Plant Reproductive Responses of Guava 'Crystal' Under Different Paclobutrazol and NPK Fertilizer Doses

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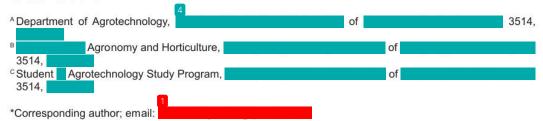
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Plant Reproductive Responses of Guava 'Crystal' Under Different Paclobutrazol and NPK Fertilizer Doses

Raden Ajeng Diana Widyastuti*^A, Hidayat Pujisiswanto^B, Hayane Adeline Warganegara^B, Eli Sabeth Sutriana^C



Abstract

preliminary study of reproductive responses of crystal guava plants under varying doses of paclobutrazol and NPK fertilizer was conducted. The research took place in a small-scale 'Crystal' orchard in Rajabasa 1, East Lampung, from Augu 15 2021 to March 2022. The study employed a 3x3 , examining complete paclobutrazol NPK fertilizer. paclobutrazol (P), had three levels: . The second pr, NPK fertilizer, was tested at three levels: (control), 250 , and The key variables measured were the number of reproductive shoots, blooming flowers, and fruits, serving as indicators of the 'Crystal' guava plant's reproductive responses. The study findings recommended the application of 2000 ppm paclobutrazol and 500 g per plant of NP fertilizer due to their significantly positive impact on reproductive shoots, blooming . Notably, there was no significant interaction observed between paclobutrazol and NPK treatments in regulating plant reproductive growth.

Keywords: reproductive shoots, guava, nitrogen, potassium, phosphorus.

Introduction

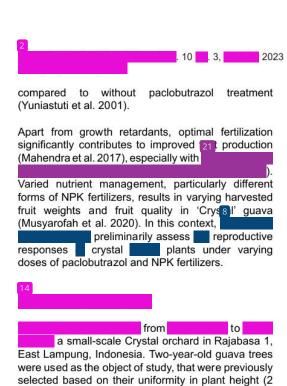
'Crystal' guava stands out as a superior fruit in Indonesia, capable of competing with imported fruits in the domestic market. Data from the Indonesia Bureau of Statistics reveals a significant rise in guava production, escalating from 200,487 tons in 2017 to 422,491 tons in 2021. This increase

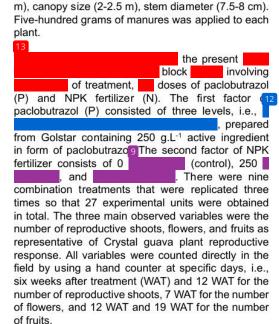
of 222,004 tons over five years underscores the fruit's growing popularity (BPS 2021). The 'Crystal' variety is particularly prized for its crunchy flesh and minimal seeds, constituting less than 3% of the fruit (Widyastuti et al. 2019a).

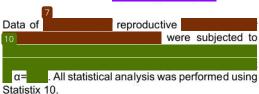
The significance of 'Crystal' guava is further amplified by its rich nutritional content, including sential elements like vitamin C and antioxidants (Hartati et al. 2020). Moreover, it is a

Hartati et al. 2020). Moreover, it is a source of sugar, fiber, protein, and minerals (Adrees et al. 2010). This nutritional profile not only adds to its appeal but also contributes to its perceived health benefits. The rising demand for 'Crystal' guava in the market emphasizes the necessity of improving guava fruit production. To cater to this demand, it is important to enhance production methods and maintain the fruit's superior quality.

Cultural techniques that have been studied to crease production and fruit quality include fruit 2022a), application (Trivedi . 2012; Goswami biofertilizer usage (Shukla . 2014; . 2021), bud thinning (. 2019b),), strangulation (Widyastuti . 2016; : Lal the application of growth retardant (Lizawati 2008). Paclobutrazol is a growth retardant that triggers reproductive responses, particularly flowering initiation. Its mechanism involves inhibiting gibberellin biosynthesis, impeding vegetative growth, and prompting flowering, as evidenced in citrus (Darmawan et al. 2014). Soil drenched paclobutrazol at 750 ppm on the 35th day after leaf rer 19 al in mango trees led to a substantial tree (96%, 74%, and 73% respectively)







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Results

revealed insignificant interaction between paclobutrazol and NPK fertilizer dose factors (Table 1). However, a single factor of paclobutrazol or NPK fertilizer significantly affected the reproductive responses of guava, as represented by the number of reproductive shoots, flowers, and fruits (Table 1).

Both paclobutrazol and NPK fertilizer significantly increased the number of reproductive shoots in guava plants at 6 and 12 weeks after treatment (WAT) (Table 2). Paclobutrazol at 2000 ppm proved to be the most efficient treatment, leading to a higher number of reproductive shoots at both 6 WAT and 12 WAT compared to paclobutrazol at 4000 ppm and the control without paclobutrazol. Specifically, it increased the number of reproductive shoots by 58% at 6 WAT and by 53% at 12 WAT compared to the control without paclobutrazol.

Similarly, in the case of NPK fertilizer, the application of 500 g per plant emerged as the most effective treatment, inducing a 58% increase in reproductive shoots at 6 WAT and a 53% increase at 12 WAT compared to the control without NPK (refer to Table 2).

application of paclobutrazol and NPK fertilizer impact flowers

3). Paclobutrazol treatment at concentrations of 2000 ppm or 4000 ppm increase in flower count, without paclobutrazol. Additionally, use NPK fertilizer at a rate of 250 g per plant increased flower numbers by 47%, whereas a dosage of 500 g per plant led to a significant 106% increase, both compared to the absence of NPK fertilizer (Table 3).

Table 1. The result of analysis of variance of 'Crystal' guava reproductive responses to different paclobutrazol and NPK fertilizer doses.

Variables	Paclobutrazol (P)	NPK (N)	Interaction (PxN)
Number of reproductive shoots	*	*	ns
Flower number	*	*	ns
Fruit number	*	*	ns

Note: ns - not significantly different, * significantly different.

Table 2. The number of reproductive shoots of 'Crystal' guava in response to different paclobutrazol and NPK fertilizer doses.

Treatments	Number of reproductive shoots		
Treatments	6 WAT	12 WAT	
Without Paclobutrazol	2.97 b	74.33 b	
Paclobutrazol 2000 ppm	3.65 a	94.33 a	
Paclobutrazol 4000 ppm	3.53 ab	87.22 a	
Without NPK	2.60 c	69.00 c	
NPK 250 g per plant	3.45 b	81.56 b	
NPK 500 g per plant	4.11 a	105.33 a	
LSD	0.59	12.10	
Note: WAT – Weeks after treatment, Means	alphabet within		

Table 3. The number of blooming flowers of 'Crystal' guava in response to different paclobutrazol and NPK fertilizer doses

Treatments	Flower number	
Without Paclobutrazol	21.11 b	
Paclobutrazol 2000 ppm	33.89 a	
Paclobutrazol 4000 ppm	30.00 a	
Without NPK	18.78 c	
NPK 250 g per plant	27.56 b	
NPK 500 g per plant	38.67 a	
LSD	8.39	
Unto Magne fellowed by the same	am not	LCD c=E%

Note: Means followed by the same are not LSD α=5%.

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4. in response to different paclobutrazol and NPK fertilizer doses

Fruit number		
12 WAT	19 WAT	
2.54 c	6.22 c	
3.63 a	12.89 a	
3.19 b	9.56 b	
2.37 c	5.11 c	
3.04 b	8.33 b	
3.96 a	15.22 a	
0.42	3.02	
	2.54 c 3.63 a 3.19 b 2.37 c 3.04 b 3.96 a	

Note: WAT – Weeks after treatment. Means followed by the same LSD _____=5%.

Both paclobutrazol and NPK fertilizer significantly increased the number of 'Crystal' guava fruits at 6 and 12 weeks after treatment (WAT) (refer to Table 4). Paclobutrazol at 2000 ppm proved to be the most effective treatment, resulting in a 43% increase in fruit number at 12 WAT and a 107% increase at 19 WAT, surpassing both paclobutrazol at 4000 ppm

and the control without paclobutrazol. Similarly,

NPK 500 g per

led to a 67% increase in fruit number at 12 WAT and a 198% increase at 19 WAT, compared to the control without NPK (Table 4)

Discussion

yielded significant reproductive shoots, with the highest shoot numbers recorded at 2000 ppm paclobutrazol, reaching 3.65 shoots at 6 weeks after treatment (WAT) and 94.33 shoots at 12 WAT. This finding aligns with a previous study by Prawitasari et al. (2005) that paclobutrazol increased the average number of induced, initiated, and differentiated shoots, inhibited vegetative growth, and stimulated the growth of reproductive shoots. The enhanced production of reproductive shoots significantly enhanced flower formation and, subsequently, the harvested fruits.

Similarly, the application of NPK fertilizer demonstrated a significant positive impact on generative shoots. Specifically, applying 500 g per plant of NPK resulted in a higher number of reproductive shoots compared to the 21 g per plant NPK treatment. This finding mirrors prior Listari Listari Listari prior prior Listari prior prior Listari prior prior Listari prior Listari prior prior Listari prior prior Listari prior prior prior Listari prior prio

Paclobutrazol application increased the number of flowers at 7 WAT, surpassing the control group significantly. This observation aligns with the findings of Rai (2004). Similarly, enhancement flowering was also evident with NPK fertilizer application. Adequate availability of NPK supports the reproductive growth, evident from the reduction in flower drop. 'Crystal' guava treated with NPK at 500 g per plant exhibited a higher number of flowers compared to those without NPK fertilizer application. The increase in flower numbers on 'Crystal' guava plants is promising, as it directly correlates with the fruit formation.

Under the treatment of 2000 ppm paclobutrazol, a higher number of fruits were formed. Similarly, applying 500 g per plant of NPK also resulted in a higher fruit yield compared to the other two treatments. This increase in fruit production directly correlated with the rise in the number of flowers, consistent with findings from Widyastuti et al. (2019a).

Similar to the impact of strangulation as reported by Widyastuti et al. (2019b), paclobutrazol exhibited significant stimulatory effects on reproductive growth responses. This effect was clearly observed in the sequential processes of flowering, fertilization, and fruit formation. Paclobutrazol not only promote the absorption of minerals, chlorophyll, and carbohydrate content in plant tissues but also heightened the dominance of reproductive growth over vegetative

growth. The dominance was closely linked to the C/N ratio leaves (leaves (leaves of the present study, future research that delves into these aspects could prove instrumental in achieving a balanced C/N ratio. Such equilibrium could, in turn, lead to increased photosynthate accumulation and flowering.

Furthermore, the application of NPK fertilizer played an important role in supplying essential nutrients to plants, promoted flowering and fruit formation (Waskito et al., 2018). Despite its efficacy, the use of paclobutrazol for regulating guava flowering and fruiting demands careful consideration due to its potential adverse effects. While paclobutrazol has a low likelihood of contaminating surface water and groundwater, there is a significant risk associated with its accumulation in aquatic life. This accumulation poses a notable concern when aquatic organisms are consumed by humans, given the genotoxic and carcinogenic risks involved (Kishore et al., 2015).

Conclusion

The application of 2000 ppm paclobutrazol significantly increased reproductive shoots, 'Crystal' guava. Concurrently, applying 500 g of per yielded results quantity reproductive shoots, . There was no significant interaction between the paclobutrazol and NPK treatments in regulating the reproductive growth of 'Crystal' guava.

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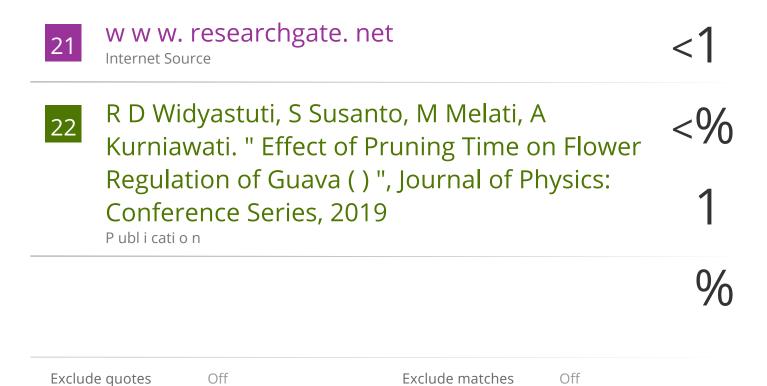
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