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EFFECT OF GIRDLING AND PACLOBUTRAZOL ON REPRODUCTIVE BEHAVIOUR AND PRODUCTIVITY OF JAMUN (*Syzygium cumini* SKEELS.) cv. AJG-85

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ABSTRACT

A field experiment was conducted at the Main Horticultural Research and Extension Centre, University of Horticultural Sciences, Bagalkot, Karnataka, during 2025-2026 to evaluate the effect of girdling and paclobutrazol on reproductive behaviour and productivity of jamun cv. AJG-85. The experiment was laid out in a factorial randomized block design with four girdling timings and four paclobutrazol levels. Girdling treatments consisted of control, deep cut during the first and second fortnights of October and the first fortnight of November, while paclobutrazol was applied to the soil at 0, 1.0, 1.5 and 2.0 g a.i. per m² canopy area. The results revealed significant effects of both girdling and paclobutrazol, as well as their interaction, on flower initiation, panicle production, flowers per panicle, fruit set and fruit yield. Deep cut during the second fortnight of October resulted in the earliest flower initiation (97.00 days), maximum number of panicles (87.31/plant), flowers per panicle (53.25) and fruit yield (7.05 t/ha), whereas deep cut during the first fortnight of November recorded the highest fruit set (58.55%). Among the paclobutrazol treatments, soil application at 1.5 g a.i. per m² canopy area resulted in the earliest flower initiation (97.13 days), maximum panicles (89.09/plant), flowers per panicle (54.25), fruit set (61.70%) and fruit yield (7.17 t/ha). The interaction between deep cut during the second fortnight of October and paclobutrazol at 1.5 g a.i. per m² canopy area recorded the highest number of panicles (102.00/plant), flowers per panicle (58.00), fruit set (64.98%) and fruit yield (8.10t/ha). The study indicated that appropriate timing of girdling in combination with an optimum paclobutrazol dose can effectively regulate flowering and improve productivity of jamun cv. AJG-85 under the agroclimatic conditions of Northern Karnataka.

Key words : Girdling, Paclobutrazol, Flowering, Fruit set, Yield, Jamun.

Introduction

Jamun (*Syzygium cumini* Skeels.), a member of the Myrtaceae family, is a significant evergreen fruit crop that is native to India (Singh, 1969) and widely distributed throughout tropical and subtropical regions of India. The fruit is consumed both fresh and in processed products and is prized for its unique flavor, appealing color and nutritional qualities. In addition to its culinary value, jamun has drawn a lot of attention due to its functional and medicinal significance (Sagrawat *et al*., 2006).

Jamun production is constrained by irregular flowering, flower and fruit drop and variable productivity despite its potential as a commercial fruit crop. (Bajpai *et al*., 2012). For perennial fruit crops, regulation of flowering and fruiting is therefore an important component of production technology. Carbohydrate availability and hormone modulation affect reproductive development and environmental factors also have a significant impact on

flowering and fruiting behavior (Gawankar *et al.*, 2019). Seasonal climatic factors have been shown to affect fruit set, flowering and reproductive phenology in jamun (Bajpai *et al.*, 2012).

Girdling is an important horticultural technique for manipulating flowering and fruiting in perennial fruit crops. In order to temporarily inhibit phloem transit and increase the accumulation of assimilates above the girdled region, a small ring of bark is removed or interrupted. Fruit development, fruit retention and floral differentiation may benefit from this alteration in assimilate distribution. Girdling can affect flowering, fruit set and fruit quality through modifications in carbohydrate distribution and plant physiological processes, according to Gawankar *et al.* (2019) reported that analysis of the practice's impact in horticulture crops. The timing and intensity of girdling have a significant impact on the reaction. Deep girdling of tertiary branches enhanced blooming, fruit set and yield in jamun cv. Konkan Bahadoli, according to Haldankar *et al.* (2014).

Paclobutrazol (PBZ) is another important plant growth regulator used for regulating vegetative and reproductive development in perennial fruit crops. It inhibits gibberellin biosynthesis and consequently restricts excessive vegetative growth. Reduced vegetative vigour can alter the source-sink relationship and favour reproductive development. Rademacher (2015) pointed out that plant growth regulators, particularly growth retardants such as paclobutrazol, have important roles in regulating shoot growth and reproductive development. Paclobutrazol has been extensively studied in mango and other perennial fruit crops for regulating flowering and yield. Yeshitela *et al*. (2004) reported that PBZ suppressed vegetative growth and improved flowering and yield in 'Tommy Atkins' mango, while Kishore *et al.* (2015) emphasized the importance of optimum concentration and application timing.

According to Deepika *et al*. (2019), PBZ application affected fruit set, blooming and floral bud initiation in jamun, indicating its potential as a crop-regulating treatment. More recently, Pawar *et al*. (2025) found that PBZ had a major impact on jamun fruit yield and flowering. However, information on the effects of girdling and paclobutrazol on the reproductive behaviour and productivity of jamun cv. AJG-85 under the agroclimatic conditions of Northern Karnataka is limited. Therefore, the present study was undertaken to evaluate the effects of different girdling timings and paclobutrazol levels on flowering behaviour, fruit set and fruit yield of jamun cv. AJG-85.

Materials and Methods

Experimental site and plant material

The research was carried out at the Main Horticultural Research and Extension Center (MHREC), University of Horticultural Sciences, Bagalkot, Karnataka, India, in 2025-2026. The experimental site is situated at roughly 16°10' N latitude, 75°42' E longitude and 542 meters above mean sea level. The area has a mild, arid climate and is part of Karnataka's Northern arid Zone. Jamun cv. AJG-85 was used in the experiment and trees were planted six by six meters apart. The University of Horticultural Sciences, Bagalkot created and assessed the promising jamun variety AJG-85 (Lakshmeshwara *et al.*, 2024).

Experimental design and treatments

The experiment was laid out in a factorial randomized block design (FRBD) comprising four girdling treatments and four paclobutrazol treatments, with two replications. Each treatment combination consisted of two plants, resulting in a total of 64 experimental plants. Girdling was performed on tertiary branches by making a 3-5 mm deep cut during the respective treatment periods in October and November. Paclobutrazol was applied as a soil drench on 30th September 2025 at 1.0, 1.5 and 2.0 g a.i. per m^2 canopy area.

Girdling treatments

G_1 : Control

G_2 : First fortnight of October

G_3 : Second fortnight of October

G_4 : First fortnight of November

Paclobutrazol treatments

P_1 : Control

P_2 : 1.0 g a.i. per m^2 canopy area

P_3 : 1.5 g a.i. per m^2 canopy area

P_4 : 2.0 g a.i. per m^2 canopy area

Cultural practices

Over the course of the experiment, consistent orchard management techniques were used. Drip irrigation was used to offer irrigation based on rainfall and soil moisture. Pre-flowering irrigation was stopped and after fruit set, irrigation was started again. Recommended orchard techniques were followed for weed control, fertilizer and plant protection.

Observations recorded

Days to flower initiation : The number of days required between treatment or application and apparent

blossom initiation was noted.

Number of panicles per plant : Each experimental tree's total number of flowering panicles was tallied and expressed as panicles per plant.

Number of flowers per panicle : The number of flowers was counted on representative flowering panicles, and the mean number of flowers per panicle was calculated.

Fruit set per panicle (%)

$$\text{Fruit set (\%)} = \frac{\text{Number of fruits formed}}{\text{Number of flowers}} \times 100$$

Fruit yield (t/ha) : The total fruit yield per hectare was calculated from individual tree yield based on a planting density of 277.78 plants per ha, corresponding to a spacing of 6 × 6 m, and expressed in tonnes per hectare (t/ha).

Statistical analysis : The data were subjected to analysis of variance appropriate for a factorial randomized block design (FRBD). The significance of the main effects and interaction was tested using the F-test at the 5% probability level. Standard error of the mean (S.Em. ±) and critical difference (CD) at the 5% probability level were used for comparison of treatment means following Panse and Sukhatme (1967).

Results and Discussion

Days to flower initiation

The time taken for flower initiation was significantly influenced by girdling and paclobutrazol, with a significant interaction between the two. Deep cut during the second fortnight of October resulted in the earliest flower initiation (97.00 days), followed by the first fortnight of October (100.75 days) and the first fortnight of November (101.00 days), whereas control plants recorded the longest duration (105.50 days). Among the PBZ treatments, soil application at 1.5 g a.i. per m² canopy area resulted in the earliest flower initiation (97.13 days), followed by 2.0 g a.i. per m² (100.25 days) and 1.0 g a.i. per m² (102.63 days), while control plants required the longest period (104.25 days). The interaction effect showed that deep cut during the second fortnight of October combined with PBZ at 1.5 g a.i. per m² canopy area resulted in the earliest flower initiation (93.50 days), whereas control plants without PBZ recorded the longest duration (112.50 days) (Table 1). The earlier flowering with deep cutting during the second fortnight of October may be attributed to temporary restriction of phloem translocation and consequent accumulation of assimilates above the treated region, which could favour reproductive development. The response to girdling was also dependent on its timing, suggesting that the second fortnight of October may have coincided more closely with the physiological stage favourable for floral induction under the prevailing conditions. Similar enhancement of flowering following girdling was reported by Haldankar *et al.* (2014) in jamun cv. Konkan Bahadoli. The promotive effect of PBZ may be associated with inhibition of gibberellin biosynthesis, which restricts excessive vegetative growth and favours reproductive development (Kishore *et al.*, 2015; Rademacher, 2015). Upreti *et al.* (2013) reported that PBZ induced early flowering in mango and was associated with reduced gibberellin levels along with changes in ABA, cytokinins and C: N ratio, indicating the physiological role of PBZ in promoting floral induction. The higher response at 1.5 g a.i. per m² in the present study suggests that this rate provided a favourable level of growth retardation for flower induction, while the significant interaction indicates that the response to paclobutrazol varied with girdling timing.

Number of panicles per plant

The number of panicles per plant was significantly influenced by girdling and paclobutrazol, with a significant interaction between the two. Deep cut during the second fortnight of October produced the highest number of panicles (87.31/plant), followed by the first fortnight of October (80.13/plant) and the first fortnight of November (72.38/plant), whereas control plants recorded the lowest number (61.81/plant). Among the PBZ treatments, soil application at 1.5 g a.i. per m² canopy area resulted in the highest number of panicles (89.09/plant), followed by 1.0 g a.i. per m² (74.78/plant) and 2.0 g a.i. per m² (73.44/plant), while control plants (64.31 panicles/plant) recorded the least. The interaction effect showed that deep cut during the second fortnight of October combined with PBZ at 1.5 g a.i. per m² canopy area produced the maximum number of panicles (102.00/plant), whereas control plants without PBZ application recorded the minimum (49.75/plant) (Table 1). The increase in panicle production following deep cutting may be associated with improved assimilate availability and altered source–sink relationships following temporary restriction of phloem translocation. Similarly, the higher panicle production with PBZ at 1.5 g a.i. per m² may be associated with moderate suppression of vegetative growth and a consequent shift in assimilate allocation towards reproductive growth. The enhancement of floral bud initiation and flowering by PBZ in jamun reported by Deepika *et al.* (2019a) supports the present findings. The significant interaction indicates that the response to PBZ was influenced by the timing of deep cutting, with second-fortnight October deep cutting

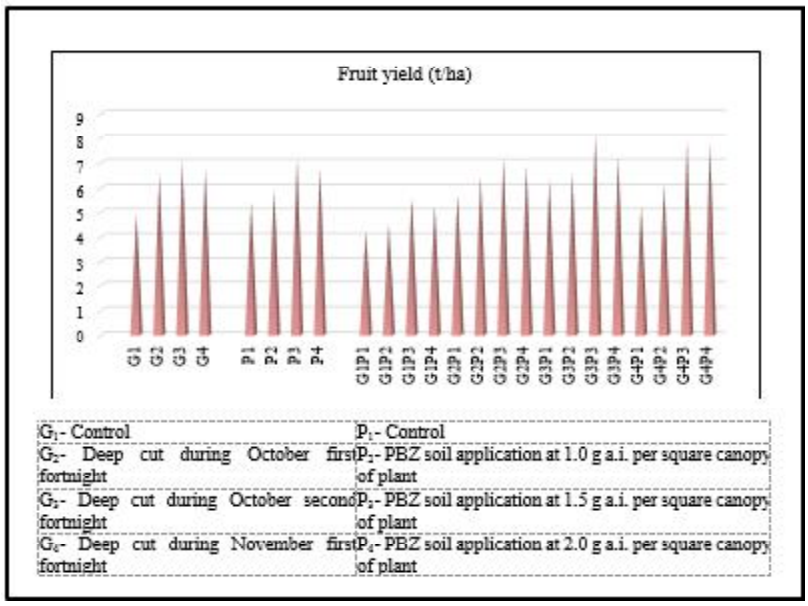


Fig. 1 : Fruit yield of jamun cv. AJG-85 as influenced by girdling and paclobutrazol.

combined with 1.5 g a.i. per m² canopy area producing the highest panicle number.

Number of flowers per panicle

The number of flowers per panicle was significantly influenced by girdling and paclobutrazol, with a significant interaction between the two. Deep cut during the second fortnight of October recorded the highest number of flowers per panicle (53.25), followed by the first fortnight of October (50.50) and the first fortnight of November (49.45), whereas control plants recorded the lowest value (45.50). Among the PBZ treatments, soil application at 1.5 g a.i. per m² canopy area resulted in the highest number of flowers per panicle (54.25), followed by 1.0 g a.i. per m² (49.38) and 2.0 g a.i. per m² (48.25), while control plants recorded 46.83 flowers per panicle. The interaction effect showed that deep cut during the second fortnight of October combined with PBZ at 1.5 g a.i. per m² canopy area produced the maximum number of flowers per panicle (58.00), whereas the minimum (43.00) was recorded in control plants without PBZ application (Table 1). The increased number of flowers per panicle following deep cutting during the second fortnight of October may be associated with enhanced assimilate availability during reproductive development. The higher response to PBZ at 1.5 g a.i. per m² suggests that a favourable level of growth retardation promoted reproductive development, while the comparatively lower response at 2.0 g a.i. per m² indicates that the response was concentration dependent. Similar concentration-dependent effects of PBZ on flowering in perennial fruit crops have been reported by Yeshitela *et al.* (2004) and Kishore *et al.* (2015), supporting the present findings.

Fruit set

The fruit set per panicle was significantly influenced by girdling and paclobutrazol, with a significant interaction between the two. Among the girdling treatments, deep cut during the first fortnight of November recorded the highest fruit set (58.55%), followed by the second fortnight of October (56.76%) and the first fortnight of October (53.14%), whereas control plants recorded the lowest fruit set (51.81%). Among the PBZ treatments, soil application at 1.5 g a.i. per m² canopy area resulted in the highest fruit set (61.70%), followed by 2.0 g a.i. per m² (60.16%), while 1.0 g a.i. per m² (49.26%) was comparable with the control (49.15%). The interaction effect showed that deep cut during the second fortnight of October combined with PBZ at 1.5 g a.i. per m² canopy area resulted in the highest fruit set (64.98%), whereas the lowest fruit set (42.05%) was recorded in control plants without PBZ application (Table 2). The improvement in fruit set following girdling may be associated with greater assimilate availability to developing reproductive sinks, thereby supporting fruitlet retention. Similar improvement in fruit set following girdling and enhanced carbohydrate availability was reported by Rivas *et al.* (2006) in citrus. The higher fruit set with PBZ at 1.5 g a.i. per m² may be attributed to moderated vegetative growth and a favourable shift towards reproductive development. The superior response at 1.5 g a.i. per m² compared with the lower and higher rates indicates a concentration-dependent response of PBZ. Improved flowering and fruit set in jamun following PBZ application were reported by Deepika *et al.* (2019a), while Pawar *et al.* (2025) reported effects of PBZ on flowering and fruit yield in jamun, supporting the present findings.

Fruit yield

The fruit yield was significantly influenced by girdling and paclobutrazol, with a significant interaction between the two. Among the girdling treatments, deep cut during the second fortnight of October recorded the highest fruit yield (7.05 t/ha), followed by the first fortnight of November (6.73 t/ha) and the first fortnight of October (6.55 t/ha), whereas control plants recorded the lowest yield (4.91 t/ha). Among the PBZ treatments, soil application at 1.5 g a.i. per m² canopy area resulted in the highest fruit yield (7.17 t/ha), followed by 2.0 g a.i. per m² (6.78 t/ha) and 1.0 g a.i. per m² (5.91 t/ha), while control plants recorded the least (5.38 t/ha). The

Table 1 : Effect of girdling and paclobutrazol on flowering behaviour of jamun cv. AJG-85.

Treatment	Days taken for flower initiation	No. of panicles/ plant	No. of flowers/ panicle
Girdling (G)			
G_1	105.50	61.81	45.50
G_2	100.75	80.13	50.50
G_3	97.00	87.31	53.25
G_4	101.00	72.38	49.45
S. Em±	**0.43**	**0.24**	**0.15**
CD at 5%	**1.31**	**0.73**	**0.45**
Paclobutrazol (P)			
P_1	104.25	64.31	46.83
P_2	102.63	74.78	49.38
P_3	97.13	89.09	54.25
P_4	100.25	73.44	48.25
S. Em±	**0.43**	**0.24**	**0.15**
CD at 5%	**1.31**	**0.73**	**0.45**
Interaction (G x P)			
G_1P_1	112.50	49.75	43.00
G_1P_2	110.00	61.88	45.50
G_1P_3	98.00	76.00	49.00
G_1P_4	101.50	59.63	44.50
G_2P_1	100.50	70.25	47.50
G_2P_2	101.50	80.25	50.50
G_2P_3	100.00	95.13	55.50
G_2P4	101.00	74.88	48.50
G_3P_1	100.00	76.88	50.00
G_3P_2	98.00	87.50	53.00
G_3P_3	93.50	102.00	58.00
G_3P_4	96.50	82.88	52.00
G_4P_1	104.00	60.38	46.80
G_4P_2	101.00	69.50	48.50
G_4P_3	97.00	83.25	54.50
G_4P_4	102.00	76.37	48.00
S. Em ±	**0.87**	**0.48**	**0.30**
CD at 5%	**2.61**	**1.46**	**0.90**

G_1- Control
G_2- Deep cut during October first fortnight
G_3- Deep cut during October second fortnight
G_4- Deep cut during November first fortnight
P_1- Control
P_2- PBZ soil application at 1.0 g a.i. per square canopy of plant
P_3- PBZ soil application at 1.5 g a.i. per square canopy of plant
P_4- PBZ soil application at 2.0 g a.i. per square canopy of plant

interaction effect showed that deep cut during the second fortnight of October combined with PBZ at 1.5 g a.i. per m² canopy area resulted in the highest fruit yield (8.10 t/ha), whereas the lowest yield (4.22 t/ha) was recorded in control plants without PBZ application (Fig. 1). The higher yield with deep cutting during the second fortnight of October may be attributed to its favourable effect on reproductive development, as this treatment also promoted

Table 2 : Effect of girdling and paclobutrazol on fruit set and fruit yield of jamun cv. AJG-85.

Treatment	Fruit set per panicle (%)
Girdling (G)a	
G_1	51.81
G_2	53.14
G_3	56.76
G_4	58.55
S. Em±	**0.54**
CD at 5%	**1.63**
Paclobutrazol (P)	
P_1	49.15
P_2	49.26
P_3	61.70
P_4	60.16
S. Em±	**0.54**
CD at 5%	**1.63**
Interaction (G x P)	
G_1P_1	42.05
G_1P_2	45.43
G_1P_3	60.47
G_1P_4	59.31
G_2P_1	51.06
G_2P_2	42.87
G_2P_3	60.37
G_2P4	58.25
G_3P_1	51.67
G_3P_2	54.28
G_3P_3	64.98
G_3P_4	60.14
G_4P_1	51.85
G_4P_2	54.46
G_4P_3	60.97
G_4P_4	62.92
S. Em ±	**1.08**
CD at 5%	**3.26**

G_1- Control
G_2- Deep cut during October first fortnight
G_3- Deep cut during October second fortnight
G_4- Deep cut during November first fortnight
P_1- Control
P_2- PBZ soil application at 1.0 g a.i. per square canopy of plant
P_3- PBZ soil application at 1.5 g a.i. per square canopy of plant
P_4- PBZ soil application at 2.0 g a.i. per square canopy of plant

earlier flower initiation, greater panicle production and more flowers per panicle, thereby contributing to higher yield. Although, the first fortnight of November recorded the highest fruit set among the girdling treatments, its yield was lower than that obtained with second-fortnight October deep cutting, indicating that final yield was determined by the combined contribution of flowering intensity, fruit set and subsequent fruit development rather than fruit set alone. The higher yield with PBZ at 1.5 g a.i. per m² may be associated with a favourable level of growth retardation and improved allocation of assimilates towards reproductive development, whereas the reduced response at 2.0 g a.i. per m² indicates that increasing the rate did not provide additional yield benefits. Similar improvement in flowering and yield following PBZ application has been reported in jamun and other perennial fruit crops (Yeshitela *et al.*, 2004; Deepika *et al.*, 2019a; Deepika *et al.*, 2019b; Pawar *et al.*, 2025).

Conclusion

The present study demonstrated that girdling timing and paclobutrazol application rate significantly influenced flowering, fruit set and fruit yield of jamun cv. AJG-85. Deep cutting during the second fortnight of October advanced flower initiation and increased panicle production, flowers per panicle and fruit yield, whereas deep cutting during the first fortnight of November recorded the highest fruit set among the girdling treatments. Among the paclobutrazol treatments, soil application at 1.5 g a.i. per m² canopy area recorded the earliest flower initiation and the highest panicle number, flowers per panicle, fruit set and fruit yield. The interaction of deep cutting during the second fortnight of October with paclobutrazol at 1.5 g a.i. per m² canopy area recorded the earliest flower initiation, highest panicle number, flowers per panicle, fruit set and fruit yield The results indicate that appropriate timing of girdling and paclobutrazol application can regulate reproductive development and improve productivity of jamun cv. AJG-85 under the agroclimatic conditions of Northern Karnataka.

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