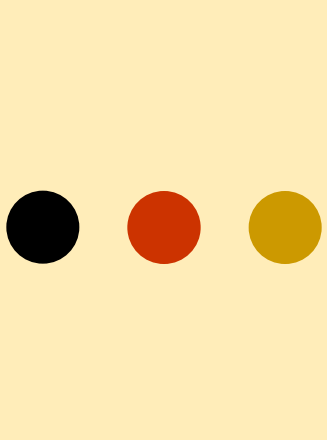


The Complexity of Silver Scurf

Gary Secor

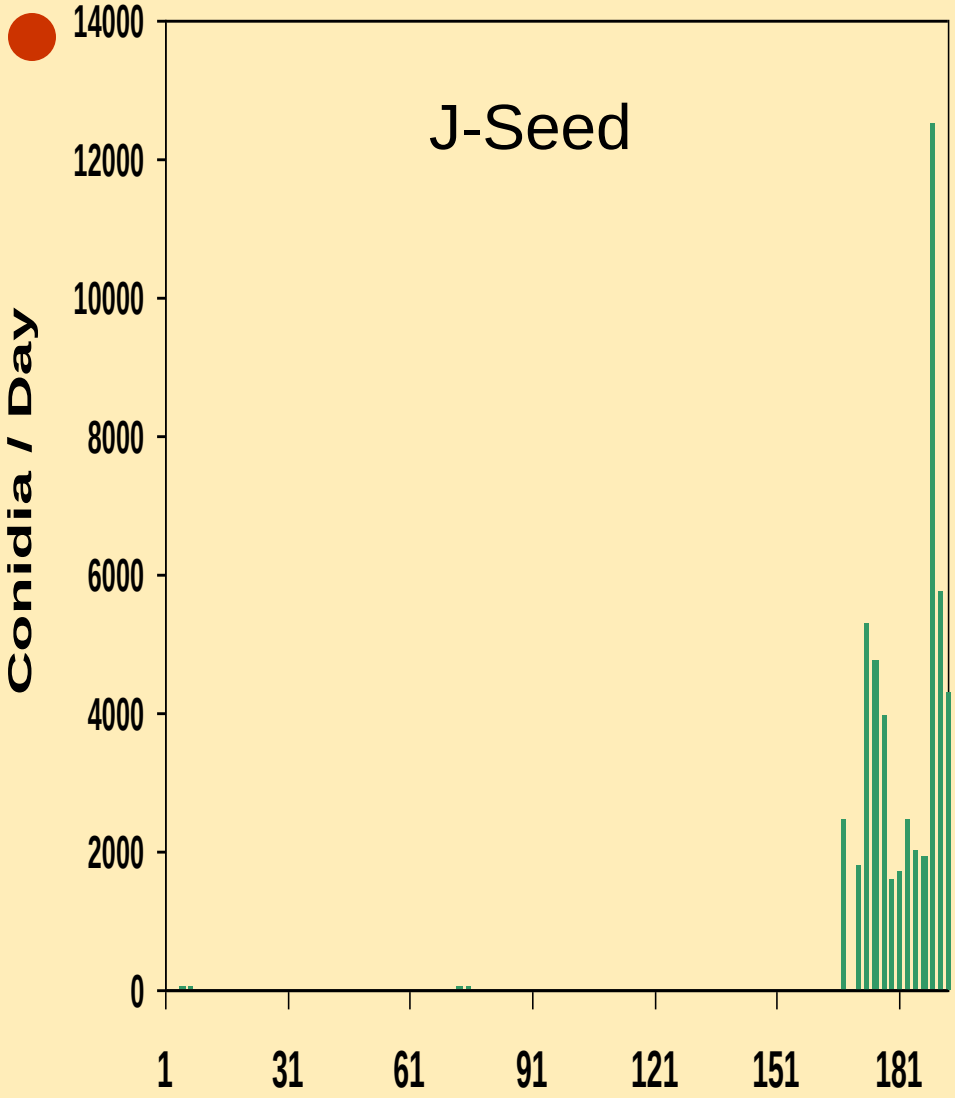
North Dakota State University

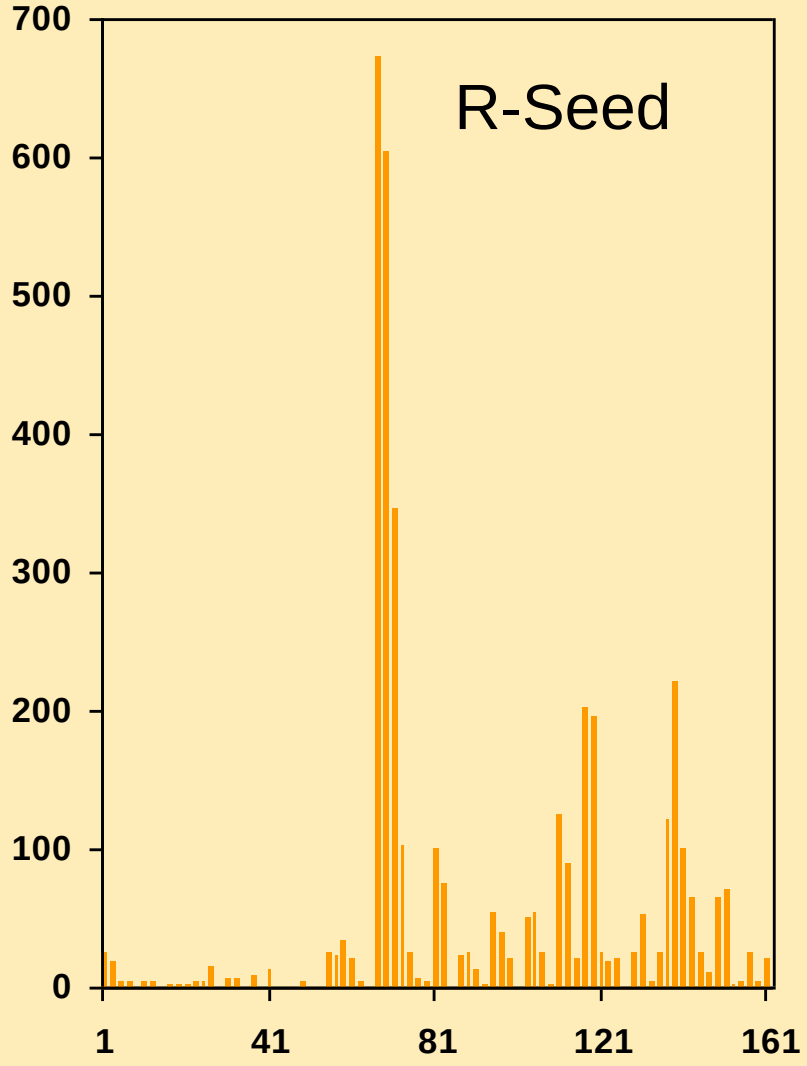
- As the need for quality and appearance increases, blemish becomes important
- Blemish traditionally caused by the fungus *Helminthosporium solani*
  - Silver scurf
- No yield loss
- Affects quality of tablestock and processing
- No foliar phase; only tubers affected
- Appears at harvest, primarily on the stem end
- Seed borne
- Spreads in storage

- Symptoms are silver gold metallic discoloration of the periderm
  - At harvest
  - Primarily on the stem end
- Moves from seed to progeny tubers
  - Sporulates on seed
  - Moves by water or via stolon to new tubers
- Also affects processing potatoes causing excessive water loss and subsequent peeling difficulties

Infection occurs in the field but spreads in storage

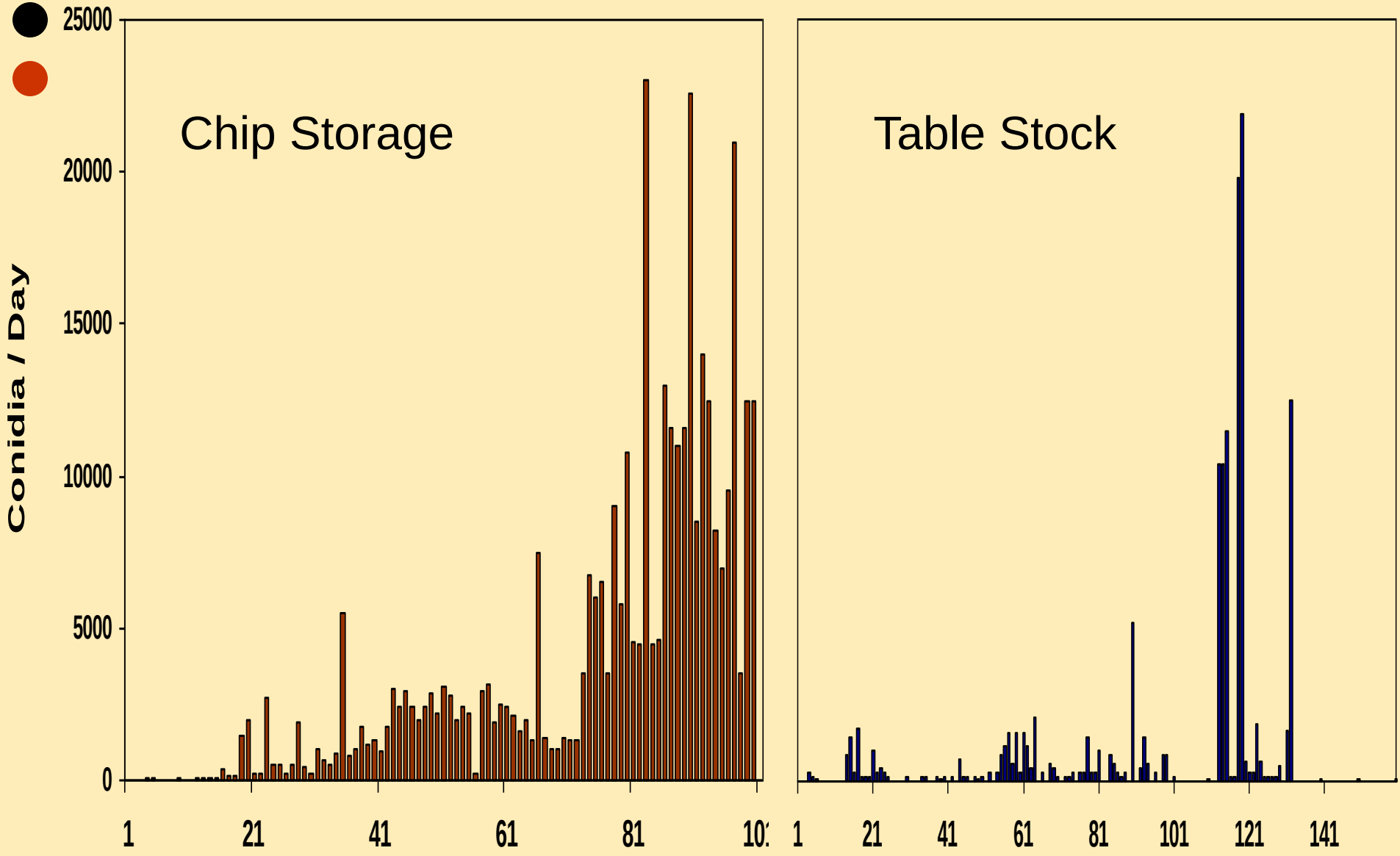
Number of Conidia of *Helminthosporium solani* Collected in Seed Storage





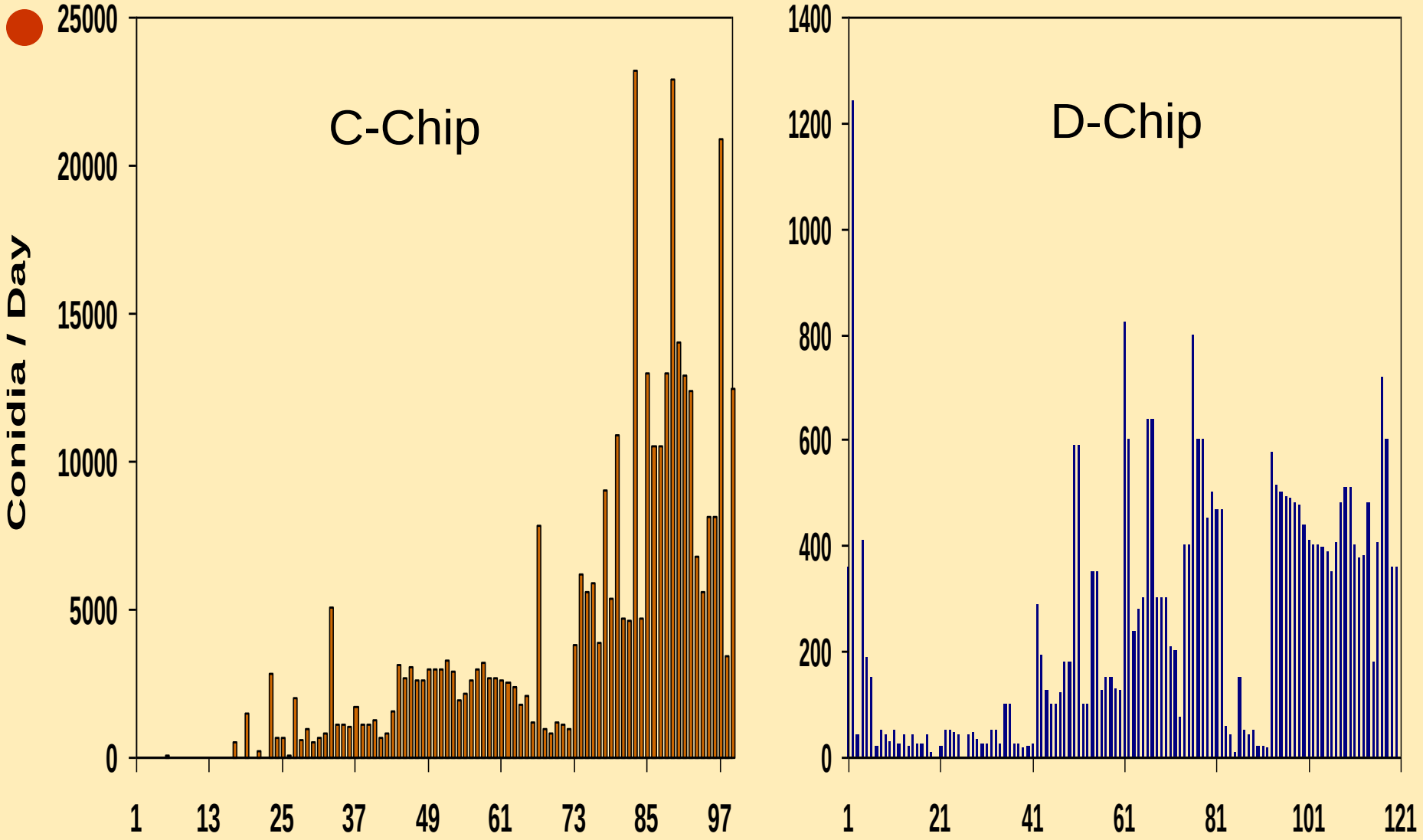
Rodriguez, et al., 1996

Number of Conidia of *Helminthosporium solani* Collected in Storage



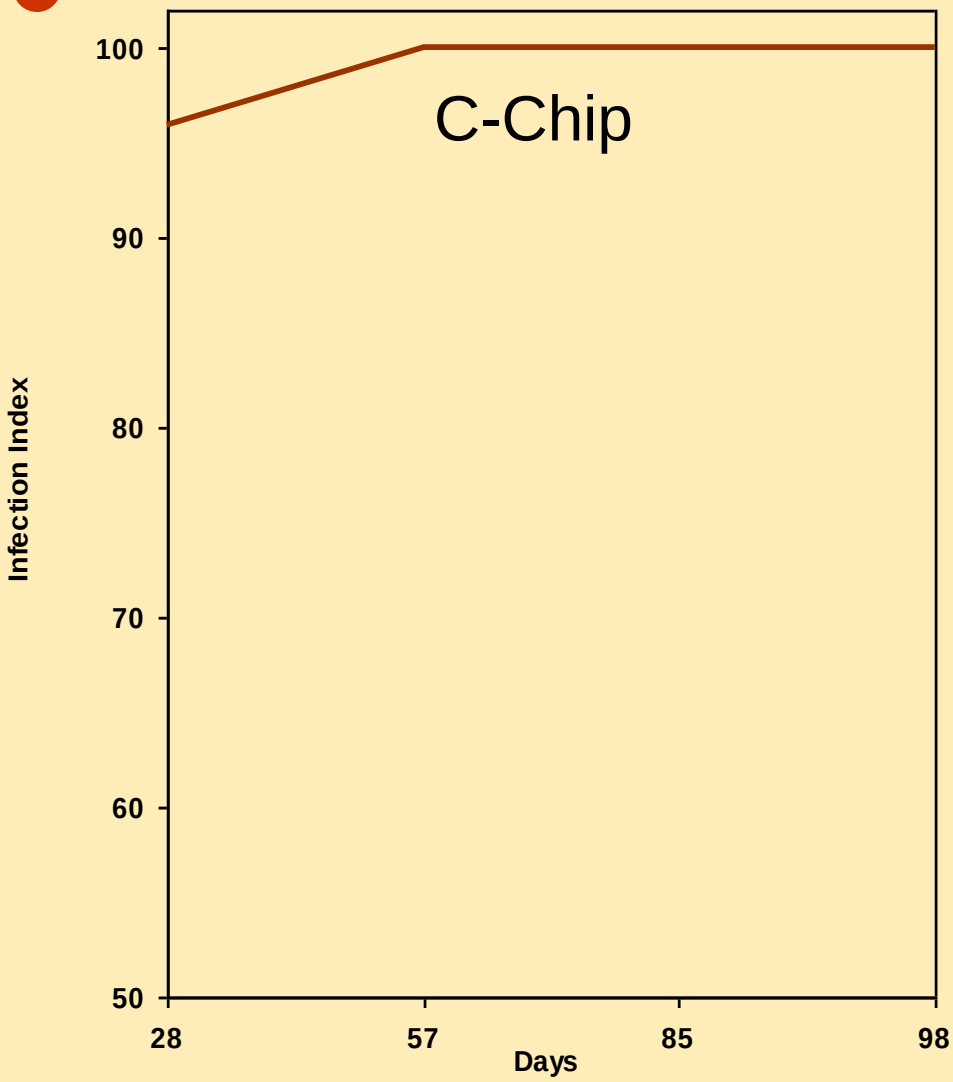
Rodriguez, et al., 1996

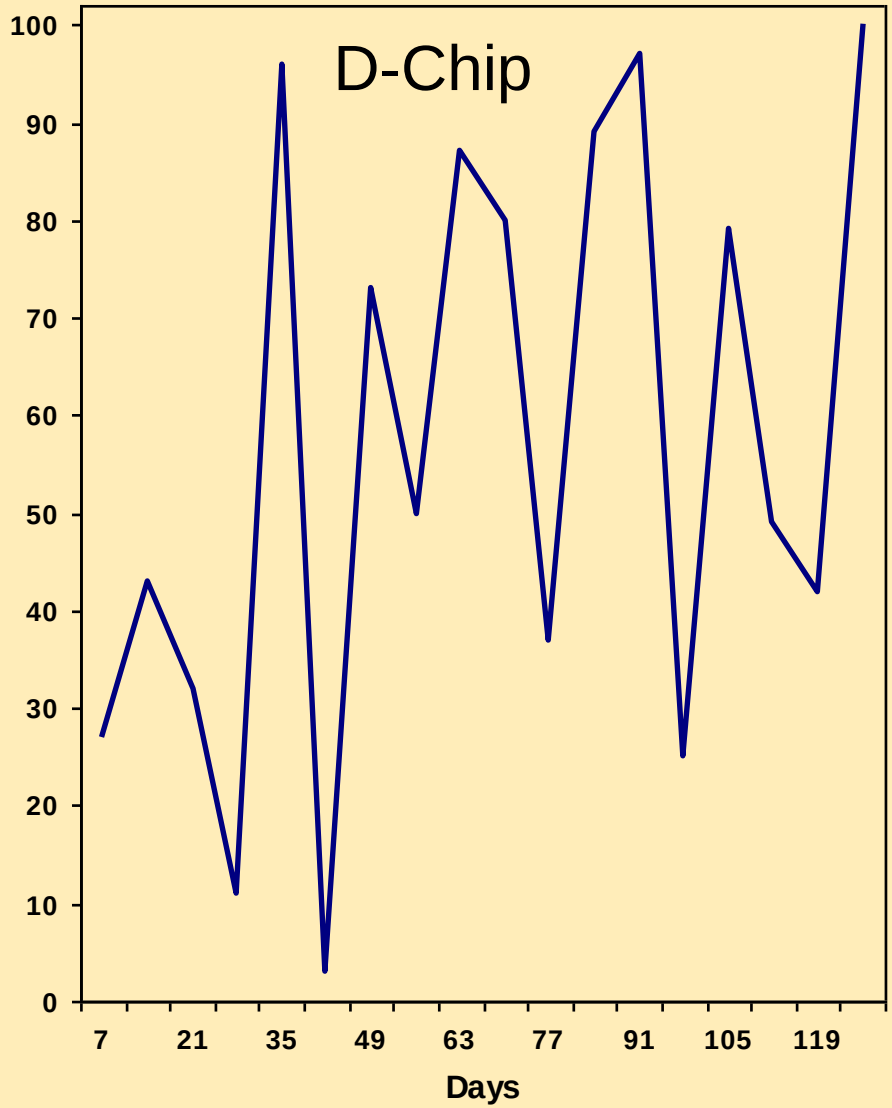
Number of Conidia of *Helminthosporium solani* Collected in Chipping Storage



Rodriguez, et al., 1996

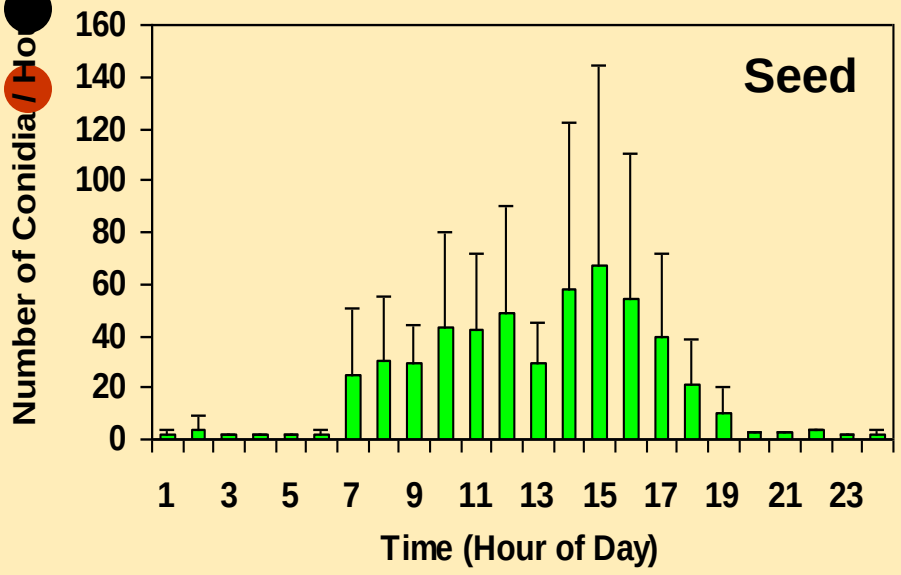
Infection of Minitubers after Exposure for 1 Week in Chipping Storage

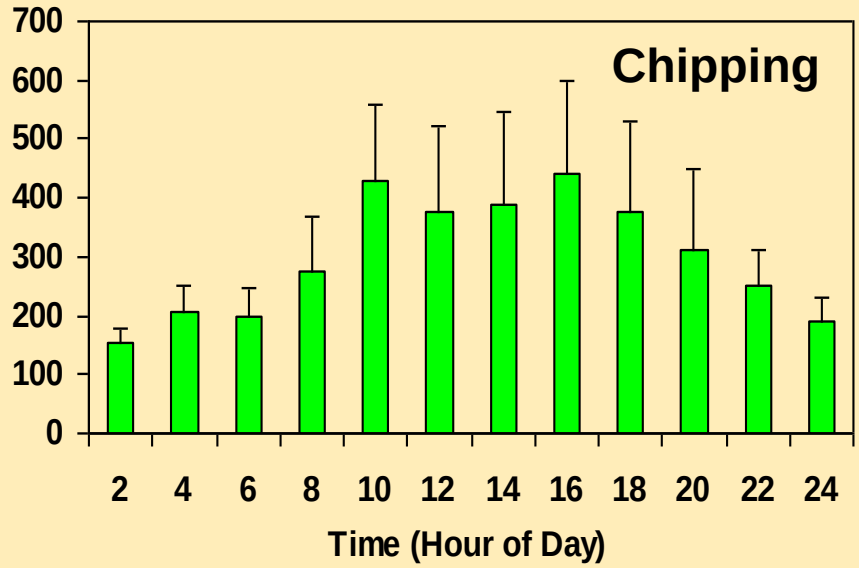


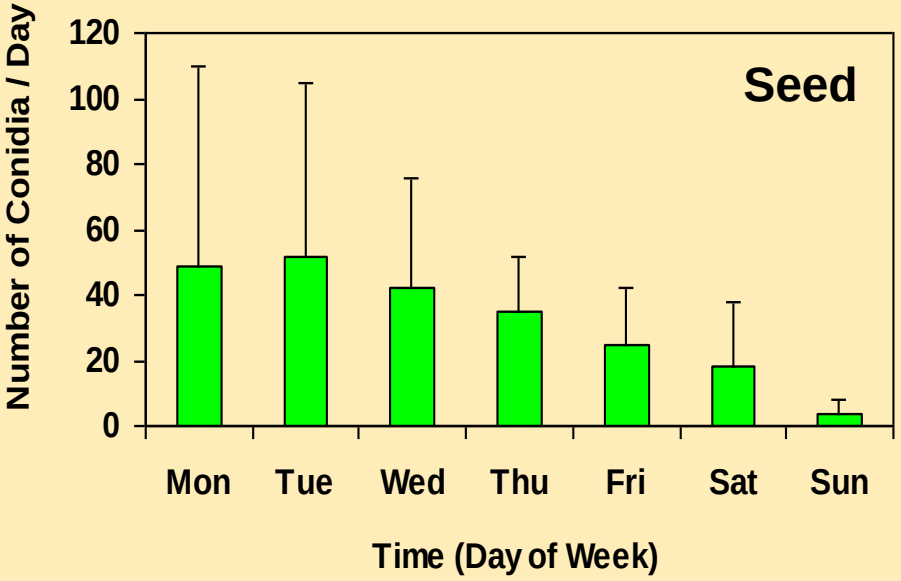


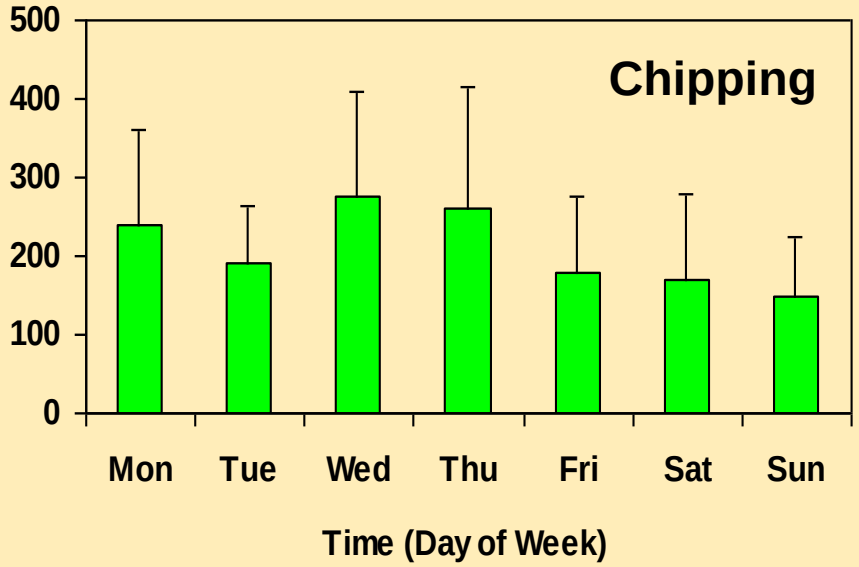
Rodriguez, et al., 1996

Number of Conidia of *Helminthosporium solani* Collected in Storage

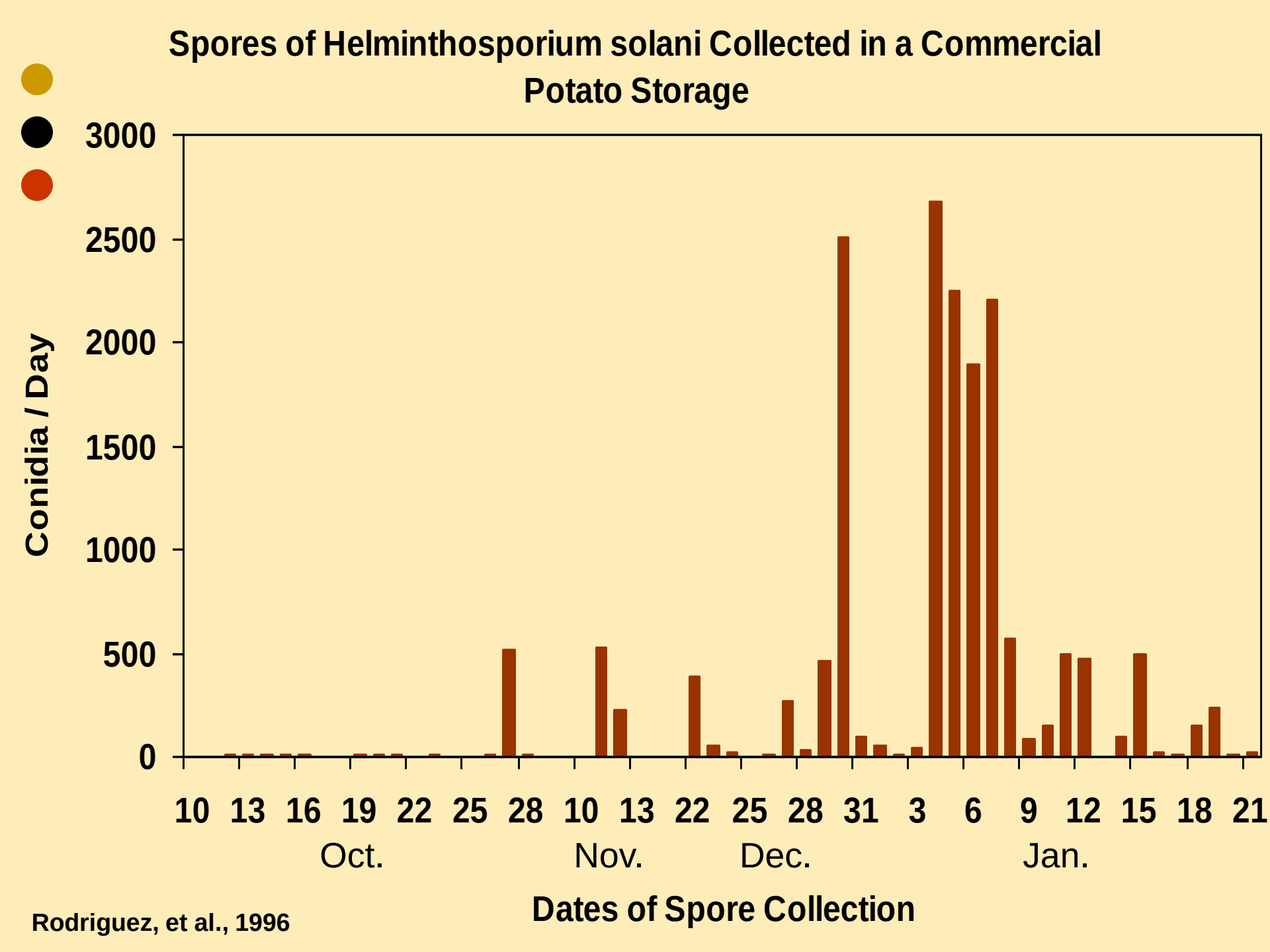








Rodriguez, et al., 1996


Spores of Helminthosporium solani Collected in a Commercial Potato Storage
Conidia / Day
3000
2500
2000
1500
1000
500
0
10 13 16 19 22 25 28 10 13 22 25 28 31 3 6 9 12 15 18 21
Oct.
Nov.
Dec.
Jan.
Dates of Spore Collection
Rodriguez, et al., 1996

Silver scurf

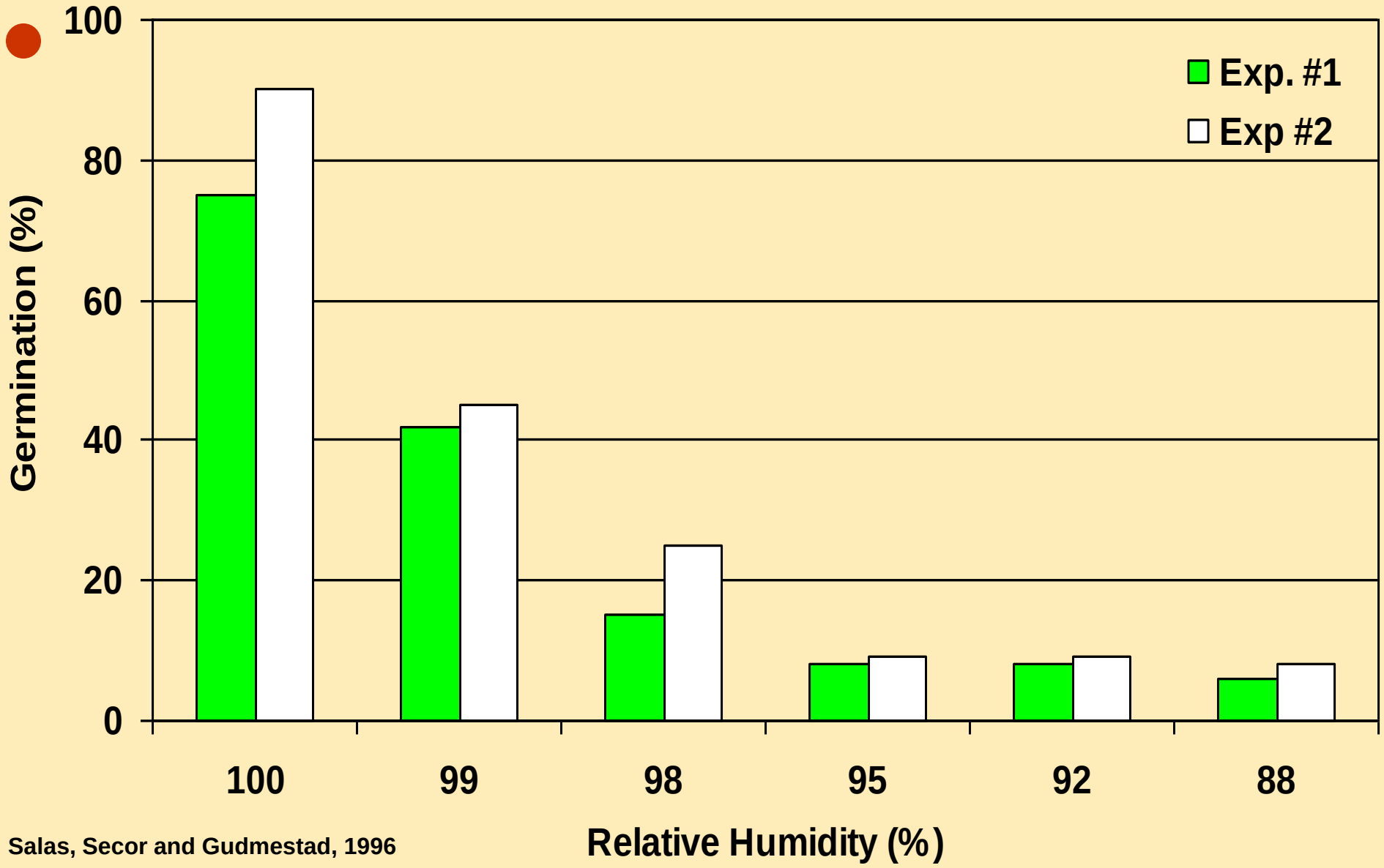
- A disease of potatoes that has no single control measure, but relies on the cumulative effect of many small methods to and control - and it’s still a problem!
  - A combination of field and storage strategies

The short version of strategies is:

- Rotation:
  - At least one year, *H. solani* is not soil borne , but is seed borne
- Sanitation
  - *H. solani* spores may survive in storage but can be eliminated by cleaning and disinfecting
- Seed free of SS:
  - Almost impossible but effective if you can find it
- Maxim MZ seed treatment plus Quadris in furrow at planting
- Quick harvest no more than 10 days between vine kill and harvest
  - The longer in the ground the more SS

- Reduced RH the first 30 days in storage
  - 90%; the trade off is more pressure bruise

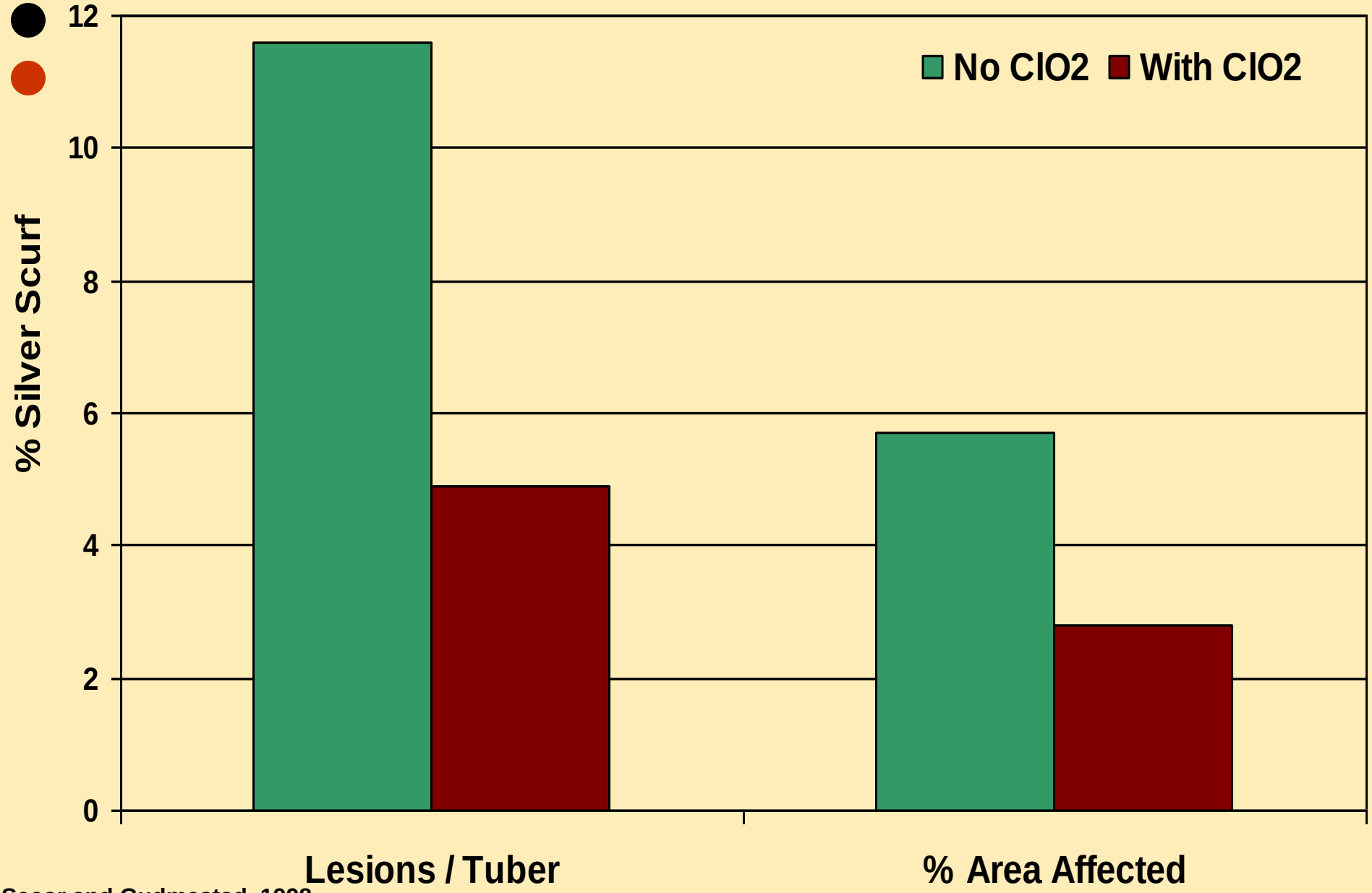
Effect of Relative Humidity on Germination of *H. solani*



Salas, Secor and Gudmestad, 1996

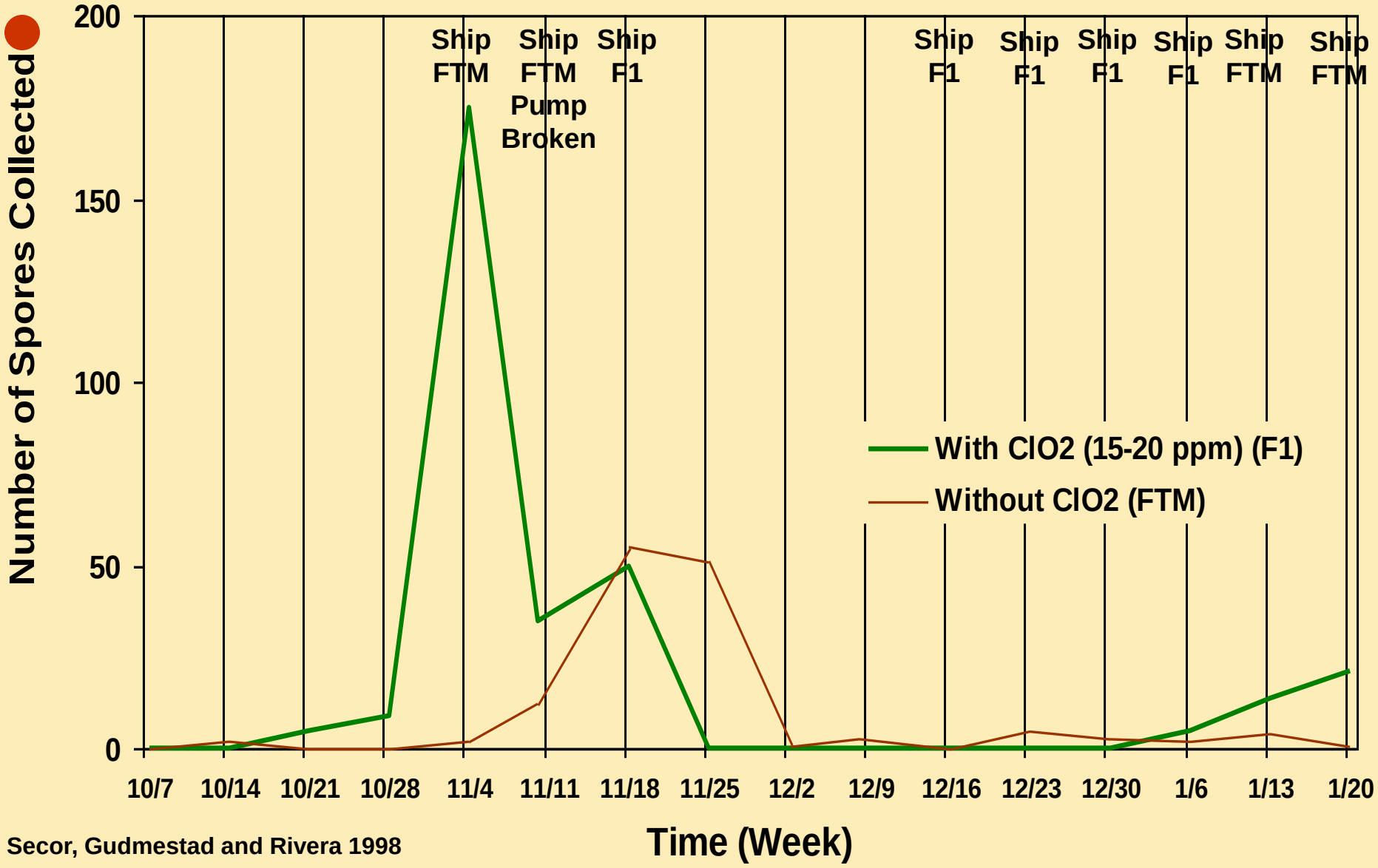
- Resistant varieties.
  - We don’t have any varieties with good resistance – but we do have species with resistance that the breeders are using
- Post harvest fungicides
  - Most *H. solani* is resistance to TBZ
  - Quadris and Maxim appear promising and registration is being pursued
  - Chlorine dioxide full time in storage at 25 ppm everytime the humidity runs
    - Kills spores that move and spread SS during storage

Silver scurf incidence and severity of tubers stored 16 weeks with and without chlorine dioxide and incubated six weeks



Secor and Gudmestad, 1998

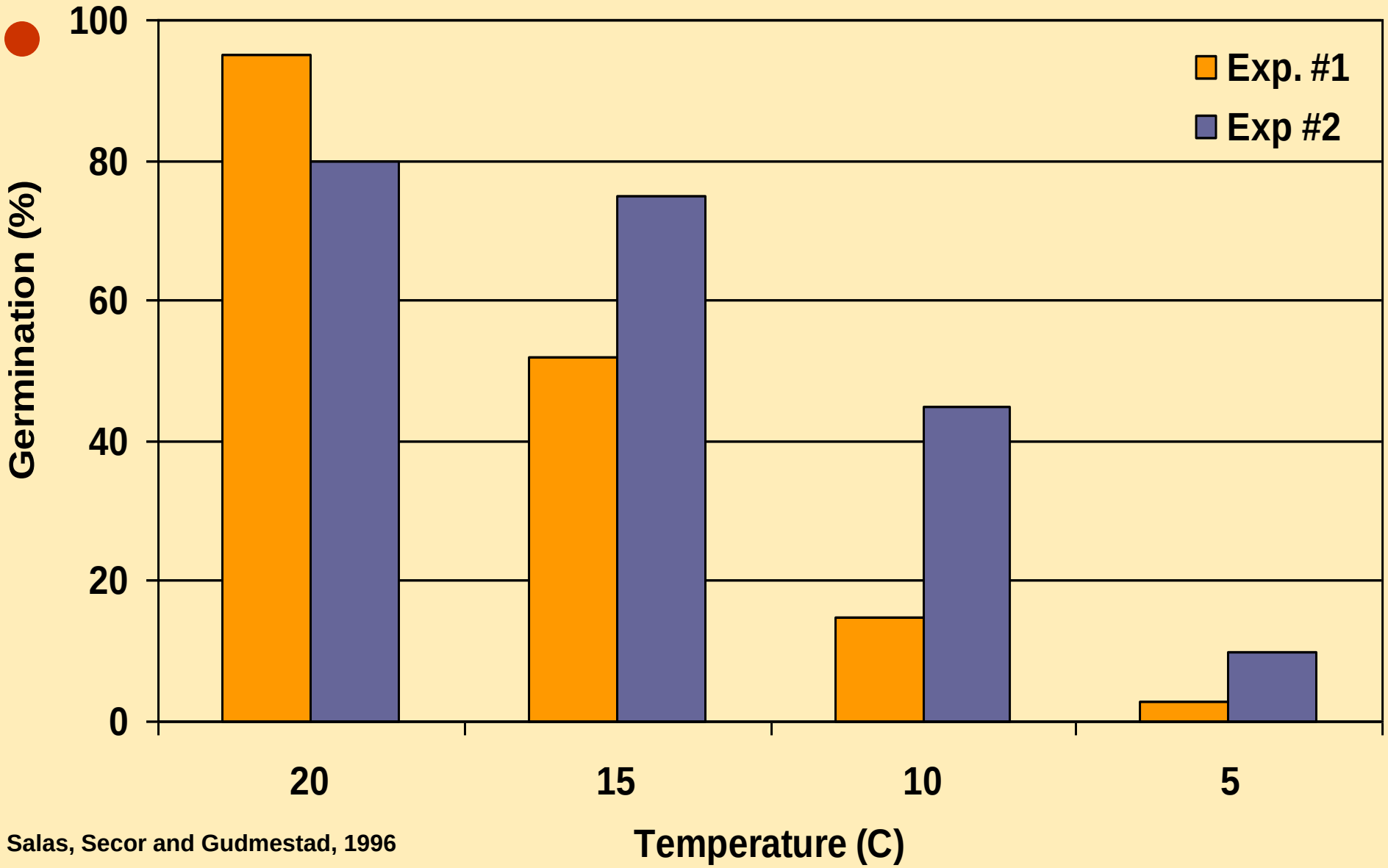
H. solani spores collected during a 16 week period from commercial potato storages with and without chlorine dioxide



Secor, Gudmestad and Rivera 1998

- Colder storage has less sporulation and SS spread

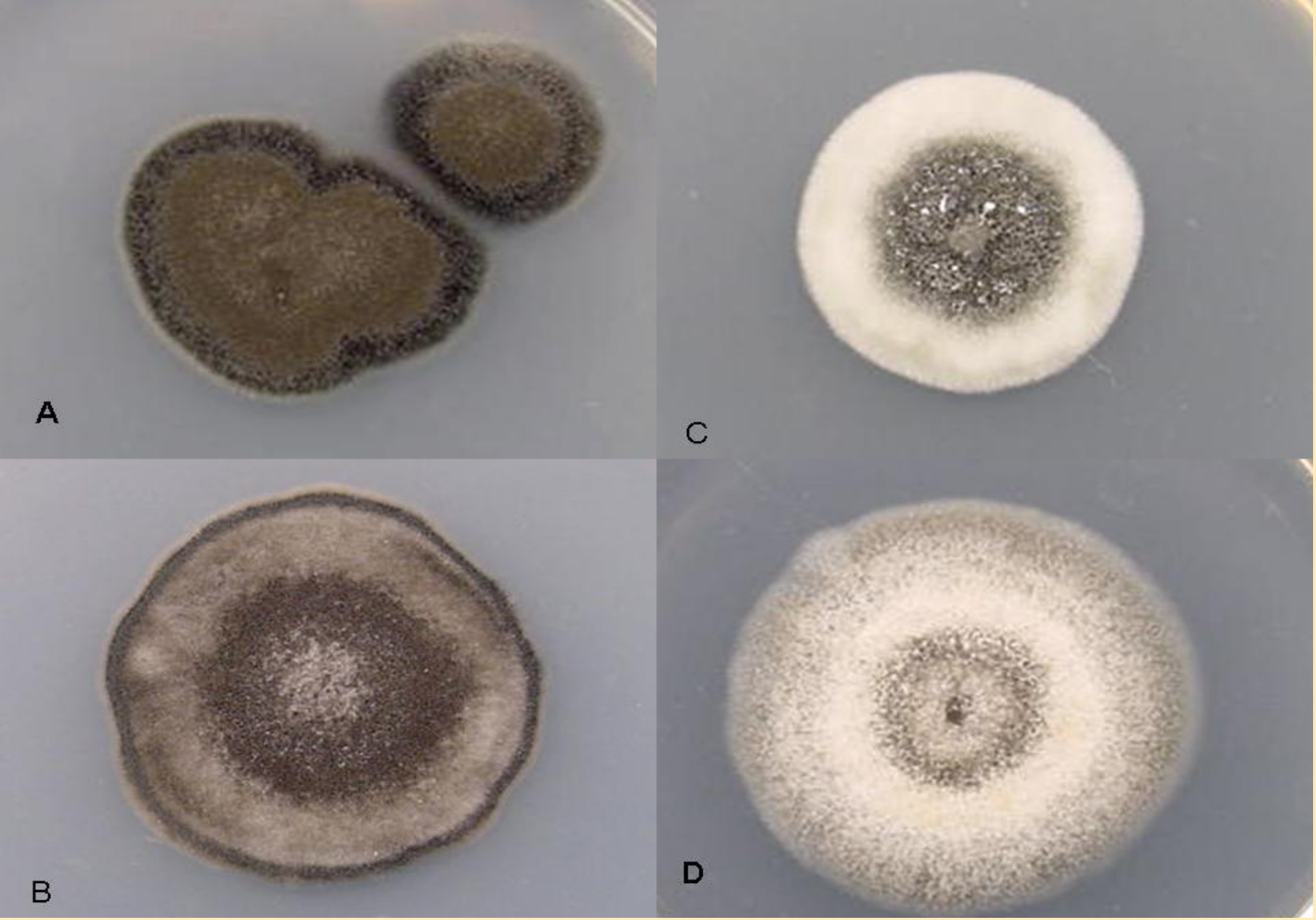
Effect of Temperature on Germination of *H. solani*



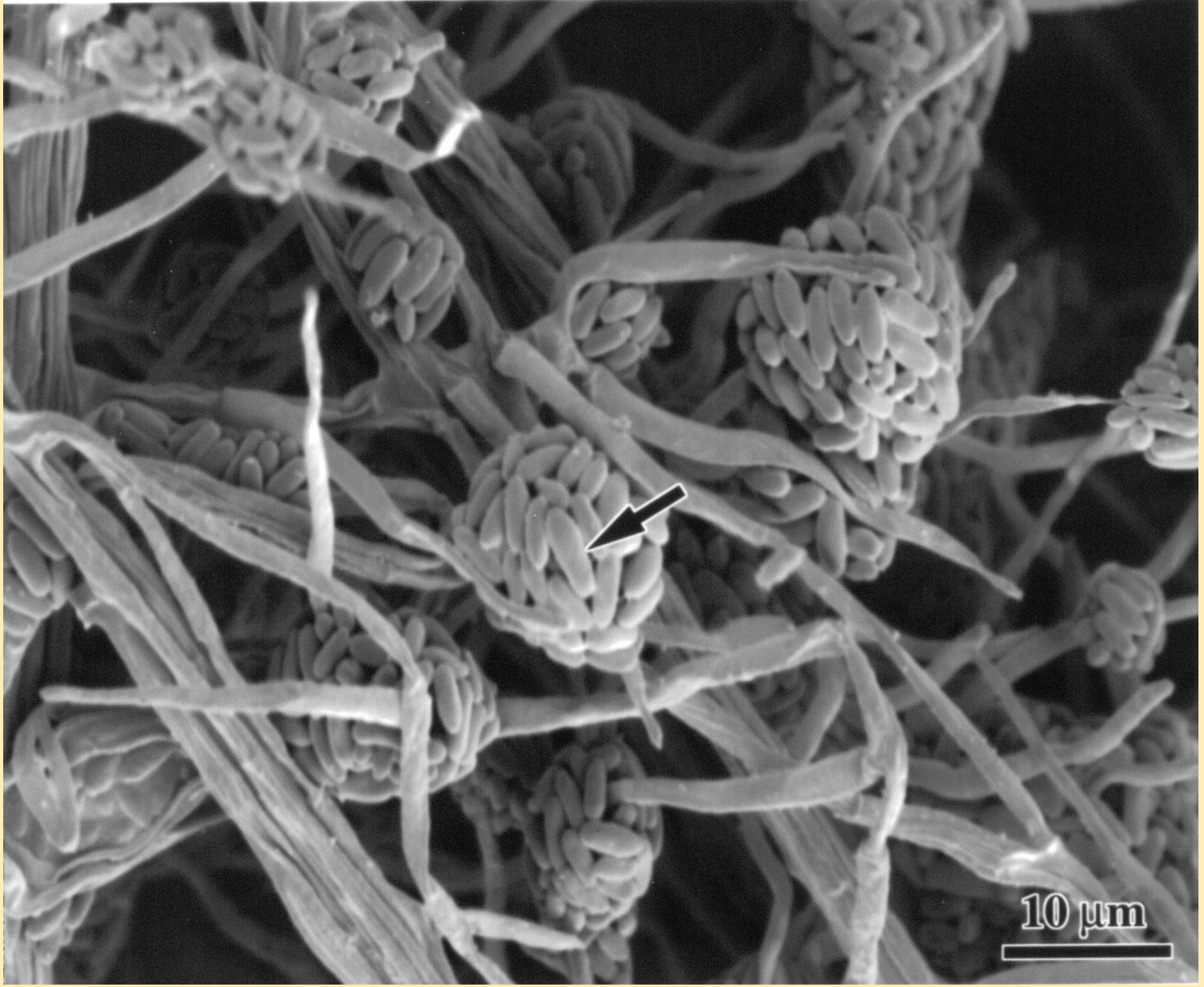
Salas, Secor and Gudmestad, 1996

Alternative Control

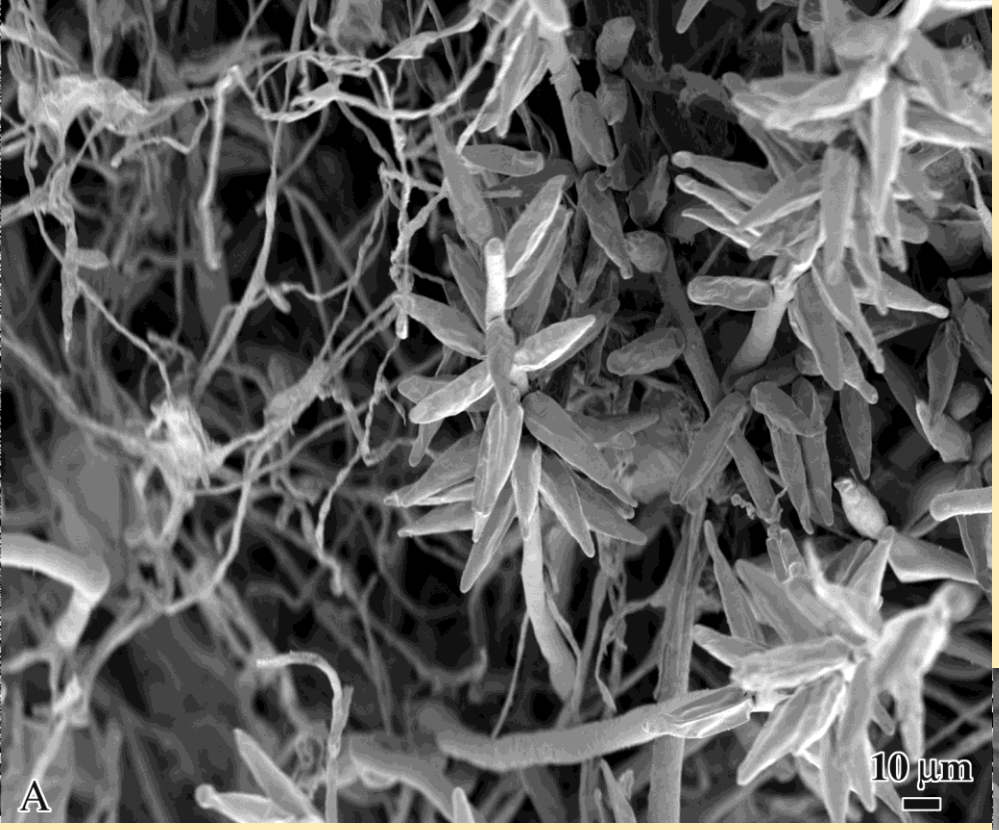
- *H. solani* in vitro doesn't perform properly all the time
- Cultures universally shows black and white growth
- Examination of cultures reveals consistent association with contaminating fungus – A*cremonium strictum*
- Research showed *A. strictum* to be a microparasite affecting *H. solani* growth

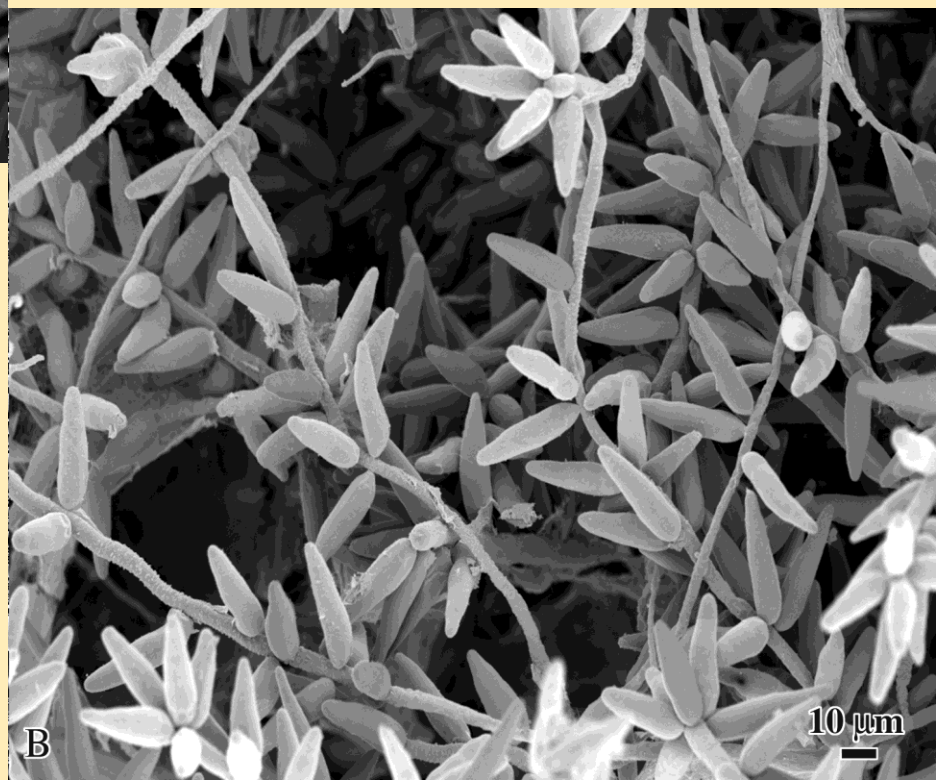


Photos of *Helminthosporium* cultures with and without *Acremonium strictum*. A. colony free of *A. strictum*. B,C D. Colonies with *A. strictum* showing sectors and white growth characteristic of contaminated *H. solani* cultures.



Scanning electron micrograph *of A. strictum*; arrow denotes conidia (magnification 500X).



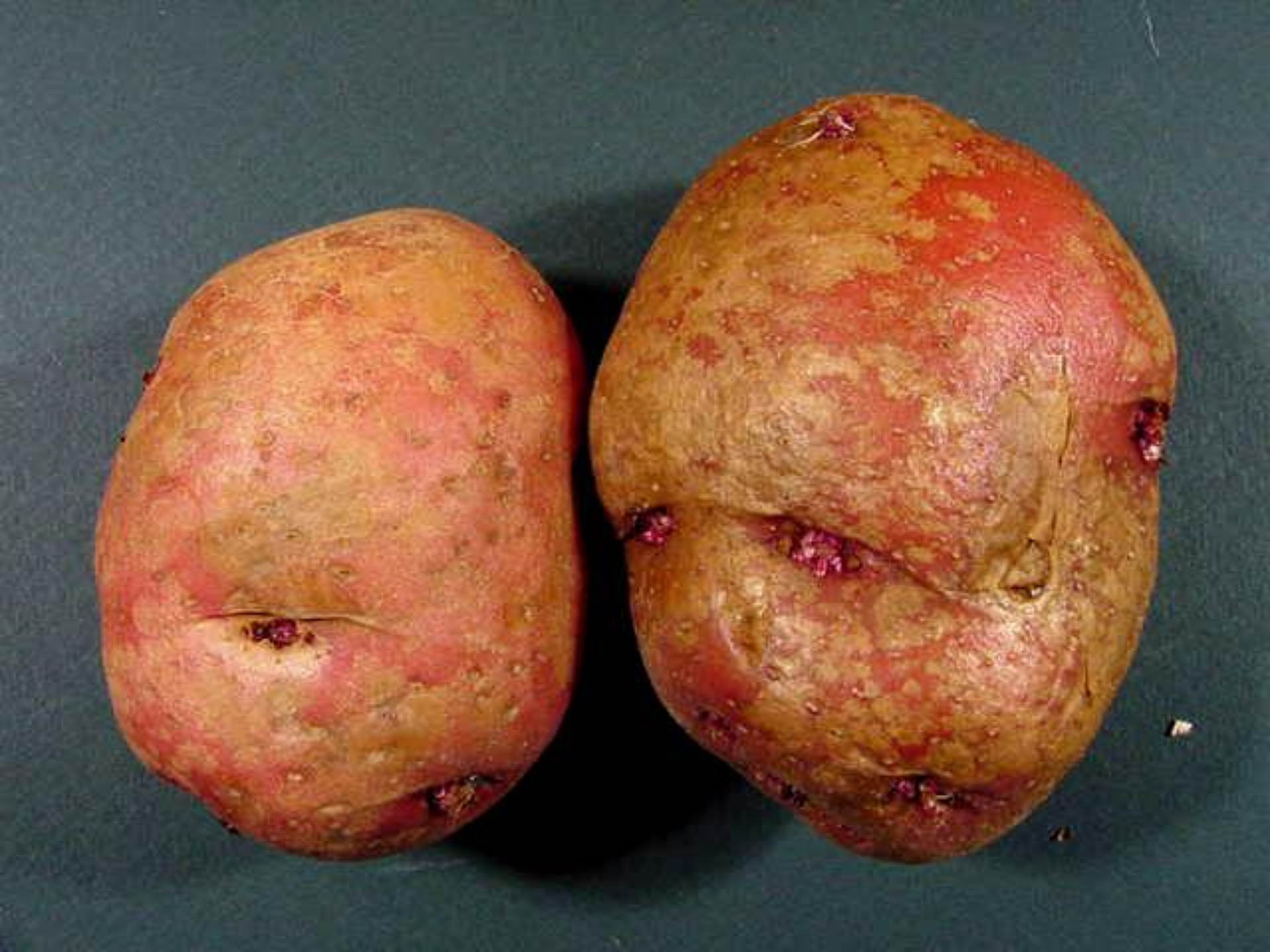


Scanning electron micrograph of *H. solani* colonies with (A) and without (B) *Acremonium strictum.*

Effects of *A. strictum* on *H. solani*

- Reduces
  - Spore production (sporulation) 35-65 %
  - Spore germination 43-53 %
  - Fungal growth 32-40 %
  - Reduces spore production on minitubers exposed to *H. solani* but not on previously infected tubers

- Over time, these strategies appear to be working; we find less silver scurf
- However blemish is still a huge problem – everywhere; what's happening??
- One of the problems are other causes of blemish
  - Black dot and physiological
- In recent years we have seen an increase in blemish caused by black dot (*Colletotrichum coccodes*



Reported to cause “bumpy tuber” in Pacific NW

- Many/most of the controls strategies for silver scurf do not work for black dot, so an accurate diagnosis of the cause of blemish is essential
- Foliar black dot can be managed by most fungicides
- We do not know the role of seed borne black dot or how to control it
- We do not have a control for blemish caused by black dot
- Black dot does not spread in storage
- Maybes
  - Seed treatment Maxim ST + Quadris (not Amistar) in furrow; probably/maybe
  - Quadris post harvest being tested; mixed results
  - Acremonium bio-control; experimental
  - PCR soil assay for disease potential (Gudmestad)
  - Vapam does not work

Surya's Survey

- Tuber blemish survey 2007
  - Conducted May 2007
  - Seed and tablestock reds from storage
  - 57 samples
  - 15 tubers per sample incubated and examined for *H. solani* and *C. coccodes*
  - Very little BD observed

Incidence of SS

Incidence (%) SS	# of samples
< 25	9
25-50	9
50-75	8
> 75	31

Severity of SS range 0 to 90%

Conclusion

- Even though silver scurf appears to be a simple disease, control still remains a challenge due to complexity of the disease