

## AB mix-NPK fertilizer combination effect on corn plants growth using Nutrient Film Technique

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### ABSTRACT

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**Keywords:**

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Corn (*Zea mays*) is one of the important food crops in Indonesia. Efforts to increase corn production continue to be made, one of which is by using appropriate fertilizer. The aim of this research is to determine the effect of the combination of AB Mix and NPK fertilizers on the growth of corn (*Zea mays*) plants using the NFT hydroponic system. This study used qualitative research methods. The data collection technique in this research is literature study, while data analysis is carried out in three stages, namely data reduction, data presentation and drawing conclusions. The findings from the research show that the use of a combination of AB mix and NPK fertilizers in the growth of corn (*Zea mays*) using the Nutrient Film Technique (NFT) technique has a significant impact. Using these two types of fertilizer together increases the growth of corn plants by increasing plant height, number of leaves, and development of the root system. In addition, with optimal nutrient availability from the fertilizer combination through the NFT technique, corn production is increased efficiently. The findings show the potential for using a combination of AB mix and NPK fertilizers in increasing agricultural yields.

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### INTRODUCTION

Corn (*Zea mays L.*) is one of the food crops that is the main choice in Indonesia after rice. Corn plants contain various essential nutrients needed by the body, such as dietary fiber, essential fatty acids, isoflavones, minerals (including calcium, magnesium, potassium, sodium, phosphorus, and iron), anthocyanins, beta-carotene, essential amino acid composition, and various other nutrients (Jubaidah et al., 2017).

In an effort to strengthen the food ecosystem and national food security, the Government continues to increase corn production to meet domestic needs and export demand. In an effort to achieve this goal, the Government has set policies through the 2022-2024 Maize Roadmap, which aims to develop corn production towards sustainable self-sufficiency. The average international corn price has increased, with the average price reaching USD 335.71 per ton in June 2022 (Kemenko, 2024).

Efforts to increase corn production continue to be fought, and one of the strategies adopted is the use of appropriate fertilizers. The application of appropriate fertilizers can provide vital support in maximizing the growth and productivity of maize plants. AB Mix fertilizer is a hydroponic fertilizer that contains complete macro and micro nutrients (Pangaribuan et al., 2022). NPK fertilizer is a compound fertilizer containing nitrogen, phosphorus, and potassium which are important for plant growth (Budianto, 2022). The use of a combination of AB Mix and NPK fertilizers is expected to have a positive influence on the growth of corn plants. NFT (Nutrient Film Technique) hydroponic system is an efficient and easy-to-apply hydroponic system.

Research by Draman et al. (2021) aims to address this gap by conducting an experiment to determine the optimal AB fertilizer concentration for plant growth in a fertigation system. The research also investigates the effects of different factors, such as pH, temperature, and light intensity, on the growth of plants using AB fertilizer in a nutrient film technique (NFT) hydroponic system. The research gap of this study is that there is a lack of information on the optimization of AB fertilizer for plant growth in fertigation using Central Composite Design.

The research gap of the by Zapałowska and Jarecki (2024) is that there is a lack of information on the specific effects of different types of compost on corn growth and yield. While there are studies on the effects of compost on other plants and soils, there is a need for research focused on corn specifically. The study aims

to address this gap by conducting experiments to determine the impact of different types of compost on corn growth and yield.

The research gap of the study by Yin et al. (2019) is that there is a lack of information on the specific effects of multiple N, P, and K fertilizer combinations on adzuki bean yield in a semi-arid region of northeastern China. The study aims to address this gap by conducting experiments to determine the optimal fertilizer combination for adzuki bean yield in this region.

Based on this background description and gaps of previous research, the study aims to determine the effect of the combination of AB Mix and NPK fertilizers on the growth of corn (*Zea mays*) plants using the NFT hydroponic system. This research can contribute new knowledge in the field of agricultural science, especially in terms of fertilizer use and hydroponic techniques. Its theoretical implications could also enrich the scientific literature on plant growth and provide a foundation for further research on corn crop fertilization and NFT applications. The purpose of this study was to determine the effect of the combination of AB Mix and NPK fertilizers on the growth of corn plants (*Zea mays*) using an NFT hydroponic system.

## METHOD

This study used qualitative research methods. The data collection technique in this study is by literature study. This approach involves searching, selecting, and analyzing various literature sources relevant to the research topic. Literature studies allow researchers to compile a comprehensive understanding of the research topic by utilizing existing knowledge from various sources, such as books, scientific journals, articles, research reports, and online materials related to the topic being researched. While data analysis is carried out in three stages, namely data reduction, data presentation and conclusions.

## RESULTS AND DISCUSSION

Corn (*Zea mays L.*) is one of the important food crops and has a strategic role in the national economy, given its multipurpose function as a food source. Almost all parts of the corn plant have economic value. Corn kernels as the main product are used as human foodstuffs, animal feed ingredients, industrial raw materials, food, beverages, paper, oil and bioethanol raw materials (Saijo, 2022). The benefits of corn are not only as foodstuffs, but also feed ingredients and other industrial ingredients (Fitria, 2018).

In order to grow and produce optimally, corn plants require adequate nutrients during their growth. Therefore, fertilization is a determining factor for the success of corn cultivation. The provision of fertilizers, both organic and inorganic, basically aims to meet the nutrient needs of plants, considering that nutrients from the soil are generally insufficient so that balanced fertilization is needed, namely fertilization that is tailored to the needs of plants and available in the soil. Fertilization is a component of production technology that affects the increase in corn production (Su'ud & Lestari, 2018). Corn plants will not give maximum results when the necessary nutrients are not sufficiently available. Fertilization can increase crop yields quantitatively and qualitatively (Pasta et al., 2015).

Fertilizer is the key to soil fertility to replace nutrients transported during harvest and replace nutrients lost due to leaching (Ramayana et al., 2021). On the market there are two types of fertilizers, namely inorganic and organic fertilizers. Inorganic fertilizers are fertilizers resulting from chemical, physical and or biological engineering processes and are the results of industrial or fertilizer manufacturing plants. While organic fertilizer is a fertilizer that mostly or entirely consists of organic matter derived from plants and / or animals that have gone through an engineering process, can be formed solid or liquid which is used to supply organic matter, improve the physical, chemical and biological properties of the soil (Dewanto et al., 2017).

Nitrogen is a nutrient needed by plants (Harsela, 2022). Lack of nitrogen nutrient levels will affect plant N uptake. In overcoming this obstacle, it is necessary to carry out balanced fertilization to increase soil and plant productivity. If inorganic fertilization is used beyond the limits of technical and economic efficiency, it will have an impact on production smoothing. Sources of organic fertilizers that can be used include straw compost, chicken, cow and sheep manure (Yuniarti et al., 2019).

Currently, Hydroponics is considered a way out of agricultural problems. Although many other technologies compete to win existence in the eyes of farmers, in fact hydroponics is the main choice (Harsela, 2022). Hydroponics is the future of agriculture because hydroponics can be cultivated in various places, both in villages, in cities, on open land or even above apartments. Hydroponics can be cultivated throughout the year regardless of the season. In hydroponic systems, nutrients are provided in the form of nutrient solutions that are easily available to plants. The nutrients provided contain all the essential nutrients needed by plants to achieve optimal growth. The success factor of hydroponic vegetable cultivation is the nutrients used, nutrients are very important for success in growing hydroponically, because without nutrients plant growth will be hampered and can provide results and vegetable production that is not optimal (Wardi et al., 2020).

Hydroponics based on the irrigation system is grouped into open systems and closed systems, while the grouping of types of hydroponic systems based on the use of media is grouped into two, namely substrate

systems and bareroot systems (Purwanto et al., 2018). Hydroponic techniques are considered capable of being a solution where the amount of land in Indonesia is decreasing every year. One of the hydroponic methods that can be used in corn cultivation is the NFT (Nutrient Film Technique) system (Pradita & Koesriharti, 2019).

The NFT system was first introduced by Dr. Allen Cooper, a researcher working at the Glasshouse Crops Research Institute, Littlehampton, England in 1970. The basic concept of this NFT is a method of cultivating plants with plant roots growing in a shallow and circulated nutrient layer so that plants can get enough water, nutrients and oxygen (Perdana & Suharni, 2022). Nutrient Film Technique (NFT) is a hydroponic system that drains nutrient solutions at plant roots through a shallow and oblique channel, forming a thin layer of nutrient film (Harsela, 2022). Water will circulate and mix with nutrient solutions according to what plants need, so that plant needs are met. Water conditions that must be considered are the acidity level of pH, oxygen, and water supply as well as environmental temperature and humidity are also maintained according to the needs of plant plants (Huda et al., 2019).

The NFT hydroponic system is one of the most widely applied hydroponic techniques because of its easier plant control and water and nutrient needs can be met properly. The Nutrient Film Technique (NFT) design is a hydroponic planting method in which part of the plant roots are submerged in a nutrient solution and part of it is on the surface of a circulating solution for 24 hours (Oktavira et al., 2022). An important aspect that determines the success of hydroponic cultivation is the nutrient solution. Plant nutritional needs that are met make growth more optimal. Plant nutrient solutions commonly used in hydroponic cultivation systems are AB mix which consists of nutrient solution stock A which contains macro elements and stock B which contains microelements. Nutrients for hydroponic cultivation can also be in the form of liquid organic fertilizers (Khodijah et al., 2021).

AB Mix nutrition is a nutrient used for hydroponic cultivation AB Mix nutrition is made in two different packaging, namely Mix A and Mix B, Mix A contains Calcium, while Mix B contains sulfate and phosphate. All three should not be mixed in a concentrated state so as not to cause precipitation, because if mixed calcium cation (Ca) in Mix A meets with sulfate anion (SO<sub>4</sub><sup>2-</sup>) in Mix B there will be a precipitate of Calcium Sulfate (CaSO<sub>4</sub>) so that Ca and S elements cannot be absorbed by the roots and when calcium cations (Ca) in Mix A concentration meet with phosphate anion (PO<sub>4</sub><sup>3-</sup>) in Mix B, then there will be a precipitate of Calcium phosphate (Ca<sub>3</sub>(PO<sub>4</sub>)<sub>2</sub>), so that Ca and P elements cannot be absorbed by the roots (Suarsana et al., 2020).

The nutrients that plants need in a hydroponic system, are added in the form of fertilizer along with water. Nutrient solutions have three main things that must be considered, namely composition, pH and EC (Harsela et al., 2020). The inorganic fertilizer used in hydroponics called AB Mix nutrition consists of a stock solution A and B containing various chemical components, serving as plant nutrients to promote growth. The elements calcium, nitrogen, potassium, and ferum in stock solution A, while magnesium, potassium, phosphate, sulfate, and microelements such as zinc, boron, manganese, and copper form stock solution B (Fadia, 2024).

Nutrient solution known as AB mix solution, it is known that the price is not economical if used on a large scale so innovation is needed as an alternative to nutrients for hydroponic plants, which is why researchers want to find alternatives to make it easier for the community, namely by utilizing several nutrient sources at relatively cheaper prices, namely NPK (Suharjo et al., 2023). Ramadiani and Susila (2015) concluded that NPK 15:15:15 compound fertilizer with nitrogen concentration equivalent to AB-Mix nutrient solution can be used on caisin, you and kale plants in hydroponic cultivation. Plants need nutrients for good growth, namely N, P and K nutrients which are essential nutrients.

The production of vegetable crops depends on water because it can affect soil moisture. For plant roots, if there is too much water, then a number of chemical and biological processes in the soil will change. The process of pollination and flowering will be hampered by heavy rains (Karomah, 2022).

The effect of AB Mix nutrition has a significant effect on plant height at the age of 2 MSPT, 3 MSPT, 4 MSPT, stem diameter at the age of 3 MSPT and 4 MSPT, the number of branch stalks at the age of 4 MSPT, flowering days, the weight of fresh fruit per sample plant at the 1st harvest and 2nd harvest. The effect of NPK Mutiara 16-16-16 nutrient concentration has a significant effect on plant height at the age of 1 MSPT, stem diameter at the age of 4 MSPT, flowering days, weight of fresh fruit per sample plant at the 2<sup>nd</sup> harvest. Treatment of AB Mix concentration at a dose of 1600 ppm (with the addition of a dose of 200 ppm every week) gave better results on the parameters of the study compared to treatment at other doses. The effect of applying NPK Mutiara 16-16-16 fertilizer at a dose of 1500 ppm (with the addition of a dose of 200 ppm every week) on average gives better results compared to the number of doses in other treatments (Zebua et al., 2023).

The importance of using AB mix and NPK fertilizers in planting corn with the NFT method. The effect of the combination of AB mix and NPK fertilizers on the growth of corn plants (*Zea mays*) using the Nutrient Film Technique (NFT) technique shows that the combination of fertilizers has a significant impact on the growth of corn plants. The use of a combination of AB mix and NPK fertilizers together increases the growth of corn plants, including an increase in plant height, number of leaves, and the development of the root system. In addition, the availability of optimal nutrients from both types of fertilizers through NFT techniques

encourages better corn crop production, demonstrating the potential of using this combination of fertilizers in increasing agricultural yields efficiently.

## CONCLUSION

The use of a combination of AB mix and NPK fertilizers in the growth of corn plants (*Zea mays*) using the Nutrient Film Technique (NFT) technique has a significant impact. The combination of the two types of fertilizers together increases the growth of corn plants by increasing plant height, number of leaves, and root system development. In addition, with the optimal availability of nutrients from the combination of such fertilizers through the NFT technique, corn crop production is efficiently increased. This finding confirms the potential use of a combination of AB mix and NPK fertilizers as an effective strategy in increasing agricultural yields in corn crops.

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