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INTERACTIVE EFFECTS OF MONOSODIUM GLUTAMATE AND PACLOBUTRAZOL ON GROWTH AND FLOWER INDUCTION OF DENDROBIUM ORCHID

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ABSTRACT

Dendrobium is one of the most widely cultivated ornamental orchids in Indonesia, valued for its aesthetic appeal and commercial potential. However, its relatively slow vegetative growth and long period to reach the flowering stage often hinder efficient production. The use of plant growth regulators and biostimulants can be an effective strategy to accelerate growth and promote flowering. This study aimed to evaluate the effects of Monosodium Glutamate (MSG) and paclobutrazol (PBZ) on the growth and floral induction of Dendrobium orchids and to determine the most effective combination for optimal performance. The experiment was arranged using a Randomized Block Design (RBD) with two factors, namely four MSG dosages (0 g/L, 7.5 g/L, 10 g/L, and 12.5 g/L) and three paclobutrazol concentrations (0 ppm, 200 ppm, and 400 ppm). Each treatment combination was replicated five times. Observations were made on plant height, number of leaves, days to flower initiation, and number of flowers per spike. Results showed that the interaction between MSG and paclobutrazol significantly influenced both vegetative and flowering parameters. The combination of 7.5 g/L MSG and 200 ppm paclobutrazol resulted in the most favorable response, producing taller plants, more leaves, earlier flower initiation, and a higher number of flowers compared to other treatments. Excessive paclobutrazol concentration tended to suppress vegetative growth without further improving flowering performance. These findings indicate that applying 7.5 g/L MSG together with 200 ppm paclobutrazol can effectively promote balanced growth and enhance floral development in Dendrobium orchids, offering practical benefits for commercial orchid cultivation in tropical environments.

Keywords: Dendrobium, Monosodium Glutamate, Paclobutrazol.

INTRODUCTION

Dendrobium is one of the most economically important orchid genera, highly appreciated for its elegant flower forms, wide color variation, and long vase life. These characteristics make it a major commodity in both local and international floriculture industries, produced as potted plants and cut flowers. The increasing global demand has positioned Dendrobium as one of Indonesia's promising export-oriented ornamental crops, particularly to countries such as the Netherlands, Korea, Japan, and Singapore (Suryana, 2015).

Despite its commercial potential, Dendrobium growth is relatively slow compared to other ornamental plants. This characteristic often results in a prolonged vegetative stage and delayed transition to flowering, thus reducing production efficiency (Sucandra et al., 2015). Therefore, improving growth performance and accelerating floral induction are crucial steps in optimizing its cultivation cycle.

Monosodium Glutamate (MSG), a common amino acid derivative widely known as a food additive, has recently attracted attention as a potential plant biostimulant. Studies have shown that MSG can enhance vegetative growth and productivity in several crops such as *Brassica rapa* (Novi, 2016) and *Arachis hypogaea* (Gresinta, 2015). The active component, glutamic acid, functions as an essential amino acid involved in nitrogen assimilation and the biosynthesis of nucleic acids, chlorophyll, hormones, and secondary metabolites (Okoye et al., 2016). These physiological roles suggest its potential to support both vegetative and reproductive development in orchids.

In addition to nutrient supplementation, the use of growth retardants such as paclobutrazol (PBZ) has proven effective in regulating plant architecture and inducing flowering. Paclobutrazol acts by inhibiting gibberellin biosynthesis and enhancing cytokinin accumulation in the shoot meristem, which promotes floral bud formation (Desta, 2021). According to Orozco et al. (2021), its efficiency depends on appropriate dosage and timing of application.

Given these findings, the present study was conducted to determine the most effective combination of Monosodium Glutamate (MSG) dosage and paclobutrazol concentration in stimulating growth and flowering of Dendrobium orchids under controlled cultivation conditions. Specifically, the aim of this study was to evaluate the individual and interactive effects of MSG and paclobutrazol on the growth and flowering responses of Dendrobium, and to identify the most effective treatment combination.

RESEARCH METHODS

The study was conducted from January to May 2025 at the Floriculture Farm of Politeknik Negeri Lampung, Indonesia. The experimental site lies in a lowland tropical area with favorable conditions for orchid cultivation, characterized by an average temperature of 25–32°C and humidity levels ranging from 70% to 85%. These environmental factors provided an optimal setting for observing the response of *Dendrobium* orchids to growth regulators.

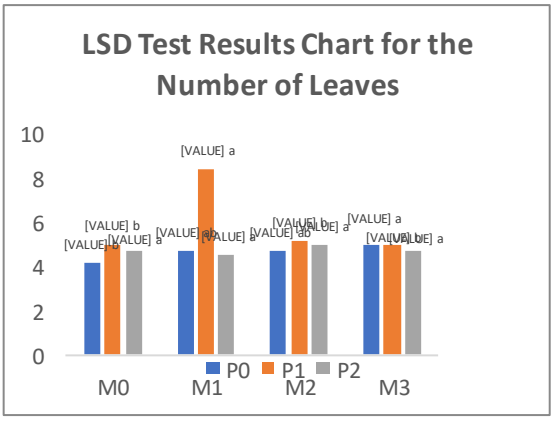
Several tools were used during the research, including plastic pots, measuring cylinders, droppers, sprayers, permanent markers, treatment boards, gloves, and protective masks. The main plant material consisted of *Dendrobium* sp. orchids with two pseudobulbs per plant, each measuring approximately 25–30.5 cm in height and bearing two to five leaves. The additional materials used were Monosodium Glutamate (MSG), paclobutrazol, Dithane M-45, Mitisun, and Curacron.

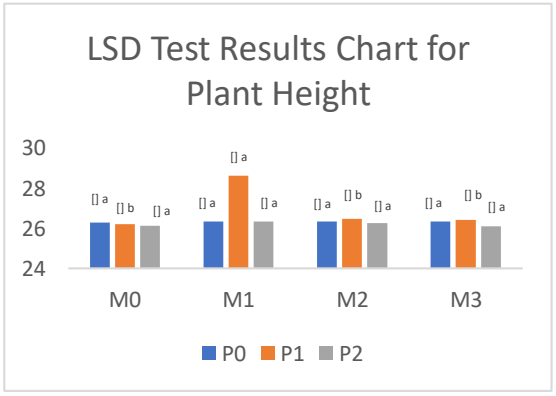
The experiment followed a two-factor Randomized Block Design (RBD). The first factor was the dosage of MSG, consisting of four levels: 0 g/L, 7.5 g/L, 10 g/L, and 12.5 g/L. The second factor was the concentration of paclobutrazol, which included 0 ppm, 200 ppm, and 400 ppm. Each treatment

combination was replicated five times, and one plant represented one experimental unit, producing a total of sixty experimental units.

MSG was applied weekly until the twelfth week after transplanting, while paclobutrazol was administered twice, at the fourth and eighth weeks after transplanting. Standard orchid maintenance practices such as watering, pest control, and nutrient management were applied consistently throughout the study period.

Observations were made on several growth and flowering parameters, including plant height, number of leaves, days to flowering, and the number of flowers per plant. The data were analyzed using analysis of variance (ANOVA) to evaluate treatment effects. When significant differences among treatments were observed, the Least Significant Difference (LSD) test at a 5% significance level was used to separate the means.





RESULTS AND DISCUSSION

Effect of MSG and Paclobutrazol Application on the Plant Height of *Dendrobium* Orchid

The results showed that the application of 7.5 g/L MSG combined with 200 ppm paclobutrazol produced the tallest plants, reaching an average height of 28.62 cm, which was higher than the other treatment combinations. This finding suggests that the use of MSG at moderate levels effectively stimulates vegetative growth in *Dendrobium*. According to Taiz et al. (2015), glutamate plays a key role in nitrogen metabolism and protein biosynthesis, both of which are essential processes for cell division and stem elongation. Therefore, supplying MSG as an additional organic nitrogen source in the growing medium likely enhanced nutrient availability and promoted greater shoot growth compared to untreated plants.

Astuti and Lestari (2019) reported that applying MSG at a concentration of 7.5 g/L to *Dendrobium* orchids increased plant height by approximately 20% compared with the untreated control. Similarly, Fitriani and Suwandi (2020) found that the combination of MSG with liquid organic fertilizer promoted the development of new shoots and enhanced stem elongation in orchids. In contrast, paclobutrazol treatment in orchids generally does not markedly increase plant height but instead contributes to sturdier stems and earlier flower initiation (Kusuma and Hartati, 2020).

Effect of MSG and Paclobutrazol on the Number of Leaves of *Dendrobium*

In this study, the combined treatment of 7.5 g/L MSG and 200 ppm paclobutrazol produced the highest number of leaves, averaging 8.4 leaves per plant, which was greater than the other treatment combinations. Nurfadillah et al. (2022) reported that the

application of MSG up to 12.5 g/L on *Dendrobium* sp. grown in coconut husk media resulted in an average of 17.67 leaves, representing the best vegetative response among the tested treatments.

Conversely, Suharman and Nurhapisah (2021) found that lower MSG concentrations (≤5 g/L) did not significantly affect leaf production during the acclimatization phase. The positive response to MSG application is attributed to its function as an organic nitrogen source in the form of glutamate, which supports nitrogen metabolism, protein synthesis, and cell differentiation processes essential for the initiation of new leaf growth.

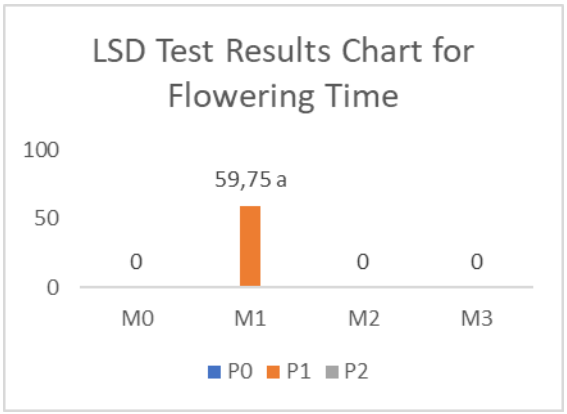
In this study, the application of paclobutrazol did not produce a significant effect on the number of leaves. However, Zheng et al. (2012) reported that paclobutrazol can enhance chlorophyll accumulation and sucrose content in the leaves of horticultural plants.

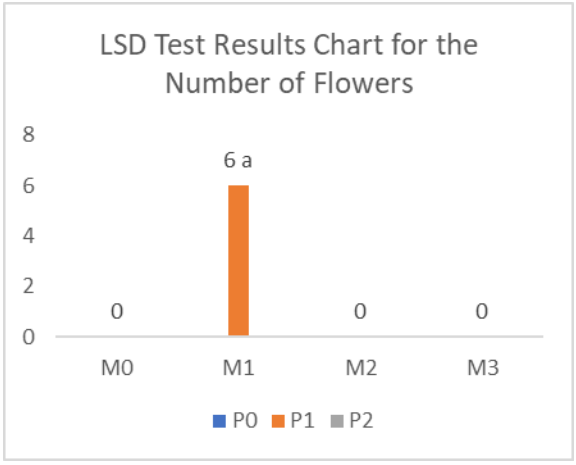
Effect of MSG and Paclobutrazol on Flowering Time and Number of Flowers of *Dendrobium*

Flowering in orchids is generally slower compared to other ornamental plants, which often requires the use of stimulants to accelerate floral induction. In this study, Monosodium Glutamate (MSG) and paclobutrazol were applied to stimulate flowering in *Dendrobium* orchids. The combination of 7.5 g/L MSG and 200 ppm paclobutrazol resulted in the earliest flowering, occurring at an average of 59.75 days after transplanting and produced the highest number of flowers per plant, averaging six flowers.

MSG acts as an organic nitrogen source in the form of glutamate, supporting protein synthesis, nitrogen metabolism, and cell differentiation, which are essential for flower initiation. Similar responses have been reported in other species; for example, MSG improved vegetative growth and reproductive traits in okra (Septiyana et al., 2019) and accelerated flower development in *Tagetes erecta* (Miarti et al., 2016).

Paclobutrazol (PBZ), a triazole-class growth regulator, inhibits gibberellin biosynthesis, reducing excessive vegetative growth and redirecting photosynthates toward reproductive development. Desta (2021) explained that PBZ increases cytokinin levels in the shoot meristem, promoting floral bud formation, while Orozco et al. (2021) emphasized that its effectiveness depends on proper dosage and timing of application.





Specifically in *Dendrobium*, Te-Chato et al. (2009) demonstrated that PBZ promotes bud break and enhances the frequency of early flowering under tissue culture conditions. Wang (2009) further confirmed that the addition of PBZ to the culture medium of *Dendrobium nobile* induced earlier flowering

and produced a higher number of flower buds compared to untreated controls.

The combined application of MSG and paclobutrazol provides both nutritional and hormonal stimulation, resulting in earlier flowering and a greater number of flowers. This synergistic effect highlights the potential of integrating organic nitrogen supplementation with growth regulators to improve the reproductive performance of *Dendrobium* orchids, offering practical benefits for commercial cultivation.

CONCLUSION

The combined application of 7.5 g/L Monosodium Glutamate (MSG) and 200 ppm paclobutrazol effectively enhanced both vegetative growth and flowering in *Dendrobium* orchids. This treatment produced the tallest plants, the highest number of leaves, accelerated flowering, and increased the number of flowers per plant. MSG acted as an organic nitrogen source supporting metabolism, protein synthesis, and cell differentiation, while paclobutrazol suppressed excessive vegetative growth and redirected photosynthates toward reproductive development.

Based on these results, the integration of MSG and paclobutrazol is recommended as a practical strategy to improve growth and reproductive performance in *Dendrobium* cultivation. For further optimization, future studies could examine the effects of this combination across different orchid varieties, substrate types, and environmental conditions to refine application protocols for commercial production.

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