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GIBBERELLIN (GA_3) CONCENTRATION AND SOAKING DURATION EFFECTS ON DURIAN SEED GROWTH (*Durio zibethinus* Murr.)

PENGARUH KONSENTRASI GIBERELIN (GA_3) DAN LAMA PERENDAMAN TERHADAP PERTUMBUHAN BENIH DURIAN (*Durio zibethinus* Murr.)

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Abstract

This research aims to determine the optimal combination of GA_3 concentration and soaking duration to improve durian seed growth. The study was conducted using a Factorial Randomised Complete Block Design (Factorial RCBD) with two treatments: the first factor is Gibberellin Concentration (K), which consists of 4 levels: 0 ppm (control), 100 ppm, 200 ppm, and 300 ppm. The second factor, Gibberellin Soaking Duration, consists of three levels: 12 hours, 24 hours, and 36 hours. The results showed an interaction between gibberellin concentration and soaking duration on the parameters of shoot emergence (with the best result at 5.43 days) and root weight (with the best result at 6.8 g).

***Keywords**: durian, gibberellin, GA_3, concentration, soaking duration*

Abstrak

Penelitian ini bertujuan untuk mengetahui kombinasi konsentrasi GA_3 dan lama perendaman yang optimal untuk meningkatkan pertumbuhan benih durian. Penelitian dilakukan dengan menggunakan Rancangan Acak Kelompok Lengkap Faktorial (RAKL Faktorial) dengan Faktor Pertama adalah Konsentrasi Giberelin (K) yang terdiri dari 4 taraf yaitu 0 ppm (kontrol), 100 ppm, 200 ppm, dan 300 ppm. Sedangkan Faktor Kedua adalah Lama Perendaman Giberelin yang terdiri dari 3 taraf yaitu 12 jam, 24 jam, dan 36 jam. Hasil penelitian menunjukkan bahwa terdapat interaksi antara konsentrasi giberelin dan lama perendaman terhadap parameter hari munculnya tunas (dengan hasil terbaik 5,43 hari) dan berat segar akar (dengan hasil terbaik 6,8 gram).

Kata Kunci : Durian, giberelin, GA_3, konsentrasi, waktu perendaman

INTRODUCTION

The application of gibberellin (GA3) has been widely recognised as a key factor in enhancing seed germination and early growth in various plant species, including economically important crops such as durian (*Durio zibethinus* Murr.). Durian has advantages and economic value, and has a vast planting area in Indonesia. The numerous durian varieties grown in various parts of Indonesia have earned this fruit the nickname "the king of fruits." (Christie & Lestari, 2019).

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Gibberellin is a plant growth regulator that can break seed dormancy and is widely used to control the synthesis of hydrolytic enzymes during seed germination, thereby overcoming both types of seed and shoot dormancy. In seeds, one of the effects of gibberellin is to promote cell elongation, so that the radicle can break the endosperm, seed coat, or fruit skin, thereby facilitating its growth. (Salisbury & Ross, 1995).

Soaking seeds in a gibberellin solution can increase the percentage of germination, maximise growth potential, enhance growth rate, and reduce the time to emergence of sprouts. (Agustiansyah *et al*., 2020). This study investigates the effects of varying GA3 concentrations and different soaking durations on the germination and initial growth of durian seeds, with the goal of identifying the optimal combination of GA3 concentration and soaking duration to enhance durian seed performance. The findings provide valuable insights for agricultural practices and nursery management in durian cultivation.

RESEARCH METHODS

The research was conducted using a Factorial Randomised Complete Block Design (Factorial RCBD) with two treatments: Gibberellin Soaking Duration, with three treatment levels, and Gibberellin Concentration, with four treatment levels, each with three replications, resulting in a total of 36 experimental units.

Tools

The tools used in this research were: hoe, trowel, rope, container, measuring cup, timer, ruler, bucket, watering can, stationery, knife, and scissors.

Materials

The materials used in this research were: durian seeds, gibberellin (GA3), soil, water, rice husk charcoal, bamboo sticks, manure, polybag, and name label.

Location Site

The research was conducted in Pajarakan Kulon Village, Pajarakan District, Probolinggo Regency, at an altitude of ± 5 meters above sea level.

Observations

The research observation parameters consist of:

1. Plant height (cm): measured height from the ground surface to the tip of the plant's growing point using a ruler, observed once a week.
2. Number of leaves (sheets): counting the number of fully opened leaves, carried out once a week.
3. Root length (cm): observing the root length, using rulers.
4. Plant weight (g): observing the fresh weight of plants, using an analytical balance.
5. Root weight (g): observing the fresh weight of roots, using an analytical balance.

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6. Day of shoot emergence (days): The number of days required for the emergence of the radicle or plumule is calculated, based on the formula:

$$Day\ of\ shoot\ emergence = \frac{N1T1+N2T2+\cdots+NxTx}{Total\ Number\ of\ Germinated\ Seeds}$$, where:

N: Number of seeds that germinate in a specific time.

The amount of time between the beginning of the test and the end, and a specific interval of the observation.

Data Analysis

All the collected data are then tabulated and analysed using the Analysis of Variance (ANOVA) with Excel software. If there is any significant difference, further analysis will be carried out using the Least Significant Difference (LSD) test at a 5% significance level.

RESULTS AND DISCUSSION

Plant Height

Based on the results of the analysis of various parameters of durian's plant height, the treatment of gibberellin concentration (K) and soaking duration (L) individually showed very significantly different results at the ages of 21, 28, 35, 42, 49, 56, 63, 70, 77, 84 HST. The best overall plant height results were achieved by K3 (300 ppm) and L3 (36 hours).

Table 1. Average Plant Height (cm) of Various Gibberellin Concentrations and Soaking Duration on Durian Seed Growth.

Treatments	Average Plant Height (cm)									
	21 DAP	28 DAP	35 DAP	42 DAP	49 DAP	56 DAP	63 DAP	70 DAP	77 DAP	84 DAP
K0	4.56 a	5.86 a	6.74 a	7.66 a	8.33 a	9.19 a	10.13 a	10.78 a	11.41 a	12.59 a
K1	5.58 b	7.06 b	9.24 b	11.91 b	13.72 b	15.89 b	17.61 b	19.18 b	21.16 b	22.21 b
K2	6.24 c	8.59 c	10.98 c	14.24 c	15.98 c	18.20 c	20.63 c	22.32 c	24.16 c	25.26 c
K3	7.33 d	9.68 d	13.48 d	16.90 d	20.19 d	23.58 d	26.77 d	28.90 d	30.87 d	31.66 d
LSD 5%	*0.5671*	*0.4752*	*0.5632*	*0.7541*	*1.0262*	*1.4719*	*1.6464*	*1.6562*	*1.8632*	*1.9470*
L1	5.39 a	7.38 a	9.24 a	11.63 a	13.53 a	15.31 a	17.35 a	18.70 a	20.02 a	21.13 a
L2	6.01 ab	7.85 b	10.11 b	12.80 b	14.60 b	16.89 bc	18.78 b	20.38 b	22.05 bc	22.86 b
L3	6.38 b	8.16 b	10.98 c	13.60 c	15.53 c	17.94 c	20.23 c	21.80 b	23.63 c	24.79 c
LSD 5%	*0.4912*	*0.41*	*0.4877*	*0.6531*	*0.8888*	*1.2747*	*1.426*	*1.4343*	*1.6136*	*1.6861*
CV	9.786	6.236	5.697	6.084	7.211	9.007	8.964	8.347	8.703	8.686

Description: Numbers followed by the same letter in a row indicate no significant difference in the LSD Test at the α = 5% level, Coefficient of Variance, and DAP=days after planting.

Pertiwi et al. (2014) stated that giving gibberellin to plants can increase the height and enlarge all parts of the plant stem. This is because the plants exhibit an excellent response to the administration of gibberellin, resulting in continued growth in plant height. While the effect of gibberellin administration on plant height is related to the function of gibberellin in the process of

cell division and enlargement, where GA can encourage the orientation of microtubules towards the agricultural axis so that cells enlarge due to the accumulation of cellulose, so that plants grow longer (Fukazawa et al., 2000).

Number of Leaves

The highest number of leaves was obtained in the K3 (300 ppm) and L3 (36 hours) treatments, respectively. Gibberellic acid (GA3) is a hormone that can stimulate the seed germination process, accelerate the formation of shoots, and the growth of plant stems and leaves. (Maharani *et al*., 2018). The addition of gibberellin hormone to plants can stimulate leaf growth, which will affect the number of plant leaves. (Lakitan, 2015). According to Farida & Rohaeni (2019). Gibberellin stimulates plant growth by accelerating the growth and cell division process, where giving gibberellin to plants with higher concentrations will increase the growth of phloem and xylem, so that the process of exchanging nutrients and water becomes better faster, so that plant leaf growth will also increase.

Table 2. Average Number of Leaves at Various Gibberellin Concentrations and Soaking Duration on Durian Seed Growth.

Treatments	Average Number of Leaves							
	35 DAP	42 DAP	49 DAP	56 DAP	63 DAP	70 DAP	77 DAP	84 DAP
K0	0.89 a	1.16 a	1.32 a	1.47 a	1.60 a	1.79 a	1.94 a	2.14 a
K1	5.78 b	6.24 b	6.72 b	7.48 b	8.02 b	8.48 b	9.09 b	9.52 b
K2	7.30 c	8.11 c	8.89 c	9.66 c	10.44 c	11.04 c	11.77 c	12.26 c
K3	8.17 d	9.28 d	9.99 d	11.37 d	12.02 d	12.54 d	12.99 d	13.40 d
LSD 5%	*0.2333*	*0.2578*	*0.2636*	*0.3377*	*0.3732*	*0.3410*	*0.4156*	*0.4345*
L1	5.25 a	5.84 a	6.39 a	7.08 a	7.64 a	8.08 a	8.63 a	9.03 a
L2	5.54 b	6.23 b	6.79 bc	7.51 b	8.03 b	8.50 b	8.92 a	9.28 a
L3	5.81 c	6.52 c	7.01 c	7.89 c	8.40 c	8.81 c	9.29 b	9.69 b
LSD 5%	*0.2021*	*0.2232*	*0.2283*	*0.2925*	*0.3232*	*0.2953*	*0.3599*	*0.3763*
CV	*4.314*	*4.255*	*4.006*	*4.611*	*4.759*	*4.121*	*4.751*	*4.764*

Description: Numbers followed by the same letter in a row indicate no significant difference in the LSD Test at the α = 5% level, Coefficient of Variance, DAP=days after planting.

Root length

The highest results in root length parameters were obtained in the K2 (200 ppm) treatment, while the soaking duration did not show any significant difference. This can be caused by the gibberellin growth stimulant, which stimulates and accelerates water absorption in plant seeds, allowing for faster seed growth and a good physiological response, resulting in normal shoot growth. (Polhaupessy & Sinay, 2014). Supardy *et al*. (2016) also stated that in addition to functioning to stimulate the development of plant stems, the gibberellin hormone is also able to accelerate leaf and root growth by stimulating the synthesis of auxin needed in the root growth process.

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Plant Weight

The highest wet weight results were obtained in the K3 treatment (300 ppm), with no significant difference observed in the soaking duration. The wet weight of a plant refers to the total amount of water and organic matter content within it. The dry weight value of the plant is influenced by the amount of water content, nutrients, and organic matter contained in a plant. (Suherman *et al*., 2016). The addition of gibberellin can affect plant cells, influencing the number of cell divisions and cell enlargement. This increase has an impact on the overall size of plant organs, which is associated with the plant's overall weight increase. (Mudyantini, 2008).

Table 3. Average Root Length (cm) and Plant Weight (g) of Various Gibberellin Concentrations and Soaking Duration on Durian Seed Growth.

Treatments	Root Length	Plant Weight
Gibberellin Concentration		
K0	12.78 a	12.00 a
K1	15.33 ab	15.23 ab
K2	19.33 c	19.02 b
K3	17.96 bc	23.94 c
LSD 5%	*3.6674*	*4.1752*
Gibberellin Soaking Duration		
L1	15.28 a	15.86 a
L2	17.76 a	17.84 a
L3	16.02 a	18.95 a
LSD 5%	*3.1762*	*3.6158*
CV	*22.944*	*24.333*

Description: Numbers followed by the same letter in a row indicate no significant difference in the LSD Test at the α = 5% level—CV = Coefficient of Variance.

Root Weight

The best results in root weight parameters were obtained in the K3L3 treatment, specifically with a gibberellin concentration of 300 ppm and a soaking duration of 36 hours. These results indicate that the higher the concentration of GA3, the greater the volume of plant roots. This is supported by the statement from Utama & Sugiyanta (2016), which stated that the administration of gibberellin has the effect of accelerating cell division and enlargement, which triggers branch multiplication so that root volume increases. Sari et al. (2014)It was also stated that the gibberellin hormone can enhance the performance of the auxin hormone by stimulating the synthesis of proteolytic enzymes, which can soften cell walls and release the amino acid tryptophan. The amino acid tryptophan helps increase auxin levels, allowing for faster water diffusion into the seeds and thereby accelerating the elongation and enlargement processes. Cell enlargement that occurs more rapidly will cause plant roots to grow longer, thereby affecting both the wet weight and dry weight of the plant roots.

Table 4. Average Root Weight (g) and Day of shoot emergence (days) on the Interaction of Various Gibberellin Concentrations and Soaking Duration on Durian Seed Growth.

Gibberellin Concentration	Gibberellin Soaking Duration		
	L1	L2	L3
Root Weight (g)			
K0	2.2 a	2.9 c	2.5 b
K1	3.6 e	3.5 de	3.3 d
K2	4.3 f	4.2 f	4.3 f
K3	4.8 g	5.1 g	6.8 h
LSD 5%	*0.2398*		
CV	*12.368*		
Day of Shoot Emergence (days)			
K0	13.2 i	12.17 h	11.6 g
K1	10.5 f	9.4 e	9.4 e
K2	8.2 d	7.4 c	7.4 c
K3	6.4 b	6.3 b	5.4 a
LSD 5%	*0.0962*		
CV	*2.199*		

Description: Numbers followed by the same letter in a row indicate no significant difference in the LSD Test at the α = 5% level—CV = Coefficient of Variance.

Day of Shoot Emergence

Based on the analysis of variance results for the day of shoot emergence, it was found that there was an interaction between the gibberellin concentration (K) and soaking duration (L). The best results were also achieved with the K3L3 treatment, specifically at a gibberellin concentration of 300 ppm and a soaking duration of 36 hours. The concentration of gibberellin can indeed make the seed coat more permeable to water and air, thereby stimulating the germination process. (Asra *et al*., 2020). Meanwhile, the effect of gibberellin concentration and soaking duration on seed emergence time stimulates germination. When the seed coat opens, various biochemical processes will occur in the seed, one of which is the conversion of carbohydrates into energy by the amylase enzyme. (Sipaurrahma & Sunarti, 2022).

CONCLUSION

The research was conducted to determine the effect of concentration and soaking duration on the growth of durian plants (*Durio zibethinus* Murr.). The results showed that the concentration of gibberellin (GA3) and soaking duration both had significant effects on Shoot Emergence and the wet root weight parameter. However, no interaction was shown for germination rate, plant height, number of leaves, and fresh plant weight.

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