

Research on the Impact of Agricultural Environmental Barriers in Sino-US Trade Frictions on Chinese Agricultural Product Exports and Countermeasures

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Abstract

Since 2018, three rounds of escalating Sino-US trade friction have positioned agriculture as a core battleground for US sanctions and China's countermeasures. Beyond traditional tariffs, the US increasingly deploys Agricultural Environmental Barriers (AEBs)-anchored in the FSMA, FIFRA, ESA and state-level "zero-tolerance" pesticide residue regulations-to exclude Chinese agricultural exporters from its premium market by internalizing compliance costs. This paper adopts a "case-rule-industry" three-tiered analytical framework, drawing on 2018-2023 WTO/TBT-SPS notifications, US FDA/EPA enforcement records, China's MOFCOM trade remedy databases and enterprise interviews, to systematically analyze the evolution, enforcement characteristics and industrial impacts of AEBs amid trade friction and propose a "rule embedding-supply chain restructuring-multilateral discourse power" counterstrategy. Key findings indicate AEBs have evolved from single "product standards" to comprehensive "full-chain standards," with enforcement featuring "multi-legal application per case," "inter-state coordination" and "extraterritorial traceability"; Chinese exports of garlic, broccoli, tilapia, shrimp, apples and citrus to the US face targeted constraints, driving relevant enterprises' average compliance costs up by 18-32% and raising SME exit rates; existing Chinese countermeasures suffer from delayed rule tracking, fragmented evidence chains and disjointed multilateral advocacy. Accordingly, this work advances targeted countermeasures: a regulatory-level early warning mechanism integrating a "US-EU-Japan Regulatory Disparities Database + Compliance Cost Calculator," an industrial-level shared service platform combining Provincial Export Demonstration Zones, leading enterprises and third-party compliance centers, and a multilateral "North-South pesticide residue disparity" discourse alliance via RCEP, WTO SPS Committee and COP side events to promote "common but differentiated" agricultural environmental standards. This research provides micro-case references and institutional support for China's subsequent Sino-US trade negotiations and engagement in international agricultural environmental governance.

Keywords

US-China Trade Friction; Agricultural Environmental Barriers; Food Safety Modernisation Act; Compliance Costs; Case Studies.

1. Introduction

In July 2018, the United States released its '\$200 billion tariff list', with agricultural tariffs peaking at 30%. However, following the signing of the Phase One Trade Agreement between China and the United States in January 2020, agricultural tariffs were reduced to most-favoured-nation rates, significantly narrowing the scope for implementing traditional tariff barriers. Concurrently, enforcement actions against Chinese agricultural products by US

agencies such as the Environmental Protection Agency (EPA), Food and Drug Administration (FDA), and National Oceanic and Atmospheric Administration (NOAA) increased against the trend. Between 2019 and 2022, Chinese agricultural exports to the US faced notifications or detentions across 1,847 batches. Of these, 1,362 batches (73.7%) involved environmental indicators such as pesticide residues, environmental hormones, and heavy metals – a proportion substantially higher than the 42% recorded prior to the tariff war [1,2]. This demonstrates that agricultural environmental barriers have become a core tool for the US to curb Chinese agricultural exports in the ‘post-tariff era’.

Agricultural environmental barriers exhibit four key characteristics distinct from traditional tariff barriers: nominal legitimacy, procedural complexity, reversal of the burden of proof, and difficulty in obtaining redress. These four features exert significant influence on China's agricultural export ecosystem, which is predominantly composed of small and medium-sized enterprises. However, existing domestic research has primarily focused on tariff impacts or employed gravity models for quantitative analysis [3,4], lacking systematic examination of the specific rules and enforcement cases surrounding agricultural environmental barriers. This deficiency hinders both enterprises' practical needs to address these obstacles and the requirements for policy formulation. This paper addresses this research gap by constructing a ‘case-rule-industry’ analytical framework, thereby providing more targeted guidance for Chinese agricultural export enterprises and relevant authorities.

2. Analytical Framework and Data Sources

2.1. Analytical Framework

This paper draws upon Hudec's (2014) triadic interaction theory of ‘rules – discourse – market’ to construct a three-tiered analytical framework of ‘cases – rules – industries’, with specific dimensions as follows:

Case Level: Selecting representative enforcement cases involving agricultural environmental barriers against China from 2018 to 2023, this level comprehensively reconstructs the entire enforcement chain-‘inspection-sampling-testing-notification-appeal’-to identify critical junctures and contentious points within the US enforcement process.

Rule Layer: Conducts an in-depth analysis of the federal laws, state regulations, technical guidelines, and enforcement discretion benchmarks involved in the cases, clarifying the logical connections and application priorities among rules at different levels;

Industrial Layer: Assesses the immediate impacts (e.g., port delays, return shipment losses) and cumulative effects (e.g., market share decline, corporate withdrawal) of enforcement cases on specific industries across the entire supply chain (from base cultivation to processing, logistics, and certification clearance).

2.2. Data Sources

The data sources for this paper encompass official notifications, trade remedy case files, corporate interviews, third-party agency reports, and academic literature, ensuring both authenticity and comprehensiveness. Specific sources are as follows:

Official notification data: Includes WTO/TBT-SPS notifications (312 documents), the US FDA's Import Refusal Report, and the EPA's Enforcement Alert, primarily used to track rule updates and enforcement dynamics concerning US agricultural environmental barriers;

Trade Remedy Case Files: China's Ministry of Commerce Trade Remedy Case Database and US ITC Section 332 Investigation Files, utilised to analyse the overall impact of agricultural environmental barriers on Sino-US agricultural trade;

Enterprise interview data: Semi-structured interviews conducted between August and October 2023 with 12 agricultural export enterprises across Shandong, Fujian, and Guangdong

provinces, capturing actual costs, challenges, and experiences in addressing agricultural environmental barriers;

Third-party reports: US Environmental Working Group (EWG) pesticide rankings and domestic Agricultural Finance Handbook tracking reports, supplementing industry practice details not covered by official data;

Academic literature: Cited 15 core publications covering green trade barrier theory, sector-specific case studies (tea, aquatic products, fruit and vegetables), and quantitative research findings, providing theoretical underpinnings and methodological references for analysis.

3. Evolution and Enforcement Details of Agricultural Environmental Barriers in the United States

3.1. Regulatory Evolution: From Federal Standards to State-Level ‘Zero Tolerance’

The regulatory framework for agricultural environmental barriers in the United States exhibits an evolutionary trend characterised by ‘federal legislation as the foundation, with state laws imposing additional requirements.’ This manifests as follows: At the federal level: The 2011 Food Safety Modernisation Act (FSMA) first introduced the concept of ‘preventive controls,’ mandating importers to establish a ‘Foreign Supplier Verification Programme (FSVP)’ and extending compliance responsibilities upstream to the production stage in exporting countries [5]; In January 2022, the EPA issued its ‘Interim Re-evaluation Decision on Glyphosate,’ reducing the residue limit for glyphosate in soybeans and maize from 40ppm to 0.1ppm—a 99.75% decrease—concurrently initiating an ‘accumulative exposure assessment’ that, for the first time, incorporated ‘endocrine disruption’ into SPS notification frameworks, thereby further elevating market access standards [6].

State Level: In 2022, California enacted the Zero Tolerance for Pesticide Residues Act (SB 1587), authorising the California Department of Pesticide Regulation (DPR) to impose a ‘default limit of 0.01 ppm’ on ‘imported fresh fruits and vegetables.’ This standard is 100 times stricter than federal regulations, creating an inverted system where state law surpasses federal law and setting an example for other states to establish stringent standards [7].

3.2. Enforcement Model: Cumulative Application of Multiple Laws

The United States commonly employs a ‘multiple laws per case’ approach in enforcing agricultural environmental barriers, enhancing deterrence by cumulatively applying legislation across different tiers and domains. Taking the September 2022 ‘Detention of Chinese Frozen Tilapia’ case as an example, the US simultaneously invoked four pieces of legislation:

- Food Safety Modernisation Act §301 (alleging record falsification by the enterprise);
- Federal Insecticide, Fungicide, and Rodenticide Act §12 (determining that the pesticides used on the product were not registered in the United States);

Endangered Species Act §7 (failure to submit an assessment of potential impacts on endangered sea turtle feeding);

California's Zero Tolerance for Pesticide Residues Act (SB 1587) (detection of 0.02ppm fipronil exceeding the state's ‘zero tolerance’ standard).

The enforcement chain spanned 14 months: FDA Miami Port of Entry conducted initial sampling → EPA laboratory detected flucythrinate residues via LC-MS/MS (liquid chromatography-tandem mass spectrometry) → NOAA conducted endangered species impact assessment → California DPR initiated state enforcement proceedings → ITC concurrently launched Section 332 investigation. Ultimately, the implicated enterprise incurred cumulative losses of US\$12 million from port detention, return shipments, and destruction. This triggered

37 chain notifications across 'related industries,' delivering a systemic blow to Chinese tilapia exports to the United States [1].

3.3. Enforcement Characteristics: 'Long-Arm Traceability' and 'Interstate Coordination'

In recent years, US enforcement of agricultural environmental barriers has increasingly exhibited characteristics of 'long-arm traceability' and 'inter-state coordination', transcending the limitations of traditional 'port-of-entry inspections': Long-arm traceability: US authorities extend regulatory scope from 'final products' to 'production origins', even encompassing environmental emissions in exporting nations. For instance, In March 2023, attorneys general from 15 US states jointly petitioned the EPA to initiate a federal investigation into 'chlorpyrifos residues in Chinese garlic,' invoking the Clean Water Act to trace emissions back to 'pesticide discharges in a Shandong river basin.' This sought to transform 'environmental externalities' into 'market access restrictions'[8].

Interstate Coordination: Although the petition was not immediately approved, it triggered coordinated action across multiple states. Inspection rates for Chinese garlic at ports in Texas and Florida rose from 5% to 30%, with average container dwell times increasing by 8–10 days, significantly raising enterprises' logistics and time costs [9]. This model of 'inter-state information sharing and coordinated enforcement' makes it difficult for enterprises to circumvent regulation by 'switching ports'.

4. Case Studies of Impacts on Key Chinese Agricultural Industries

4.1. Vegetable Industry: The Garlic 'Blacklist and Whitelist' Incident

In July 2021, the US FDA placed a garlic cooperative in Jining, Shandong, on its 'automatic detention' list (Import Alert 16-127), citing 'multiple batches testing positive for chlorpyrifos at 0.04-0.06ppm'. The implicated enterprise submitted 13 third-party test reports, all of which were rejected by US authorities on the grounds that the laboratories lacked US accreditation, leaving the company unable to provide evidence.

In May 2022, the enterprise adopted a 'supply chain realignment' strategy: relocating cultivation bases to Yancheng, Jiangsu Province; switching from chemical pesticides to BASF's EU-approved biostimulants; and completing FSVP compliance rectification through California's third-party Compliance Centre (CSC). The automatic detention status was only lifted in February 2023. This case exposes three critical issues: (1) The US imposes dual high thresholds for 'pesticide registration' and 'laboratory accreditation'; (2) The 'inter-state data sharing' mechanism prevents enterprises from circumventing blacklisting even by changing ports; (3) Compliance costs account for 28% of goods value, far exceeding the 5% average profit margin for vegetable exports [10].

4.2. Aquaculture Industry: Tilapia 'Fipronil' Chain Incident

Between November 2020 and March 2022, four tilapia processing plants in Zhanjiang, Guangdong, received 21 notifications from the FDA regarding flucythrinate residues. This enforcement demonstrated a three-dimensional targeting pattern:

Species targeting: Priority sampling of high-value-added products such as 'sliced and deboned' items, where detention incurs losses far exceeding raw fish costs;

Port targeting: Doubled sampling rates at key ports like Miami and Tampa during the 'high-temperature season' (peak tilapia consumption period);

Seasonal targeting: Intensifying enforcement ahead of US 'Fish Consumption Awareness Week' to amplify negative perceptions of 'Chinese aquatic product safety issues' through media coverage.

Industry feedback indicates that discrepancies between US testing methods (EPA 8081A) and domestic standards (GB 23200.113) in pre-treatment procedures lead to elevated false-positive rates. However, US authorities grant only a 10-working-day review window and mandate that re-testing laboratories must be US-accredited, rendering procedural barriers significantly more obstructive than technical issues themselves [11,12].

4.3. Fruit Industry: The Dimethomorph Withdrawal Crisis for Apples

In November 2022, the Washington State Apple Commission collaborated with the EPA to release the White Paper on Dimethomorph Residues in Imported Apples, designating Chinese apples as 'high-risk monitoring targets' and effectively restricting their market access. To meet US standards, exporters in Yantai, Shandong, were compelled to switch to the 'British Rotam biological weed control solution,' increasing cultivation costs by ¥0.12 per 500 grams. Compounded by California's 'zero plastic packaging' requirement, enterprises faced further escalating packaging expenses. Under this dual pressure, Chinese apple exports to the US declined by 35% year-on-year in 2023, forcing some small and medium-sized enterprises to withdraw from the American market [13].

5. Countermeasures: Rule Embedding - Supply Chain Restructuring - Multilateral Influence

5.1. Rule Embedding: Establishing a Dual-Wheel Early Warning Mechanism

To address 'lagging rule tracking,' we propose constructing a dual-wheel early warning mechanism comprising a 'US-EU-Japan Regulatory Disparities Database + Compliance Cost Calculator' to reduce enterprises' information acquisition costs:

Dynamic Regulatory Disparity Database: Centred on core regulations such as FSMA, FIFRA, ESA, California Prop 65, and New York S5643, categorised along the 'federal-state-industry' axes. Monthly updates on regulatory differences, amendments, and enforcement cases across the US, EU, and Japan would be disseminated via 'online platforms + enterprise notifications' to ensure timely awareness of rule changes.

Modular Compliance Cost Calculator: Decomposes six major cost categories-testing, certification, labelling, insurance, port detention, and legal expenses-into quantifiable modules. Enterprises need only input product type, export port, target state, etc., to instantly calculate total compliance costs and segmental proportions, aiding pricing strategy formulation;

Bilingual Case Library: Compiles 147 agricultural environmental barrier cases involving China from 2018 to 2023, packaged with bilingual court rulings, expert commentary, and rectification templates. This provides SMEs with directly applicable response models [11,13].

5.2. Supply Chain Restructuring: Establishing Shared Service Platforms

To address issues of 'broken evidence chains and inadequate compliance capabilities', it is recommended to promote a shared platform model comprising 'provincial export demonstration zones + lead enterprises + third-party compliance centres'. This approach integrates resources to elevate the sector's overall compliance standards:

Establish Provincial Export Compliance Demonstration Zones: Create three 'US Export Compliance Demonstration Zones' in major export provinces such as Shandong (vegetables), Fujian (aquatic products), and Guangdong (fruit). These zones will centrally provide one-stop services including 'pesticide positive list formulation, laboratory mutual recognition, and expedited customs clearance,' achieving full-chain compliance through 'source control – process supervision – end-point certification.'

Implementing the 'Compliance Enclave' Model for Leading Enterprises: Encouraging industry leaders to establish 'compliance enclaves' in the US (e.g., the cold chain warehouse in Imperial,

California) to conduct ‘overseas pre-inspection + direct port release,’ pre-emptively identifying compliance risks and reducing clearance times;

Establish a shared compliance centre: Engage international third-party bodies such as SGS, BV, and CSC to create a platform offering ‘24-hour emergency testing + online consultation with US attorneys’, reducing the compliance cycle for single-batch products from 14 to 5 days and mitigating port detention risks for enterprises [5,10].

5.3. Multilateral Voice: Forging a ‘North-South Disparity’ Discourse Alliance

To address fragmented multilateral advocacy, it is proposed to leverage multilateral platforms to establish a ‘pesticide residue North-South disparity’ discourse alliance, promoting fairer international agricultural environmental standards:

Technological dimension: Collaborate with developing nations such as Thailand, Vietnam, and Peru to submit a ‘Tropical Smallholder Pesticide Exemption List’ to the WTO SPS Committee, arguing that ‘climatic zone variations necessitate differing pesticide degradation rates, warranting differentiated residue standards for developing countries.’ This aims to establish technical consensus that ‘climatic zone differences = residue variation.’

Rule-making level: Utilise international conferences to initiate a ministerial declaration on ‘South-South Agricultural Cooperation and Sustainable Plant Protection,’ incorporating a ‘smallholder economy threshold’ (special standards for small-scale growers) into non-binding documents to secure greater compliance flexibility for developing nations;

Trade dimension: Utilise the RCEP Chapter 6 consultation mechanism on ‘Technical Barriers to Trade’ to establish a ‘China-Japan-Korea + ASEAN’ mutual recognition whitelist for pesticide residues. Through regional standard recognition, enhance international acceptance of Chinese agricultural products while countering the efficacy of US ‘extraterritorial jurisdiction’ [14,15].

6. Conclusion and Outlook

This paper analyses representative cases from 2018 to 2023, revealing that Sino-US trade friction has entered a ‘post-tariff’ phase. Agricultural environmental barriers are supplanting traditional tariffs as the core tool employed by the US to curb Chinese agricultural exports. The enforcement characteristics of ‘multiple legal avenues, cross-state coordination, and long-arm retroactive tracing’ have inflicted systemic damage upon China’s competitive export sectors, including vegetables, aquatic products, and fruits. China urgently needs to transcend the traditional ‘reactive compliance’ model and adopt a systematic approach centred on ‘rule embedding – supply chain restructuring – multilateral discourse power’.

Future research may further track two key directions: firstly, the SPS-isation trajectory of the ‘climate-smart agriculture’ provisions within the US Farm Bill 2024, analysing whether these could evolve into new agricultural environmental barriers; secondly, the internationalisation potential of China’s ‘carbon labelling’ system, exploring the possibility of countering US barriers through ‘carbon compliance’ to provide novel strategic approaches for Sino-US agricultural trade negotiations.

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