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Comparison of the Microbial-Vac System® to Excision for Sampling of Beef Trimmings

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Microbial-Vac Systems, Inc.

Outline

- What is the Microbial-Vac (M-Vac) and How Does it Work?
- Plant Staged Comparison of M-Vac to Excision on Trim
- Recovery of Low Level (1 – 5 CFU) *E. coli* O157:H7 from Meat Surfaces
- Summary
- Conclusions

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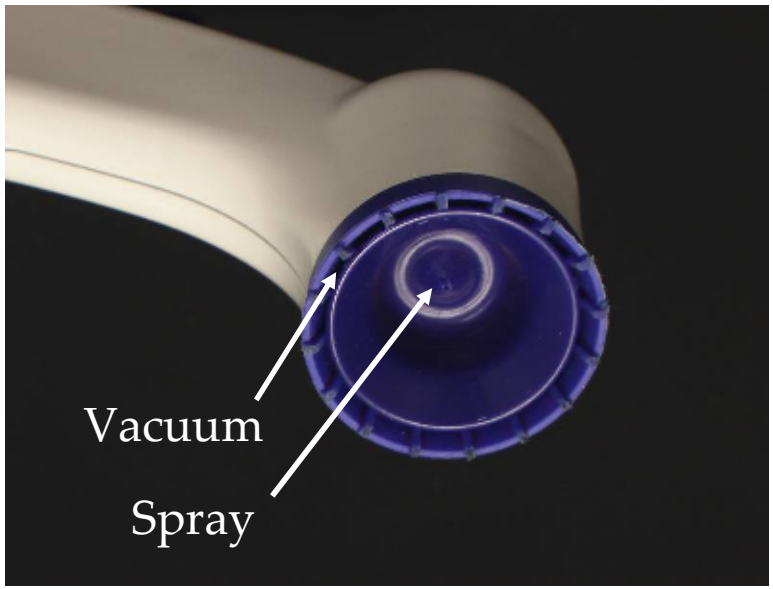
M-Vac System

Support Equipment Case (SEC)

Surface Rinse Solution (SRS)

M-Vac & Sampling Head (MS Kit)

Sample Collection Bottle



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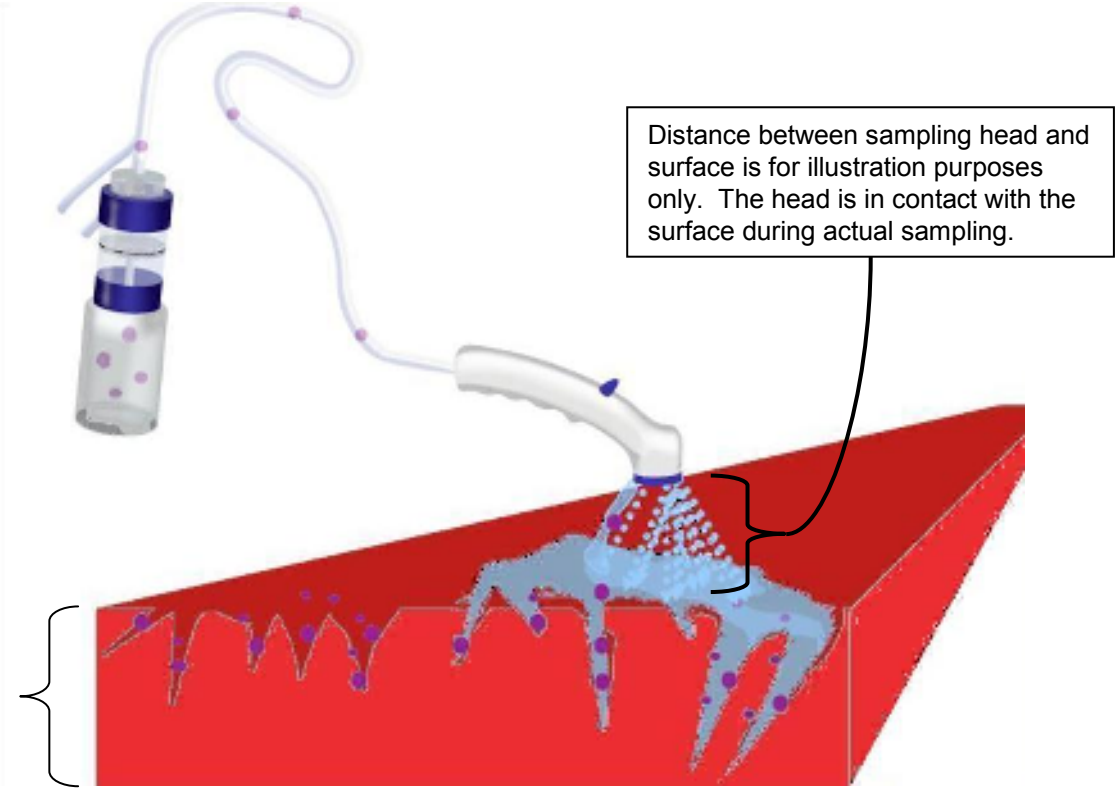
How It Works



Spray and vacuum action performed simultaneously

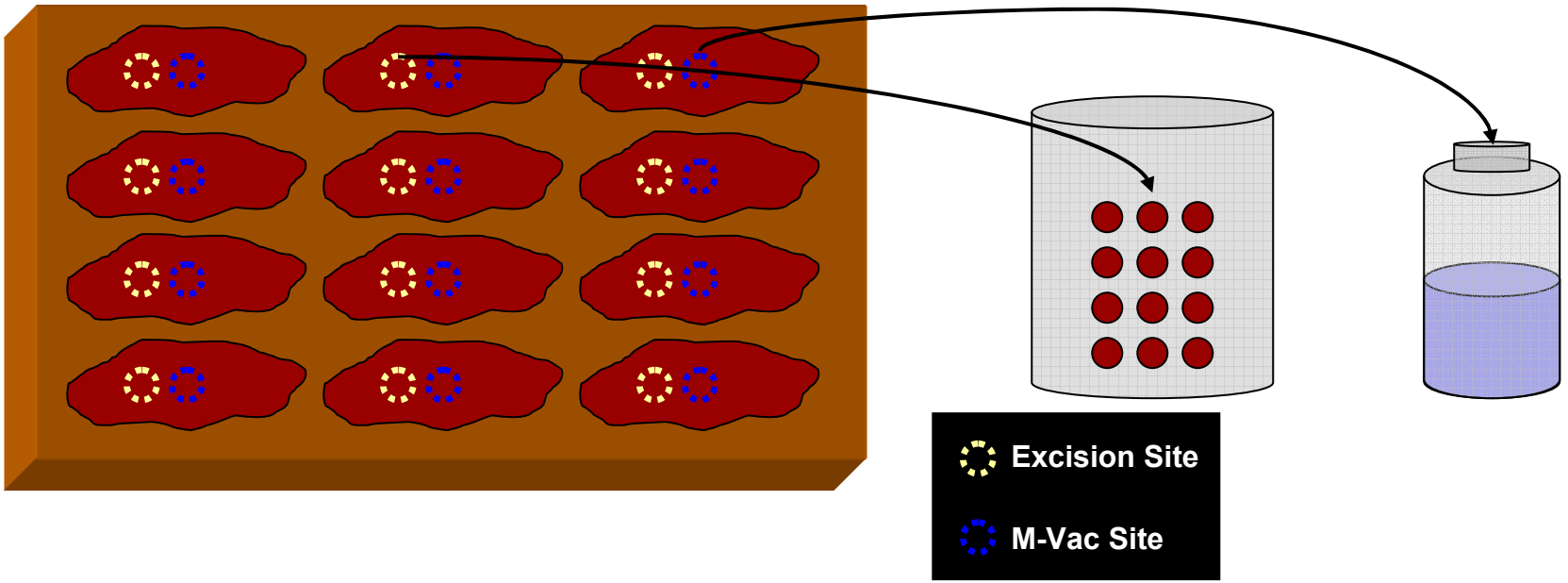
- Sampling head sprays sterile buffer onto surface to penetrate crevices and suspend microbes
- Solution/microbes are subsequently vacuumed up into the sample collection bottle
- Non-destructive sample acquisition
- Sample collection bottle is then removed, sealed and sent to lab

Plant-Staged Studies

- Compared the M-Vac to excision technique on beef trim at three different processing facilities
- Facilities agreed to allow quantification of APC, TC, and presence/absence of generic *E. coli*
- Conducted on the fabrication floor

Procedures for Plant-Staged Studies

- Each sample consisted of 1 site from each of 12 randomly selected pieces of meat

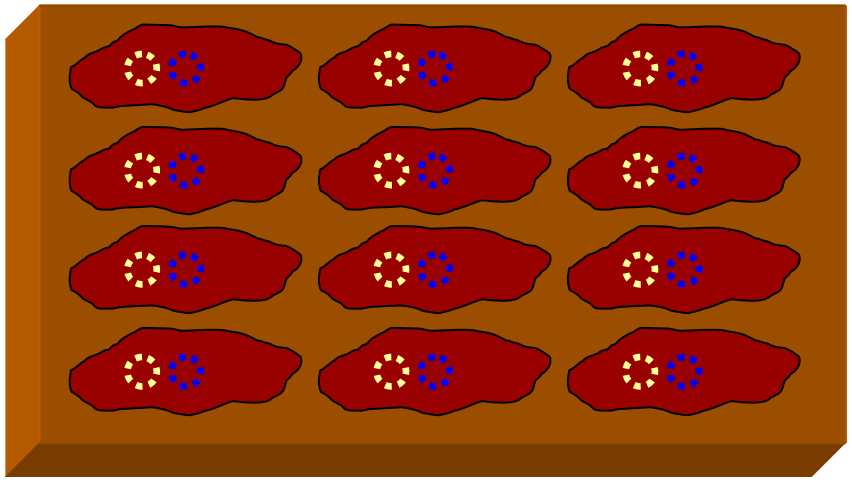


  - Excision and M-Vac samples were in close proximity to each other on each piece of meat.
  - Sites were 11.5 square cm per technique

Procedures for Plant-Staged Studies

(cont.)

- Twenty samples were taken at each facility



X 20

- Sampling technique for each site
  - Excision sites were cut to a thickness of ¼ - 1/8”
  - M-Vac sites were collected with 2 passes of the sampling head over each site

Procedures for Plant-Staged Studies
(cont.)

- Lab processing
  - Excision samples had 100 mL of diluent added and then hand massaged for 2 minutes
  - M-Vac samples were shaken for 5 seconds
- Each sample was plated onto Petrifilm™ for APC, TC, and +/– for generic *E. coli*
- Film was incubated at 37°C for 48 hours prior to direct plate count/visual inspection

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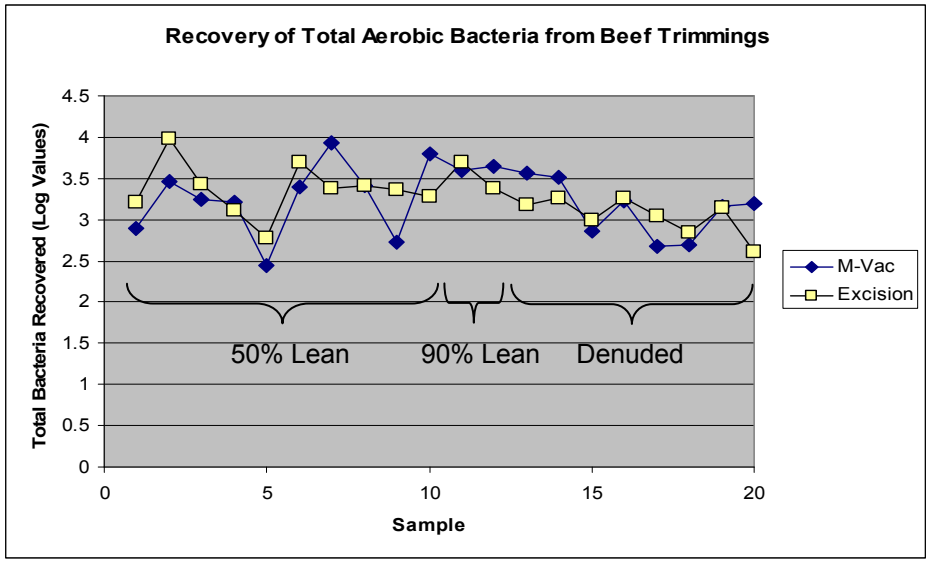
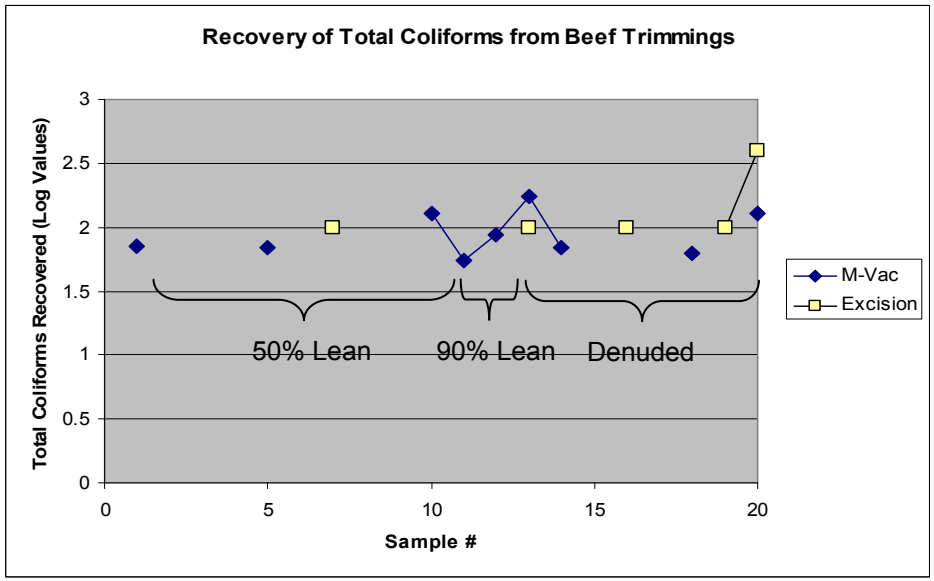
Equality with Excision - Plant A





Coliform data points at zero are not shown on graph.

	+/– for Generic *E. coli**	
	Method	
Sample	M-Vac	Excision
1	–	–
2	–	–
3	–	–
4	–	–
5	–	–
6	–	–
7	–	–
8	–	–
9	–	–
10	–	–
11	–	–
12	–	–
13	–	–
14	–	–
15	–	–
16	–	–
17	–	–
18	–	–
19	–	–
20	–	–
Total	0/20	0/20

50 % Lean

90 % Lean

Denuded Product

*Negative (-) on Generic E. coli signifies that it was not present at detectable levels. Positive (+) signifies that it was.

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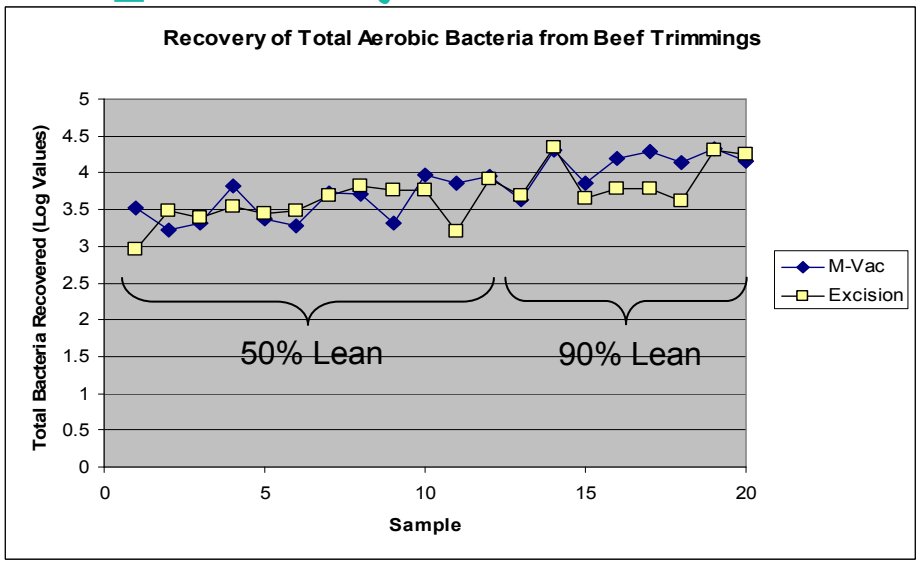
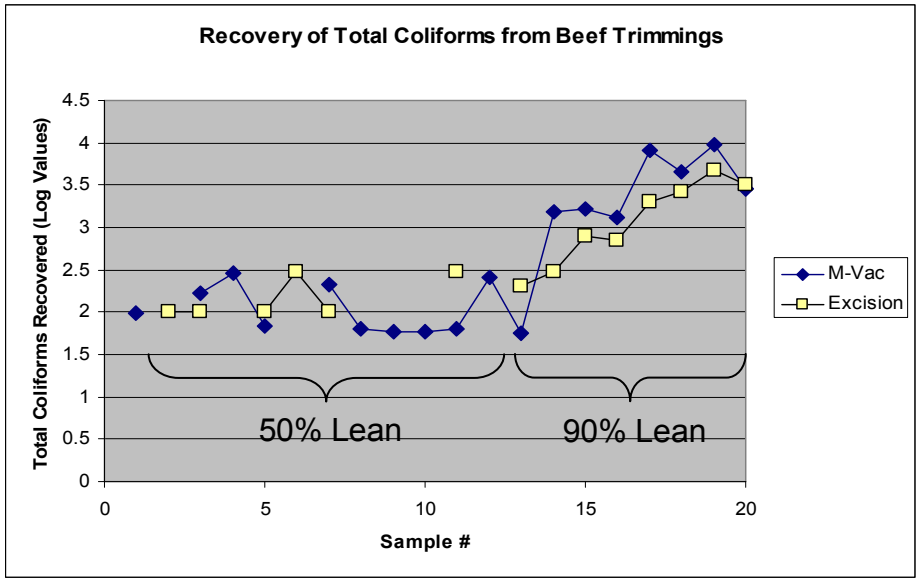
Equality with Excision - Plant B





	+/– for Generic *E. coli*	
	Method	
Sample	M-Vac	Excision
1	–	–
2	–	–
3	+	–
4	–	–
5	–	–
6	–	+
7	–	–
8	–	–
9	–	–
10	–	–
11	–	–
12	–	–
13	–	–
14	–	+
15	+	+
16	+	+
17	+	+
18	+	+
19	+	+
20	+	–
Total	7/20	7/20

50% Lean

90% Lean

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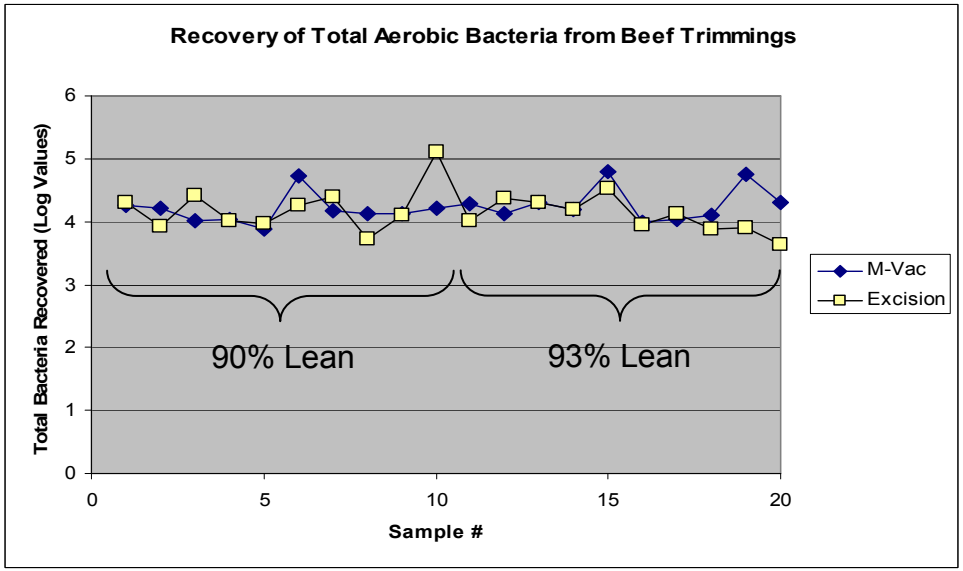
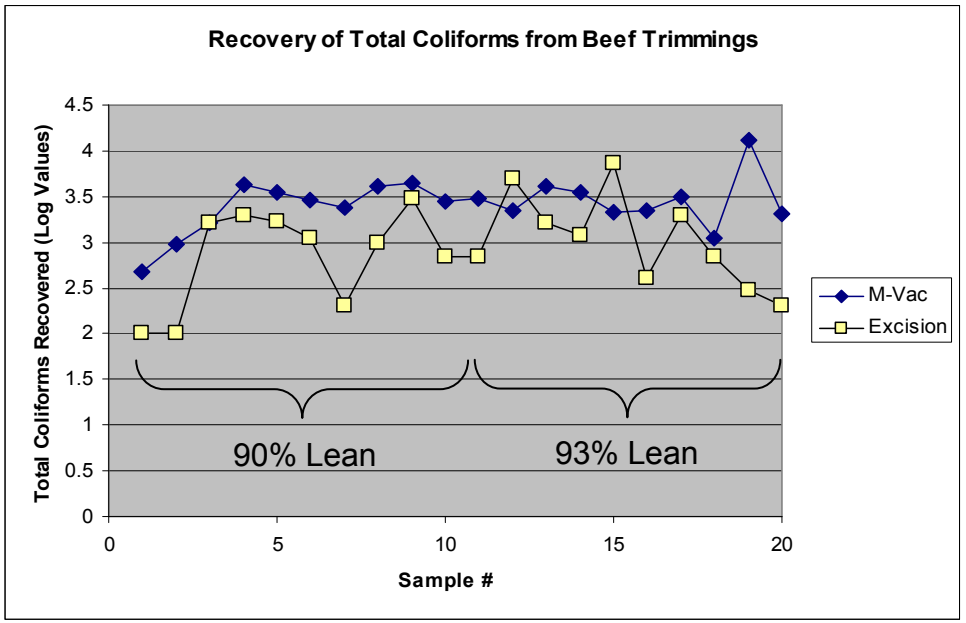
Equality with Excision - Plant C





	+/– for Generic *E. coli*		
		Method	
	Sample	M-Vac	Excision
90% Lean	1	–	–
	2	–	–
	3	–	–
	4	–	–
	5	–	–
	6	–	–
	7	+	–
	8	+	–
	9	–	–
	10	+	–
93% Lean	11	–	–
	12	–	–
	13	–	–
	14	+	–
	15	–	–
	16	–	–
	17	–	–
	18	–	–
	19	–	–
	20	+	–
	Total	**5/20**	**0/20**

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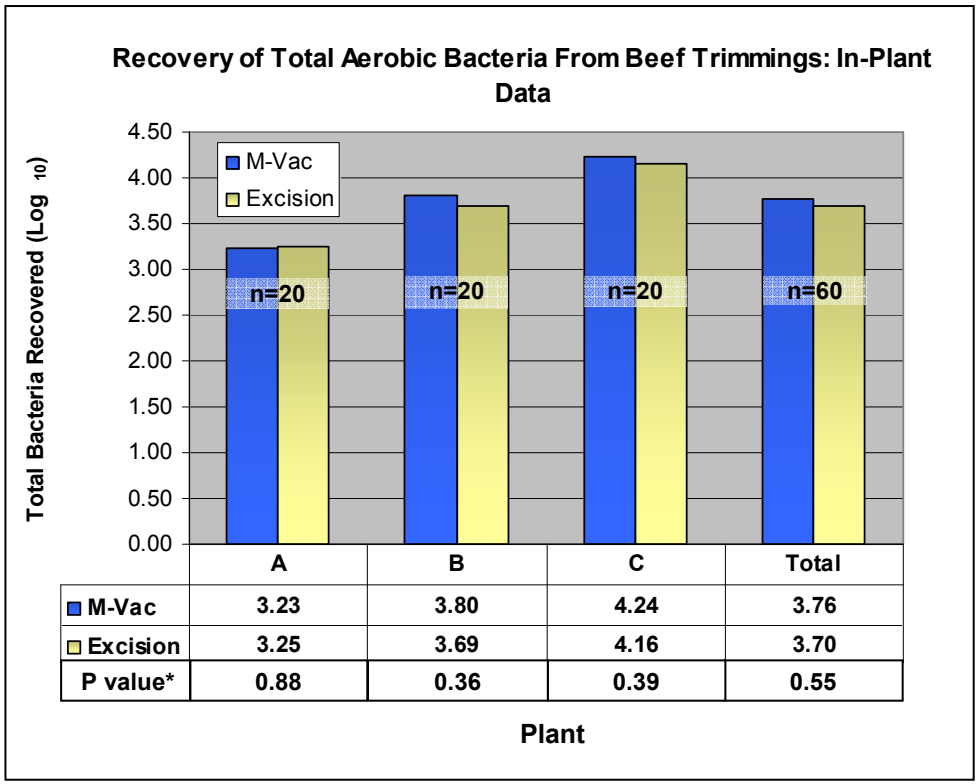
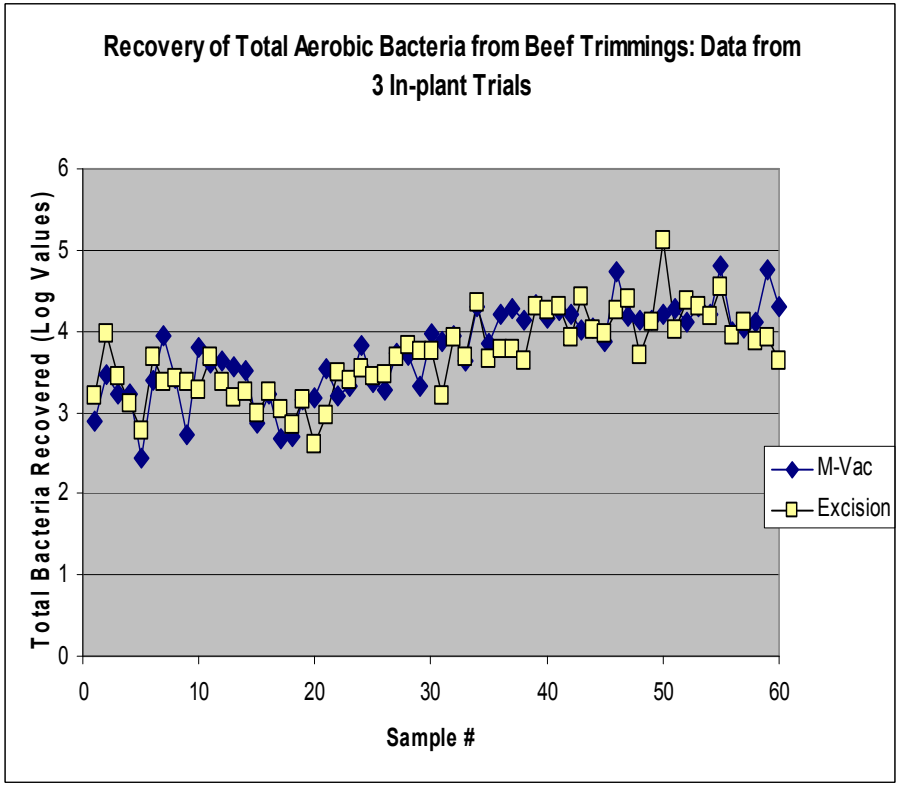
Combined Plant-Staged Data Total Aerobic Bacteria Count



	A	B	C	Total
M-Vac	3.23	3.80	4.24	3.76
Excision	3.25	3.69	4.16	3.70
P value*	0.88	0.36	0.39	0.55



*P values were calculated using an un-paired t-test. No significant differences were observed between the two sampling techniques in any plant or in the combined data (P<0.05).

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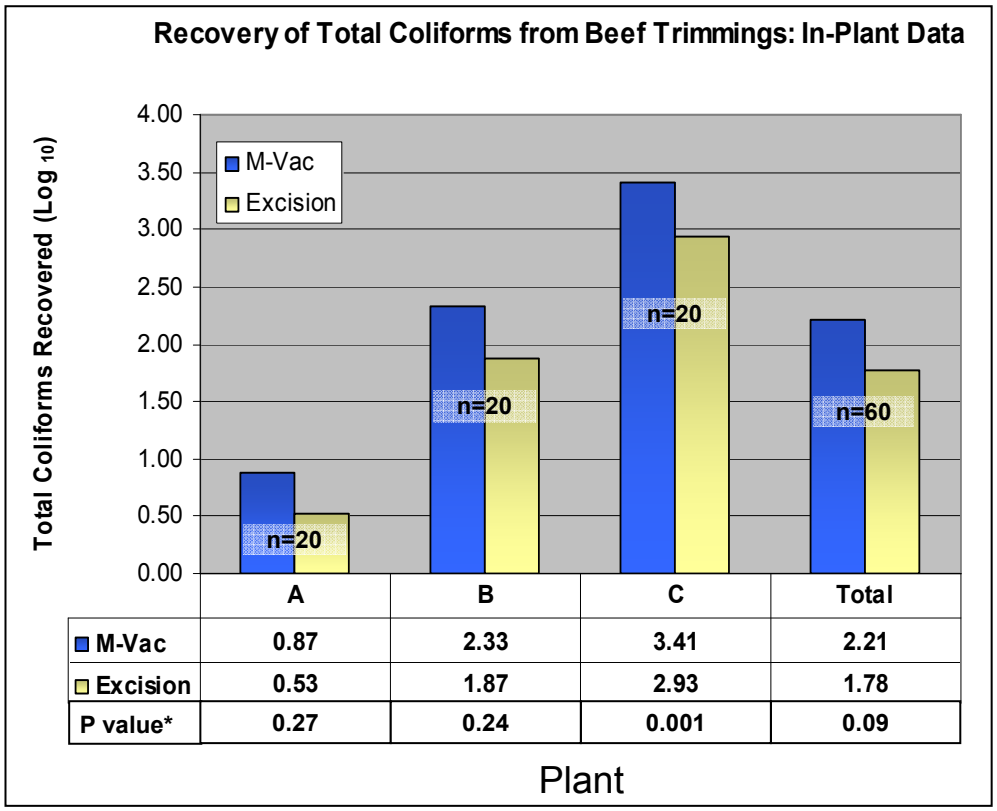
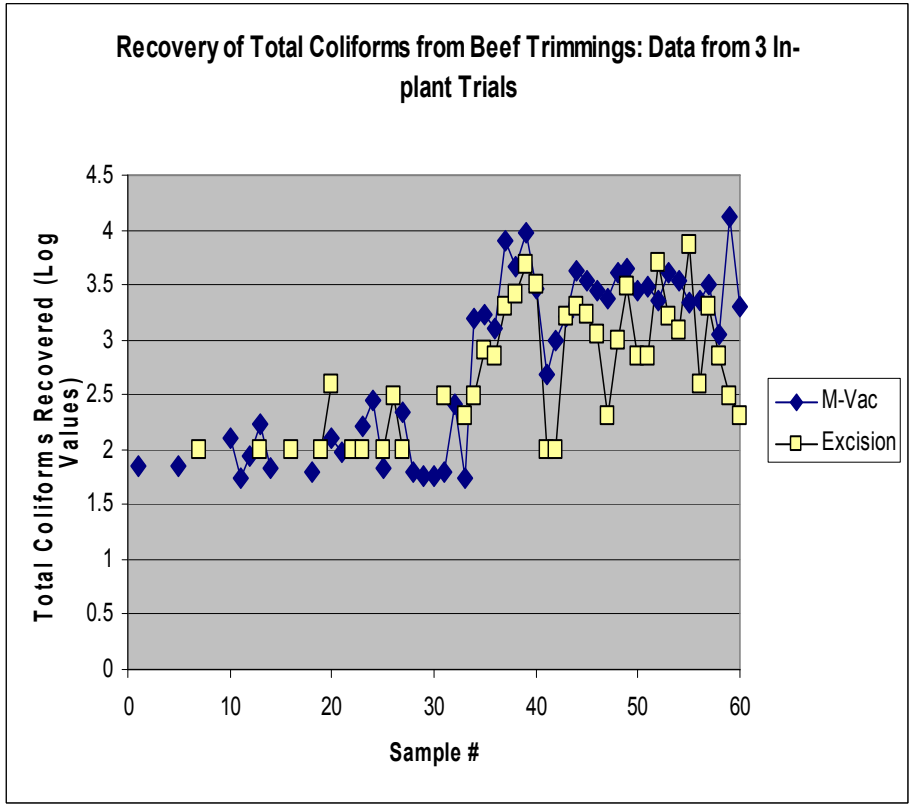
Combined Plant-Staged Data Total Coliforms



	A	B	C	Total
M-Vac	0.87	2.33	3.41	2.21
Excision	0.53	1.87	2.93	1.78
P value*	0.27	0.24	0.001	0.09

*P values were calculated using an un-paired t-test. Significant differences were observed between the two sampling techniques in plant C (P<0.05).



Coliform data points at zero are not shown on graph

Combined Plant-Staged Data Generic E. coli

Plant	Method	% of Samples *E. coli* +
Plant A n=20	M-Vac	**0.0%** (0/20)
	Excision	**0.0%** (0/20)
Plant B n=20	M-Vac	**35.0%** (7/20)
	Excision	**35.0%** (7/20)
Plant C n=20	M-Vac	**25.0%** 5/20
	Excision	**0.0%** (0/20)
Total n=60	M-Vac	**20.0%** (12/60)
	Excision	**11.7%** (7/60)

- No significant differences between techniques in any plant at the 5% probability level
- Plant C highlights the random nature of contamination on beef trimmings
- Given the high level of variability between the three plants, doing statistics in the combined data would be an unfair test

Low Level Contamination Testing

- Evaluate M-Vac equivalence to excision for recovery of low level (1 – 5 CFU) *E. coli* O157:H7 contamination
- Two modes of contamination
  - Pre-Rigor: Hide removal to Hot box
  - Post-Rigor: Down stream processing (cross contamination from piece to piece, knives, conveyor belts, etc.)
- For evaluation purposes pre and post refers to the condition of the meat at the time of inoculation
- Both modes were sampled post-rigor

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Procedures for Low Level Contamination Testing – Lab Work

- Brisket & Flank sections collected from freshly slaughtered carcasses
  - Pieces chilled at least overnight for post-rigor work
- Outlined sites on each piece inoculated w/ 1 – 5 CFU *E. coli* O157:H7
- Inoculated sites held overnight at 2 – 4°C
- After refrigeration each site sampled with either M-Vac or Excision
- mEHEC broth added to samples and incubated at 42°C overnight
  - 5X mEHEC used for M-Vac samples to give a final concentration of 1X (25 mL 5X into 100mL sample)
  - 1:5 dilution by weight of excision sample to 1X mEHEC followed by 2 min. of hand massage
- Enriched samples then processed via standard procedures for BioControl GDS (> 98% sensitivity) with results reported as +/– for O157:H7

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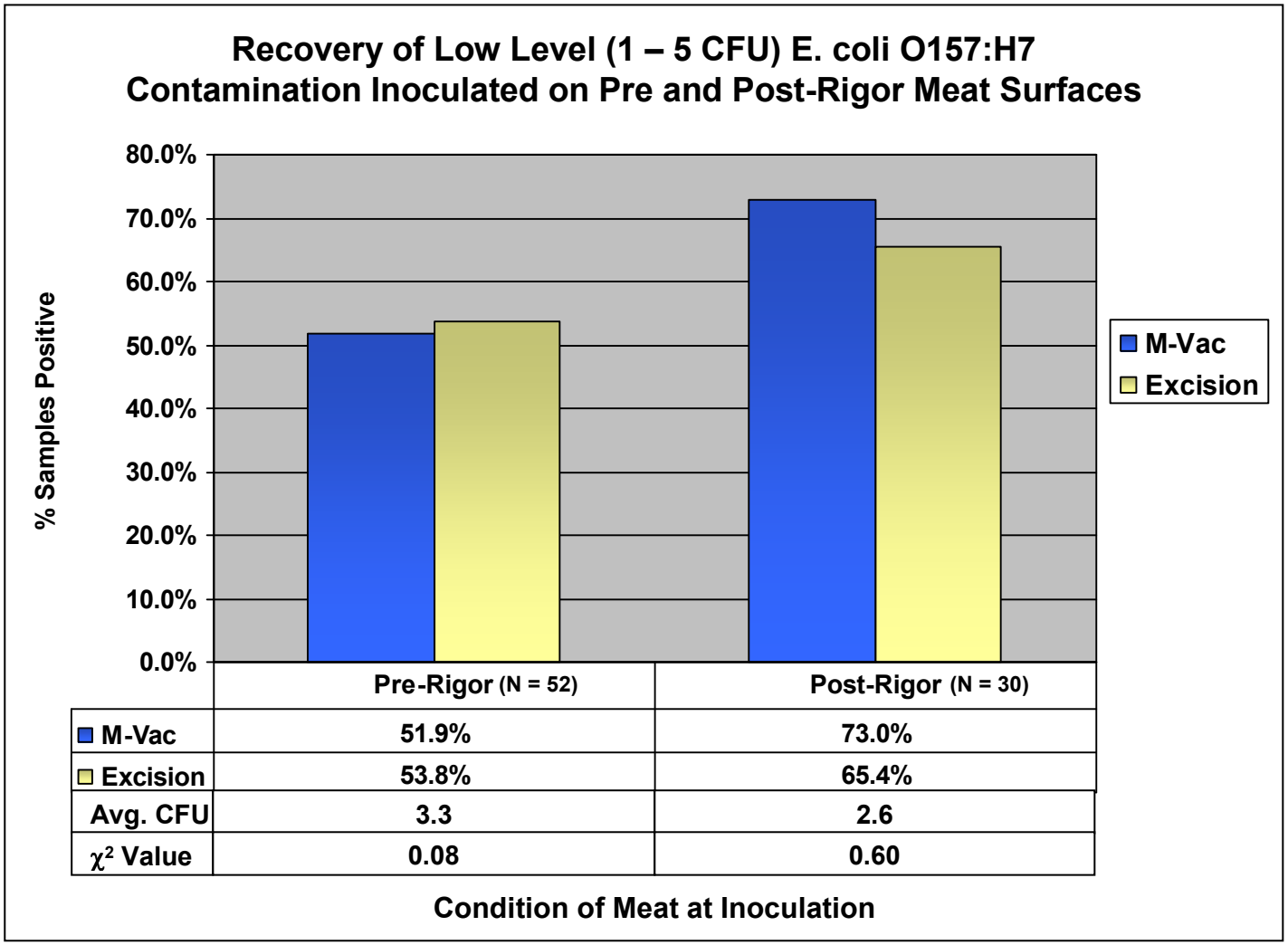
Low Level Contamination Data



No significant differences were observed in either treatment at the 5% probability level. A χ^2 value > 3.84 would have suggested a significant difference at the 5% probability level.

Summary

- The M-Vac technique was equivalent to excision on beef trim in the plant setting
  - Total Aerobic Bacteria
  - Total Coliform
  - Generic *E. coli*
- Low level testing shows M-Vac recovery rates that are not significantly different than excision regardless of the mode of contamination (pre vs. post-rigor)

Conclusions

- The M-Vac produces bacteria recoveries from meat surfaces that are not significantly different than excision
- The M-Vac is a suitable alternative sampling technique to excision for accomplishing N-60 sampling of trim leading to increased labor savings
- Greatly Increased Laboratory Efficiency
  - 92.5% less volume of media required*
  - No need for 2 min hand massage of each sample
  - Less incubator space required
- Non-destructive sampling
- Increased Personnel Safety (no knives, scalpels, etc.)

*Assumes 1.2 L of media for N-60 excision samples and 90 mL of 5X media for M-Vac N-60 samples.

Special Thanks . . .

- University of Tennessee
- USDA Meat Animal Research Center
- Texas A&M
- U.S. Army*
- MSI Lab Staff: Dr. Bruce Bradley, Kevin Church, Kelly Tesar, & Amanda Vos

This material is based upon work supported by the U.S. Army Contracting Agency – Dugway Proving Ground Directorate of Contracting under Contract No. W911S6-06-C-0004. Any opinions, findings and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the U.S. Army Contracting Agency – Dugway Proving Ground Directorate of Contracting.

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