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Evaluation of Auxin Contents in Oil Palm Leaves in Response to Different Watering and Fertilization Regimes

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Abstract

The current study is the first to examine the auxin concentration of oil palm seedlings leaf below the effect of the aqueous sacristy and following the application of organic fertilizer. The harmful effects of the continual usage of inorganic fertilizers can be mitigated using chicken dung fertilizer. The aim of this research is to ascertain the effect of watering and chicken manure on the auxin levels of prenursery oil palm seedlings. From June to September 2021, with 6 treatments and 3 replications, this research was conducted utilizing the CRD (completely randomized designed) method. The treatments used were W1=0.40 2 aquatic day-1, W2=0.40 2 aquatic days-2, and W3= 0.40 2 aquatic days-4. S0 = managed, S 1 = 0.60 kg, and S 3 = 0.69 kg made up of the chicken manure. The outcomes demonstrated that the therapy had no discernible effect, but there were reduced leaves auxin contents at lower watering. Up to 0.75 kg of chicken manure resulted in greater auxin concentrate ons.

Keywords: Oil palm, Fertilization regimes, Watering regimes, Drought stress

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1. Introduction

Studying plant features, especially from a physiological perspective emphasizing auxin, is necessary since drought presents a substantial barrier to oil palm farming in diverse places. Auxin, as a general term, is an essential hormone to research since it can cause elongation in shoot cells [1]. To fully comprehend how oil palms respond to drought stress, it is essential to undertake a physiological investigation that primarily focuses on growth at a certain age [2]. Water availability is a crucial element in the management of oil palm nurseries. When there is a lack of water or when chicken manure fertilizer is used, each oil palm plant responds differently. Notably, chicken manure fertilizer exhibits considerable potential and can be successfully integrated into the soil, particularly under challenging grounds in places like Indonesia [3]. Farmers' practices vary greatly regarding giving water to oil palm seedlings at the prenursery stage. Some farmers irrigate their crops with 0.2 liters daily, while others prefer to water them with 0.3 liters [4]. Due to differences in watering techniques, it is essential to examine how auxin levels and oil palm growth are impacted by various watering regimens [5]. The significance of auxin in response to water shortage can be better understood by researching the impact of drought and different watering methods on oil palm physiology [6,7]. To create measures to lessen the detrimental effects of water shortage on oil palm development and productivity, it is helpful to understand the precise physiological changes brought on by drought stress and the subsequent changes in auxin levels. Furthermore, investigating the impacts of chicken manure fertilizer in conjunction with water accessibility might offer helpful information for enhancing nutrient management practices and increasing plant resistance under challenging environmental conditions. The paper [8] provided an understandable summary of research conducted over the last fifty years on the mineral nutrition of mature Tenera oil palms. We make an effort to fill the knowledge gap between basic studies and plantation management by offering data that is both factually accurate and practically useful. Our focus is on plant nutrition, with an overview of the growth of oil palms under challenging conditions. The paper [9] explained the existence of a sophisticated and elaborate response system that varies for each plant species and might be explained by comprehending and researching the various metabolic pathways in charge of producing secondary metabolites. Plants respond to biotic and abiotic processes that cause changes in their environment. Numerous researchers have looked into how abiotic stress affects both the primary and secondary metabolisms of plants. The study [10] examined the studies on MLE as biological stimulants to improve crop yield and growth. They also emphasize study gaps in the existing information regarding MLE

application and its potential introduction to smallholder agricultural systems to supply phytonutrients. Generally speaking, MLE is a low-cost, long-lasting, environmentally amiable, and organic biological stimulant that can be utilized to enhance the development and production characteristics of different crops under both stress-free and stressful circumstances. The paper [11] described that the completely randomized factorial model was utilized to test the impacts of Plant Growth-Promoting Bacteria and Arbuscular Mycorrhizal Fungi vaccination with various soaking reign on the features of development, antioxidant capacity, and essential oil (EO) made up of the drought-sensitive plants Dracocephalum Moldavia. Even though research indicates that aquatic shortage stress stunts plant growth, Plant Growth-Promoting Bacteria or Arbuscular Mycorrhizal Fungi individually or in combo considerably reduced the stress's negative impacts. The paper [12] aimed to provide a summary of recent developments in the study of the interactions between abiotic anxiety, plant response, biostimulant effects, and functional foods generated from plants, with a particular emphasis on plant metabolites as the connection between the environment and the food chain. The study [13] stated that decreased growth, the growth of roots, shoot growth, and leaf growth were among the morphological effects of water deficiency on plants that were studied. These effects ultimately resulted in both qualitative and quantitative yield reductions. Interactions between water and nutrients, the effectiveness of sunshine, pigment content, respiratory rate, outlet closures, and other physiological features of drought were also investigated. The paper [14] determined the impact of utilization of a herb-derived PH under four nitrogen fertilization levels on greenhouse baby greens by assessing structural and factors related to colorimetry, mineral makeup, carbs, protein molecules, and amino acids. When N fertilization was increased from 1 to 30 kg, the fresh yield of spinach plants that had not been treated or treated with biostimulants grew in response. However, after reaching a plateau, this indicates that 45 kg is the luxury level of N consumption. The study [15] expressed that oil palm clones created using the tissue culture procedure were transplanted in two distinct habitats, an open field and a biosafety screen house, as a genetically homogeneous planting material. For accurate metabolite characterization, the metabolome of several plant sections, Root tissues, spear leaf tissues, and mature leaf tissues, were investigated using gas and liquid methods known as mass spectrometry identification and chemometrics information processing. The article [16] investigated how stress modulators affect nutritional content, antioxidants, and vegetative development is the goal of this study. When there is a water shortage and tension. During the 2019–2020 growing season, with ten treatments and 3 replications, a factorial study was conducted utilizing a randomized full-block arrangement. The paper [17] offered an analysis of the application of fertilizers, worm castings, and nitrogen, phosphorus, and potassium to enhance seedlings and stable oil particles as markers of the caliber of the Moringa oleifera trees' output under Calcium-rich sand circumstances. In this test, it was discovered that raising the vermicompost level using nitrogen, phosphorus, and potassium. Fertilization and combining treatments in the study's growing seasons greatly enhanced all metrics and the production of seedlings and fixed oil from the drumstick tree. The study [18] described the effects of DS on legumes are discussed, along with the underlying mechanisms, and suggested management strategies to lessen the impact of water stress. We cover the physiological mechanisms, growth indicators, and yield that are impacted by water stress. Mechanisms, a wide range of management strategies (including agronomic practices, inoculation with Rhizobacteria and arbuscular mycorrhizal fungus to stimulate plant growth), quantitative trait loci, efficient genomics, and cutting-edge approaches are all thoroughly analyzed. They suggest that creating cultivars of drought-tolerant legumes requires the fusion of various tactics, including cutting-edge gene editing technologies, agronomic, and biotech methods. The study [19] examined how the black cumin's development indices and yield responded to methanol and nitrogen under drought stress. During the 2019-2020 academic year, split plots based on a random full-block design with three sections and three repetitions were employed in an experiment at the Medicinal Plants Research Centre, Shahed University, Tehran, Iran. The key factor was drought stress, which had four levels of severity (non-stress, minor, moderate, and severe). Using a deficit irrigation system, the paper [20] analyzed the effects of dates palm and pista biochar, vermicompost, and a combination of the two on eggplant development, yield, and water consumption efficiency. Results demonstrate that under normal circumstances, and particularly when water was scarce, aubergines growth in foliage, yield, and water consumption efficiency were all improved by using vermicompost and biochar. The study [21] said that the saplings of Populus simonii were grown in hydroponic fluid containing less than 5% polyethylene glycol, and their ability to take up water, tolerate drought, and regulate hormones was examined in relation to the amount of nitrogen they were given.The P. simonii seedlings responded to the drought by slowing down; net photosynthesis and evaporation rates are declining, whereas permanent nitrogen isotope content (15N), total soluble chemicals, and natural waters use efficiency (WUEi) are rising. Development of drought-resistant crop cultivars and adoption of better management techniques, such as the endogenous use of osmoprotectants, managing crucial macro and micronutrients, and using natural amendments, are two ways to lessen the negative effects of drought, according to [22].

The current study is the first to examine the auxin concentration of oil palm seedlings leaf below the effect of the aqueous sacristy and following the application of organic fertilizer.

2. Materials and methods

Seedlings of the Tenera oil palm were acquired between June and September of 2021.Watering treatments included =0.40 liters per day, W2=0.40 liters every two days, and W3= 0.40 liters every four days. Chicken manure fertilizer included S0 = control, S1 = 0.60 kg, and S3 = 0.69 kg planting 〖media〗^(-1). This experiment employed the CRD technique and included 6 treatments and 3 replications. In Bogor, research on leaf auxin was done on seedlings that were three months old. The assessment of variance source was used for statistical analysis and data processing.

3. Results and Discussions

Three-month-old oil seedlings were used for the auxin observations. The treatment's impact was inconsequential (Table 1 and figure 1). Lower water levels and more chicken dung were found to have more significant auxin amounts. This finding is consistent with earlier research investigations showing that organic fertilizer has no discernible impact on the growth of oil palm trees. The effect of watering and chicken manure treatment at various levels was also not significant. According to research findings, auxins and Cytokinin govern different developmental pathways for regulating stress adaption responses in a dynamic and complimentary manner. After a certain period, plants grow resistant to fertilizer due to inorganic fertilizers, necessitating the first resorting to physical and biological fertilizers. On the other hand, using chicken dung, which has a relatively lower nutrient value, calls for a large quantity. Plants respond to organic fertilizers more slowly than inorganic fertilizers in the near run. Up to 0.75 kg of chicken dung fertilizer produced superior outcomes compared to lesser amounts. The findings of the current study showed that water is necessary for the synthesis of auxin, where tryptophan serves as its precursor. Even though there was no appreciable difference between them, it is claimed that the more fantastic chicken manure fertilizer could resist the increased water humidity, leading to higher auxin concentrations. The best development of oil palm seedlings in the prenursery was achieved with a mixture of up to 72% compost and humus.

Table 1. Therapies vs. ppm

Therapies	ppm
W1=0.30 1 $days^{-1}$	2.40
W2=0.30 1 $days^{-2}$	2.35
W2=0.30 1 $days^{-3}$	2.31
S0	2.35
S1=0,50 kg $media^{-1}$	2.42
S2=0,75 kg $media^{-1}$	2.45

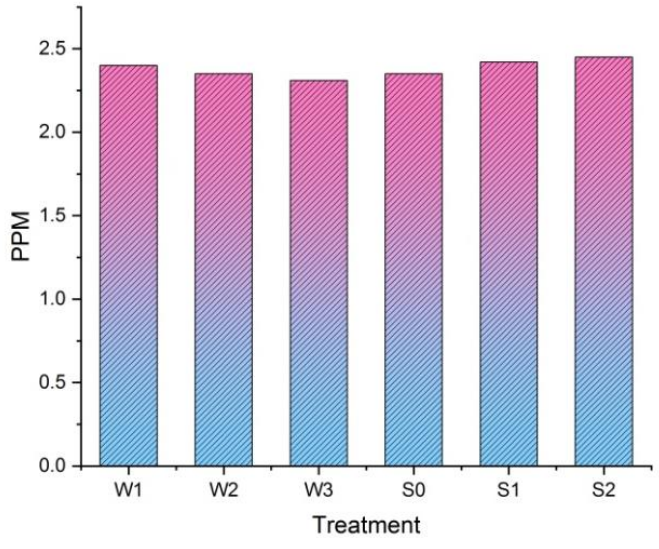

Figure 1. Therapies vs. ppm

4. Conclusions

The following inferences can be derived from the study's findings: Watering planting media with 0.40 2 of water for one day and four days reduces the amount of leaf auxin, albeit the effect was insignificant compared to other levels. The amount of leaf auxin in fertilizer made from chicken dung up to 0.75 kg planting media-1 is rising.

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