The New Zealand Institute for Plant & Food Research Limited

Greenhouse experiments assess effects of soil nutrients on *Spongospora subterranea* infection of potato

Richard Falloon[1,2], Denis Curtin[1], Ruth Butler[1], Farhat Shah[1], Loreto Hernandez[1] & Ikram Khan[1]

[1]New Zealand Institute for Plant & Food Research, [2]Bio-protection Research Centre, Lincoln University

2nd International Powdery Scab Workshop
Pretoria, South Africa. 29 July-1 Aug 2014

Australian Potato Research Program stakeholders

APRP1

Field survey of powdery scab in crops (MASH trials)

Soil test results (ppm)

Soil element/factor	High levels of powdery scab	Low levels of powdery scab
Zinc	3.8	7.9
Nitrogen	57	85
Iron	56	215
Sulphur	3.0	5.6
Potassium	495	324
Calcium	2046	1457
Boron	0.67	0.47
pH	5.6	5.3

Greenhouse experiments

Uninoculated or

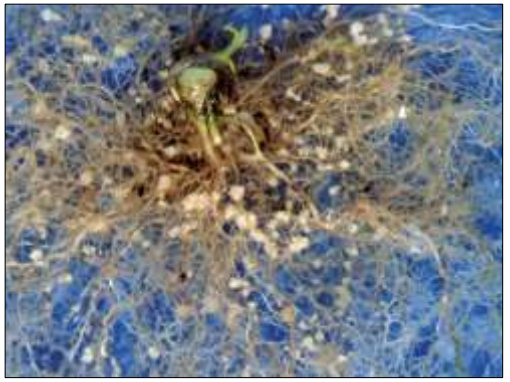
inoculated with *S. subterranea*

- **Water uptake**
- **Plant parameters**
- **Root infection (root galls)**

Susceptible cultivar ('Iwa')

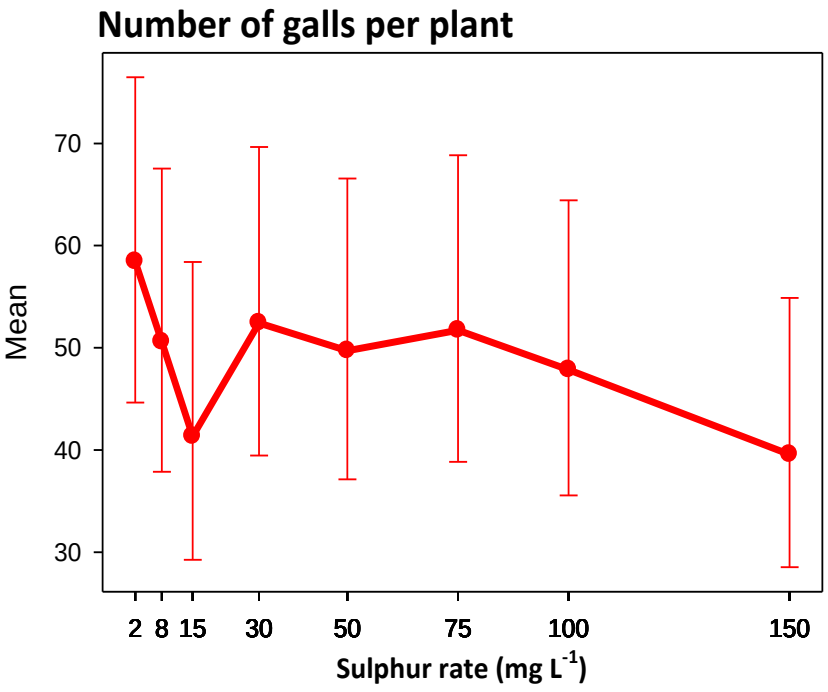
Numbers of root galls

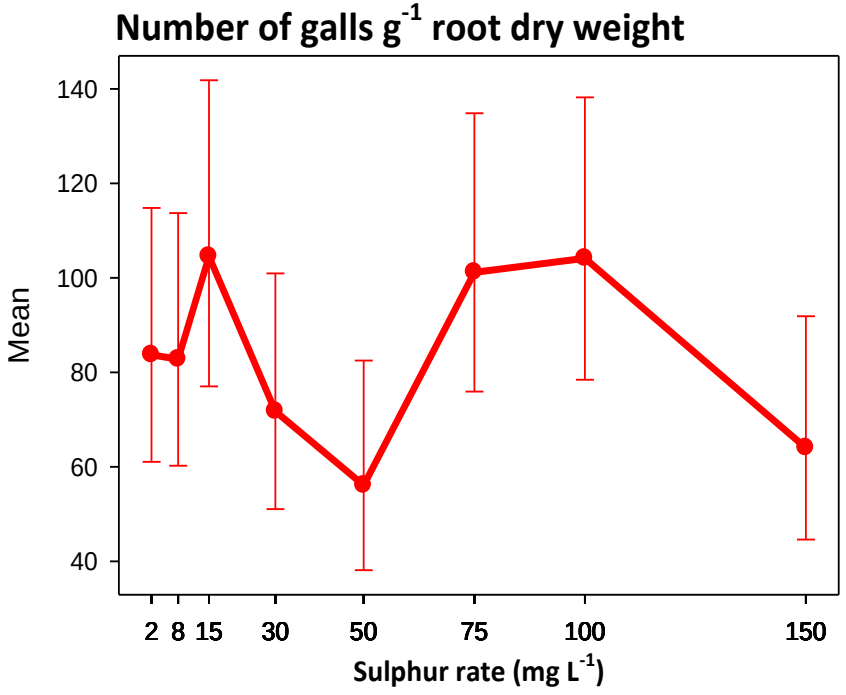
Previous results

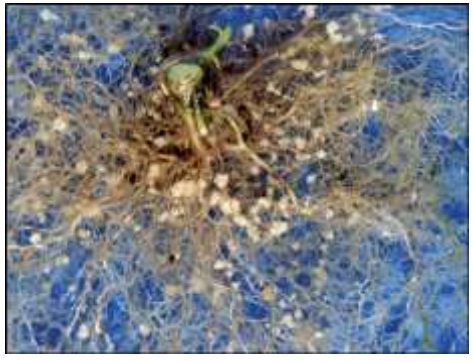


- Sulphur - reduces disease
- Boron - reduces disease
- Ammonium N - reduces disease
- Nitrate N - small reduction
- Manganese - small reduction
- Zinc - small reduction
- pH - no effect
- Iron - no effect

Sulphate sulphur

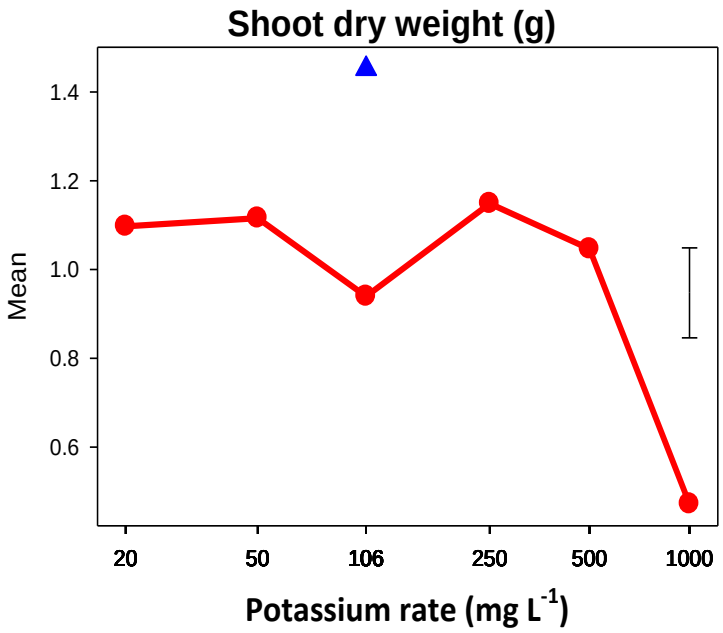


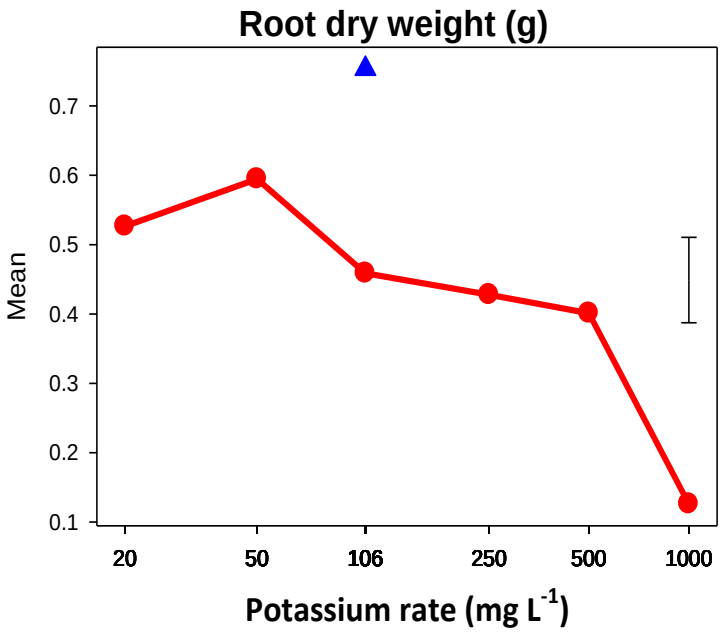


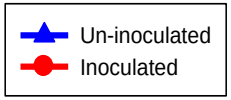


Potassium

Shoot and root weights

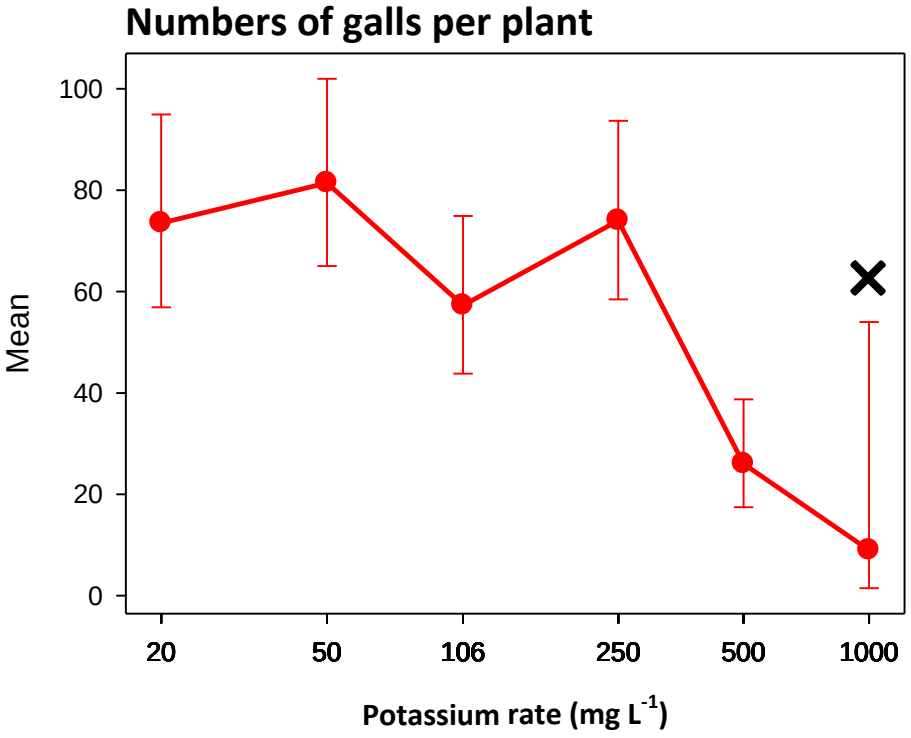


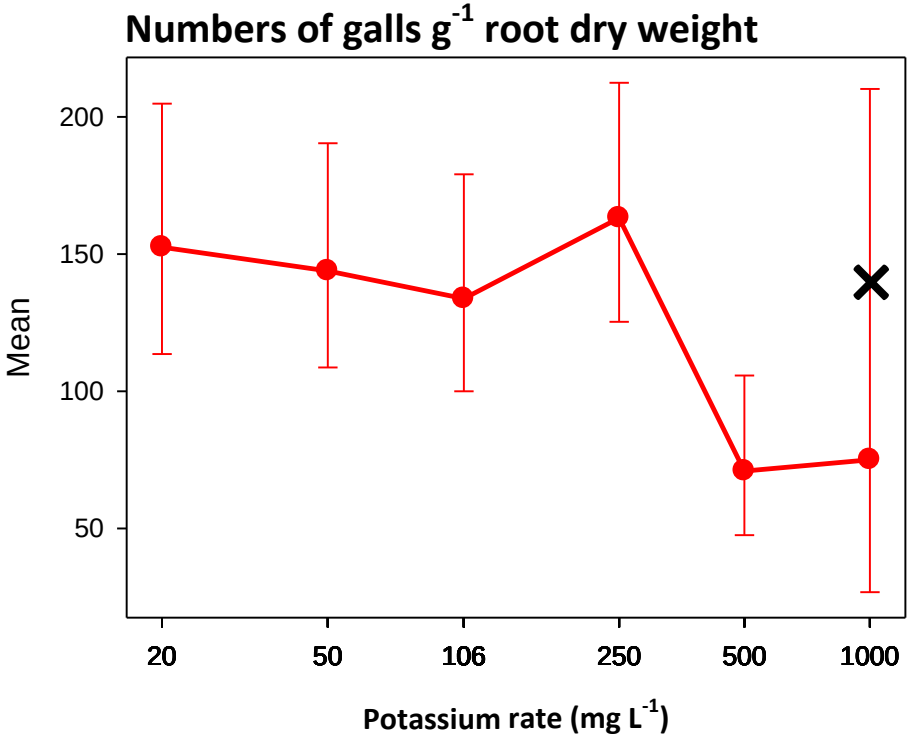


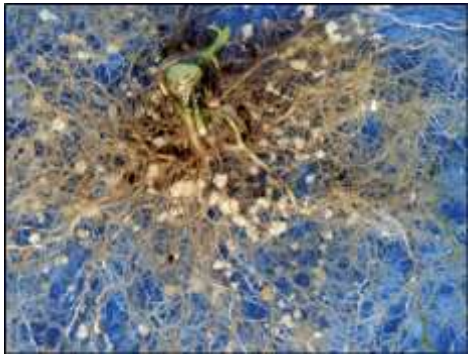


Potassium

Root galls

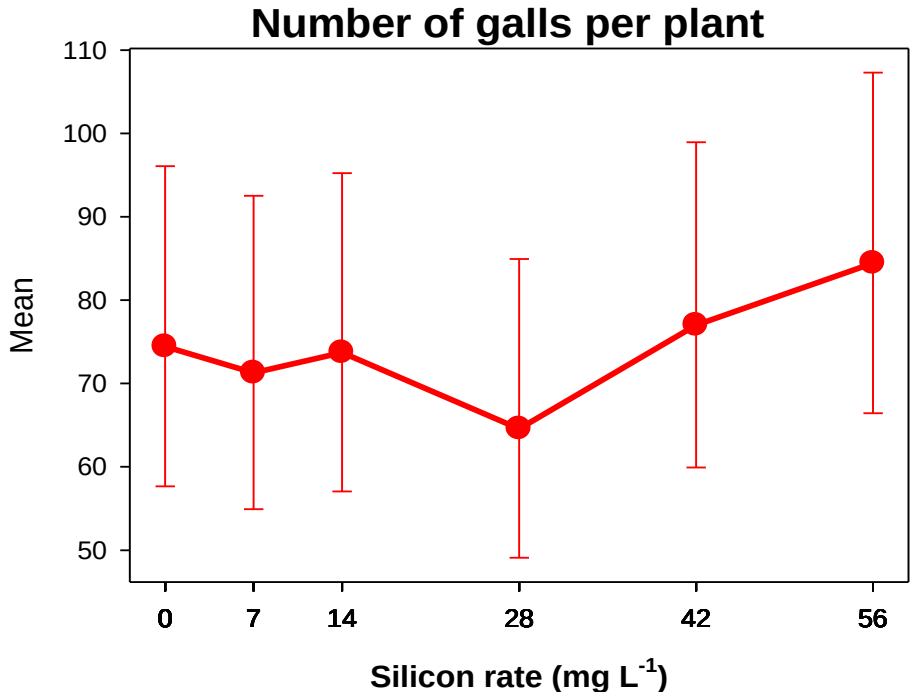


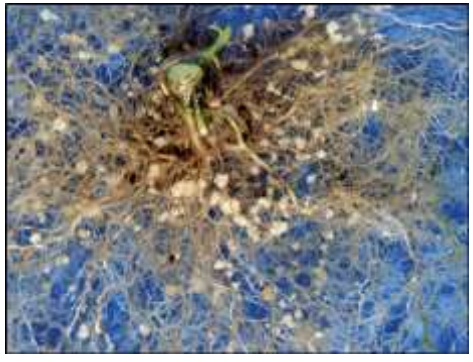




Silicon

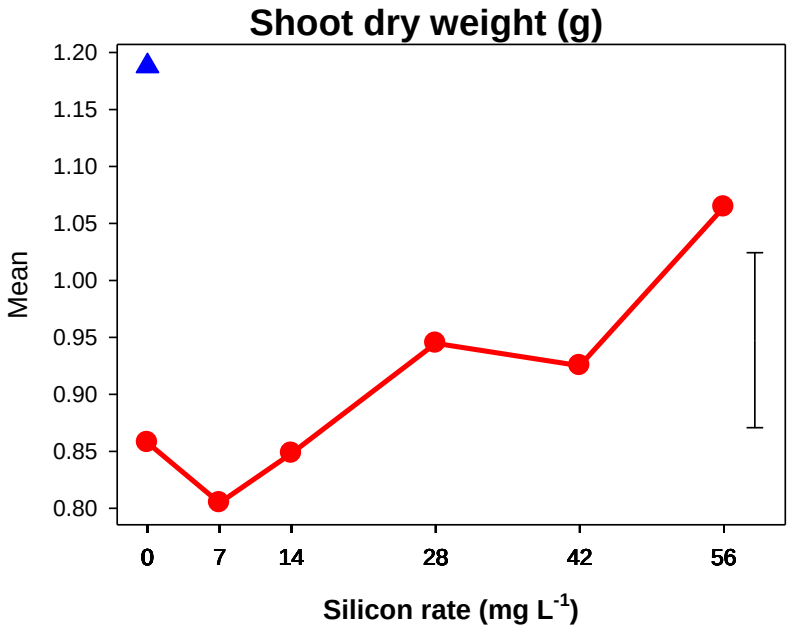
Root galls

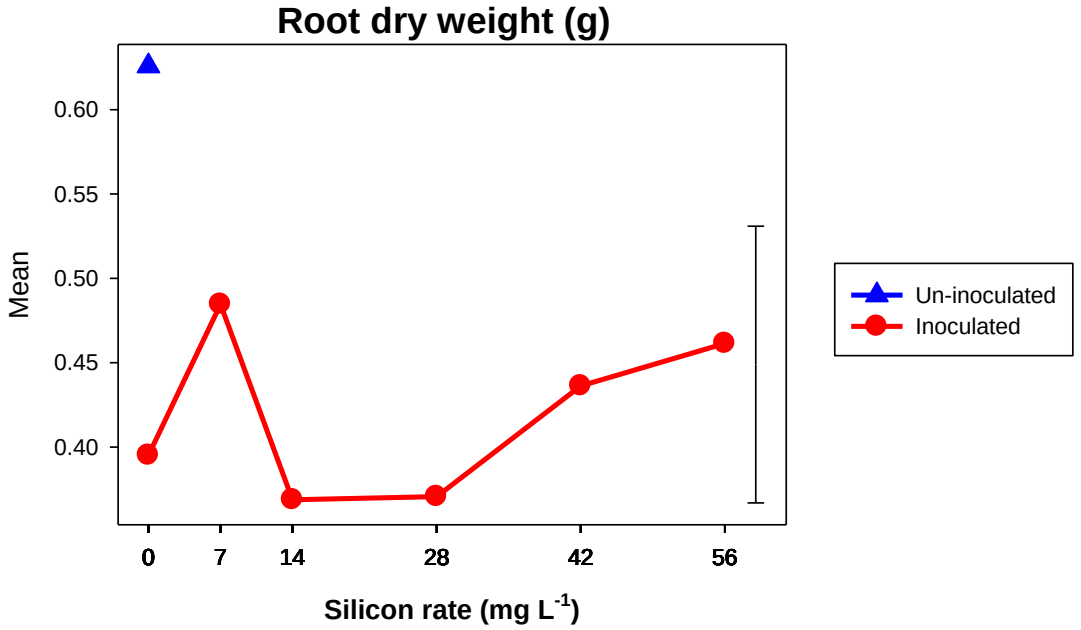




Silicon

Shoot and root weights





Silicon rates and irrigation regimes

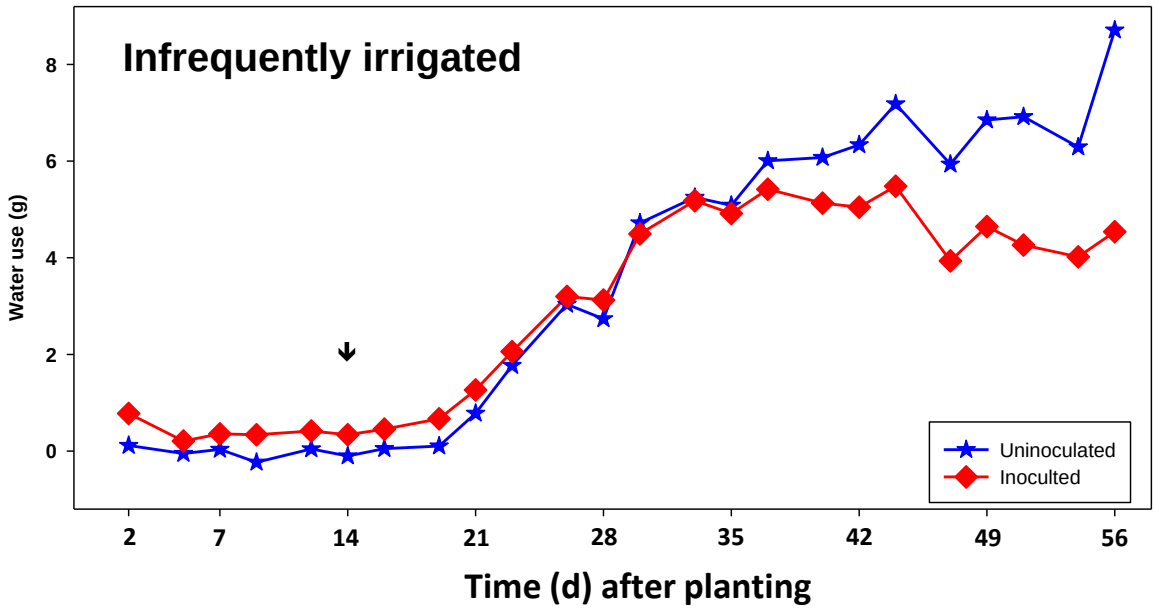
Silicon rates (sodium metasilicate)

- **0, 14, 28, 42, 56 or 84 mg L^{-1}, in nutrient solutions**

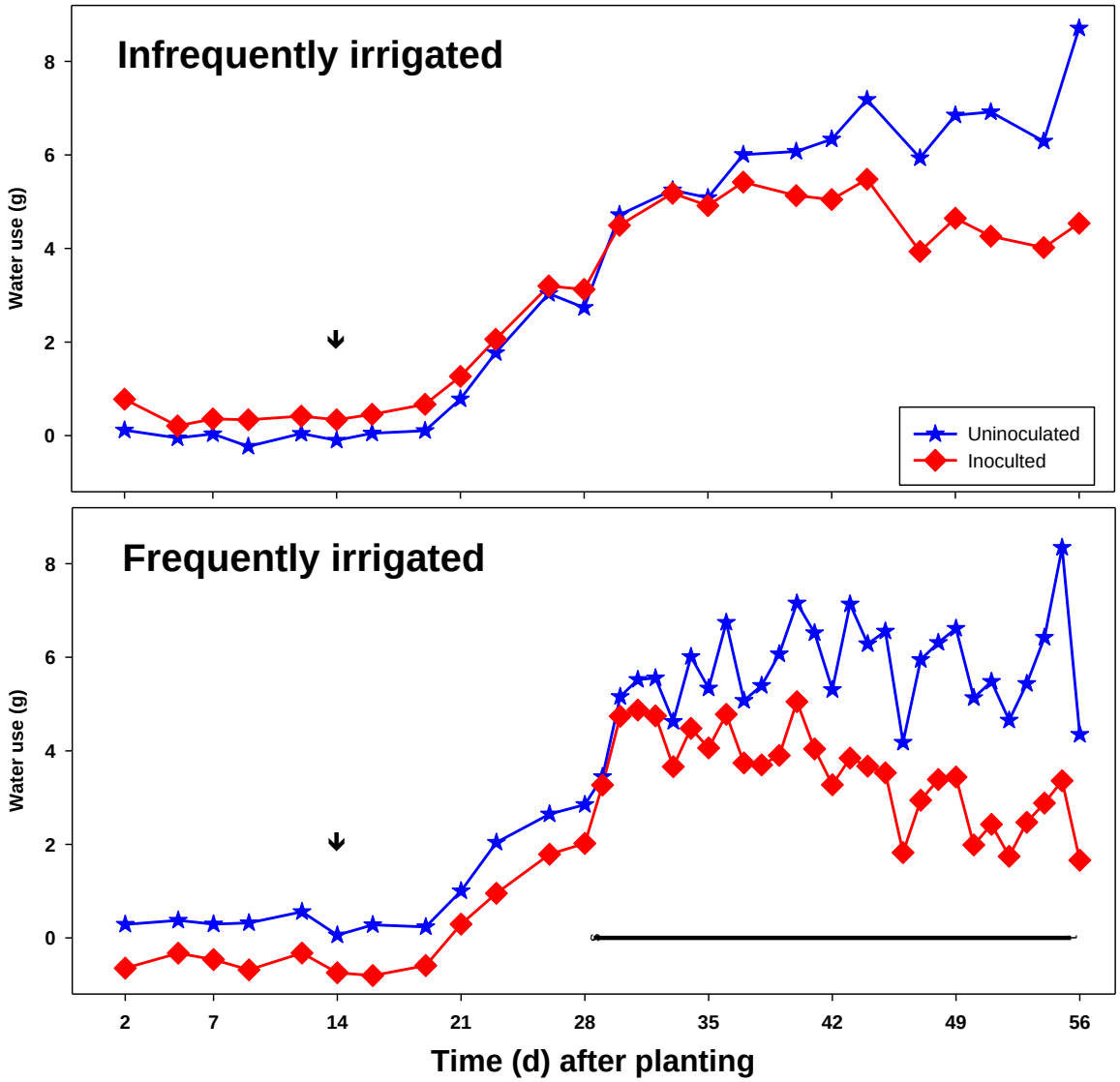
Irrigation

- **infrequent (2 - 3 day intervals)**
- **frequent (each day)**

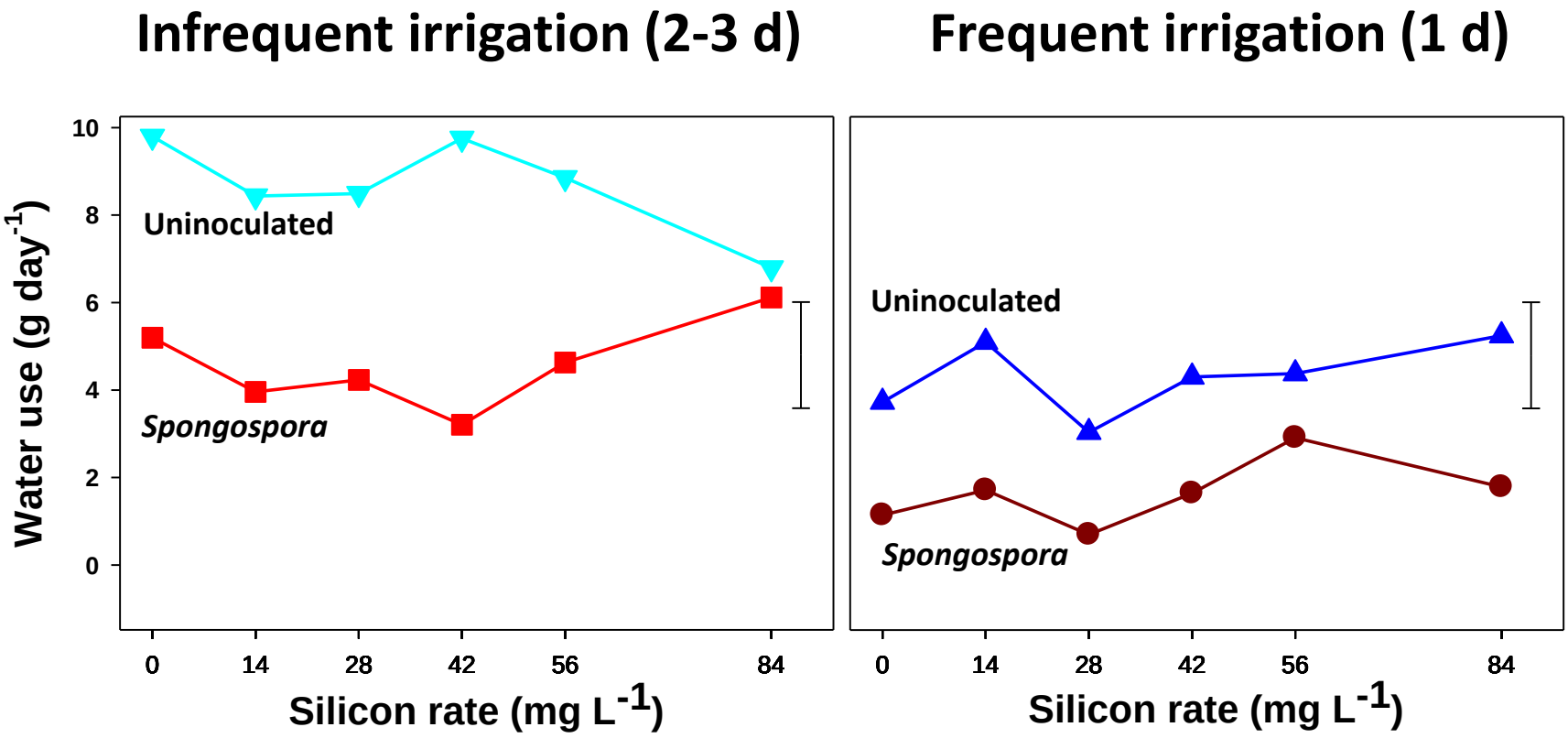
Daily water use



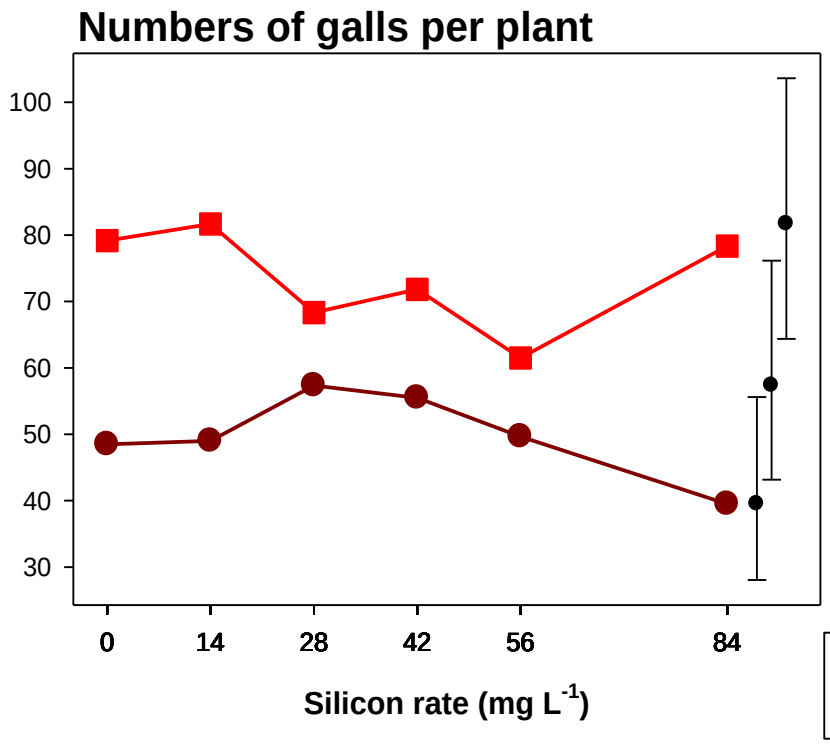
Daily water use

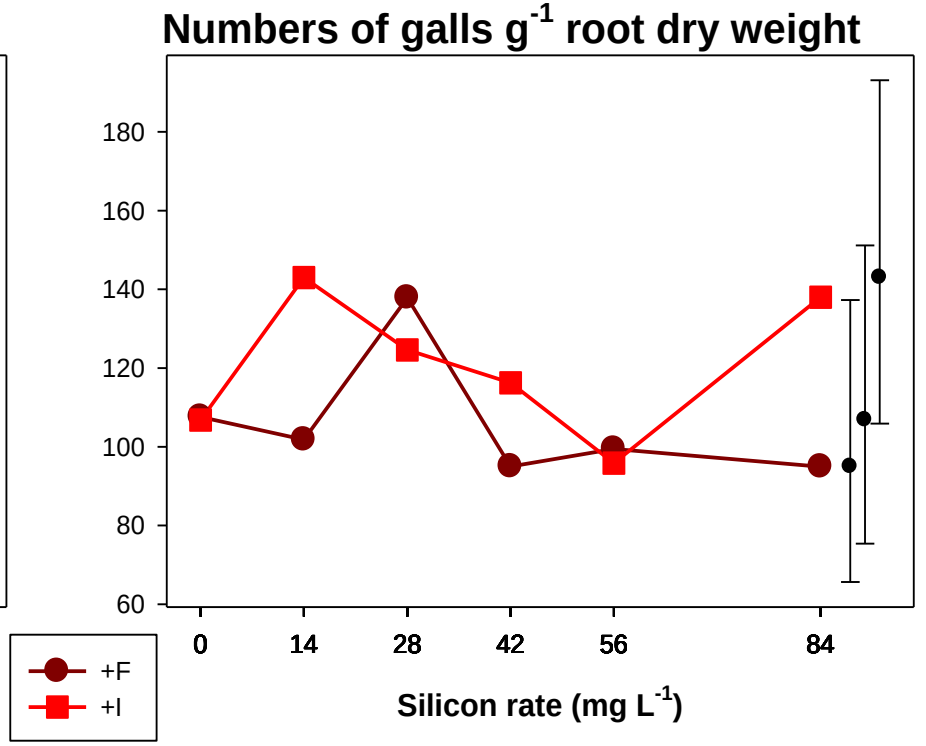


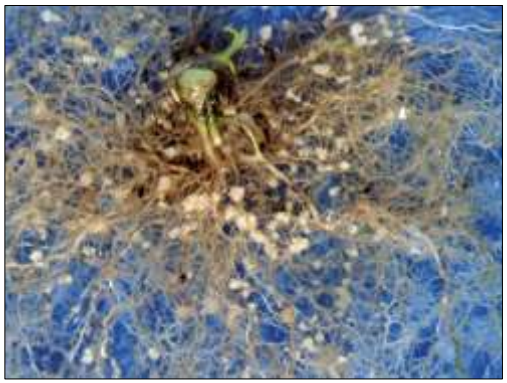
Daily water use (42 d after inoculation)

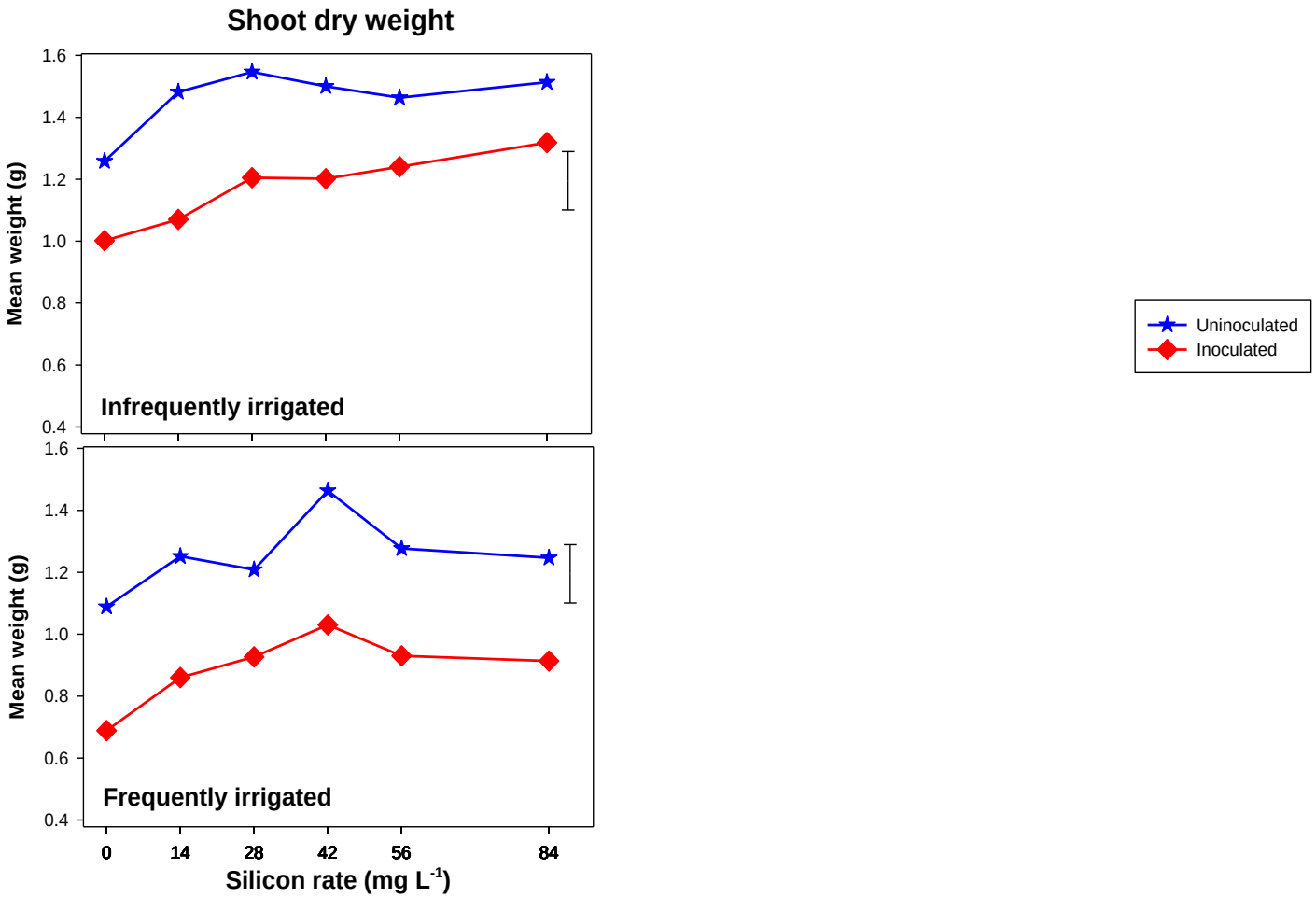


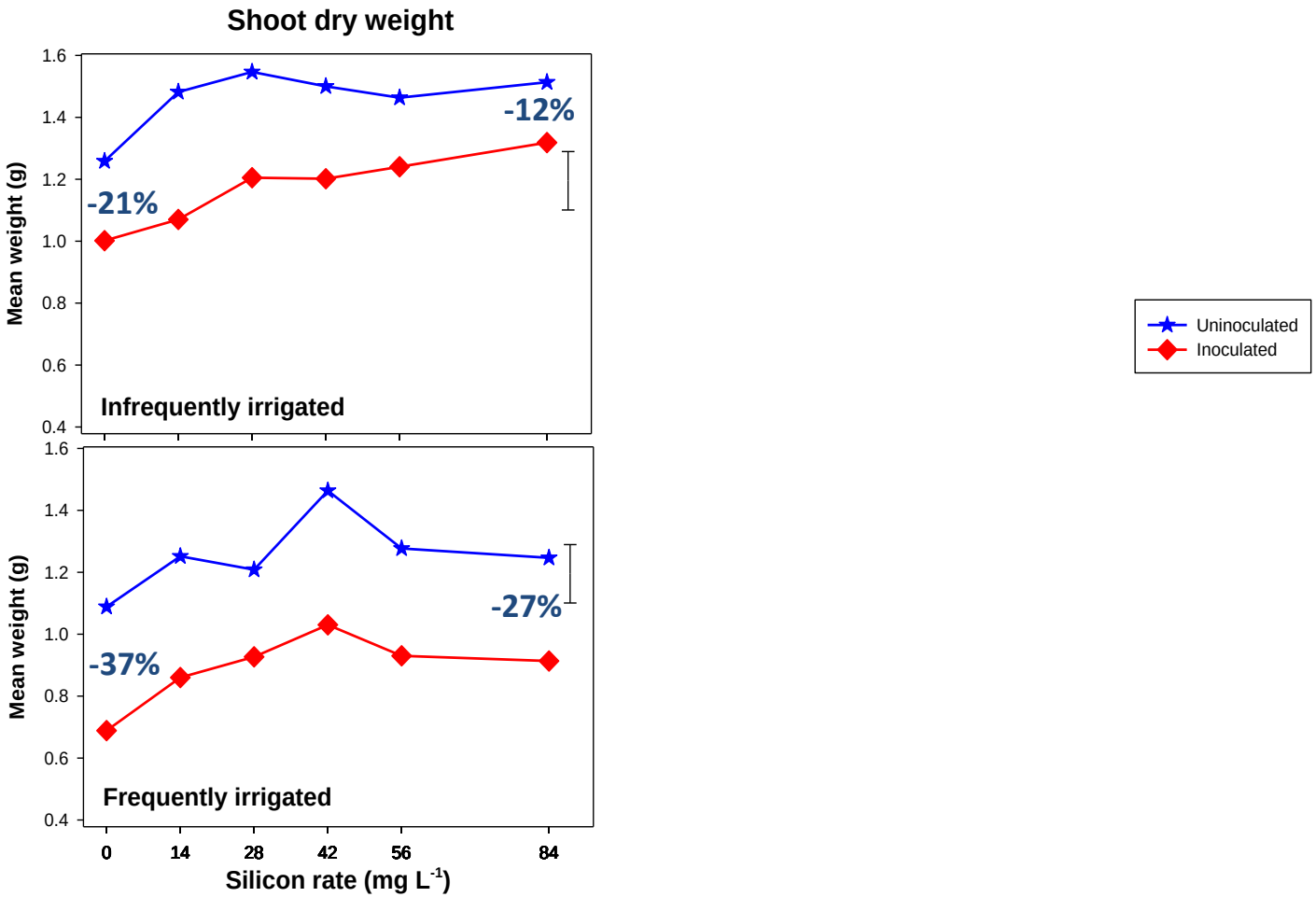
Intensity of root hyperplasia

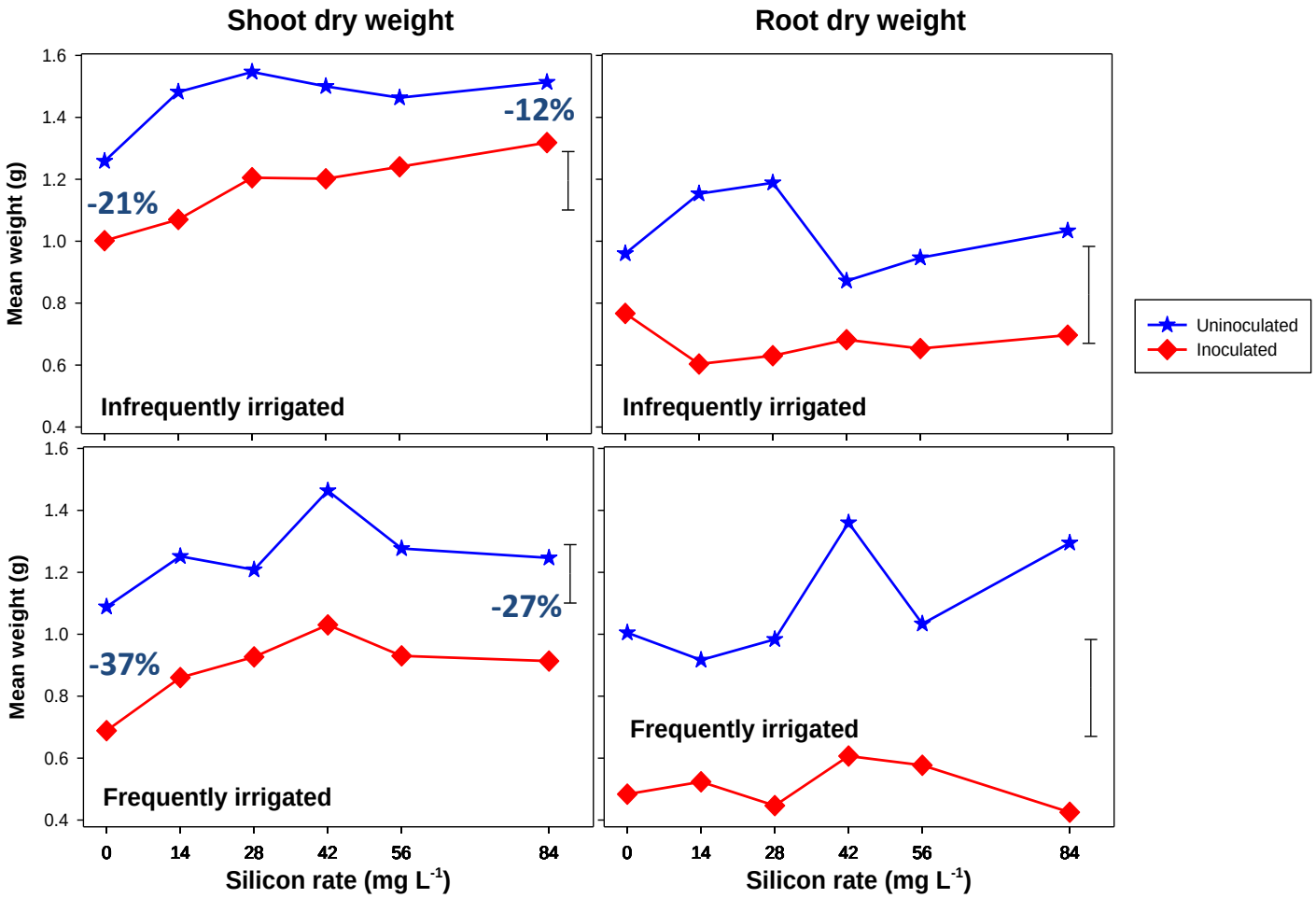




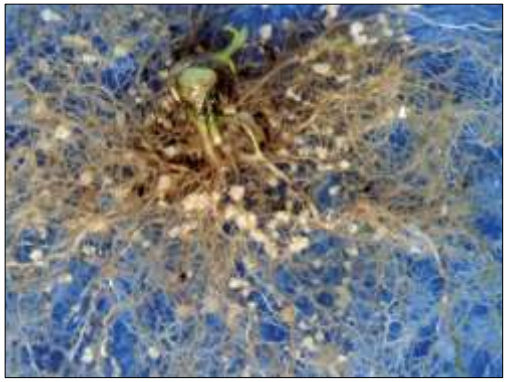



Shoot dry weight
Mean weight (g)
1.6
1.4
1.2
1.0
0.8
0.6
0.4
Infrequently irrigated
Frequently irrigated
0
14
28
42
56
84
Silicon rate (mg L-1)
Uninoculated
Inoculated


Shoot dry weight
Mean weight (g)
1.6
1.4
1.2
1.0
0.8
0.6
0.4
-12%
-21%
Infrequently irrigated
Mean weight (g)
-27%
-37%
Frequently irrigated
0
14
28
42
56
84
Silicon rate (mg L-1)
Uninoculated
Inoculated


Shoot dry weight
Root dry weight
Mean weight (g)
1.6
1.4
1.2
1.0
0.8
0.6
0.4
-12%
-21%
Infrequently irrigated
Infrequently irrigated
-27%
-37%
Frequently irrigated
Frequently irrigated
0
14
28
42
56
84
Silicon rate (mg L-1)
Silicon rate (mg L-1)
Uninoculated
Inoculated

Conclusions



- Sulphur - reduces disease
- Boron - reduces disease
- Ammonium N - reduces disease
- Silicon possibly "alleviates" effects of *Spongospora* root infection (from two expts)

Other factors

pH - no effect on root infection

Iron - no effect

Sulphate sulphur - no effect

Manganese - small reduction

Zinc - small reduction

Nitrate N - small reduction

Potassium - small reduction (high rates)