RESPONSE the Giving of IAA (Indol-3-asetic acid) Concentration on Tobacco Plant Production (Nicotiana tabacum L) Local Variety Payakumbuh

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DOI: https://doi.org/10.56293/IJASR.2024.6103

IJASR 2024
VOLUME 7
ISSUE 5 SEPTEMBER - OCTOBER **ISSN: 2581-7876**

Abstract: Tobacco is a botanical species that yields goods of a refined and elaborate character. The quality level is contingent upon the individual preferences of each purchaser. Tobacco is a distinctive and gratifying commodity that lacks a universal accepted worldwide standard, unlike other agricultural goods. One significant determinant influencing tobacco plants throughout the cultivation phase of the crops. The incorporation of growth regulators in the manufacturing process is a factor that warrants consideration. Auxin is a ubiquitous hormone synthesised in plant tissues during periods of active division. Auxin plays a crucial part in the cellular processes of division, expansion, and specialisation. Auxin type IAA has emerged as a viable choice for application. The present study used a fully randomised design, including four treatment levels: 0, 100ppm, 200ppm, and 300ppm IAA concentration. The measurements under investigation in this study encompass leaf width, leaf length, fresh weight, and overall crop yield at the time of harvest. Analysis of the harvest findings at 60 days after planting (DAP) and 75 DAP reveals variations in leaf width and leaf length. However, no differences are detected at 90 DAP. There were no significant differences seen in the fresh weight and overall yield of the crops in terms of total leaf weight and plant weight.

Keywords: Consentration Giving IAA, indigenous cultivars, tobacco plants

1. Introduction

Tobacco is categorised as a facility that produces processed commodities. The assessment of quality is dependent on the specific tastes of each consumer. Unlike other agricultural commodities, tobacco is a unique and high-quality product that does not have a universally recognised global standard. The cigar tobacco agribusiness now confronts several challenges, including anti-smoking campaigns, regulations enforced by the Framework Convention on Tobacco Control, the consolidation of major cigarette manufacturers, a shift in consumer preference from large cigars to smaller ones, and the presence of competitors in the cigar tobacco sector. (Budiarto, 2007).

Given that tobacco plants are specialised agricultural commodities, every cultivation site has distinct attributes and yields tobacco of different quality levels (Djumali, 2008). Both environmental factors and the agricultural techniques used by growers have an impact on the distinctiveness of this tobacco. The productivity and quality of tobacco are affected by various environmental parameters, including soil conditions (including physical and chemical properties of the soil), soil texture, soil moisture, and microclimate rainfall (including temperature and humidity) in the surrounding area of the planted fields. Sudaryono, 2004. The present issues in the agricultural industry go beyond the downstream sector; the primary problems that need focus are the upstream elements, specifically production issues. One crucial component exerts a substantial influence on tobacco plants during the cultivation phase of the harvests. Consideration should be given to the incorporation of growth regulators in the production process.

Botanical growth regulators are bioactive compounds produced by plants having broad applicability in various plant tissues, at several production sites, and serving varied roles within the plant. Plant growth regulators, or phytohormones, are bioactive compounds that function as growth promoters in plants (Cokrowati & Diniarti, 2019). Botanical growth regulators function actively during all stages of a plant's life cycle. Compounds such as auxin, cytokinin, gibberellin, abscisic acid, and emissive hormone are included. Our analysis also identified substances such as brassinosteroids, salicylic acid, strigolactones, and jasmonic acid. The vegetative development of plants is influenced by hormones through their effects on plant elongation, branching, and organ differentiation (Sezgin & Kahya, 2018).

Auxin is a hormone predominantly produced in anatomical tissues of plants during active division. Auxin has a distinct function in the cellular processes of somatic division, proliferation, and specialisation. Indole Acetic Acid (IAA), a synthetic hormone, is assigned the classification of an auxin. The auxin group of growth regulators, comprising NAA, IAA, IBA, and 2,4-D, has the ability to increase osmotic pressure, enhance cell permeability, reduce pressure on cell walls, promote cell wall development and flexibility, and initiate protein synthesis. Furthermore, auxins play a crucial role in stimulating cell elongation and increasing size, whereas cytokinins, such as kinetin and BAP, contribute to cell proliferation. (Widiastoety, 2014). The aim of this work is to evaluate the influence of targeting the growth regulator IAA on the dynamics of tobacco plant output.

2. Research Methodology

Time and place

The implementation of this research was carried out from February 2022 to July 2022. The experiment was conducted at the experimental garden of the State Agricultural Polytechnic of Payakumbuh, Jl. Raya Negara, KM. 7 Tanjung Pati, Harau District, Limapuluh Kota Regency, West Sumatra.

Tools and materials

The tools and materials used in this research are local Rudau gadang tobacco seeds, Indole acetic acid (IAA), nitrogen fertiliser (N), phosphate fertiliser (P), potassium fertiliser (K), a fungicide with an active ingredient of Mankozeb 80%, and an insecticide with an active ingredient of Deltamethrin 25 g/l. The tools used in the implementation of this research are an analytical balance and an oven.

Experimental Design

The experimental design in this study uses a completely randomised design (CRD). It consists of 4 levels: 0 ppm (A0), 100 ppm (A1), 200 ppm (A2), and 300 ppm (A3) per plant. The data were analysed statistically using analysis of variance (ANOVA) and further testing with the Tukey test at a 5% significance level.

Implementation of research

Planting

The variety of tobacco used is the local Payakumbuh tobacco known as Rudau Gadang. The planting distance used is 100 cm × 50 cm. The age of the seedlings is 45 days after sowing. (HSS). After that, planting is done by making a hole right in the centre of the planting hole, which is then covered with a shelter made from banana stems.

Maintenance

In the field, the replacement of dead plants is carried out until the plants are 2 weeks old. Weeding and rolling. Weeding is carried out according to the condition of weed growth in the research area, while rolling is done after the plants are 4 weeks old. The treatment with IAA was administered 40 days after planting (DAP) and 45 days after. Fertilisation was carried out 45 days after planting, with a dosage of 5 grammes of urea, 5 grammes of SP36, and 5 grammes of KCL applied by making holes about 5 cm deep on the sides of the plants, which were then covered with soil.

Pest and disease control

Pest control using an insecticide with the active ingredient deltamethrin, 25 g/L, applied at a dosage of 1 cc/L of water. For controlling fungal attacks, a dosage of 1 gramme of the active ingredient Mancozeb 80% is used. If there is an increase in attacks, the dosage of fungicide and insecticide will be increased.

Harvest

Harvesting is done in stages, with the harvesting times as follows: (a) first harvest at 65 days after planting (DAP) for the lower leaves, with 2-4 leaves harvested; (b) second harvest at 75 DAP for the middle leaves, with 8-10 leaves harvested; and (c) third harvest at 90 DAP for the upper leaves, with 6-8 leaves harvested.

Observation Variable

The research observations conducted are leaf width at harvest time, leaf length at harvest time, fresh leaf weight at harvest time, and total tobacco leaf weight per plant.

3. Results and Discussion

Leaf width tobacco plants

Based on the analysis of variance regarding the width of tobacco leaves at harvest (table 1), during the first harvest at 65 days after planting (DAP), which involved the lower leaves of the tobacco plant, no statistical differences were found. The second harvest, which involved the middle leaves of the tobacco plant, showed a difference when comparing the treatment with 300 ppm IAA to the control. The third harvest, conducted at 90 DAP, did not show any significant statistical differences in leaf width.

Table 1. Average leaf width of tobacco plants at harvest time. (cm)

Treatment	Average		
	Age 65 DAP	Age 75 DAP	Age 90 DAP
0 ppm IAA	27,67a	25,00 b	15,33a
100 ppm IAA	28,67a	25,33 b	17,00a
200 ppm IAA	32,00a	31,00 ab	21,33a
300 ppm IAA	35,00a	32,33 a	24,67a

Note: The average values followed by the same letter do not differ significantly according to the Tukey's Honestly Significant Difference (HSD) test at a significance level of 0.05.

Table 1, which examines the use of IAA for the parameter of leaf width at the first harvest (age 65 DAP), indicates that the leaf width remains unchanged at harvest compared to the control group. At the harvest age of 75 days after planting (DAP), the leaf width of the tobacco plants is significantly influenced by the content of indole-3-acetic acid (IAA). The leaf development in the central region of the tobacco plant is facilitated by the optimum absorption of sunlight, so enabling the continuation of leaf development until it attains its peak growth stage. Moreover, the tobacco leaves' width at harvest, 90 days after initial planting, varies between 15.33 cm and 24.67 cm. The heterogeneity in the tobacco leaf width is attributed to genetic elements and the specific conditions of the plant's cultivation. The study undertaken by (Permana et al., 2022) identified a correlation between the type of tobacco and the seeding site, indicating that the leaf width varied between 20.66 cm

Length of the leaf Tobbaco Plant

Significant differences were seen in the length of tobacco plant leaves at the lower leaf stage at 65 days after planting (DAP) when applying an IAA dosage of 300 ppm compared to the control. However, no significant differences were found between the doses of 100 ppm and 200 ppm IAA. The leaf length at 75 DAP exhibited a notable disparity between the application of a 300 ppm concentration and no application. However, the application of IAA concentrations of 100 ppm and 200 ppm did not differ significantly from the control. The longitudinal dimension of the collected foliage from the upper section of the tobacco plant exhibits a remarkably similar leaf length.

Applications of IAA at a concentration of 300 ppm led to the greatest increase in leaf length. In the absence of the treatment, the length of the lower leaves of the tobacco plant is at its minimum, measuring 45.33 cm. Application of auxin type IAA leads to a substantial enhancement in leaf growth to facilitate plant development, particularly in the vegetative stage of the plant. (Debitama et al., 2022) The application of IAA on rubber plants can augment the vegetative development of the plants. Furthermore, apart from the availability of IAA, there exist other variables, specifically the genetic makeup of the plant and the conditions found in its developing habitat. Tobacco is a geographically specialised crop, so its characteristics are shaped by the exact area where it is cultivated.(Permana et al., 2022) present evidence of a relationship between the selection of tobacco plant kinds and the specific planting sites. The application of the identical cultivar in the identical geographical area yielded a leaf length of 54.05 cm, but the identical cultivar in an alternative site attained a leaf length of 36.78 cm. Furthermore, according to (Barokah et al., 2023) leaves of Kebumen tobacco plants have a length of 61 cm.

Table 2. displays the mean leaf length of tobacco plants at harvest time (cm).

Treatment	Average		
	Age 65 DAP	Age 75 DAP	Age 90 DAP
0 ppm IAA	45,33 b	44,00 b	33,00a
100 ppm IAA	50,67 ab	46,00 b	34,33a
200 ppm IAA	52,33 ab	51,00 ab	35,33a
300 ppm IAA	59,67 a	59,67 a	36,33a

Note: The average values followed by the same letter do not differ significantly according to the Tukey's Honestly Significant Difference (HSD) test at a significance level of 0.05.

Leaf weight and crop production Tobbaco Plant

Leaf yield is the primary indicator of tobacco plant productivity, which directly influences the amount of tobacco cut and scrap generated. (DS et al., 2023) The moisture content of the leaves is a determinant of the tobacco plant's productivity; furthermore, it also impacts the quality of the tobacco product. Results from statistical analysis indicate that there is no statistically significant variation in (table 3) the weight of leaves taken at 60 days after planting (DAP), 75 DAP, and 90 DAP when applying concentrations of IAA at 100 ppm, 200 ppm, and 300 ppm. The uniformity in the impact of IAA concentrations on leaf weight suggests that the ideal level for plant growth has been achieved. Multiple elements, particularly the presence of nutrients in the soil, exert a significant impact on the development of plants, therefore enabling them to optimise their growth. The fulfilment of nutritional needs can facilitate optimal plant development. (Marsono & Lingga, 2013) Furthermore, the study conducted by (Soemarah et al., 2020) revealed variations in the development of tobacco plants when different dosages of fertiliser were applied. The average weight of tobacco leaves varied between 95.52 grammes and 136.15 grammes.

Table 3. The average total weight of leaves harvested from a single plant. (gram)

Treatment	Average			Total weight of leaves/plants.
	Age 65 DAP	Age 75 DAP	Age 90 DAP	
0 ppm IAA	101,67 a	125,67 a	101,33 a	378,00 a
100 ppm IAA	113,67 a	102,00 a	104,33 a	330,00 a
200 ppm IAA	117,00 a	148,00 a	111,00 a	438,00 a
300 ppm IAA	163,67 a	160,00 a	126,33 a	328,67 a

Note: The average values followed by the same letter do not differ significantly according to the Tukey's Honestly Significant Difference (HSD) test at a significance level of 0.05.

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