



# RESEARCH ON THE PRODUCTION OF FERMENTED KOMBUCHA TEA AND ITS INFLUENCE ON THE GERMINATION CAPACITY FOR DIFFERENT VEGETABLE SPECIES

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**Abstract:** Kombucha is a fermented beverage that is currently sold and home-brewed on all continents, with a history of up to 2000 years. In the present research a possible bio-stimulating effect of kombucha on plants was considered. Seeds treated with kombucha tea solutions of low concentrations (1% and 3%) a positive influence on germination was observed compared to the control, both by an increased germination speed and an increased total number of germinated seeds in some cases.

## • Introduction

Kombucha is obtained by the fermenting action of the culture on certain types of tea (green and black). The drink is usually called "kombucha tea" to differentiate it from the membrane that is formed by the action of yeasts and bacteria during fermentation, which is a symbiotic growth of acetic bacteria and osmophilic yeasts organized in a biological cellulosic membrane. The aim of the present research is to test the influence of kombucha fermented tea on the germination capacity of peas, cucumbers, lettuce and radish. Each species was tested with five variants of aqueous kombucha tea solutions, respectively 1%, 3%, 5%, 10% and 25%.

## • Material and method

The experiment took place on a dedicated table, protected from temperature and humidity variations, and from direct sunlight. The temperature and relative humidity of the air had constant values between 22-24 °C and 55-70% RH, respectively. In the first part of the experiment four different kombucha tea recipes were fermented for 14 days, with daily observation of cultures and collection of samples for analysis. Daily measurements included determination of sugar content (Brix%) by using an optical refractometer and determination of pH using a high-precision digital pH meter, herein obtaining the tea necessary for the treatment of seeds. In the final part of the experiment, a possible bio-stimulating effect of the fermented tea on plants was considered, investigating the influence of the beverage on the germination capacity for four species of vegetable plants, namely peas (*Pisum sativum*), cucumbers (*Cucumis sativus*), lettuce (*Lactuca sativa*) and radishes (*Raphanus raphanistrum* subsp. *sativus*). For each of the studied species six Petri dishes corresponding to the different concentrations were prepared, resulting in a total of 24 dishes with 30 seeds each, constituting a total of 720 seeds.

## • Results and discussions

In the first phase of the experiment the correct fermentation of the culture and the obtaining of a quality drink were achieved. In the case of all four variants a decrease in pH and sugar content could be observed. The testing of the bio-stimulatory effect showed a clear positive influence of low-concentration kombucha solutions on germination, both by determining faster germination and by increasing the total number of germinated seeds in some cases. In the case of pea seeds the best results, expressed by the germination rate and the total number of germinated seeds, were obtained in the case of the variant treated with 1% kombucha solution, reaching 100% germination on day seven (30/30 seeds) compared to the control that reached a maximum of 27. The 3% kombucha solution had the most pronounced effects on cucumber seeds, reaching a germination rate of 100% on day three. In the case of lettuce and radish seeds, the same pattern was observed, the 1% and 3% solutions having beneficial effects on the germination time, as well as on the total amount of germinated seeds.

## • Conclusions

The research described in this paper sheds light on kombucha and introduces it to the world of horticulture, demonstrating the beneficial effects of fermented tea on seed germination. The recommended recipe for kombucha for consumption is: 8g green / green-black tea + 70g white sugar + 6-8% starter liquid + „mother” culture / 1 liter of water. Concentrations of 1% and 3% were beneficial for all species studied, both in terms of germination time and the total percentage of germinated seeds. In the case of the 5% concentration, a faster onset of germination was observed in all species, but no improvement was observed in the total amount of germinated seeds. High concentrations of 10% and 25% had negative effects on germination in all species.