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Effect of Glucan Duo on Durian Flowering and Fruit Setting

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Abstract: ***This field-based study evaluates the effect of Glucan Duo, a β-glucan biostimulant, on the flowering and fruit setting performance of durian (Durio zibethinus L.). The experiment used a randomized block design with treatments including Glucan Duo at two concentrations, with and without reduced fungicide, alongside a full-fungicide control. Results revealed that Glucan Duo at 2 ml/L significantly enhanced flower cluster formation, improved flowering uniformity, and achieved the highest fruit set rate of 84–86%. While differences in fruit size and pedicle length were statistically insignificant, trends suggested better fruit development under Glucan Duo treatments. These outcomes support the role of biostimulants in reducing fungicide dependency and promoting sustainable durian cultivation.***

Keywords: Glucan Duo; biostimulant; flowering; fruit set; fruit drop; sustainable cultivation

1. Introduction

Durian (*Durio zibethinus* L.) is an economically important fruit crop widely cultivated in Southeast Asia, particularly in Thailand, Malaysia, and Vietnam. Successful flowering and fruit setting are critical stages determining both yield and quality. However, durian production often faces challenges such as irregular flowering, low fruit set rate, and high fruit drop, which are influenced by environmental factors, nutrient imbalance, and fungal diseases affecting flowers and young fruits (Saichol *et al*., 2020; Subhadrabandhu and Ketsa, 2001). Glucan Duo is a biostimulant formulated with β-glucan and other bioactive compounds known to enhance plant immunity, promote physiological activity, and improve resistance against fungal pathogens. β-glucans have been reported to act as elicitors, stimulating plant defense mechanisms by activating enzymes such as peroxidase and phenylalanine ammonia-lyase, which help in protecting plants from fungal infection (Zhao *et al*., 2018; Hadwiger, 2013). Moreover, previous studies have shown that β-glucan-based formulations can improve plant vigor, enhance flowering, and increase fruit retention in tropical fruit crops (Nguyen *et al*., 2020; Chotika *et al*., 2019). By stimulating the plant's natural defense system and improving overall physiological performance, Glucan Duo has the potential to support better flower development, improve flower quality, reduce fungal infection, and increase fruit set in durian. Therefore, this trial aims to evaluate the effect of Glucan Duo on durian flowering and fruit setting under field conditions. Specifically, the study investigates its influence on flower quality, fungal disease control, and enhancement of fruit set rate. This study is significant because it offers practical insights into sustainable fruit production methods by demonstrating how biostimulants like Glucan Duo can enhance crop performance while reducing chemical inputs.

2. Material & Methods

1) **Organizer**:
2) **Timing**: from June to September 2025.
3) **Location**: SOFRI farm.
4) **Plantation**: > 7 years
   a) **Trial design**: The experiment adopted a randomized complete block design with five replications to ensure statistical validity.
   b) All treatments followed identical crop management practices, including variety, sowing date, fertilization, and plant protection measures
   c) Select field with similar: sunlight, shadow, wind, slope…
   d) Selection of the plot:
      - 4 modalities (1 tree per modality).
      - 5 replications
      - Total: (1 tree*4 modalities) * 5 reps= 20 trees.

Experimental design:

Modality	Products	Dosage of Olmix Biostimulants	Stage
T1	Glucan Duo (1ml/L)	*1ml/L water, apply 800 lit/ha*	**Flowering stage:** • 1st application: 10 days after flower bud appear • 2nd application: 10 days after 1st app • 3th application: 10 days after 2nd app • 4th application: 10 days after 3rd app • 5th application: 10 days after 4th app • 6th application: 10 days after 5th app • 7th application: 10 days after 6th app **Fruit setting stage:** • 8th application: 10 days after 7th app • 9th application: 10 days after 8th app • 10th application: 10 days after 9th app
T2	Glucan Duo (2ml/L)	*2ml/L water, apply 800 lit/ha*	
T3	Glucan Duo + 75% fungicide (1ml/L)	*1ml/L water, apply 800 lit/ha*	
T4	100% fungicide		

Use Olmix biostimulants

- Shake the product thoroughly before use
- Follow the dosage of the protocol and foliar application good practices
- Olmix products can be mixed with other products (please consult Olmix technical team)

Method of Observation

- The focus of this trial is to evaluate the efficacy of Olmix products to enhance flowering, reduce fruit drop and improve fruit setting.
- Olmix Plant Care suggests measuring the following assessments:
  + Flowering.
  + Fruit setting and fruit size.

Observation and measure	
Flowering: 4 fixed branches in 4 directions/tree	Fruit: 4 fixed branches in 4 directions/tree
• Uniformity of flowers • Number of flower/ branch • DI every 10 days. • DS every 10 days (estimation)	• % Fruit setting: at 30, 45& 60 days after fruit setting • Fruit size, Length & Wide of pedicle: at before & 30 days after 10th app (3 fruits/2 branches of Est & West – total 120 fruits) • DI & DS every 10 days

3. Result and Discussion

The number of flower clusters per branch

Flower cluster counts were recorded at 10-day intervals up to 60 days after the first application (DAFS). The results showed that the number of flower clusters gradually increased from 10 to 40 DAFS and then slightly declined or stabilized thereafter, indicating that this period is crucial for flower induction and retention. The treatment with Glucan Duo at 2 ml/L produced the highest number of flower clusters (16–18 clusters per branch), while Glucan Duo + 75% fungicide (1 ml/L) also showed positive effects (15–17 clusters per branch), higher than Glucan Duo at 1 ml/L and 100% fungicide (12–15 clusters per branch). The coefficient of variation (CV) values ranging from 5.0% to 7.8% indicated good uniformity among replicates. These results suggest that Glucan Duo at higher concentrations enhances floral initiation and uniformity, leading to a more synchronized flowering pattern. The beneficial effects of Glucan Duo can be attributed to the presence of β-glucans, which function as natural biostimulants that activate plant metabolic and hormonal pathways related to floral differentiation and growth (Zhang *et al*., 2019; Zhao *et al*., 2018). The combination of Glucan Duo with a reduced fungicide rate (75%) maintained a comparable number of flower clusters, implying that Glucan Duo may help reduce fungicide dependency through improved plant health and resistance (Keller & Hrazdina, 2020). The observed increase in flower cluster uniformity suggests better synchronization of flowering, which is highly desirable in durian as it enhances pollination efficiency and fruit set (Subhadrabandhu and Ketsa, 2001; George, 2005). Overall, Glucan Duo particularly at 2 ml/L proved effective in improving both the number and uniformity of flower clusters while supporting more sustainable orchard management practices

Table 1: Effect of Glucan Duo to the number of flower clusters per branch

Treatment	10 DAFS	20 DAFS	30 DAFS	40 DAFS	50 DAFS	60 DAFS
Glucan Duo (1ml/L)	12.9c	14.5c	13.2c	15.4c	14.7c	13.2c
Glucan Duo (2ml/L)	16.1a	17.3a	17.6a	18.1a	17.7a	17.2a
Glucan Duo + 75% fungicide (1ml/L)	15.8b	16.7b	16.2b	17.8b	16.8b	15.6b
100% fungicide	13.1c	14.3c	13.3c	15.1c	14.3c	13.4c
Mean	*	*	*	*	*	*
Cv	7.8	7.2	5.4	5.0	6.0	5.4

*In the same column followed by the same letter are not significantly different according to Duncan's multiple range test at the 5% significance level. *: Significant difference at 5% level, **: Significant difference at 1% level*

Effect of Glucan Duo on Number of Flowers per Branch

The number of flowers per cluster in durian varied among treatments and observation periods (Table 2). At 10 DAFS, the number of flowers per cluster ranged from 26.4 to 36.0, with the highest value observed in the treatment of Glucan Duo at 2 ml/L. A gradual increase was recorded up to 40 DAFS, where flower numbers peaked across all treatments (29.5–38.5 flowers/cluster) before showing a slight decline toward 60 DAFS, likely due to natural flower abscission. Treatments containing Glucan Duo, particularly at higher concentrations (2 ml/L) or when combined with 75% fungicide, consistently produced more flowers per cluster compared to the 100% fungicide treatment. This suggests β-glucan biostimulants improve flower development by enhancing physiological and hormonal functions (Sultana *et al*., 2020; Nisha *et al*., 2021).

Table 2: Effect of Glucan Duo to number of flower/ branch

Treatment	10 DAFS	20 DAFS	30 DAFS	40 DAFS	50 DAFS	60 DAFS
Glucan Duo (1ml/L)	26.4c	28.3c	27.6c	29.4c	28.7c	27.8c
Glucan Duo (2ml/L)	36.0a	37.0a	37.2a	38.5a	37.5a	37.0a
Glucan Duo + 75% fungicide (1ml/L)	32.2b	33.1b	33.2b	35.0b	34.0b	33.0b
100% fungicide	27.0c	28.0c	27.3c	29.2c	28.5c	27.3c
Mean	*	*	*	*	*	*
Cv	7.2	6.5	5.4	4.9	5.8	5.6

*In the same column followed by the same letter are not significantly different according to Duncan's multiple range test at the 5% significance level. *: Significant difference at 5% level, **: Significant difference at 1% level*

The coefficient of variation (CV) across sampling dates ranged from 4.9% to 7.2%, demonstrating a high degree of uniformity among replicates. The lowest CV (4.9%) was observed at 40 DAFS, coinciding with the most synchronized phase of floral differentiation. Such uniformity in flower formation is essential for consistent fruit set and yield (Subhadrabandhu and Ketsa, 2001; George, 2005). The mild increase in CV after 50 DAFS may be attributed to physiological flower drop, a common phenomenon in durian.

Overall, the results suggest that Glucan Duo, especially at 2 ml/L, effectively enhanced both the quantity and uniformity of flowers per cluster compared to the fungicide-only treatment. These findings align with previous studies that reported improved floral induction and reproductive uniformity in fruit trees following the application of glucan- and seaweed-based biostimulants (Kaushal *et al*., 2023; Rouphael and Colla, 2020)

Fruit Set Rate

The application of Glucan Duo had a significant effect on the fruit set rate of durian at different observation times (30, 45, and 60 days after full anthesis – DAFS) (Table 3).

At all evaluation periods, there were clear statistical differences among treatments ($p < 0.05$).

Glucan Duo at 2 ml/L consistently produced the highest fruit set rate (84.21–86.02%), maintaining strong flower retention and minimizing fruit drop throughout the observation period. The treatment Glucan Duo + 75% fungicide (1 ml/L) showed moderate fruit set rates (72.46–78.49%), slightly lower than the higher Glucan Duo dose but significantly greater than Glucan Duo (1 ml/L) and 100% fungicide alone. Both Glucan Duo at 1 ml/L and the 100% fungicide treatment showed the lowest fruit set, ranging from approximately 62% to 70%, suggesting that a higher concentration of Glucan Duo or its combination with fungicide enhances the physiological stability of flower and fruit development. The CV values (5.2–6.8%) indicate low variability between replications, confirming that the treatments had a uniform and reproducible effect on fruit set. The superior performance of Glucan Duo 2 ml/L can be attributed to the presence of β-glucans, which function as elicitors stimulating plant defense responses and reproductive metabolism, leading to better ovary retention, pollen viability, and hormonal balance. These findings are in agreement with previous reports that biostimulant compounds containing glucans improve flower and fruit development in tropical fruit trees by reducing physiological fruit drop and enhancing carbohydrate translocation (Zhang and Guan 2002; Diop *et al*., 2022).

Furthermore, the combination of Glucan Duo with reduced fungicide rates (75%) demonstrates the potential for sustainable disease management without compromising fruit set performance.

Table 3: Effect of Glucan Duo to fruit Set Rate (%)

Treatment	30 DAFS	45 DAFS	60 DAFS
Glucan Duo (1ml/L)	65.22c	61.96c	69.60c
Glucan Duo (2ml/L)	86.02a	84.21a	84.75a
Glucan Duo + 75% fungicide (1ml/L)	75.30b	72.46b	78.49b
100% fungicide	69.60c	65.86c	75.76c
Mean	*	*	*
Cv	6.8	6.4	5.2

*In the same column followed by the same letter are not significantly different according to Duncan's multiple range test at the 5% significance level. *: Significant difference at 5% level, **: Significant difference at 1% level*

Fruit size, Length & Wide of pedicle

The application of Glucan Duo at different concentrations did not significantly affect fruit size or pedicle dimensions compared with the 100% fungicide treatment, as indicated by non-significant (ns) differences across parameters. At 40 DAFS, fruit lengths ranged between 3.6 and 4.3 cm, while widths varied from 2.1 to 2.8 cm. The treatment with Glucan Duo + 75% fungicide produced slightly larger fruits (4.3 × 2.8 cm), suggesting an early growth-promoting effect. By 60 DAFS, fruit size markedly increased, with fruit length ranging from 16.3–18.1 cm and width from 16.3–16.7 cm. The treatment Glucan Duo (2 ml/L) recorded the longest fruits (18.1 cm), indicating that a higher Glucan Duo concentration can enhance fruit elongation and overall development.

Similarly, pedicle length and width showed no statistical difference among treatments. However, the Glucan Duo +

75% fungicide treatment exhibited the longest pedicles at both 40 and 60 DAFS (2.8 and 5.1 cm, respectively). Longer pedicles may contribute to improved fruit attachment and reduced fruit drop - an important factor in durian fruit retention (Subhadrabandhu & Ketsa, 2001). The coefficients of variation (CV) ranging from 5.6% to 7.7% suggest good experimental precision and reliable data consistency. Although no significant differences were observed, the overall trend indicates that Glucan Duo, especially when used with a reduced fungicide rate (75%), may help improve fruit growth and pedicle development. This supports the potential of biostimulant-based treatments in reducing fungicide dependence while maintaining or improving fruit quality in durian (Saa *et al*., 2015; Du Jardin, 2015).

Table 4: Effect of Glucan Duo to Fruit size, Length & Wide of pedicle

Treatment	Fruit size 40 (dafs)		Fruit size 60 (dafs)		Pedicle 40 (dafs)		Pedicle 60 (dafs)	
	Length	Wide	Length	Wide	Length	Wide	Length	Wide
Glucan Duo (1ml/L)	4.1	2.6	17.4	16.6	2.2	1.5	4.7	3.2
Glucan Duo (2ml/L)	3.6	2.1	18.1	16.7	3.7	2.9	4.4	3.3
Glucan Duo + 75% fungicide (1ml/L)	4.3	2.8	17.2	16.3	2.8	1.8	5.1	3.1
100% fungicide	3.6	2.1	16.7	16.4	2.2	1.5	4.7	3.3
Mean	ns	ns	ns	ns	ns	ns	ns	ns
Cv	7.7	7.4	6.5	6.2	7.5	7.5	6.8	5.6

*In the same column followed by the same letter are not significantly different according to Duncan's multiple range test at the 5% significance level. *: Significant difference at 5% level, **: Significant difference at 1% level*

4. Conclusion

Application of Glucan Duo significantly improved flowering performance and fruit set in durian. The treatment at 2 ml/L consistently produced the greatest number of flower clusters, higher flower uniformity, and the highest fruit set rate compared with the fungicide-only control. The combination of Glucan Duo with 75% fungicide also demonstrated strong efficacy, indicating that fungicide use could be reduced without compromising performance. Although the differences in fruit size and pedicle dimensions were not statistically significant, the overall trend favored Glucan Duo treatments. Overall, Glucan Duo particularly at 2 ml/L proved effective in enhancing reproductive success, improving plant physiological activity, and promoting sustainable durian cultivation by strengthening plant resilience and reducing dependency on chemical fungicides.

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