Barriers to Adopting Sanitation for Managing Soilborne Pathogens in Strawberry Production

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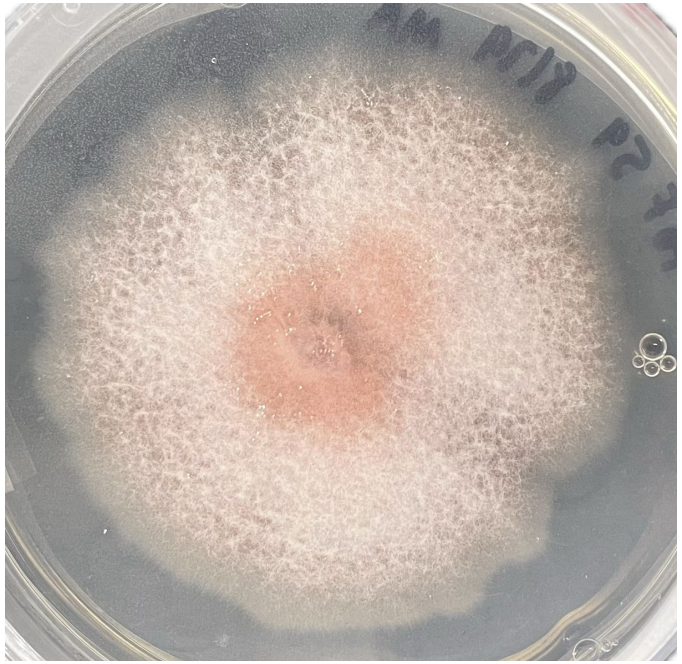
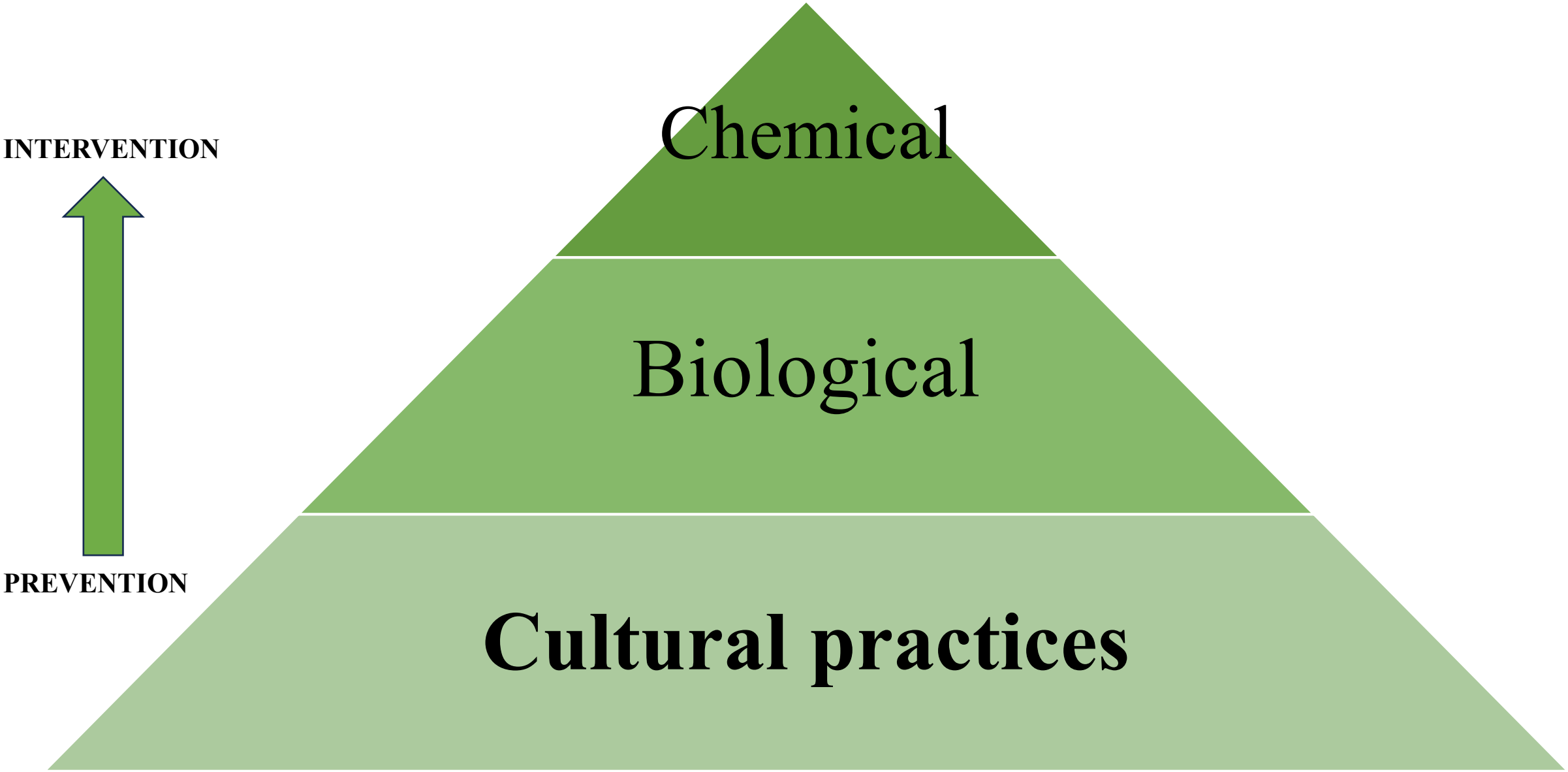
Introduction

- Strawberry Industry
  - Methyl bromide was the go-to solution for diseases until the phase-out in 2005 (Holmes et al., 2020)
    - It led to new pathogens and an increased disease pressure from existing pathogens:
      - *Fusarium oxysporum* f. sp. *fragariae*
      - *Macrophomina phaseolina*
      - *Phytophthora cactorum*
      - *Verticillium dahliae*




INTERVENTION
PREVENTION
Chemical
Biological
Cultural practices

Means of transferring soil between fields

Project overview

Lab *in-vitro* assay

Field study

Survey

Lab *in-vitro* assay

- Objectives
  - To compare pathogen survival after exposure to different sanitizing agents.
  - To evaluate the sanitizer concentration and contact time.

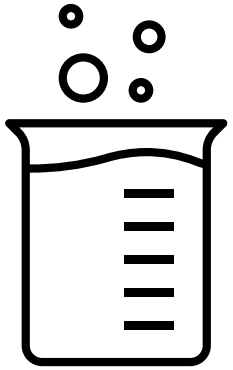
Materials and Methods - Sanitizing agents

Treatment	Sanitizing Agent	Active Ingredient	Concentration
1	sterile deionized water	none	NA
2	bleach	sodium hypochlorite	8,250 ppm
3	ethanol	ethyl alcohol	700,000 ppm
4	Lysol ®	benzyl-p-chlorophenol	3,487 ppm
5	MG 4-Quat ®	octyl decyl dimethyl ammonium chloride	150 ppm
6	Oxidate 2.0 ®	hydrogen peroxide & peracetic acid	2,710 ppm
7	Physan 20 ®	dimethyl benzyl ammonium chloride	100,000 ppm
8	Virkon S. ®	potassium peroxymonosulfate, sodium chloride	2,140 ppm

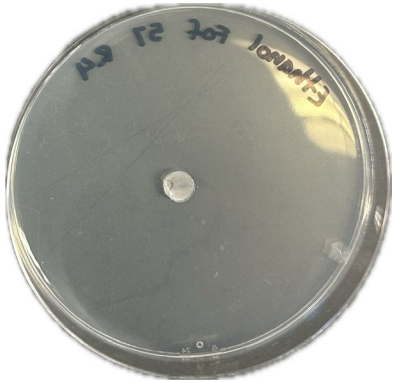
Materials and Methods

Fusarium oxysporum f. sp. *fragariae*, race 1

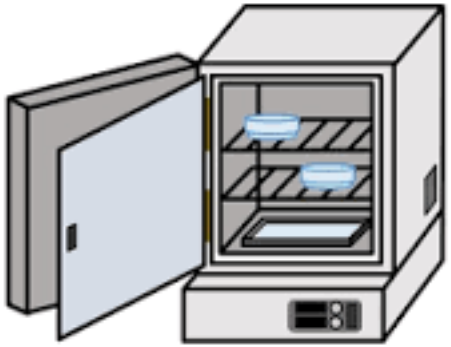
grow on cellophane



introduced a sanitizing agent

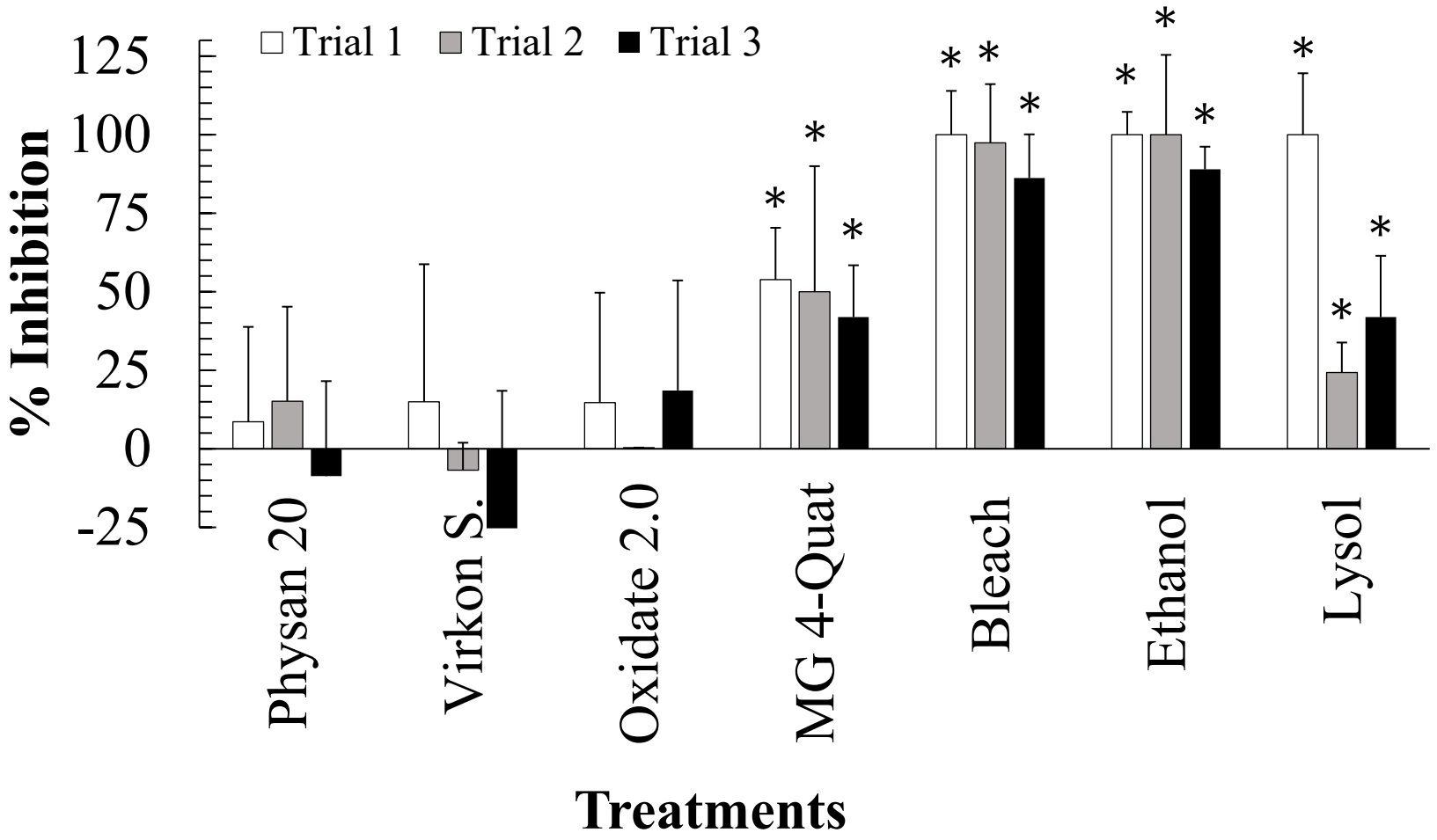


7 days at 20 ºC



diameter measurement

Results



* = statistically significant

Field study

- Objectives
  - To identify problem areas on farm equipment where soil commonly accumulates.
  - To determine the most effective pressure washer settings and timing for soil removal.

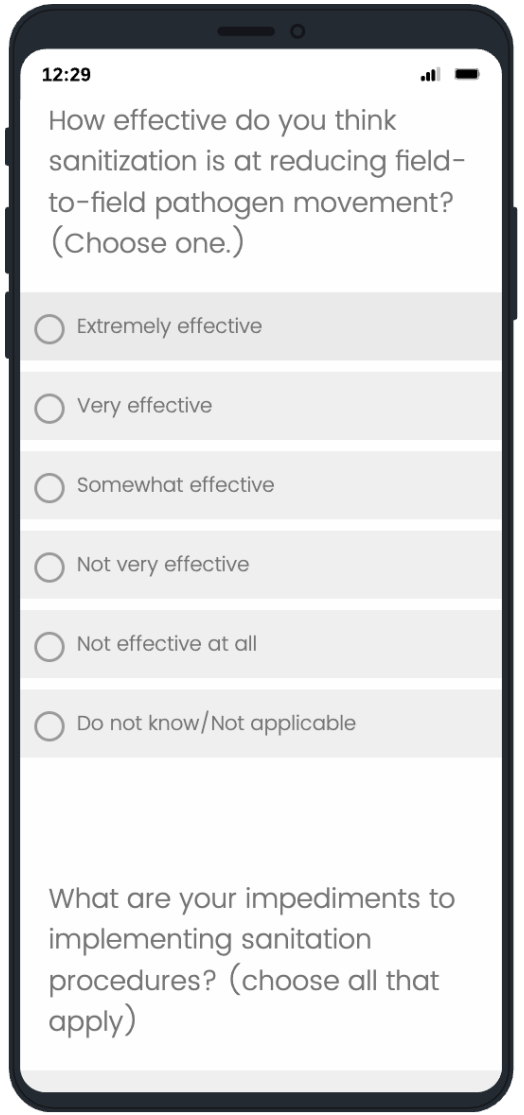
Pressure washer spray nozzle settings		
Spray angle	**Spray pattern**	**Notes**
15 °		**High pressure (3100 PSI)**
25 °		**High pressure (3100 PSI)**
40 °		**High pressure (3100 PSI)**
Long range soap		**Low pressure (500-1000 PSI)**
Short range soap		**Low pressure (500-1000 PSI)**

Results

- Soil accumulates most around tires, bumpers, and wheel wells (wheel wells carry the most).
- Higher PSI and a narrow (15°) spray pattern improve soil removal efficiency.
- Optimal pressure washing removes soil in ~15 minutes.

Survey objectives

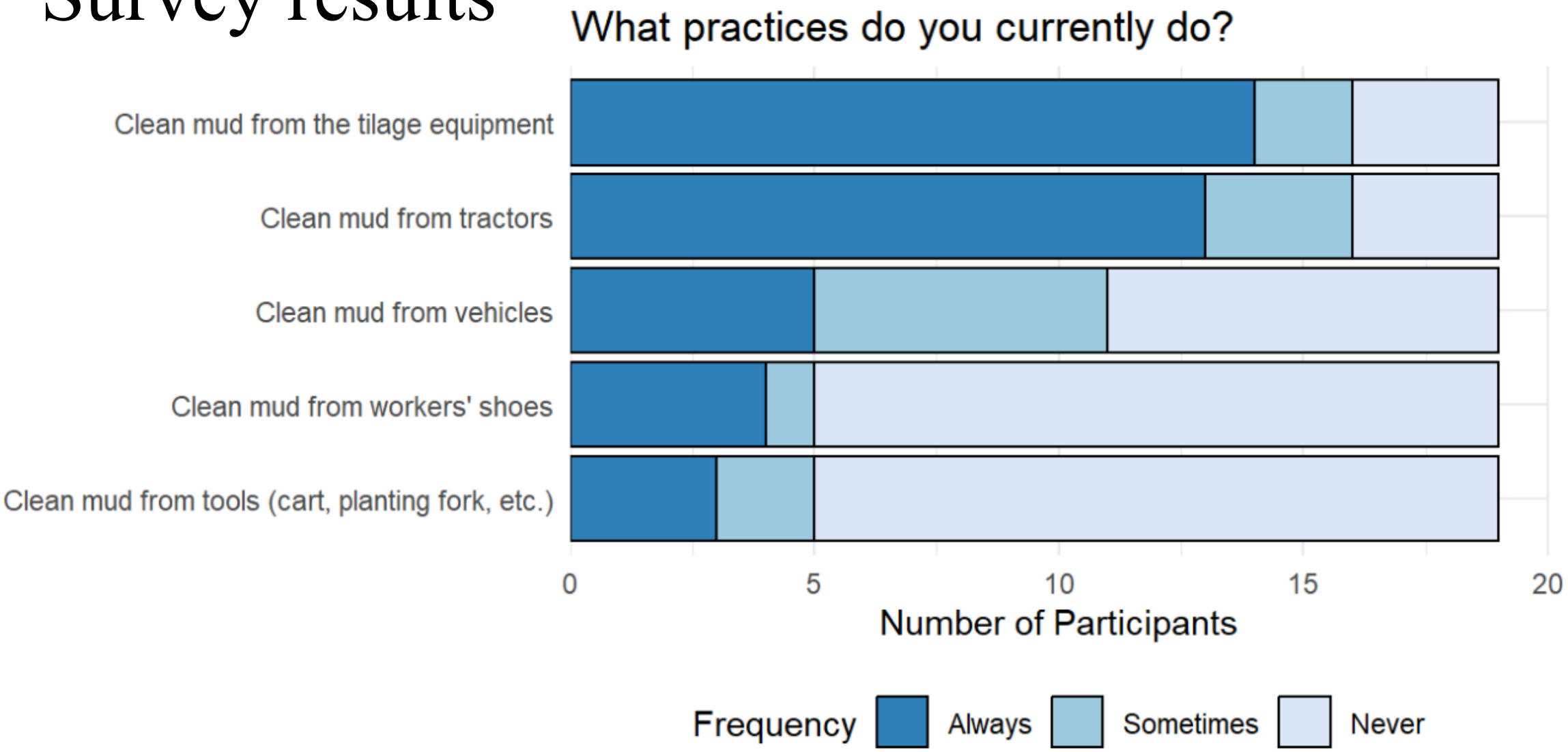
- Identify current industry sanitation practices and areas needing greater attention



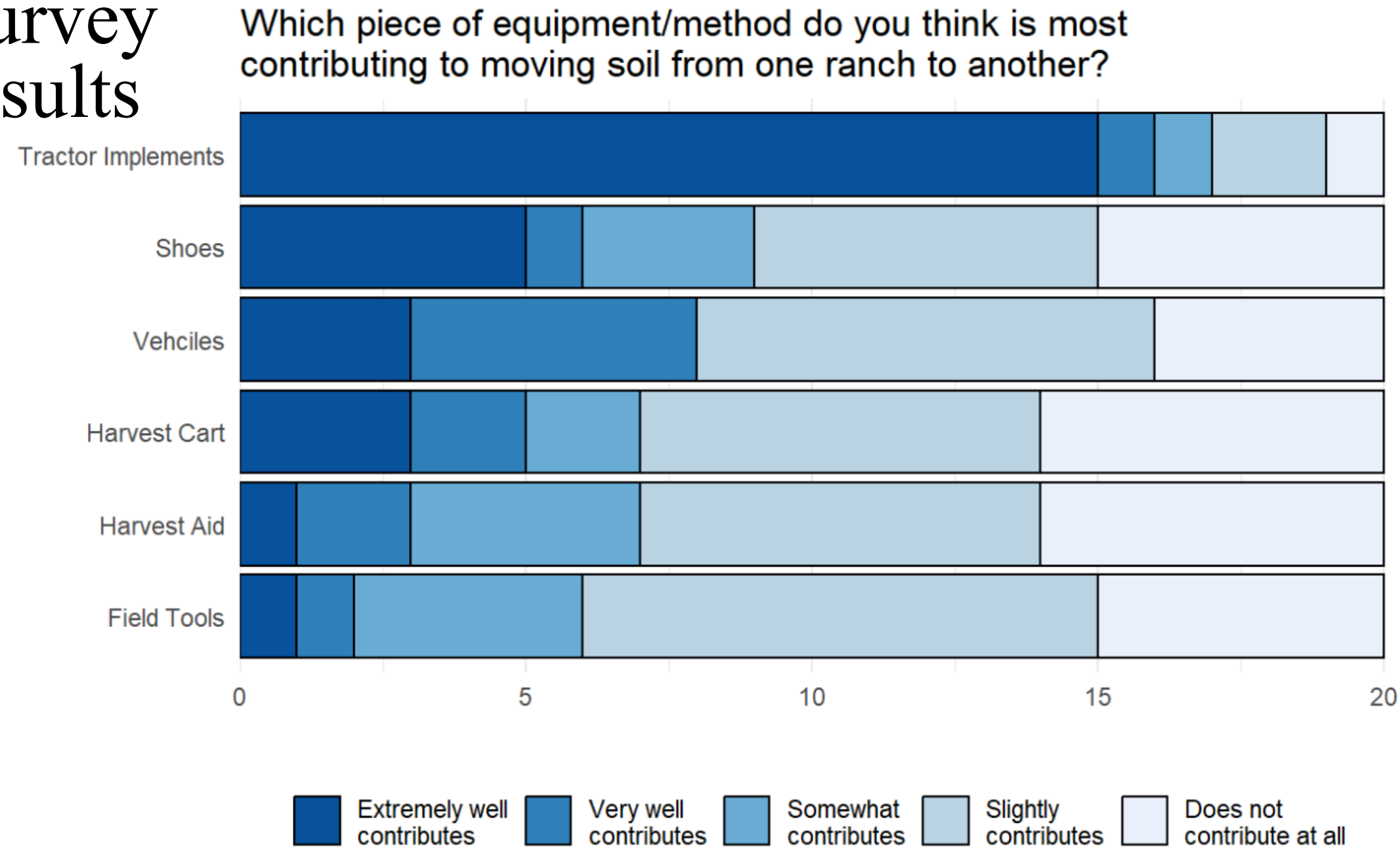
Methods

- In-person, over Zoom, or email
  - 24 survey responses
- 3 districts
  - Santa Maria
  - Oxnard/Ventura
  - Watsonville
- 17 questions
  - Current sanitation practices, pathogen awareness, barriers and challenges, adoption and effectiveness

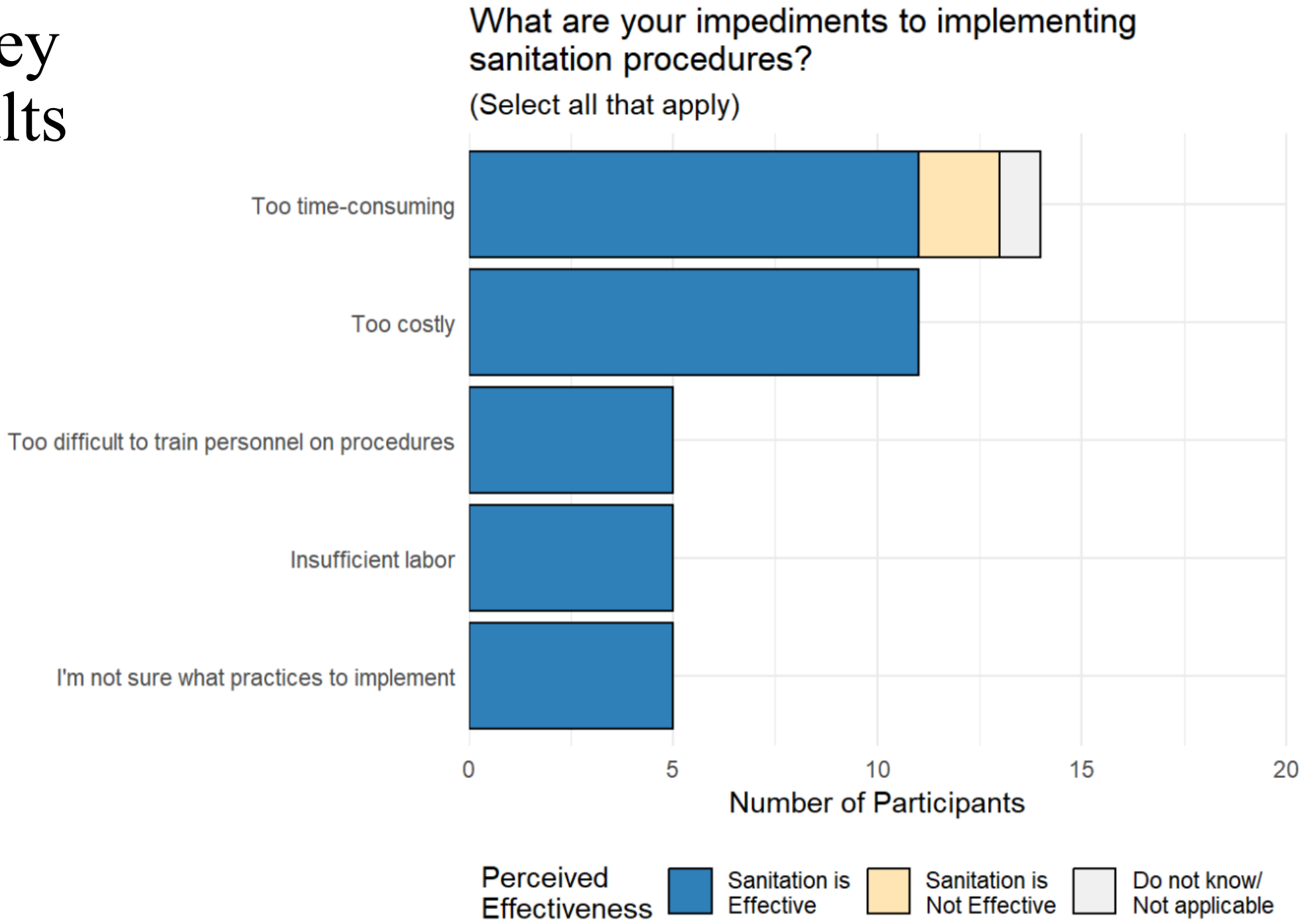
Survey results



Survey results



Survey Results



Conclusion

- Lab study
  - Bleach showed the highest inhibition of *Fusarium oxysporum* f. sp. *fragariae* race 1
  - Ethanol and Lysol® were also effective but warrant further evaluation for cost and safety
- Survey
  - Survey results highlighted interest in one-on-one meetings with growers, PCAs, and farm crews to support implementation.
  - Growers also requested educational events and accessible best management practice (BMP) guides tailored to on-farm sanitation.

Next Steps

- Lab study
  - test sanitizing agents on spores, the “survival” structures in soil
- Survey
  - collecting responses from growers in the Santa Maria district
  - Oxnard/Ventura survey

Questions?