

Outbreak Suggests Seed Disinfection May Reduce the Risk of Sprout-Associated Salmonellosis

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Background

Sprouts (alfalfa, clover, radish, bean) are common vehicles for enteric pathogens. Most outbreaks are due to contaminated seed lots.

Seed lots are typically large ($\geq 18,000$ kg) and often used by numerous growers in widely dispersed locations over many months.

Control efforts have focused on:

- 1) discouraging consumption (unacceptable to some) and 2) attempting to disinfect seeds before germination.

In lab studies, pre-soaking with hypochlorite (e.g., 20,000 ppm $\text{Ca}(\text{OCl})_2$) can reduce *Salmonella* to undetectable levels on artificially inoculated seeds. These data and the continued occurrence of outbreaks led the FDA in 1999 to require seed disinfection by growers.

In early 1999, we investigated an outbreak that offered an opportunity to assess the efficacy of seed disinfection in preventing disease among sprout consumers.

Methods

Salmonella isolates identified by private labs are sent to public health labs for serotyping; this is required in Oregon.

Three *Salmonella* Mbandaka isolates were identified within 1 week in January 1999, suggesting a common-source outbreak (1988-98 mean, 1.5 cases/year).

All Oregon counties, surrounding states, and the CDC were notified immediately. The initially reported cases were confined to Oregon.

Preliminary interviews were conducted by local health department nurses using standardized case investigation forms (see *sample form*). Sprouts—a perennial suspect in geographically dispersed outbreaks of salmonellosis—quickly became a focus of the investigation.

Food histories for the first 10 cases reported in Oregon were compared to age- and phone prefix-matched controls.

Sprouts consumed by cases were traced to their origins.

Environmental investigations were conducted at produce retailers and wholesalers and with sprout growers and seed distributors.

Sprouts and seed samples were collected and cultured for *Salmonella*. *Salmonella* isolates were subtyped by PFGE and micro-restriction fingerprinting.

Results

Initial concerns about sprouts (based on demographics, case distribution, and preliminary food histories) were corroborated by case-control study results. Nine of 10 cases recalled alfalfa sprout consumption vs. 0/20 controls ($p=0.002$). No other plausible common source was identified.

Among cases who consumed sprouts, 8/9 reported definite ($N=5$) or possible ($N=3$) consumption of brand X sprouts (see figure, *Initial Sprout Tracebacks*).

On February 12, press releases were issued, announcing a “voluntary” recall of alfalfa sprouts produced by grower X.

S. Mbandaka was later cultured from alfalfa sprouts and ungerminated seed collected at the brand X facility.

Eventually, outbreak cases were identified in 4 states: Oregon ($N=40$), California ($N=21$), Washington ($N=19$), and Idaho ($N=5$) (see figure, *Epidemic Curve*). Cases in Oregon, Washington, and Idaho were linked to brand X sprouts.

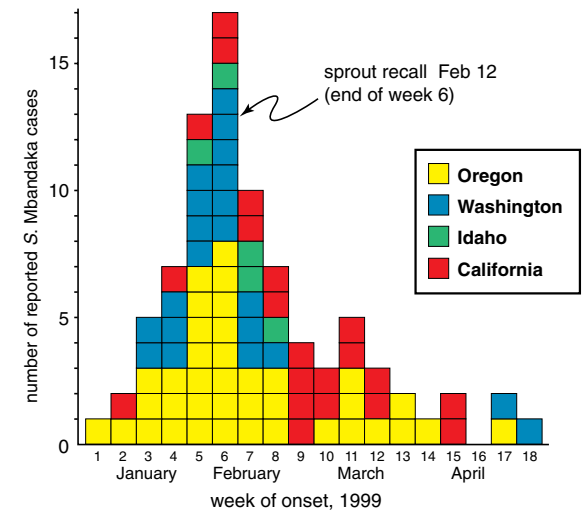
A common outbreak pattern was identified by molecular typing (PFGE and micro-restriction fingerprinting). This pattern differed from those of “sporadic” isolates obtained before the outbreak, which were heterogeneous.

The implicated seed came from an 18,000 kg lot (lot 8119) milled from alfalfa grown in the Imperial Valley of Southern California. Lot 8119 had gone to 4 growers in California, 1 in Florida, and grower X in Washington (see figure, *Seed Distribution*).

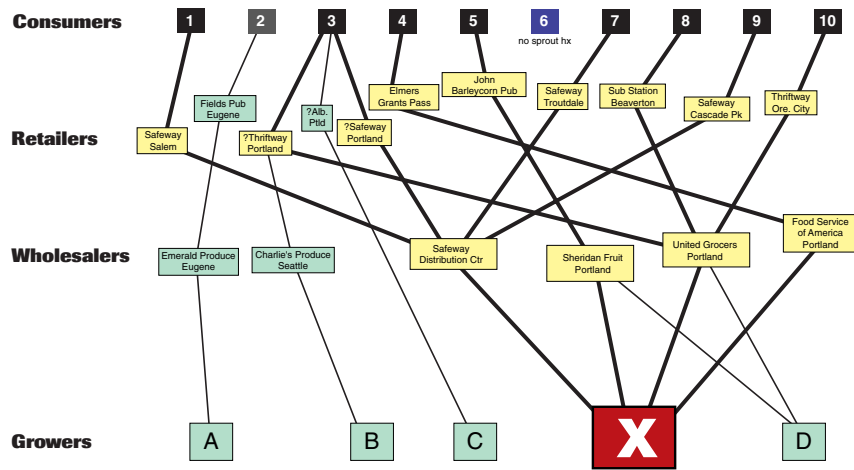
The California cases were linked to grower Y in San Diego.

Although documentation was incomplete, the 3 sprouters that were *not* linked to any cases (and who used ~41% of the seed) reported disinfecting with 20,000 ppm $\text{Ca}(\text{OCl})_2$ or 500 ppm NaOCl.

Epidemic Curve



Initial Sprout Tracebacks, Oregon



Conclusions

This outbreak provided a natural experiment to assess the efficacy of alfalfa seed disinfection in reducing the risk of infection among sprout consumers. Cases were traced only to those growers who did not disinfect seed. Growers who disinfected (even with as little as 500 ppm NaOCl) were not linked to any cases.

There are significant limitations to these data, however, and we cannot conclude that seed disinfection is an effective means of preventing sprout-associated illness.

First, seed disinfection procedures could not be verified at any site. None of the growers maintained production logs or other documentation of disinfection practices.

Second, some of the growers who disinfected used relatively little of the implicated lot.

Third, although *S. Mbandaka* was recovered from almost every sample tested (both from ready-to-eat sprouts and from seed collected from grower X, from grower Y, and from the originating warehouse), the contamination of the seed lot may not have been uniform.

Fourth, post-production handling, either in distribution or by consumers, could have varied the risk to consumers. Publicity, which differed from state to state, may have affected reporting.

Seed disinfection may be better than nothing, but how much better is unclear. Data from other outbreak investigations (e.g., Proctor et al. 2000, slide presentation in session 27, Monday, 1–2:30) indicate that even the FDA-recommended disinfection with 20,000 ppm Ca(OCl)₂ can be inadequate.

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Seed Distribution, Lot 8119

Lot 8119 (18,000 kg) derived from one alfalfa field, grown in the Imperial Valley of Southern California. Only 32% had been distributed by the time of the embargo.



5,850 kg went to 6 growers in 3 states. Of that, ~3,855 kg (66%) was sprouted and sold to consumers.

Grower	CA 1	CA 2	CA 3	FL 4	X (Washington)	Y (California)
Seed Used (kg)	0	45	300	900	860	1750

Although documentation was poor, 3 of the 5 growers allegedly disinfected seed before germination. Cases were linked only to the 2 that did not disinfect, who produced ~59% of the sprouts from this lot.

Disinfection	n.a.	20,000 ppm Ca(OCl) ₂	500 ppm NaOCl ?	20,000 ppm Ca(OCl) ₂	none	none
Linked Cases	none	none	none	none	Oregon Washington Idaho	California