Band Steam Application for Disease and Weed Control in Lettuce

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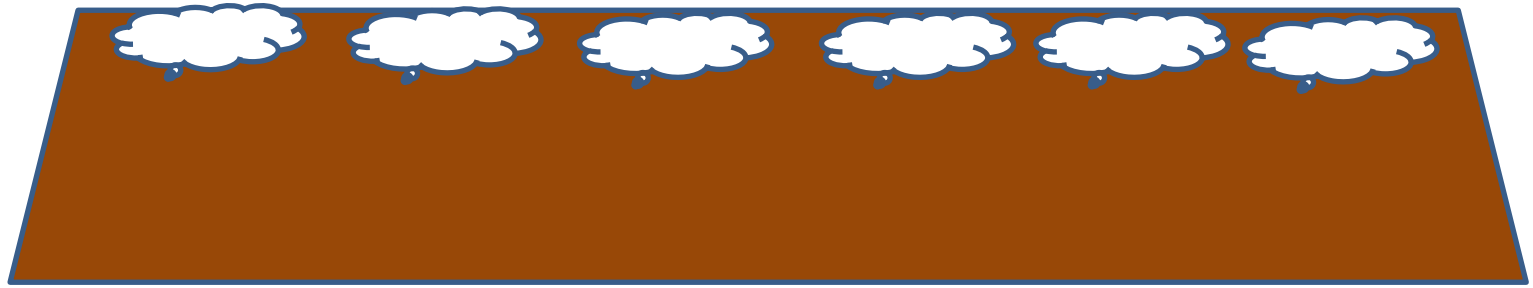
Assumptions

- **There are viable engineering solutions to improve the efficacy of steam and make it an economic solution for control of soil borne diseases and weeds in vegetable crops.**

Objective: Evaluate precision applied band steam in vegetables for control of soilborne diseases and weeds.

Seed lines disinfested with steam

Steam is
injected into
intra row soil



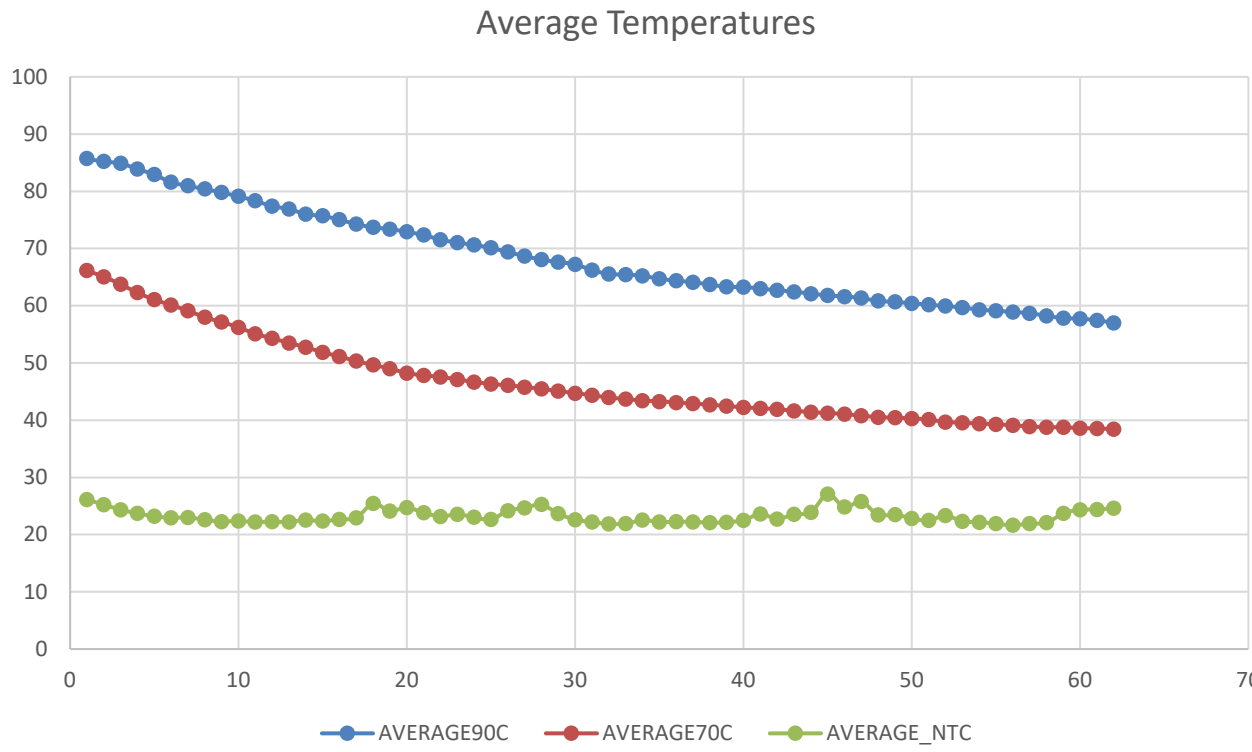
Soledad Operations Trial June 5-6, 2024

- Objective was to optimize performance speed
- In field with 1,420 ft runs the operation speed was 3.07 hours per acre treated one 80” bed per pass
- Costs per acre
  - Fuel $319.41
  - Labor $138.15
  - Machine $150.09
  - Total $607.65

Blanco Fusarium Trial

- **Steam was applied on 80” beds at 70° and 90°C (158° and 194° F) July 24, 2024.**

Blanco Fusarium Trial

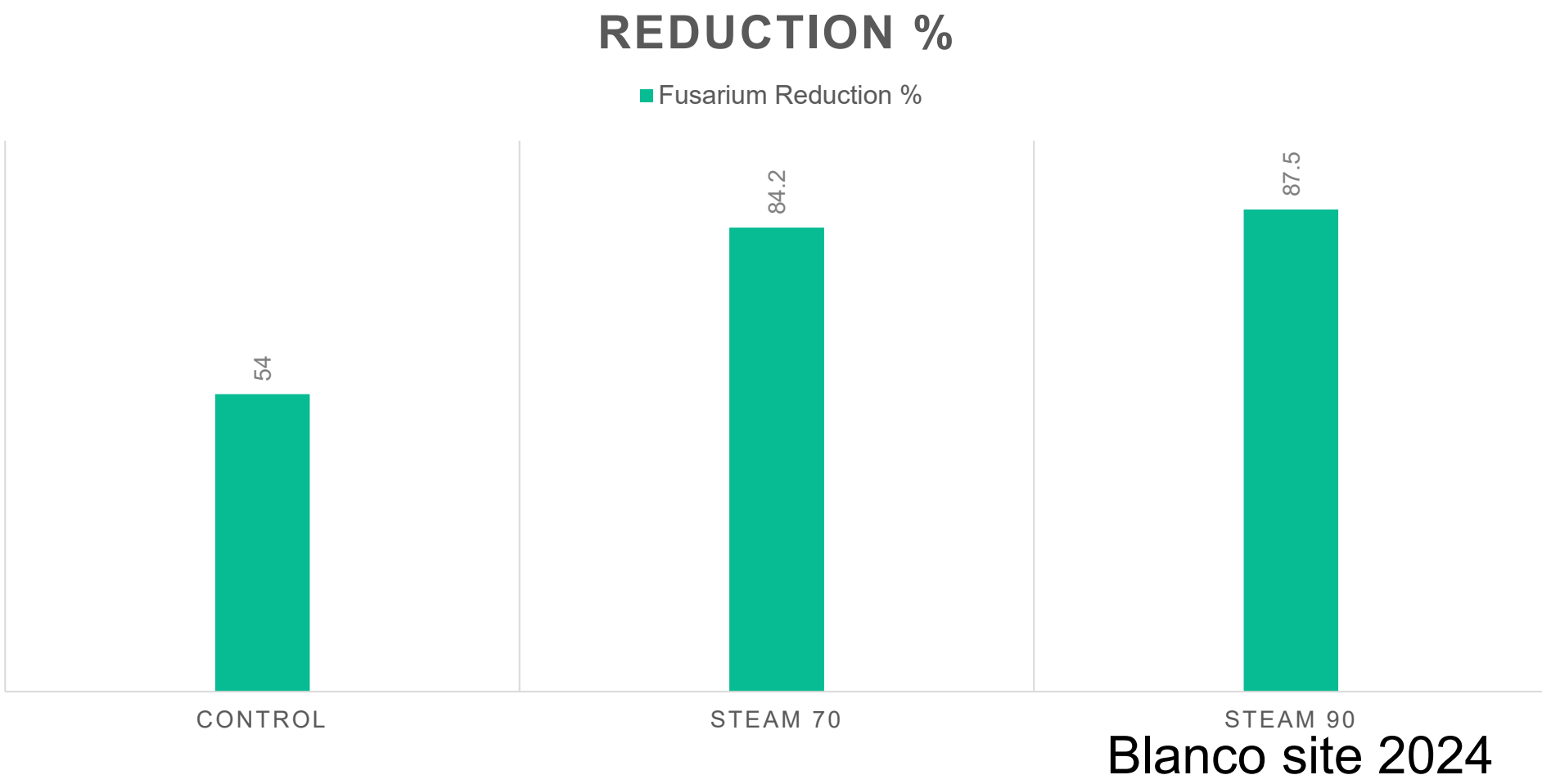


Susceptible lettuce plants

Treatment	Blackhorse 2	Lucky 4
	Survival %	
Control	11.5	0.0 b
70C	25.0	8.5 b
90C	60.0	57.5 a

Data collected 9.30.24
Blanco site

Fusarium Inoculum Reduction in soil



Blanco site 2024

Fusarium control, 70C, 90C

Control

70

90

Spreckels lettuce trial

- Steam applied to bed top of 40-inch beds August 29, 2024
- Lettuce planted August 30, 2024
- Replicated 4 times
- Treatments were control, 70C & 90C
- Weed, Lettuce drop, Fusarium, and Verticillium control (artificially inoculated)

Weed control & hand weed time

Treatment	Weeds	Time
	1,000/acre	Hours/acre
Control	1,281.8 a	201.0 a
70C	29.5 b	20.5 b
90C	2.0 b	12.1 b

Data collected 9.27.24 at Spreckels CA

Fusarium Relative Infection %

Spreckels site 2024

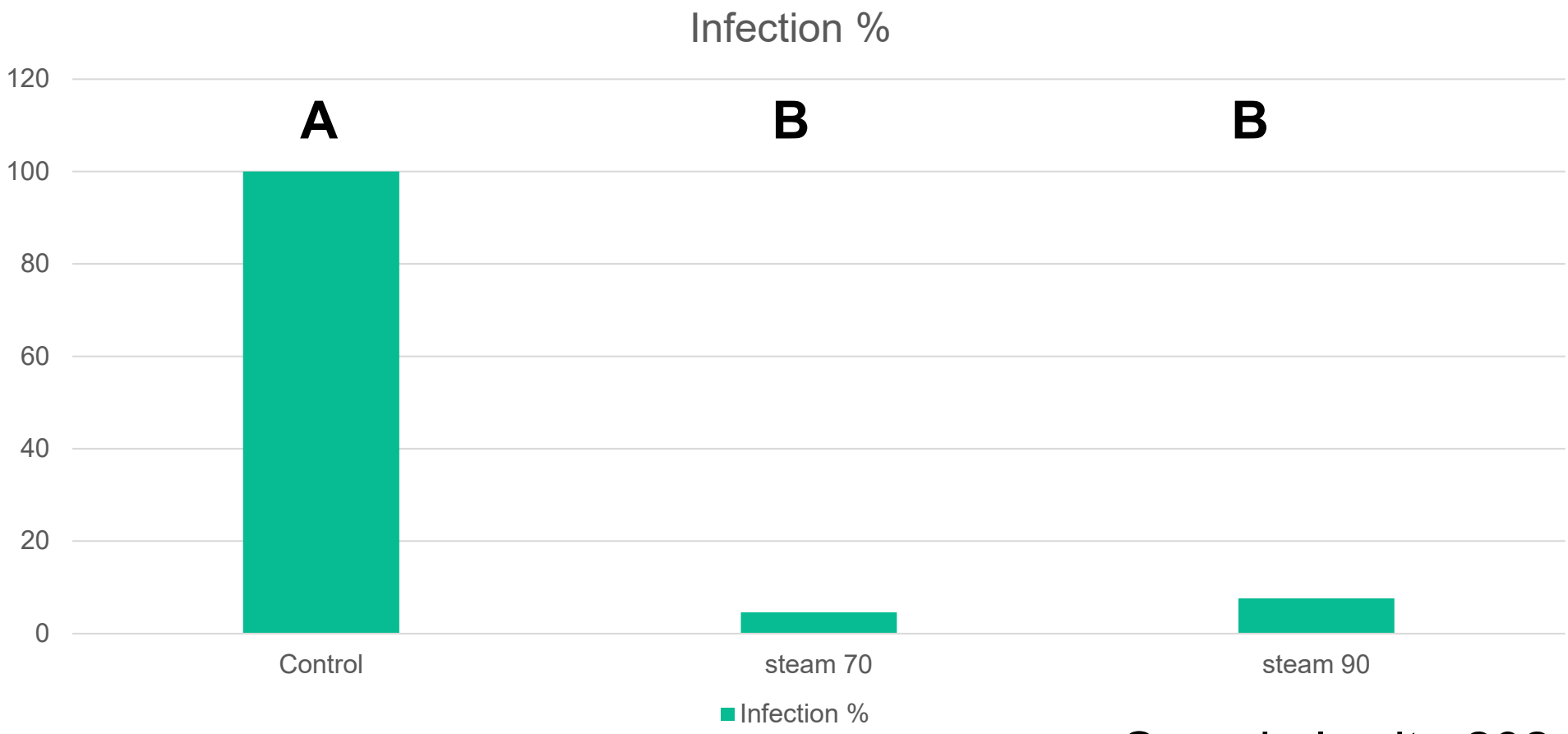
Fusarium control, Spreckels 70C, 90C

Control

70

90

Lettuce Drop Relative Infection %



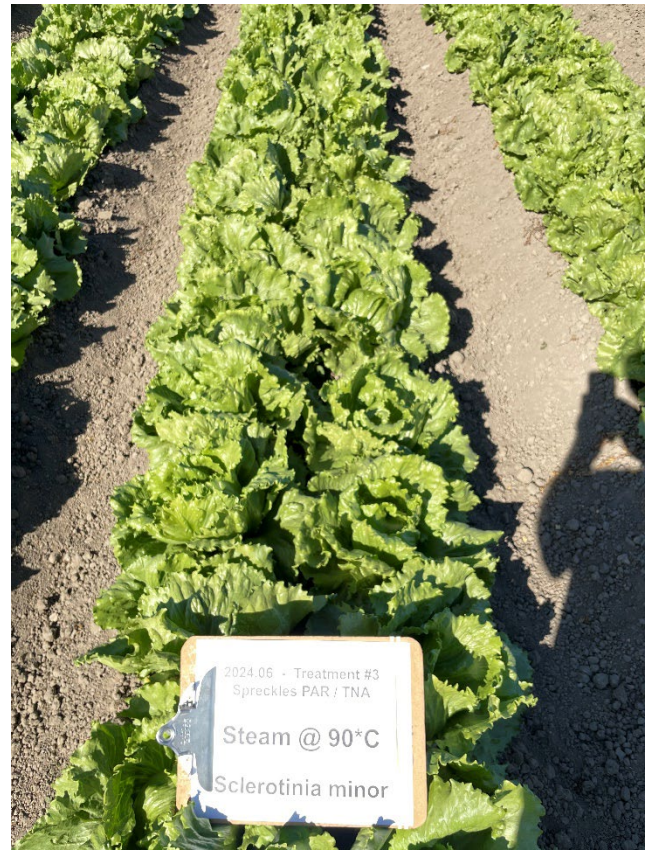
Spreckels site 2024

Lettuce drop control, Spreckels 70C, 90C

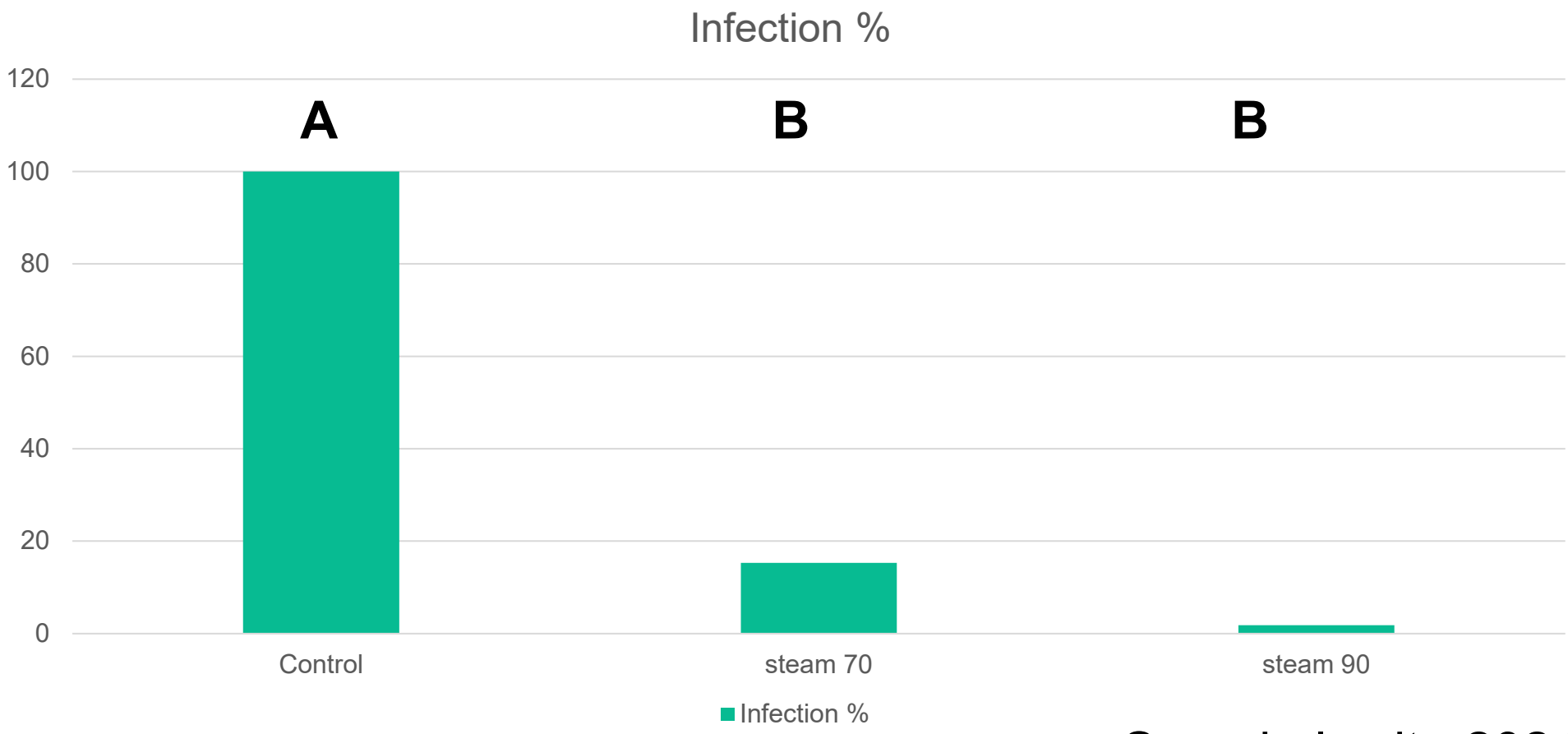
Control

70

90



Verticillium Relative Infection %



Spreckels site 2024

Verticillium control, Spreckels 70C, 90C

Control

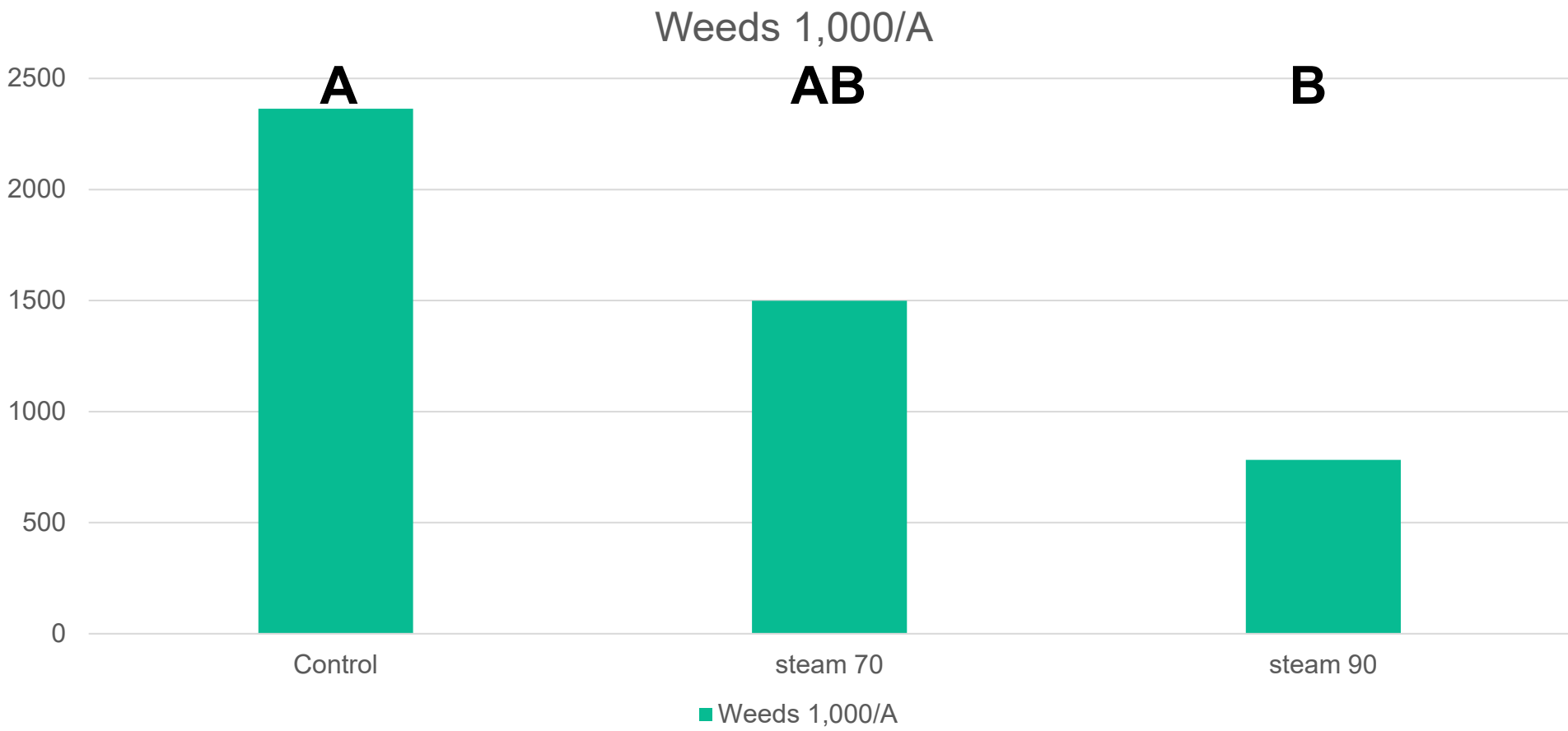
70

90

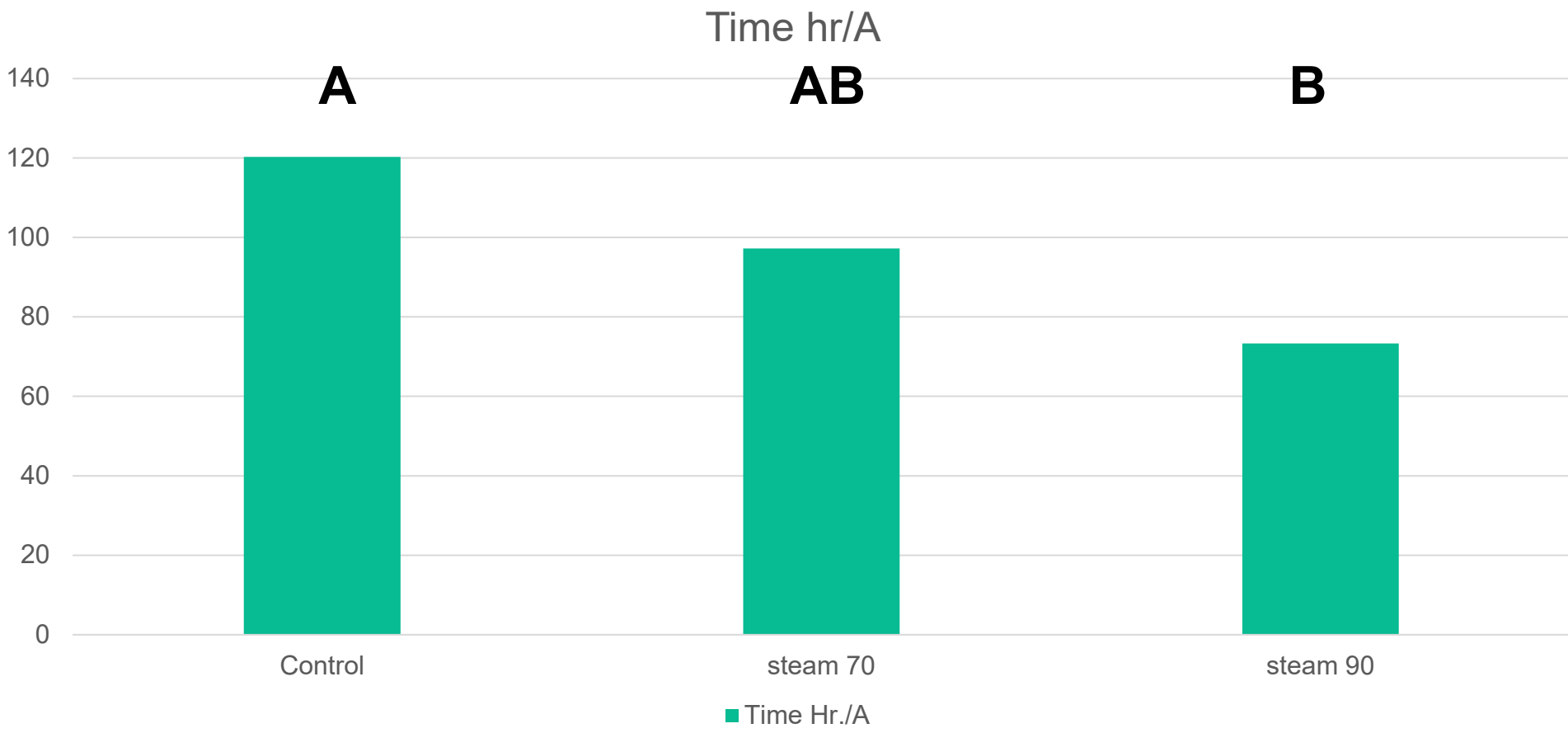
Field station study

- Steam applied July 16, 2024
- Treatments were control, steam 70˚ & 90˚ C
- 4 replicates RCBD
- Weed, disease control and yield

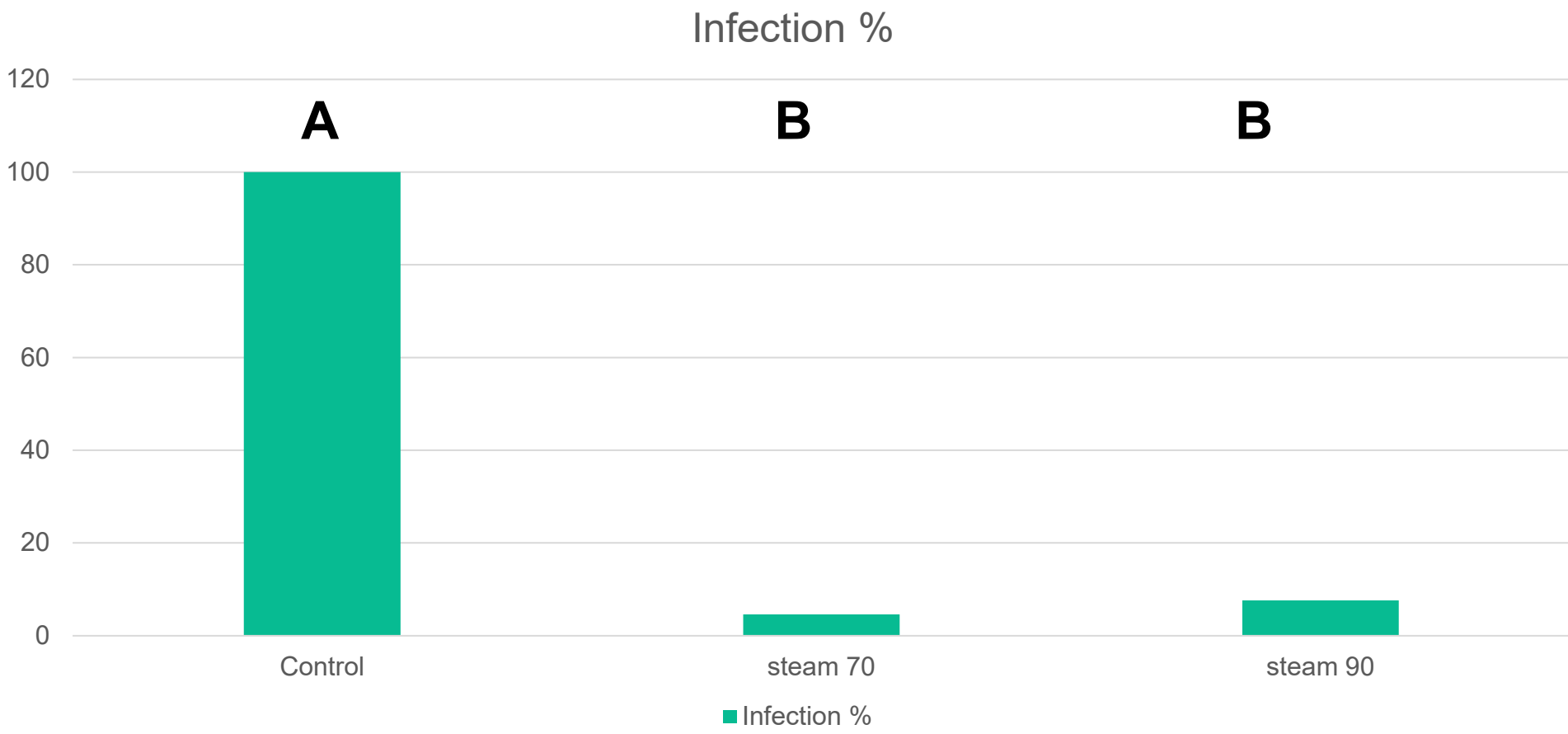
Total number of weeds in the seedline band – Hartnell 2024



Hand weed time – Hartnell 2024



Lettuce Drop Relative Infection %

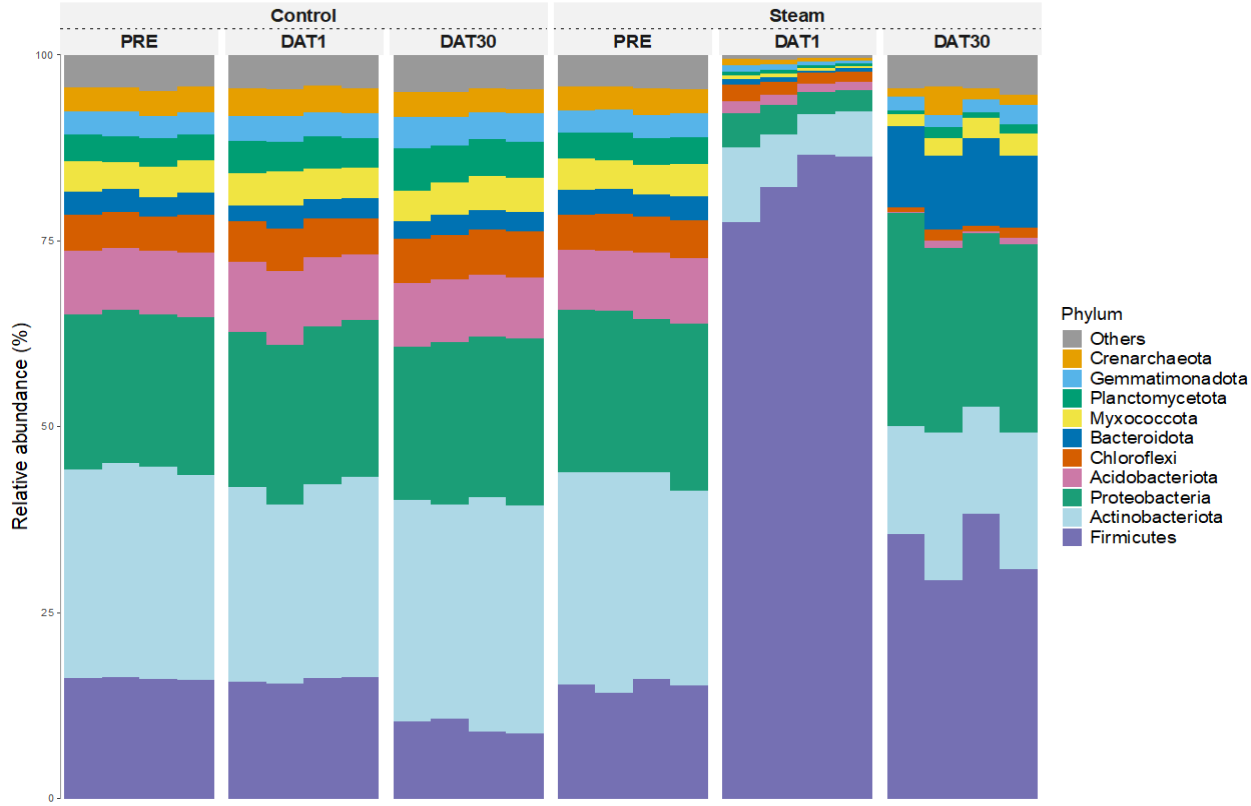


Hartnell site 2024

Impact of steam on soil microbial communities

- The impact of steam on soil microbial communities has been a concern in the past.
- MS student Erika Escalona has conducted research on the impacts of band steam on soil microbial communities.
- DNA was extracted from soil samples
- Amplicon sequencing of the DNA was conducted using the Illumina MiSeq System at the UC Davis Genome Center.

Steam effects on soil microbial communities



Escalona Thesis
2024

Impact of steam on soil microbial communities

- Soil microbes generally recovered 30 days after steaming
- Band steam only treats part of the soil which likely contributes to the recovery.

Conclusions

- **Steam suppresses Fusarium best at 90°C**
- **Steam suppresses weeds, lettuce drop & Verticillium**
- **Cost estimates of $607 per acre can likely be reduced by more efficient water handling equipment. Eg. 3,000 gallon water truck and wider treatment width.**


AMMABLE
PROPANE
FLAMMABLE
PROPANE
FLAMMABLE