This report will answer the following question:

What are known negative effects to humans (if any) when pesticides and fertilizers are used for tea?

I discuss fertilizers and pesticides separately and then discuss both in relation to tea farmers.

Fertilizers

Fertilizers play an important role in the cultivation of tea as they are highly-nutrient intensive. Tea plants are often picked for young leaves and shoots and constant harvesting of young leaves can deplete soil nutrients. Tea plantations have been adopting the use of chemical fertilizers, especially nitrogen fertilizers as results support that it can be effective in yield and quality production (Han et al., 2008; Kang et al., 2019). The use of fertilizers to increase yield production is reasonable to meet global demands for tea as natural gardens do not produce high yields. However, excessive fertilization can lead to environmental problems such as land degradation, soil acidification, and greenhouse gas emissions (see Kang et al., 2019). In fact, an overview of tea gardens in China found that overuse of chemical fertilizers was a common problem with over 30% of tea plantations suffering from excessive use (Kang et al., 2019).

To my knowledge, no research can be found on the effects of fertilizers in relation to human health. Most research focuses on the effects of fertilizer on the environment, crop yield, and quality of the tea (Kang et al., 2019; Raza et al., 2025). In this case, fertilizer use is likely to have an indirect effect towards human health as existing research supports that overuse of poor management can affect the production of tea (Kang et al., 2019; Raza et al., 2025).

Pesticides

Pesticides are often used to control for insects and pests, but pesticides usage can introduce toxicity and pollutants into the environment. Food safety standards have set maximum residue limits (MRLs) regarding the maximum amount of pesticide residues for various crops. MRLs are the maximum concentration of a pesticide residue expressed in milligrams per kilo (mg/kg) (FAO and WHO, 2025, p. 19). Countries and organizations can have different standards for what MRL values are considered acceptable.

In the case of tea, pesticides can be problematic without proper care. Unlike other fresh leaves, tea leaves are not typically washed of chemicals as tea leaves are manufactured directly after harvest (Fernandes et al., 2023). Pesticide

residues can be left on tea leaves over time as certain types teas are valued for their aging process.

The research on the effects of pesticide residue on human health is mixed. Some research suggests that the risk of pesticide residues to human health are negligible (Feng et al., 2022; Yang et al., 2020). However, others call for more careful research of using pesticides in tea (Lu et al., 2020; Fernandes et al., 2023). Taiwanese researchers have found that pesticide residues from triazophos, carbofuran, and endosulfan pose significant risk to human health as these pesticides are known to be highly toxic and soluble (Lu et al., 2020). A review of existing papers found that the among the different types of Chinese teas, scented tea had the most heavy metal contamination that exceeded safety standards (Hu et al., 2023). Scented teas are often sprayed with chemical pesticides which explain the high amounts of heavy metals present in detection (Hu et al., 2023). In addition, the types and concentrations of pesticide use can vary which call for more studies regarding long term effects (Fernandes et al., 2023).

Tea Farmers and Fertilizer/Pesticide Use

In general, tea farmers may opt to avoid using pesticides and fertilizers.[1] In Kūnmíng, informants state that tea forests tend to grow well without the use of fertilizers and pesticides (Ma, 2018). In J◎ngmài, farmers report that they do not use fertilizers and pesticides as part of their management system (Li et al., 2023). In Fènghuáng, some farmers opt to use natural methods for deterring insects and producing their own fertilizers (Lin et al., 2022). The skepticism of using commercial pesticides and fertilizers is because of concerns that using chemicals will damage the biotic and abiotic parts of the ecosystem that are beneficial for the growth and quality of tea (Lin et al., 2022). As one farmer states:

> "*I do not use those market-bought fertilizers because I am not sure what has been added to them. I compost and fertilize with soybean residue and the tea trees grow very well*." (page 11, Lin et al., 2022)

Informants and farmers claim that using pesticides and fertilizers can have negative affects on the ecological system (Lin et al., 2022; Ma, 2018). In extreme cases, the abuse of chemical fertilizers and pesticides have lead to the death of tea

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[1] One consideration is the use of pesticides from the perspective of the tea industry. Generally, discussion of pesticides are often considered taboo. The reason is because admitting pesticide use can lead to negative stigmas of not buying your tea. The more pressing concern is farmers using pesticides and the lack of personal protective equipment (PPE). Will from Farmerleaf provides a thoughtful discussion here: https://www.youtube.com/watch?v=DNWZJTOBeDc

tress in Fènghuáng (Lin et al., 2022). Evidence from tea plantations support that intensive management can lead to crops being more susceptible to pests and diseases, which in turn can ultimately harm the environment and human health (Yan et al., 2020).

Pesticides and fertilizers are often used in modern farming conventions and some evidence suggests these applications can affect the quality of tea. One recent paper examined the quality of five varieties of oolong tea under two different management systems (He et al., 2024). The first management system was an artificial tea garden that was naturally grown for 35 years without any artificial management, deep soil ploughing, or use of pesticides and fertilizers. The second was a conventional management system that involved cutting plantings, pruning management, conventional herbicide weeding, conventional pesticide use, and standard deep ploughing. They found that oolong varieties produced through conventional management system had higher aesthetic appeal and higher catechines compared to naturally grown varieties. However, naturally grown varieties were found to have better taste and aroma compared to varieties that were conventionally managed.

Conclusion

Both fertilizers and pesticides are important in manging tea production as they have effects in the growth of tea and deterring unwanted pests. Fertilizers are not known to have negative effects on health health, and some evidence suggest that the effect of pesticide residue on human health is negligible. However, research has called for further investigation into investigated certain types of pesticides and long-term effects. Moreover, the overuse of fertilizers and pesticides can have negative effects on the surrounding ecosystem which thereby affect the quality of the tea.

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