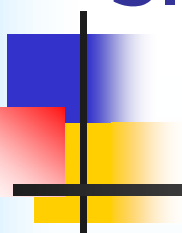


Choosing the right dose of *P. hermaphrodita* – does slug density matter ?



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The System



The grey field slug
Deroceras reticulatum



Phasmarhabditis
hermaphrodita
(Nemaslug)



Aims

- Combine two previously published descriptive models into a new predictive model
- Test the new model over a range of nematode/slug densities
- Make recommendations on more efficient use of *P. hermaphrodita*



Previous Descriptive Models

Glen, D.M., Wilson, M.J., Brain, P. & Stroud, G. (2000) Feeding activity and survival of slugs, *Deroceras reticulatum*, exposed to the rhabditid nematode, *Phasmarhabditis hermaphrodita*: a model of dose response. *Biological Control*, **17**, 73-81.

Hass, B., Glen, D.M., Brain, P. & Hughes, L.A. (1999) Targeting biocontrol with the slug-parasitic nematode *Phasmarhabditis hermaphrodita* in slug feeding areas: a model study. *Biocontrol Science and Technology*, **9**, 587-598.

Glen *et al.*, 2000

- 6 Nematode doses
- Two exposure periods (3 & 5 days)
- Monitored feeding in petri dishes over time





Glen *et al.*, 2000

$$E = \frac{L(t)}{1 + \left(\frac{\text{dose} \times (t - \text{lag})}{A} \right)^B}$$

$E(t)$ = Leaf area by treated slugs consumed at time t

$L(t)$ = Leaf area eaten by untreated slugs at time t

A , B and lag are constants for each exposure time

Dose = numbers of nematodes per box

T = time in days

Hass *et al.*, 2000



- Outdoor mini-plot experiment
- 1 nematode dose
- 4 application patterns
- Measured damage over time
- Only uniform application data used



Hass *et al.*, 1999

$$E_i(t) = \frac{L(t)}{1 + \left(\frac{(t - lag)}{\exp(t_{50,i})} \right)^B}$$

$E(t)$ = Leaf area by treated slugs consumed at time t

$L(t)$ = Leaf area eaten by untreated slugs at time t

R = % Reduction in feeding

B and lag are constants for each exposure

T = time in days



Combining the Models

- Express nematode dose as nematodes/slug
- Express damage as a percentage reduction of control
- Generalise description of time dependence
- Amalgamate time dependent and dose dependent models



Jo Smith's New Model

$$C = \left(\frac{R}{(100 - R)} \right)^{1/B} \times \left(\frac{Wt^Z}{p_s(t - lag)} \right)$$

C = Nematode numbers per slug

R = % Reduction in damage

W & Z = Fitted parameters (14576 & 2.1151 respectively)

B & P_s = Values used by Glen *et al.*, 2000

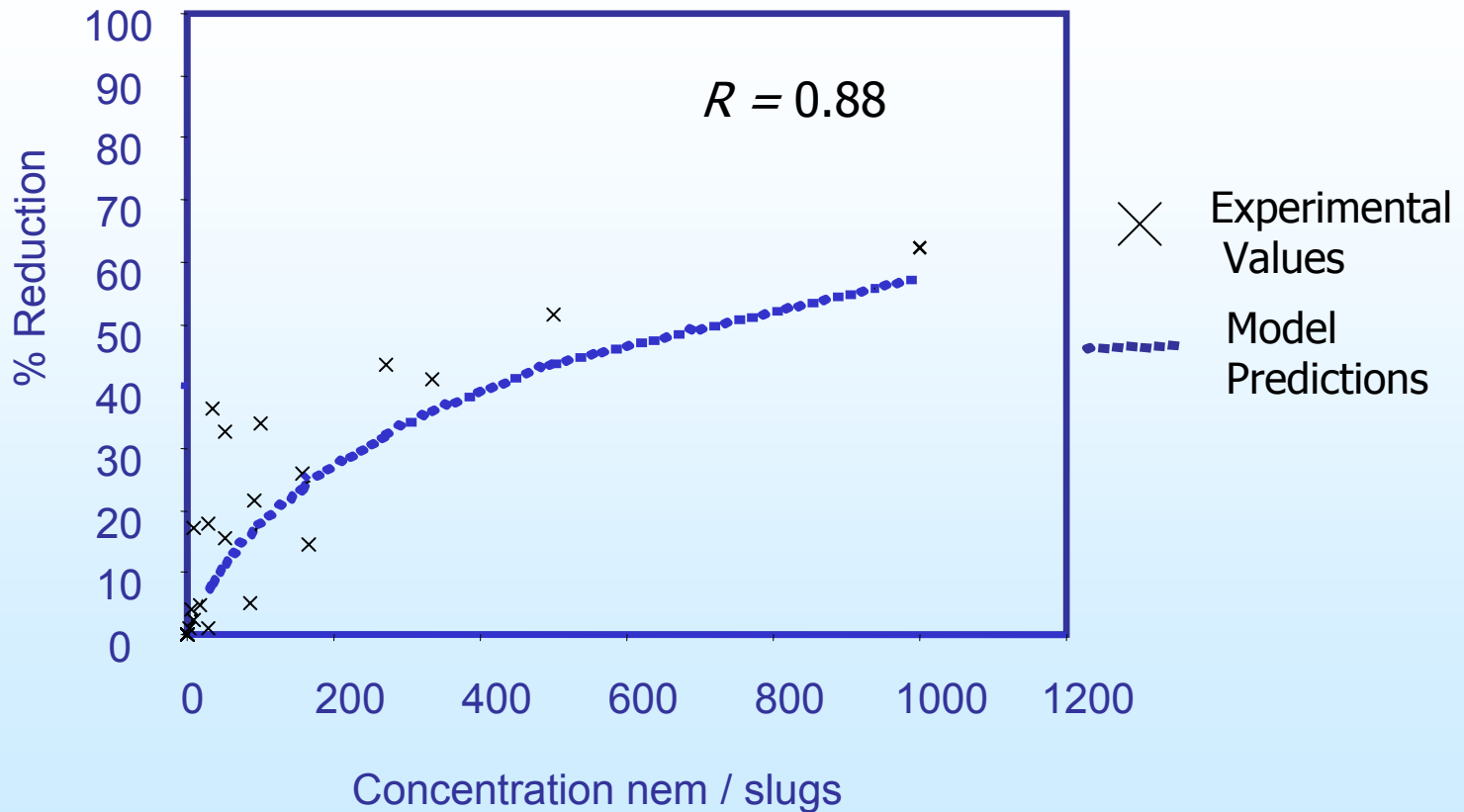
T = time in days

Testing the Model

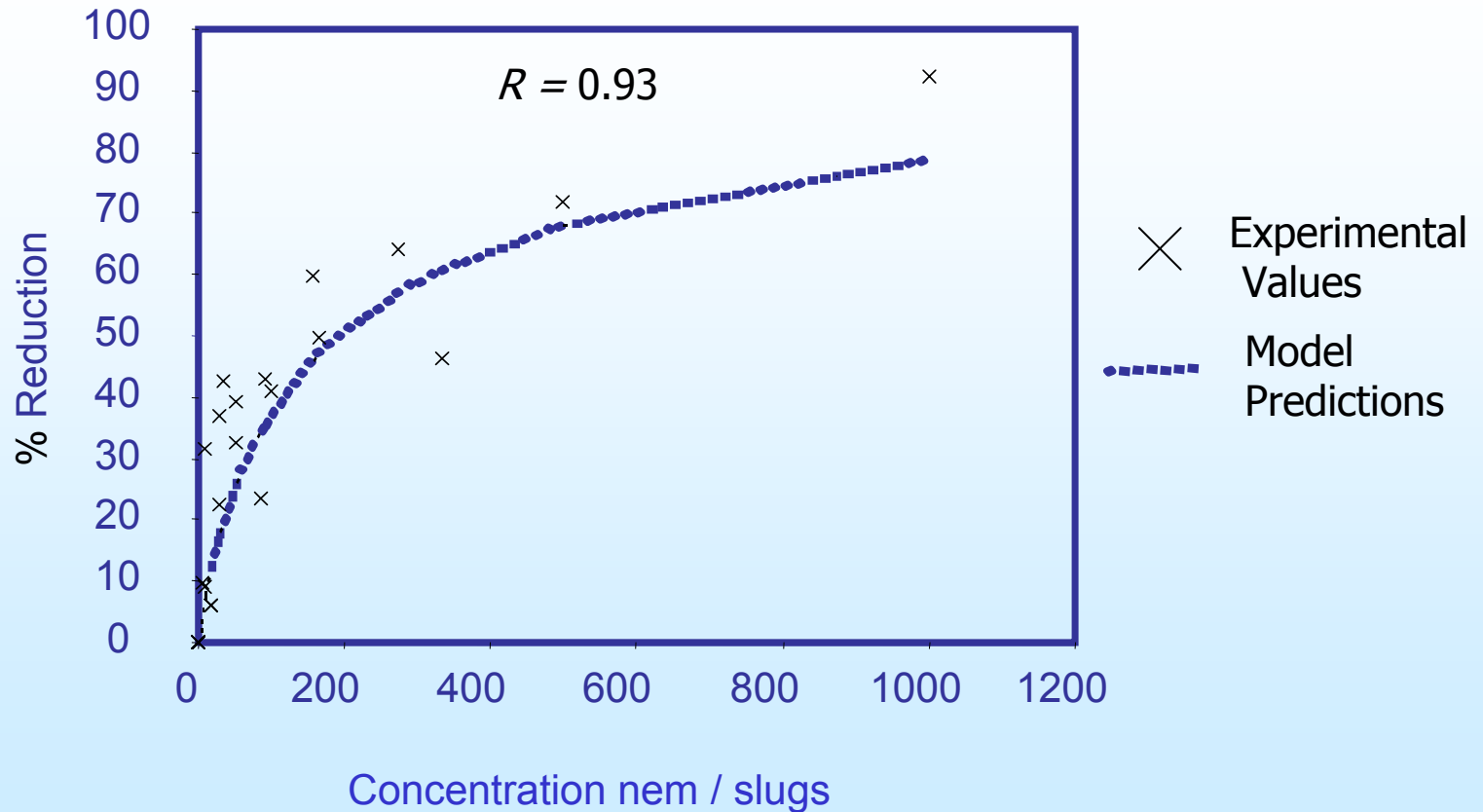


- Micro plots in unheated greenhouse
- 5 nematode doses
- 5 slug densities
- 3 feeding assessment dates
- 2 replicates x 3 experiments (6 reps in total)

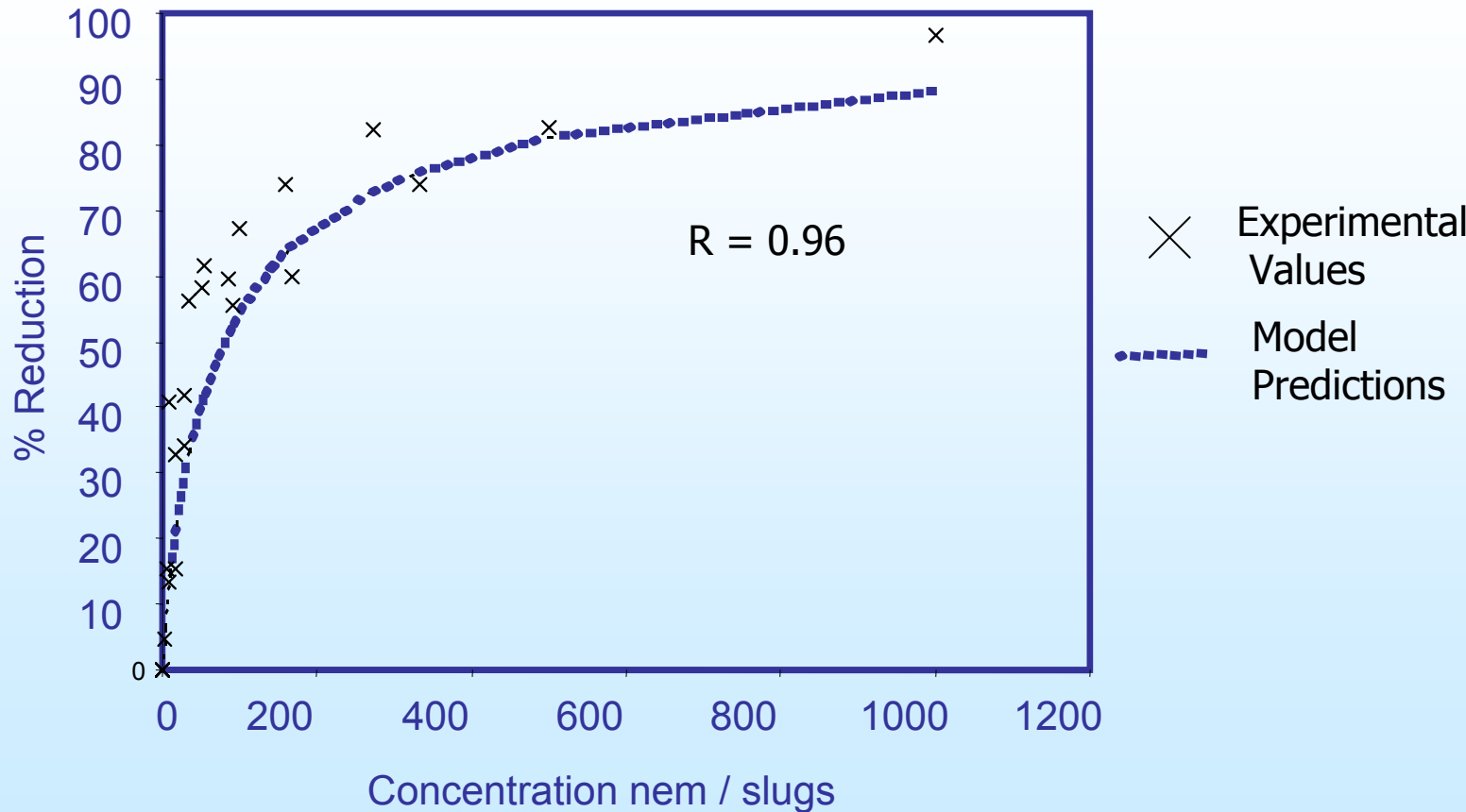
Day 6 Assessment

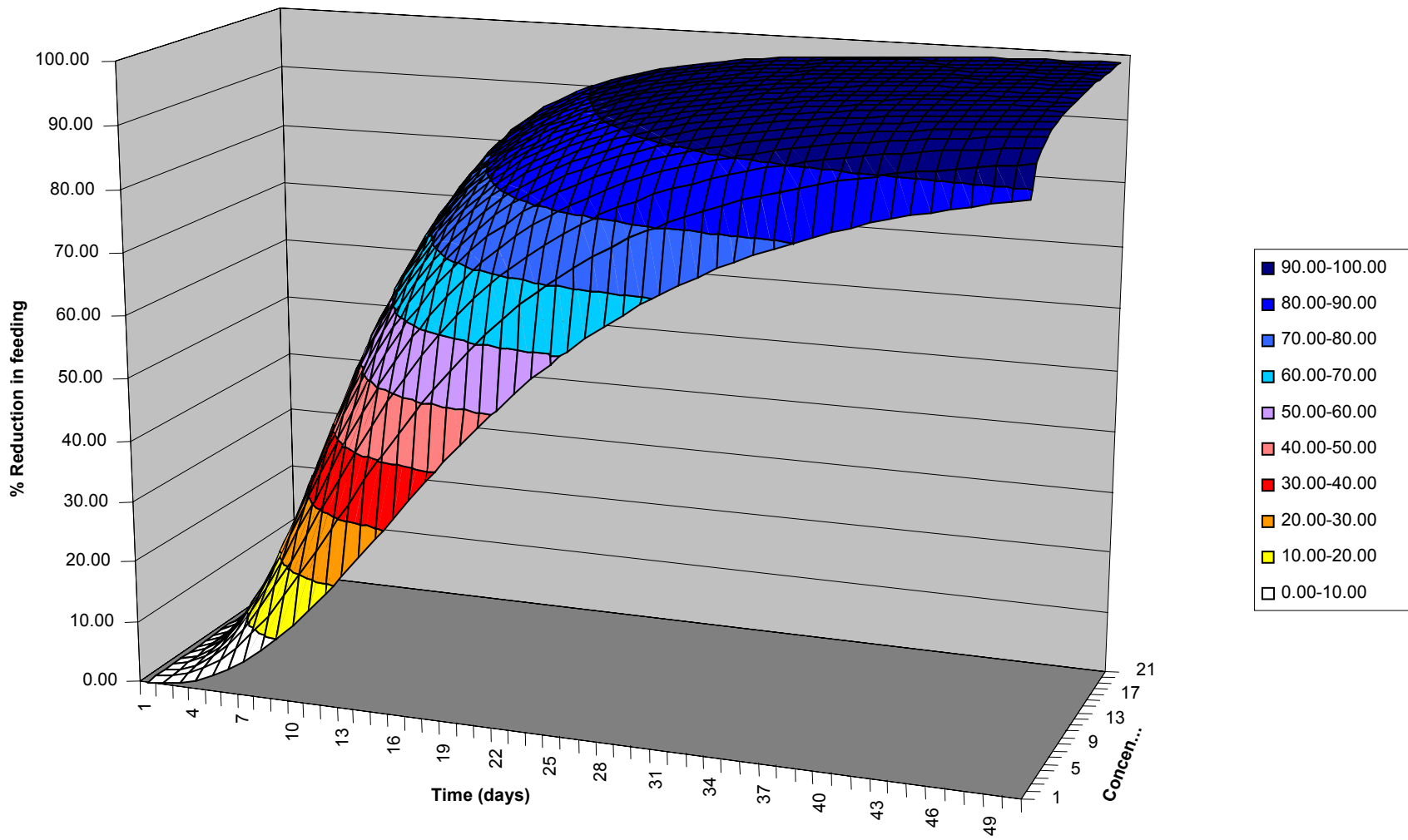


Day 9 Assessment



Day 12 Assessment



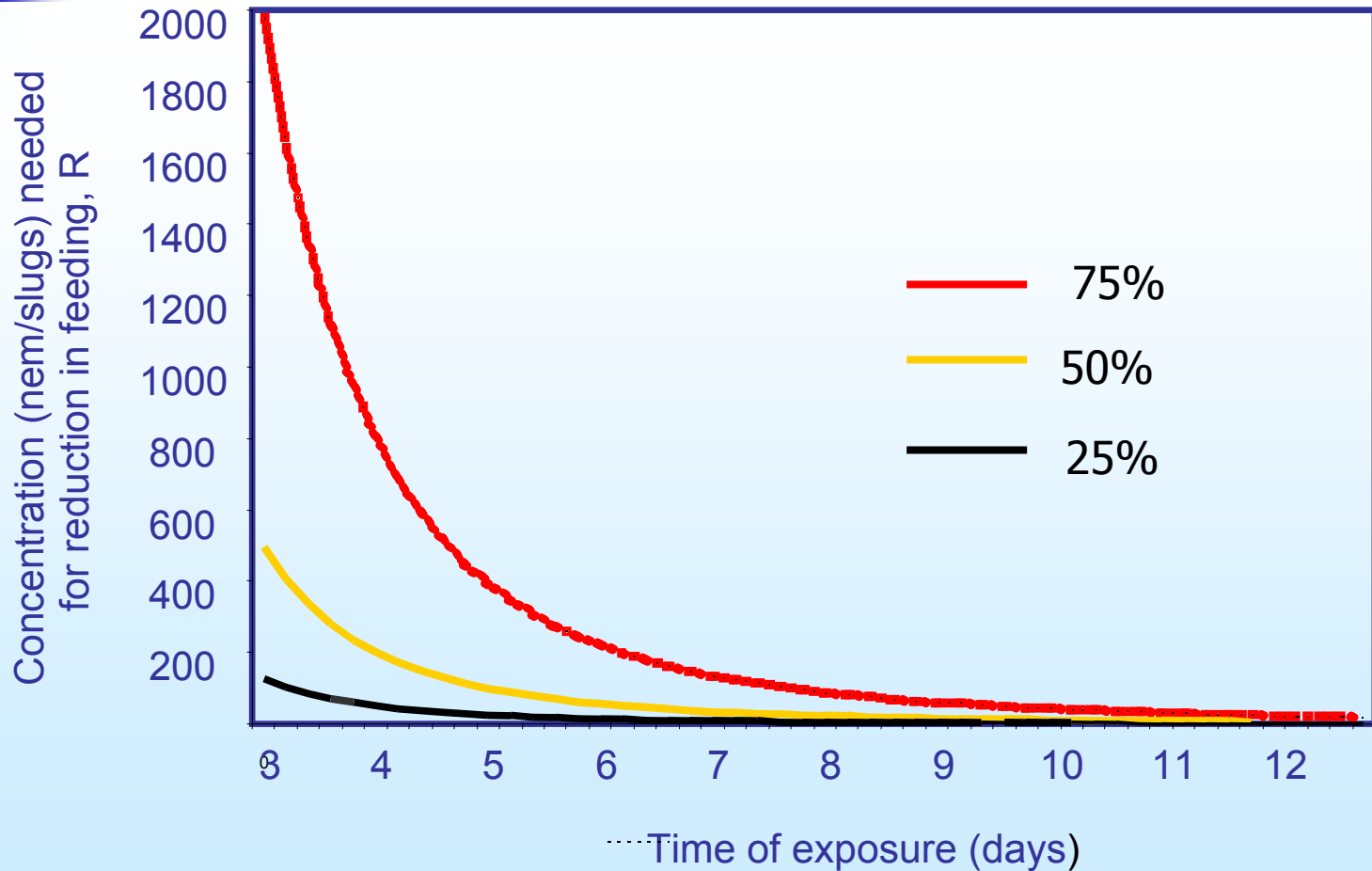




Using the Model

- For a given % reduction in crop damage the model tells us how many nematodes to put on, at any given time before the crop would be damaged
- The slug population needs to be estimated first

Using the Model





Conclusion

- Yes – slug density does matter
- This makes sense !



Future Needs

- Easier slug population estimates
- Economic damage thresholds for high value crops
- Tests with other slug species