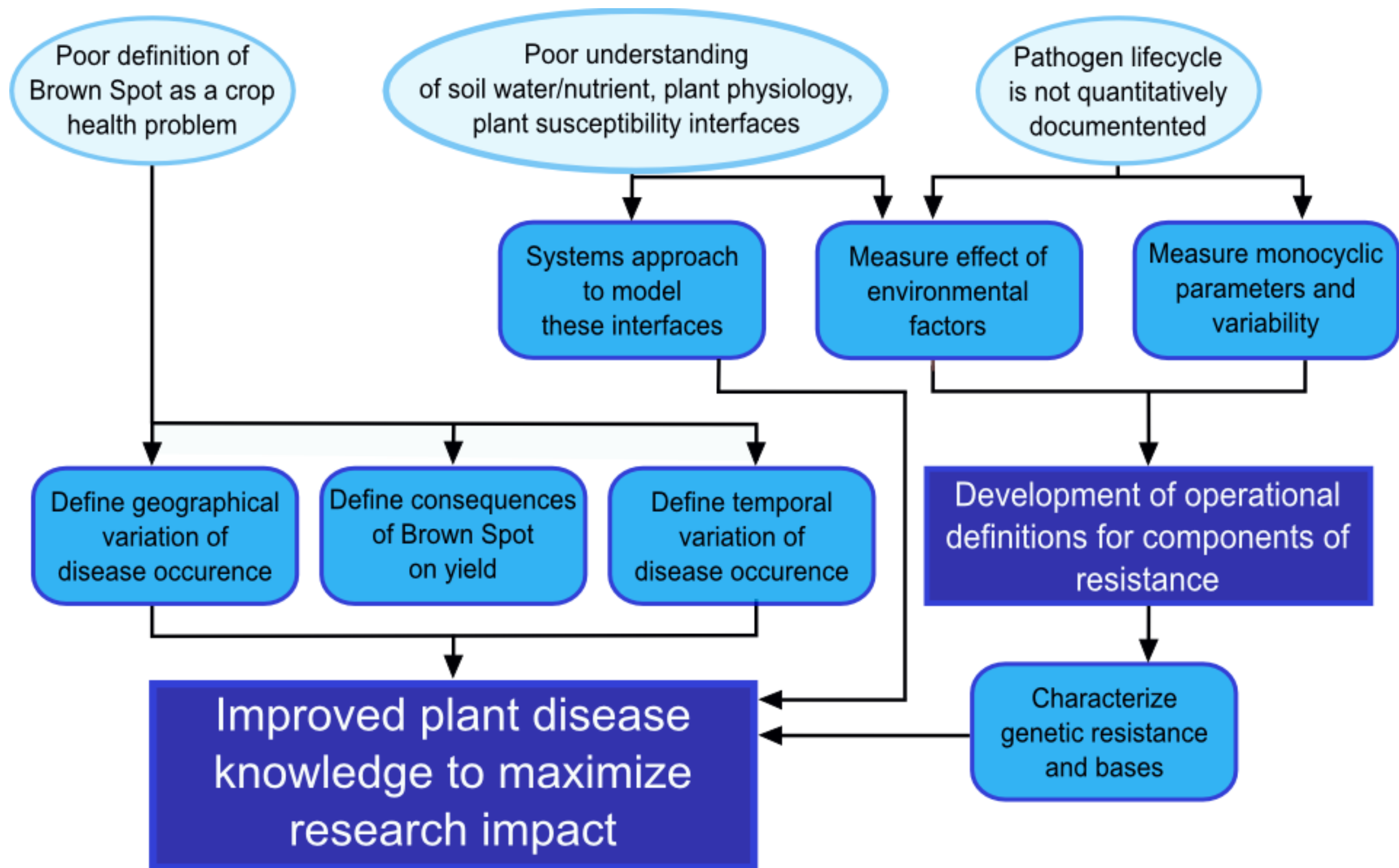
What can we do?



View BS as a model pathosystem




Barnwal *et al.* 2013



Barnwal *et al.* 2013



Why is brown spot so poorly understood?



“...the genetic bases of rice tolerance to unfavourable physical environment and of rice resistance to the pathogen are connected...”

Barnwal *et al.* 2013

Again, a special thank you

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