

# Comparison of Organic Liquid Fertilizer and Urea Liquid Fertilizer Utilization for Grade Improvement of Tea Seedling

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**Abstract.** Tea productivity should be supported by growth material quality, particularly tea seedling. The ready-planted tea seedling was often insufficient due to the minimum requirement are not met, therefore the stimulating agents were needed to increase the maturity of the tea seedling. This research investigates the effect of organic liquid and urea liquid fertilizer application on the growth-promoting of tea seedling. The experiment was conducted at a tea nursery and grade C of GMB 7 tea seeds were selected. Randomized Block Design was done by five treatments (tap water, 1% Urea Liquid Fertilizer, 2% Urea Liquid Fertilizer, 0,5% Organic Liquid Fertilizer, 1% Organic Liquid Fertilizer) and 5 replications, the application of treatments once every two weeks. The observed parameters were seed height, the number of leaf, shoot root dry weight, and the S/R ratio. Application of organic liquid fertilizer showed up to 56% improvement compared to all applications of urea liquid fertilizer but not significantly different compared to tap water application on seed height and number of a leaf. Application of urea liquid fertilizer causes leaf-burnt to plant tissue that subsequently inhibits the growth of tea seedling. However, organic and urea liquid fertilization was not sufficient to upgrade the seed to a ready-planted seed (grade A).

## 1. Introduction

Tea is a prospective functional food commodity to be developed into various products in Indonesia, covering an estate area of 104 thousand ha and nearly 80% of which are spread across West Java [1]. Tea production is influenced by several internal factors, including the capital, raw materials, and labor. The research conducted by [2] regarding the analysis of factors that influence tea production success in the Bah Butong estate, PTPN IV North Sumatra, shows that raw material is the most influential tea production factor with a regression coefficient of 0.956. Tea seedling is the primary raw material in the cultivation of tea plants, which dramatically impacts productivity when the plant has entered its maturity period.

Optimization of tea seedling was needed to achieve the demand with good quality seeds. Tea revitalization with good clonal quality is necessary, considering that there are still many tea plantations based on seed origin in Indonesia, especially in West Java, with a percentage of around 23.5% [3]. The effort to increase the production of fast maturity and quality tea seeds and reduce the mortality rate below 20% should be encouraged. The criteria of good quality seedlings have 30 cm of height, at least five leaves, a healthy appearance, and the presence of young taproots [4].

Optimizing tea seedling should be supported by nutrient supply as a growth promoter. Fertilization could be done in two ways, soil application (soil dressing) and leaves application (foliar fertilizer).

Foliar fertilizer application is currently starting to be popular due to its relatively easy application. Also, the root of tea seedling that was not yet fully grown could be stimulated by foliar fertilization. In general, foliar fertilization could accelerate the absorption of nutrients by plants, especially micronutrients [5]. Considering the properties of foliar fertilizers that are easily absorbed by plants, it often has negative consequences when the dosage, frequency, and nutrients form are not applied correctly. Excessive concentrations of foliar fertilizers, especially inorganic form, could trigger plant toxicity marked by necrosis or damage to plant tissue [6].

Biofertilizers and organic fertilizers were known able to restore soil and plant health [7]. Furthermore, the application of organic or bio-based fertilizers positively impacts increasing plant antioxidant metabolites [8]. Biofertilizer and organic fertilizers are usually used as a nutritional supplement due to the low of nutrients in these fertilizers and the rate of mineralization was not as fast as inorganic fertilizers [9]. Therefore, this study aimed to determine the effect between the foliar application of inorganic liquid fertilizer made from urea and liquid organic fertilizer on the growth of grade C tea seedlings.

## 2. Materials and methods

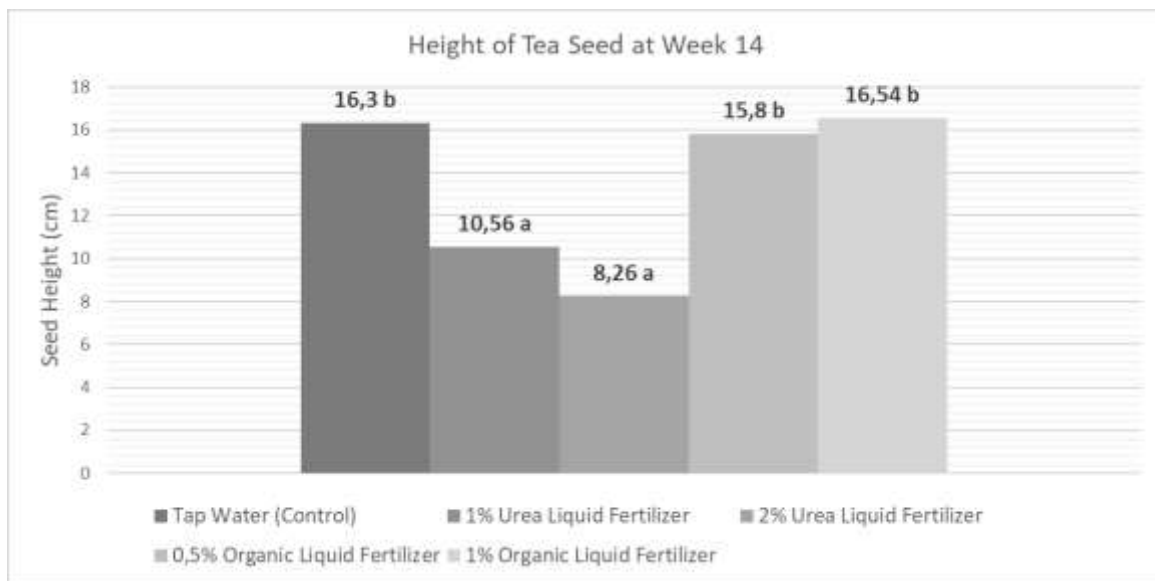
The research was carried out from March 2020 to July 2020 in the screen house, the Laboratory of Soil and Plant Nutrition, Research Institute of Tea and Cinchona. Experiments were carried out by comparing the effect of the application of organic liquid fertilizers and inorganic fertilizers on grade C tea seedling. Randomized Block Design (RBD) was done consisting of five treatments (tap water, 1% Urea Liquid Fertilizer, 2% Urea Liquid Fertilizer, 0,5% Organic Liquid Fertilizer, 1% Organic Liquid Fertilizer) and five repetitions of each treatment.

The grade C and five months old of tea seedling were selected with a height seed between 10-11 cm. The foliar treatment method was carried out by spraying fertilizer that has been dissolved in tap water onto the leaf organs of the seedlings. The treatments' application and observation were carried out every two weeks with the duration of the experiment for 14 weeks (3.5 months). The growth parameter was observed, consist of height and number of seedling leaves, root volume, and shoot root ratio (S/R). Observation data were performed on the Anova to see the effect on response and the Duncan Multiple Range Test (DMRT) test to see each measurement's significance at the 95% confidence level with the support of SPSS version 21 software.

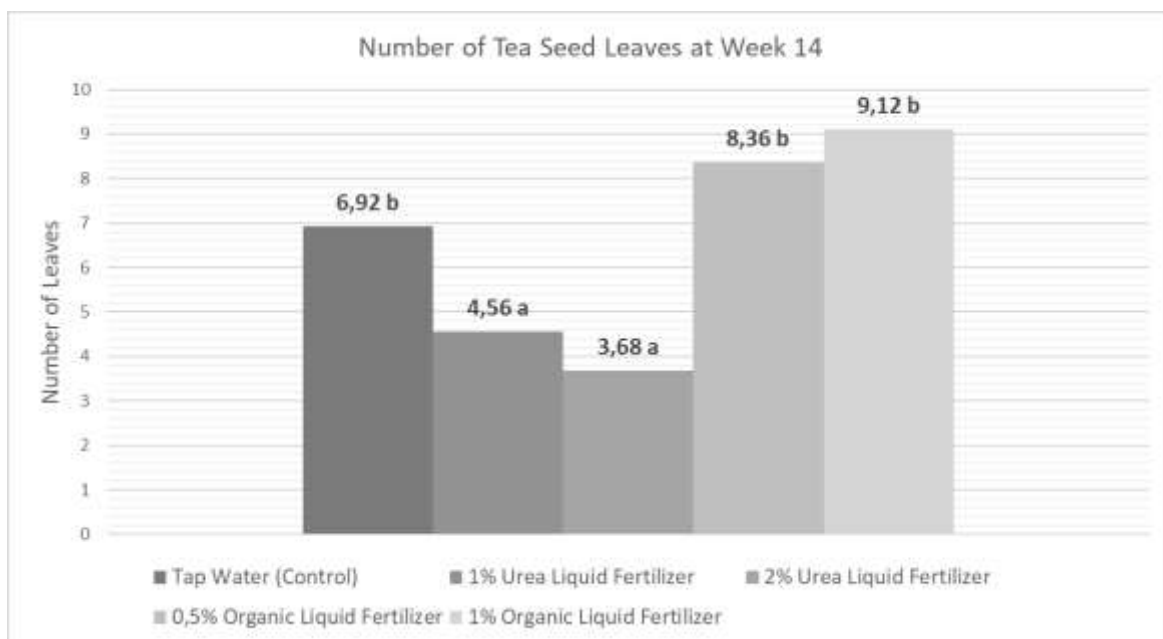
## 3. Result and discussion

**Height and number of seedling leaves.** The application of urea liquid fertilizer and organic liquid fertilizer significantly affected the height and number of seedling leaves at week 14. The application of organic liquid fertilizers with concentrations of 0.5% and 1% showed a higher height and number of seed leaves compared to using 1% and 2% urea liquid fertilizer but not a significant difference with tap water treatment (control) as the comparison presented in figures 1 and 2.

A higher result on organic liquid fertilizer than urea liquid fertilizer could occur due to several external factors. The urea liquid fertilizer application once every two weeks was expected to increase base saturation that subsequently exhibits an excessive concentration of chemical compounds accumulated on the leaf surface. Luxurious urea concentrated exhibit osmotic stress and toxicity to the plant organs causing damage or necrosis to plant organs known as leaf-burn [10]. In contrast to organic liquid fertilizer with active ingredients in the form of organic and natural microorganisms, it shows no significant effect on the toxicity of plant organs [11]. Furthermore, most of the nutrients present in organic liquid fertilizers are not directly available to plants or in low amounts and need microorganism support for mineralization [12].



**Figure 1.** Comparison effect of urea and organic liquid fertilizer application on height tea seedling



**Figure 2.** Comparison effect of urea and organic liquid fertilizer application on several tea seedling leaves

**Root volume and shoot root ratio (S/R).** The application of urea liquid fertilizer and organic liquid fertilizer showed a significant effect on root volume and shoot dry weight but not significant on root dry weight of tea seedlings as presented in table 1. The application of 1% organic liquid fertilizer resulted in root volume (32.3 ml) and shoot dry weight (1.68 g) the best compared to other treatments. The resulting S/R ratio was above 1, except for the application of 2% urea fertilizer with a value of 0.98. In comparison, the highest value was obtained in the control and treatment of 0.5% organic liquid (1.85).

**Table 2.** Effect of urea liquid fertilizer and organic liquid fertilizer application on root volume, shoot dry weight, root dry weight, and S/R ratio of tea seedling

Treatments	Root Volume (ml)	Dry Weight (g)		S/R Ratio
		Shoot	Root	
Tap Water (Control)	31,39 a	1,19 ab	0,73 a	1,85
1% Urea Liquid Fertilizer	31,55 a	1,00 a	0,85 a	1,28
2% Urea Liquid Fertilizer	31,65 a	0,80 a	0,98 a	0,98
0,5% Organic Liquid Fertilizer	31,45 a	1,49 bc	0,85 a	1,85
1% Organic Liquid Fertilizer	32,30 b	1,68 c	1,07 a	1,41

The increase in shoot dry weight resulting from organic liquid fertilizer application was expected due to the nutrient sources provided are more varied and have a role in shoot growth and leaf maturation. Based on research [13] urea foliar fertilizer not affected the affecting other mineral concentration in leaf organs. The organic liquid fertilizer contained active microbial contained were expected to producing secondary metabolite compounds such as phytohormones. The phytohormones produced by many microbes were auxins, gibberellin, and cytokinin [14]. Auxin phytohormones could stimulate vegetative growth by triggering cell doubling acceleration in young tissues [15]. These phytohormones also contribute to promoting the root growth of tea seeds so that there is an increase in the roots' volume. The research of [16] showed that the application of phytohormone-producing microbes could increase the root length of maize plants by up to 29.1%.

Based on the resulting S/R ratio data, the application of urea liquid fertilizer and organic liquid fertilizer stimulates the growth of tea seeds in the direction of shoot growth. In general, the S/R ratio value > 1 indicates that the nutrients produced from the treatment input and photosynthate are allocated as carbohydrates, especially for the formation of stems and leaves [17]. Although organic liquid fertilizer was able to increase shoot growth and root development of tea seeds significantly, this organic fertilizer could upgrade of tea seeds category to grade A seeds due to the resulting height being <25 cm. Furthermore, there is no real effectiveness from organic liquid fertilizer compared to tap water on the tea seeds.

#### 4. Conclusion

The application of organic liquid fertilizer had a positive effect on the height and number of leaves of tea seedlings compared to the application of urea liquid fertilizer, but no significant difference compared to the application of tap water (control). Application of 1% organic liquid fertilizer showed an increase in root volume and shoot dry weight of tea seed. Application of 1% and 2% urea liquid fertilizer once every two weeks exhibit tissue damage subsequently the growth of tea seeds was inhibited. Furthermore, each treatment had not shown a seed upgrade to be the ready-planted seed grade (grade A), indicated by the average seed height was still below 25 cm.

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