



Tea Steeped in Toxics

Weak regulations and enforcement result in contaminated imported tea in U.S. market

By Nikita Naik

During the cooler weather months, many will turn to a cup of hot tea as the perfect comfort drink. For the health-conscious, tea increasingly has become the preferred beverage choice because of its many health-protective benefits.

Reason for Concern

Yet, the allowance of hazardous, pesticide import residues – banned, canceled or not registered in the U.S. – raises serious safety questions. One critical concern stems from a U.S. Environmental Protection Agency (EPA) decision in 2013 that allows a banned pesticide in tea imported from China until mid-2016. EPA's decision to provide "additional time to transition to an alternative" to the highly toxic organochlorine insecticide endosulfan¹ puts consumers in harm's way. However, this is only the tip of the iceberg when it comes to hazardous levels of pesticides in tea. Reports from India and China find high levels of banned pesticides and violative residues in tea products, pointing to a lack of enforcement and strong regulations on pesticide use in major tea exporting countries.^{2,3} In the U.S., the Food and Drug Administration (FDA) consistently finds high levels of illegal residues on imported

tea that eventually finds its way to the American consumer. This includes permethrin (a synthetic pyrethroid, linked to cancer and endocrine system disruption), DDE (a metabolite of DDT, banned in the U.S. in 1972), heptachlor epoxide (a derivative of the pesticide heptachlor, which was banned in the U.S. for use in agriculture and as a termiticide due to its carcinogenicity and persistence in the environment),⁴ and acetamiprid (a bee-toxic neonicotinoid).^{5,6} Meanwhile, a 2014 U.S. Government Accountability Office (GAO) report found that FDA now tests less than one-tenth of one percent of all imported foods,⁷ which is especially problematic for tropical products such as tea, since the imported share in the U.S. is nearly 100 percent due to a near absence of domestic production.⁸ These issues underscore a number of lapses in the journey from tea cultivation to importation, increasing consumer exposure to a dangerous blend of pesticides in conventional tea.

Large Market, Widespread Exposure

Tea is the most commonly consumed beverage in the world, second only to water.⁹ True tea, distinct from herbal tea, is sourced from the leaves of a plant known as *Camellia sinensis* and is processed in different ways to produce varieties like white, yellow, green, oolong, and black tea.

Worldwide tea production has increased significantly over the past 10 years, growing from 3.89 million tons in 2006-2008 to 5.06 million tons in 2013, a 30 percent increase.¹⁰ World tea exports, with China, India, Kenya, and Sri Lanka as the major exporters, reached 1.77 million tons in 2013, a five percent increase over 2012.¹¹ World tea consumption continues to surge, with Russia, the United Kingdom, Pakistan, and the U.S. as the leading importers in this market.^{12,13} Tea imports into the U.S. have nearly tripled over the past 15 years alone, according to the U.S. Department of Agriculture (USDA).¹⁴

Degree of Contamination with Pesticide Residues

Over the past few years, numerous reports have been published that point to high levels of toxic and illegal pesticide residues contaminating popular tea brands, underscoring the consequences of weak regulations and lack of proper enforcement in countries like India and China that export a large proportion of tea that ends up in the U.S. The presence of these pesticide residues in tea highlights a litany of problems within the industry, with broad implications for the safety of imported food and the adequacy of U.S. enforcement against hazardous and violative pesticide residues in food.

Regulation of Pesticides in Tea in Exporting Countries

Poor regulations and enforcement in exporting countries can contribute to higher levels of pesticide residues in tea leaves. Developing countries often lack rigorous pesticide laws and training resources for pesticide inspectors and users, and the rapid growth of their agricultural markets outstrip the ability of regulatory and enforcement agencies to keep pesticide use in check.¹⁵ Many developing countries, without internationally sponsored programs, forego or limit such control programs and maintain the use of older, non-patented, cheaper, more toxic, and environmentally persistent chemicals that can be manufactured within the country itself.¹⁶ While many of these chemicals have been banned in “western” countries, they are still freely available elsewhere.¹⁷ For example, in Vietnam, another major exporter, pesticide use

increased from 14,000 tons in 1990 to 50,000 tons in 2008, yet pesticide control laws have not been implemented in a way that reflects this increase, largely due to a lack of resources, and knowledge of the law on the part of regulators, enforcement, and other factors.^{18,19} The lack of strong regulations governing pesticide use in countries like India and China has far reaching implications.

Contamination of Tea from India and China

In 2014, a Greenpeace India investigation, *Trouble Brewing: Pesticide residues in tea samples from India*, found that nearly 94% of the tea samples tested in India contained at least one of 34 different pesticides, while over half contained a toxic cocktail of more than 10 different pesticides.²⁰ The report relied on tests of 49 branded and packaged teas. Eight of the top 11 companies that make up a large part of the tea market in India were represented, including Hindustan Unilever Limited, a subsidiary of the global multinational company Unilever. Popular brands included in the study are Twinings and Lipton.

The residues found include DDT, which has been banned for use in agriculture in India since 1989, and endosulfan, which was banned in India in 2011. Over half of the samples tested contained illegal residues –either those that are not approved for use in tea cultivation or exceed allowed limits.²¹ In addition to registered pesticides that have been long banned from agricultural use in tea cultivation in India (DDT, and triazophos), also found were (i) suspected mutagens and neurotoxicants (monocrotophos), and (ii) insecticides associated with the global decline in bee populations (neonicotinoids like thiacloprid and thiamethoxam). Some of the most frequently detected pesticides include thiamethoxam (78%), cypermethrin (73%), acetamiprid (67%), thiacloprid (67%), DDT (67%), deltamethrin (67%), dicofol (61%), imidacloprid (61%), and monocrotophos (55%).²²

The Greenpeace India report also provides several concrete examples of tea with residues of pesticides that are not registered for use in India. According to the report, 68% of the 34 detected pesticides were not registered at the time of publication for use

Not Just Pesticides – Other Contaminants Found in Tea

Heavy metal contamination in tea leaves has been documented. Lead concentrations in Chinese tea were found in a study with 32% of samples exceeding the national maximum permissible concentration (MPC) of 2.0 mg/kg. An increasing trend in lead concentration on tea leaves was documented from 1989 to 2000. Proximity to highway and surface dust contamination was found to cause these elevated concentrations, as well as uptake of lead in soil by the roots of the tea plant.⁴⁴ Up to 83% of teas have lead levels considered unsafe for consumption during pregnancy and lactation, as well as excessive levels of manganese and aluminum.^{45,46}



Photo by André Karwath via Wikimedia

Disclosure of pesticides found in tea leaves in violative samples – what are they?

Under FDA's Pesticide Monitoring Program (PMP), imported samples, like that of tea, are collected at the point of entry into U.S. commerce. Illegal residues are defined as residues that are found at a level above EPA tolerance or FDA Action Levels (guideline levels for unavoidable residues of canceled pesticides that persist in the environment), or residues at a level of regulatory significance for which EPA has established no tolerance.

An analysis of the most recently published FDA data on residue levels in tea (black, green, and oolong) from 2008 to 2012 reveals a high rate of violations. Out of the 65 samples of tea analyzed over these five years, nearly 30 percent had two or more illegal residues, with one sample from 2012 containing up to 14 violations. Of the 94 violations found in these samples, 76 were listed as “no registration” and 18 as “excess of tolerance.” Many of these violations are for pesticides that are currently used in U.S. agriculture, but lack a tolerance and presumably exposure data for use in tea, such as acetamiprid (a neonicotinoid), or permethrin (a pyrethroid). Other chemicals that were found to be in violation have been long banned from use in the U.S., including DDE (a DDT metabolite), carbendazim (MBC) (not allowed for use in agriculture),⁴⁷ and heptachlor epoxide (a derivative of the pesticide heptachlor, which was banned in the U.S. for use in agriculture and home use due to its carcinogenicity and persistence in the environment).⁴⁸

Violative Pesticides Found in Tea and Their Health Effects

(Source: U.S. Food and Drug Administration, Pesticide Monitoring Program, 2008-2012)

Pesticide	Adverse Health Effects*
3-HYDROXYCARBOFURAN**	Endocrine Disruptor, Reproductive/Developmental Effects, Possible Cholinesterase Inhibitor, Possible Neurotoxicant
ACETAMIPRID	(Insufficient Data)
BIFENTHRIN	Endocrine Disruptor, Neurotoxicant, Possible Reproductive/Developmental Effects
BIPHENYL	Neurotoxicant
BUPROFEZIN	Possible Reproductive/Developmental Effects
CARBENDAZIM (MBC)	Possible Carcinogen, Mutagen, Possible Endocrine Disrupter, Reproductive/Developmental Effects
CHLORPYRIFOS	Possible Endocrine Disrupter, Reproductive/Developmental Effects, Cholinesterase Inhibitor, Neurotoxicant
CYPERMETHRIN	Possible Carcinogen, Possible Mutagen, Possible Reproductive/Developmental Effects
DCPA (CHLORTHAL-DIMETHYL)	Possible Carcinogen, Possible Reproductive/Developmental Effects
DDE, P,P'- (DDT)	Carcinogen, Mutagen, Endocrine Disruptor, Cholinesterase Inhibitor, Possible Neurotoxicant
DICOFOL	Possible Carcinogen, Possible Endocrine Disrupter, Neurotoxicant
DIFENOCONAZOLE	Carcinogen, Possible Reproductive/Developmental Effects
DINOTEFURAN	Possible Reproductive/Developmental Effects
FENHEXAMID	Possible Endocrine Disrupter
FENPROPATHRIN	(Insufficient Data)
FENVALERATE	Endocrine Disrupter, Possible Neurotoxicant
FLONICAMID	Possible Carcinogen, Reproductive/Developmental Effects
FLUCYTHRINATE	Possible Reproductive/Developmental Effects, Neurotoxicant
FLUDIOXONIL	Possible Carcinogen, Possible Reproductive/Developmental Effects
FLUFENOXURON	Possible Carcinogen, Endocrine Disrupter, Possible Reproductive/Developmental Effects
HEPTACHLOR EPOXIDE (HEPTACHLOR)	Carcinogen, Possible Endocrine Disrupter, Reproductive/Developmental Effects, Neurotoxicant
IMIDACLOPRID	Mutagen, Possible Reproductive/Developmental Effects, Possible Neurotoxicant
LAMBDA-CYHALOTHRIN	Possible Reproductive/Developmental Effects, Possible Neurotoxicant
OMETHOATE	Cholinesterase Inhibitor, Neurotoxicant
PERMETHRIN	Possible Carcinogen, Endocrine Disrupter, Reproductive/Developmental Effects, Possible Cholinesterase Inhibitor, Neurotoxicant
PHOXIM	Cholinesterase Inhibitor, Neurotoxicant
RESMETHRIN	Possible Carcinogen, Endocrine Disrupter, Reproductive/Developmental Effects, Neurotoxicant
TEBUCONAZOLE	Possible Carcinogen, Reproductive/Developmental Effects
TRIAZOPHOS	Cholinesterase Inhibitor, Neurotoxicant

*These pesticides focus solely on those in violation of U.S. law, and thus represent only a small percentage of all pesticides found in U.S. tea imports, which result in human exposure.

** Health effects of parent chemical carbofuran

on tea by the CIBRC (Central Insecticides Board and Registration Committee), although some appeared on lists of pesticides recommended for use on tea at the state level, indicating inconsistencies in regulations or recommendations at the regional and national levels. Of the neonicotinoid insecticides detected in the samples, only thiacloprid and thiamethoxam are registered for use on tea production in India.²³ Two neonicotinoids, acetamiprid and imidacloprid, not approved for use in tea cultivation, are among the most commonly found residues in the report. Other illegal pesticide residues detected include the insecticide tebufenpyrad, a pyrazole miticide/insecticide, which is not registered for use in India.²⁴ Endosulfan was found in about 8% of tea samples in the Greenpeace India investigation, despite being banned for production, use, and sale throughout India following a 2011 Supreme Court decision, although the chemical is still registered for use by CIBRC.

Other unapproved pesticides found in the report include monocrotophos, classified by the World Health Organization (WHO) as a Class Ib (highly hazardous) pesticide that has not been registered for use in tea production at the government level due to its WHO designation. Methamidophos, found in two samples, is another WHO Class Ib pesticide and is not registered in India for any use; its parent compound,

acephate, is not approved for use on tea crops, either.²⁵ Triazophos is also a WHO Class Ib pesticide that is not approved for use on tea in India, although it is registered.²⁶

Rampant contamination of tea leaves with pesticides has also been found in China. In April 2012, Greenpeace China released a report, *Pesticides: Hidden Ingredients in Chinese Tea*, which found evidence of pesticide residues in popular tea brands. The report found that all of the 18 samples tested had traces of at least three different pesticides.²⁷ In total, 29 different pesticides were detected, including reproductive and developmental toxicants (carbendazim, benomyl, myclobutanil, and flusilazole) and bee-killing chemicals (imidacloprid and acetamiprid).²⁸ Twelve of the samples had traces of pesticides banned for use on tea by China's Ministry of Agriculture (including methomyl and fenvalerate).²⁹ Six samples contained a mix of over 10 pesticides, with one sample containing up to 17 different pesticides.³⁰

U.S. Regulations of Tea Imports: High Violations and Little Monitoring

With the exception of meat, poultry, and certain egg products, for which USDA is responsible, FDA is charged with enforcing EPA toler-

Import Tolerances on Tea –A Closer Look at Endosulfan

According to EPA, when no U.S. registration for a pesticide exists for a specific commodity, interested persons may submit a petition requesting that EPA establish an import tolerance (or tolerance exemption) for a pesticide residue on a food or feed commodity, which will allow the food or feed treated with the pesticide in foreign countries to be lawfully imported into the U.S.⁴⁹ The term "import tolerance" is used as a convenience to refer to a tolerance that exists in the U.S. for which there is no accompanying U.S. registration, but that meets U.S. food safety standards.⁵⁰ According to the Global Maximum Residue Limits Database and the Code of Federal Regulations, tea leaves are shown to have 21 pesticide tolerances, of which 11 are import tolerances.^{51,52} This is not surprising for a commodity like tea, which is largely imported due to lack of domestic commercial output, but allows for a way in which consumers can be exposed to pesticides that are otherwise not allowed for use in the U.S. Although requesting an import tolerance requires data on product chemistry, residue chemistry, and toxicology so that EPA can assess potential dietary risk and make the required acceptable risk finding, the agency does not require data on worker exposure, residential exposure, or environmental fate and effects, which are required if the pesticide were registered for use in the U.S.⁵³

In 2010, EPA proposed to phase out all tolerances for endosulfan during the period 2012 to 2016 based on use, as it "can pose unacceptable neurological and reproductive risks to farmworkers and wildlife and can persist in the environment."⁵⁴ However, in 2013, EPA allowed residues of the cancer-causing insecticide endosulfan on imported Chinese teas until July 31, 2016, in order to provide "additional time to transition to an alternative to endosulfan" and raising serious concerns of further exposure to the toxic carcinogen for farmworkers and consumers.⁵⁵ The agency proposed a transition time that would allow growers time to adopt alternatives, with the last four uses ending on July 31, 2016.⁵⁶ For tea, EPA proposed an immediate revocation, since there is little, if any, endosulfan used in tea production in the U.S.⁵⁷ However, the Chamber of Commerce of the Zhejiang International Tea Industry filed a complaint indicating that it would need five years or less to find feasible alternatives to endosulfan.⁵⁸ It also indicated that it was unable to provide comment on the tolerance revocation ruling since EPA did not provide proper notice to the World Trade Organization.⁵⁹ In acknowledging this oversight, EPA now allows endosulfan residues of 24 parts per million (ppm) in imported Chinese tea until July 31, 2016.⁶⁰ Despite the risks posed by endosulfan residues, EPA sees the decision as "appropriate," raising questions of whether EPA is putting economic interests ahead of public health.⁶¹

A Closer Look into Current Efforts in Tea Sustainability: Rainforest Alliance Certification

The Rainforest Alliance Certified™ (RAC) seal, a little green frog, is found on tea and other products around the world and asserts a certain level of sustainability that aims to protect workers and their families, as well as wildlife and habitat. It does not meet organic standards in prohibiting all hazardous pesticide uses. As of 2012, Rainforest Alliance outpaced organic and Fairtrade certification in countries like Kenya and India (unlike China, in which most of the compliant production was organic certified).⁶² RAC standards are set by a coalition of non-profit conservation organizations all over the world, known as the Sustainable Agriculture Network (SAN).

RAC's Sustainable Agriculture Standard includes pesticide use criteria.⁶³ The standards address worker safety through measures such as education of pesticide labels, storage, protective equipment, and restricted entry intervals. If a consumer is looking to avoid exposure to pesticides in their tea, however, RAC does not ensure that a labeled product is free of residues. Unlike organic agriculture, which adheres to a default prohibition of synthetic fertilizers and pesticides, which are subject to the National List of Allowed and Prohibited Substances review, SAN's standards allow for the use of some agrochemicals that fall outside the approved organic list.

Certain toxic pesticides are prohibited from use under RAC's "critical criteria," including:

- Substances – biological, organic, or agrochemical – that are not legally registered for use in the country.
- Agrochemicals on the List of Banned or Severely Restricted Pesticides in the U.S. by EPA or banned or severely restricted in the European Union.
- Substances banned globally under the Stockholm Convention on Persistent Organic Pollutants (POPs).
- Substances listed in Annex III of the Rotterdam Convention on Prior Informed Consent (PIC).
- All Pesticide Action Network Dirty Dozen substances.

The farm may have a plan for eliminating the use of World Health Organization (WHO) Class Ia (Extremely Hazardous) and Ib (Highly Hazardous) technical grade active ingredients of pesticides and for "reducing the use" of WHO Class II (Moderately Hazardous) technical grade active ingredients. (The farm may choose not to incorporate this criterion as part of RAC's 80% compliance requirement for "applicable criteria.") Farms that comply with this criterion must demonstrate that there are no viable alternatives that exist for a type of pest or infestation, the pest or infestation has or would have resulted in significant economic damage, and measures must be taken to substitute these WHO Class Ia, Ib, and II technical grade active ingredients of pesticides. Additionally, farms must "take steps to avoid introducing, cultivating, or processing" transgenic crops.⁶⁴



ances for imported foods (as well as domestically produced foods shipped in interstate commerce). Due to resource constraints and the sheer volume of U.S. imports, FDA is unable to inspect and test for pesticide residues on all imported foods, using certain tools to allow for a more targeted approach. These tools include an automated screening system called PREDICT (Predictive Risk-based Evaluation for Dynamic Import Compliance Targeting), which utilizes data such as inherent product risk ratings and results of facility inspections to assign a risk score that informs the agency whether a physical examination of the product is warranted.^{31,32,33} FDA may issue import alerts, which can result in "detention without physical examination" (DWPE) and refusal of subsequent shipments from the importer.³⁴

According to reports from FDA's Pesticide Monitoring Program (PMP), which analyzes and reports on pesticide residue levels in imported and domestic food, tea has been listed multiple times over the past five years as an import commodity that "may warrant special attention," a designation that is triggered for commodities with (i) at least 20 samples analyzed or with a minimum of three violations, and (ii) a violation rate of 10 percent or higher.

Over these five years, tea appeared on this list in 2008 with a 23% violation rate,³⁵ and again in 2011 with a 26.7% violation rate.³⁶ In FDA's most recent report for 2012, oolong tea was found to have a 100% violation rate, and an overall 50% violation rate for all tea samples analyzed.³⁷ While the sample sizes in FDA's analyses are small, they highlight a persistent problem regarding tea imports – imported tea samples contain pesticide residue higher than established tolerances or for which no tolerance has been established, putting American consumers at risk.

There is evidence that FDA's approach to monitoring imported food is insufficient. A 2014 GAO Report, *Food Safety: FDA and USDA Should Strengthen Pesticide Residue Monitoring Programs and Further Disclose Monitoring Limitations*, criticizes FDA for not testing for several commonly used pesticides with established tolerance levels, such as the herbicides glyphosate and 2,4-D, as well as not using statistically valid methods consistent with the Office of Management and Budget (OMB) to collect information on incidence and level of pesticide residues. In 1993, FDA analyzed over 12,000 domestic and imported food samples for pesticide residues, but this number was reduced to a low

of 5,000 in 2008. The report states that FDA now tests less than one-tenth of one percent of all imported fruits and vegetables, equating to about one test out of every 2,100 entry lines.³⁸ This has major implications for tea because it is primarily imported into the U.S. A 1987 GAO report, *Federal Regulation of Pesticide Residues in Food*, points to a historic inadequacy in FDA's approach to monitoring imported food, singling out the agency's inability to prevent adulterated foods from reaching the marketplace.³⁹

The results of FDA's PMP, and the agency's conclusion that pesticide residue levels are "generally in compliance" with EPA's permitted uses and tolerances, are not derived from comprehensive evidence and statistically valid methods. The inadequacies suggest that these violation rates could be severely underreported and highlight major shortcomings in FDA's approach to the monitoring of pesticides on imported produce.

A 2010 report from the National Academies of Sciences, titled *Enhancing Food Safety: The Role of the Food and Drug Administration*, highlights limitations in FDA's domestic and imported food programs. For example, foreign producers may have trouble understanding or even accessing FDA requirements or may be unable to access EPA-approved pesticides. Additionally, when FDA takes action on import shipments, communication of the action may not occur within the country or to other countries.

The international bodies seeking harmonization of standards for pesticide residues are not working to ensure adequate protection of consumers and farmworkers. Standards, such as those in the European Union (EU), have allowable levels that are often lower than many countries, including the Codex Alimentarius (created by the Food and Agriculture Organization [FAO] and the World Health Organization of the United Nations to develop harmonized

international food standards).⁴⁰ The reduction of pesticide use should be accomplished on both sides of the import/export equation. Importing countries like the U.S. and EU, must continue to monitor imports and reduce Maximum Residue Limits (MRL) and tolerance levels for hazardous pesticides. Exporting countries like China and India can maintain their economic edge in the tea industry by implementing stronger regulations and enforcement of pesticide use and by bolstering their organic tea output.⁴¹



Photo by Haneburger via Wikimedia.

Other efforts to increase sustainability include standards developed by organizations including Fairtrade International, IFOAM Organic International (formerly International Federation of Organic Agriculture Movements), and Rainforest Alliance (see box), the Ethical Tea Partnership (ETP), and UTZ Certified, which together have certified or verified 12 percent of global tea production as of 2011/2012.⁴² According to the International Institute for Sustainable Development, one-third of production is subject to voluntary sustainability standards on the international market (or 4% of global tea production and 9% of exports).⁴³

Conclusion

The presence of pesticide residues in tea leaves may undermine the popular beverage's status as a health tonic. The U.S. primarily imports its tea from China, India, and Sri Lanka, where regulations on pesticide use, worker protection, and environmental contamination oftentimes do not measure up to U.S. and international standards. Additionally, FDA's failure to properly monitor imports, including that of tea, means that certain illegal pesticides are ending up in the food supply of U.S. consumers. Given these problems, consumers should choose products certified and labeled organic, which prohibits the pesticides that are found in residue surveys and verifies that growers are in compliance with organic systems management plans and allowed substances.

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