Reading the White Paper: A Modern Guide to USDA Bulletin No. 930

A Companion to Technical Bulletin No. 930 – "Home Canning Processes for Low-Acid Foods" (November 1946)

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This companion guide was created to help readers understand the original USDA-adopted science behind home canning low acid foods Technical Bulletin No. 930, which represents research on thermal processing food for shelf stability. This guide explains the scientific methods used, highlights critical findings, and connects them to modern canning practices used for decades. This guide is not a replacement for the original, but rather, it is an interpretive bridge from 1946 to today.

How It All Started

From the period 1918 to 1921, attention was focused upon numerous outbreaks of botulism caused by commercially canned products. However, outbreaks persisted in home canned foods at the rate of 10 to 12 per year. During this time, home canning processes were generally an arbitrary extension of the commercial processes.

In 1946, four US citizen researchers, Edward Toepfer (Technologist), Howard Reynolds (Bacteriologist), Gladys Gilpin (Food Specialist), and Katherine Taube (Household Equipment Specialist), published Technical Bulletin No. 930. Their work in 1946 laid the foundation for the low-acid foods home canning safety guidelines we use to this day. What makes this white paper extraordinary is its scientific rigor and the clarity with which it explains the thermal behavior of *Clostridium botulinum* spores.

It was summarized in the bulletin's introduction that*, "In spite of the fact that the initial temperatures of the foods canned in these experiments were low and the pressure canner and water were cold at the start, the results indicated that home-canning processes at 240° F. which have been generally recommended for many foods may be more severe than necessary."*

Technical bulletin No. 930 walks readers through the logic of **how and why** home canning safety protocols were developed, not just what to follow. It is both sobering and empowering to see how these standards emerged from real research, not bureaucratic assumption.

It was adopted by the United States Department of Agriculture on December 5, 1946, and published, giving us access to this knowledge, science and math. For access to the entire technical bulletin, click here for a downloadable PDF.

Technical Bulletin No. 930 Highlights

1. Over-Inoculation for Safety Margin (pp. 11-25)

All test foods were deliberately inoculated with large numbers of spores… far exceeding what would be expected in domestic kitchen conditions. Further, the researchers summarized and admit they suspect that the home canning processing times can be lowered when compared to commercial canning processing times.

> *"In addition, the number of spores used for inoculated packs was somewhat in excess of the normally expected natural spore load."*
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> *"The reported data indicate that processes based on inoculated packs with putrefactive anaerobe No. 3679 are more severe than necessary to destroy the natural spore load normally present on vegetables and meats as prepared for home canning. They provide evidence for suspecting that home-canning-process times may be safely based on lower sterilizing values than are considered necessary in commercial canning…Absence of adequate data on normal spore loads and the resistance of spoilage organisms in different food media make it necessary to choose processes which are probably excessive in many instances. Further reductions may be justified when sufficient experimental data are obtained which will define more precisely the heat resistance and slopes of thermal-death-time curves of spoilage organisms in various food media."*

This confirms that the tests were done under worse-case, laboratory-controlled conditions. The resulting process times account for a massive margin of safety and are not reflective of typical home kitchen contamination levels.

2. Heat Resistance vs. Destruction (pp. 1)

Spores are not "alive" in the conventional sense and cannot be "killed", rather, they must be **denatured** through heat and moisture to prevent them from germinating. The white paper discusses how different foods impact the time required to achieve that denaturation.

> *"Adequate processes must be based, then, upon the time- temperature relations necessary for destruction or inactivation of spoilage organisms in various types of products."*

What the bulletin doesn't say, however, is that pressure canning is the only viable solution to properly denature *C. botulinum* spores. Instead, it emphasizes that **lethality is a function of both time and temperature**, not temperature alone.

3. Importance of Natural Cooling (pp. 8)

> *"Experimentally, the curve for short process times shows that the temperature of the food may remain constant for some minutes or increase slightly before cooling."*

This confirms that **residual heat during cool-down is part of the total lethality**. It's not just the minutes at pressure, or the length of time at boiling, it is the full thermal curve.

4. Time/Temperature Flexibility (pp. 5-14)

The authors offer clear examples where longer boiling (at 212°F) compensates for not achieving pressure canner temperatures (240°F). This is critical in supporting the idea that **lethality is a function of total heat exposure**, not temperature alone. The tables and graphs show decimal reduction trends (D-values) that acknowledge temperature-time tradeoffs.

> *"The lethal rates for s=18 are small at Fahrenheit temperatures near 200, but increase rapidly as the temperature approaches 250, as shown by the following tabulation..."*

Their published and adopted research demonstrates how longer times at lower temperatures (such as boiling water at 212°F) can still produce lethal effects, provided the heat penetrates to the geometric center of the jar and processing time is sufficient.

5. Storage Safety Is Vital (PDF pp. 3)

To test the lethality of the canning process, jars were intentionally incubated at 98.6°F (for meat) and 86°F (for vegetables) for at least 4 months, temperatures known to encourage any surviving spores to germinate into active bacteria. This simulated poor storage conditions and was designed to provoke spoilage if the process had been insufficient.

> *"After incubation at 98.6° for at least 4 months, gross spoilage occurred among inoculated quart jars processed 60 minutes, some spoilage from an 80-minute process, and no spoilage from 90- and 100-minute processes."*

Just as important, it demonstrates that if a spore *does* survive processing, it still requires favorable conditions to germinate—namely, warmth, moisture, and lack of oxygen.

That's why cool, dry storage is crucial. To prevent spore germination and toxin production, store your home-canned foods at temperatures between 50–70°F (10–21°C), away from sunlight and humidity. Proper storage is your second layer of protection after safe processing.

Then Versus Now: Addressing the "Outdated" Claim

Many online critics claim the 1946 bulletin is "outdated" and insist there's newer research to prove pressure canning is the only safe method. But the truth is—**the science hasn't changed**:

- Recent peer-reviewed studies on thermal inactivation of non-proteolytic *C. botulinum* spores **confirm** the same principles of time-temperature flexibility.
    - For instance, a 2024 study modeled thermal death times in plant-based foods and found that 185°F (85°C) for ~50 min or 176°F (80°C) for 129–270 min can achieve a 6-log reduction of spores fsis.usda.gov+9en.wikipedia.org+9foodprotection.org+9en.wikipedia.org+15 pmc.ncbi.nlm.nih.gov+15frontiersin.org+15.
    - Another review from 2024 reiterates that heat resistance varies with spore type and food matrix, but moist heat over time remains consistently lethal pmc.ncbi.nlm.nih.gov.
- Organizations like WHO and the USDA FSIS still teach that spores survive boiling but can be inactivated by **sufficient** moist heat or higher heat established using pressure journals.asm.org+15who.int+15pmc.ncbi.nlm.nih.gov+15.

The Bottom Line:

- The 1946 bulletin isn't "antique" – it's the **original empirical research**.
- Modern science continues to **validate its findings**, often expanding upon the same principles rather than disproving them.
- No newer study has shown that only pressure canning works; rather, all legitimate research supports the conclusion that **time + temperature + moisture** are the core pillars of microbial inactivation when preserving low-acid food in glass jars.

A Note From The Canning Diva®

A Personal Reflection on USDA Technical Bulletin No. 930

What I love most about this bulletin is its honesty. It doesn't pander. It doesn't dilute. It speaks with scientific integrity while assuming the reader is capable of comprehension. That alone should give us pause—and hope. These were scientists, not influencers, trusting that truth and transparency would protect families better than fear ever could.

As a modern educator, I strive to do the same.

Many have lost the ability to teach without tearing down. Somewhere between memes and message boards, we stopped reading the actual research and started weaponizing soundbites. I've seen it firsthand: people posting photos of my books in the trash, labeling thoughtful canning discussions as "unsafe," and silencing innovation by removing canners from Facebook groups for daring to ask, *why?*

It's exhausting. And it's unproductive.

Here's the truth: the science of home canning is not a one-note rulebook. It's a synergy. A balanced equation of time, temperature, and acidic value. Each plays a vital role, and when understood together, they form the framework of safety. Add to that proper storage, and you've built a shelf-stable environment grounded in logic, not fear.

This bulletin proves what many of us have known in our gut: that canning is both art and science. That longer boiling times at 212°F can, under the right circumstances, provide the same protection as shorter times at 240°F. That spores don't need to be "killed", they need to be rendered inert. That food safety isn't just about hitting a number; it's about understanding the process.

So, let's stop treating one another like enemies within the canning community.

Whether you're pressure canning venison or boiling carrots in a water bath, we're all here for the same reason: to nourish, preserve, and protect the food we've worked hard to grow, buy, or prepare. Let's make space for honest dialogue, for critical thinking, and for reclaiming the knowledge that was freely given to us in research like this.

Because when we elevate the conversation, everyone gets safer**.**

– Diane Devereaux,
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