



TECHNICAL NOTE

Use of Humic Acid in Tea Production: Effects on Soil pH, Aluminum Toxicity and Tea Productivity

Prepared by Ken & Tech Limited

Introduction

Tea (*Camellia sinensis*) is unique among commercial crops because it thrives under acidic soil conditions. The optimum soil pH for tea production is generally considered to be between **4.5 and 5.5**. Maintaining this pH range is essential for root development, nutrient availability and long-term productivity.

As a result, tea producers are often concerned that the use of humic acid products may raise soil pH above the optimum range. Based on current scientific evidence, this concern appears to be largely unfounded.

Does Humic Acid Increase Soil pH Excessively?

Humic acid products typically have a pH between 5.5 and 7.0. However, the pH of the product itself is not the same as its effect on soil pH.

Scientific studies have demonstrated that humic acid generally acts as a **soil buffer**, causing only minor changes in soil pH rather than shifting acidic soils to neutral conditions. In tea plantations, humic acid applications have resulted in either:

- Small increases in soil pH (typically 0.1–0.3 pH units), or
- No statistically significant change in soil pH.

For example, research conducted in Chinese tea plantations reported an increase in soil pH from approximately **5.05 to 5.20** following humic acid application, while improving tea yield and quality.

Another study on humic acid-based fertilizers in tea concluded that soil pH did not change significantly following fertilizer application.

Therefore, it is highly unlikely that normal application rates of humic acid products would increase a tea soil from pH 4.5–5.0 to pH 6.5.



Reduction of Aluminum Toxicity

Many tea-growing soils in Kenya are strongly acidic and contain elevated levels of soluble aluminum (Al^{3+}).

Although tea is relatively tolerant to acidic soils, excessive aluminum can still:

- Restrict root development.
- Reduce nutrient uptake.
- Lower phosphorus availability.
- Decrease overall plant vigor and productivity.

Numerous studies have demonstrated that humic substances bind soluble aluminum ions and reduce their toxicity.

Research has shown that humic acid can:

- Complex and immobilize Al^{3+} ions.
- Reduce aluminum uptake by plant roots.
- Promote root growth even under acidic conditions.

This mechanism is particularly important in tea production because it allows plants to benefit from acidic soils while minimizing the harmful effects of excessive soluble aluminum.

Benefits of Humic Acid in Tea Production

Published research has reported several positive effects of humic acid applications in tea plantations, including:

Improved Root Development

Humic substances stimulate root growth and increase root biomass, allowing more efficient uptake of nutrients and water.

Improved Nutrient Utilization

Humic acid increases nutrient availability and nutrient use efficiency, particularly for phosphorus and micronutrients.

Increased Soil Buffer Capacity

Humic substances improve soil buffering and stabilize soil chemical conditions, reducing the impact of soil acidification.



Enhanced Soil Organic Matter

Long-term tea productivity is strongly associated with maintaining soil organic carbon and soil quality. Organic amendments and humic substances contribute positively to these parameters.

Improved Yield and Tea Quality

Several studies have reported improvements in both tea yield and tea quality following applications of humic acid fertilizers.

Practical Implications for Tea Growers

Based on available scientific evidence, the use of humic acid products such as Maxyield at recommended rates:

- ✓ Does **not** raise soil pH to undesirable levels.
 - ✓ May slightly increase pH in extremely acidic soils, thereby reducing aluminum toxicity.
 - ✓ Improves root development and nutrient uptake.
 - ✓ Enhances soil health and biological activity.
 - ✓ Supports long-term tea productivity and sustainability.
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Recommendation

Because tea-growing conditions vary between regions and soil types, local validation trials are recommended.

Ken & Tech recommends monitoring:

- Soil pH
- Exchangeable aluminum
- Root development
- Leaf nutrient status
- Yield and quality parameters

over several production cycles to quantify the benefits under local conditions.



Selected References

Effects of Applying Humic Fertilizers on Tea's Yield, Nutritional Quality and Soil Fertility in a Tea Garden

https://www.researchgate.net/publication/301747387_Effects_of_Applying_Humic_Fertilizers_on_Tea%27s_Yield_Nutritional_Quality_and_Soil_Fertility_in_a_Tea_Garden

Humic Acid-Based Tea Specific Organic Fertilizer

<https://www.bdbotsociety.org/public/article/2019%20September%20%28Special%29/17.pdf.pdf>

Effects of Humic Acid on Root Development and Nutrient Uptake Under Aluminum Toxicity

https://www.researchgate.net/publication/273116014_Effects_of_Humic_Acid_on_Root_Development_and_Nutrient_Uptake_of_Vicia_faba_L_Broad_Bean_Seedlings_Grown_under_Aluminum_Toxicity

Aluminum Detoxification by Humic Substance Extracted from Peat Soil

<https://journal.unila.ac.id/index.php/tropicalsoil/article/download/23/452>

Application Effects of Humic Acid Fertilizer on Tea

<https://www.xsyagri.com/?p=22>

Aluminum in Plants: Benefits, Toxicity and Tolerance Mechanisms

<https://pmc.ncbi.nlm.nih.gov/articles/PMC9880555/>

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