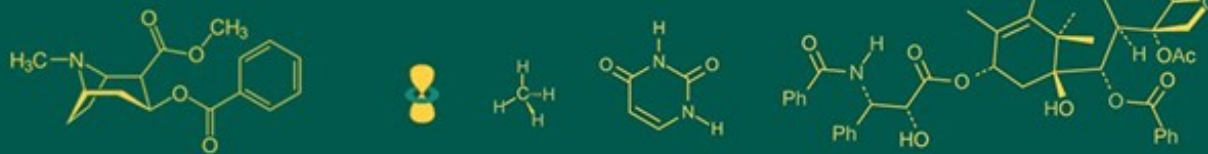


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Effect of growth substances on germination and seedling growth of passion fruit (*Passiflora edulis* Sims.)

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ABSTRACT

The present study evaluated the effects of plant growth substances on seed germination and seedling performance of passion fruit (*Passiflora edulis* Sims.) under shade-net nursery conditions at the Arecanut Research Centre, Navile, Shivamogga, during 2025–26. The treatments comprised two fruit types (*V*), viz., *V*₁ = purple passion fruit (*Passiflora edulis* var. *edulis*) and *V*₂ = yellow passion fruit (*Passiflora edulis* var. *flavicarpa*), and sixteen plant growth substance treatments (*P*). The experiment was laid out in a factorial completely randomized design (FCRD), comprising 32 treatment combinations with two replications. Yellow passion fruit recorded 72.65 per cent germination at 60 days after sowing (DAS), took 23.84 days to attain 50 per cent germination and recorded 14.88 cm seedling height, 11.55 leaves, a vigour index-I of 1316.85 and 72.59 per cent survival. Seeds soaked in *GA*₃ at 250 ppm for 20 minutes recorded the highest germination (95.14%) at 60 DAS, the earliest attainment of 50 per cent germination (13.75 days), the highest vigour index-I (2354.92) and survival percentage (91.25%). The interaction *V*₂*P*₇ (yellow passion fruit seeds soaked in *GA*₃ at 250 ppm for 20 minutes) recorded the highest germination (95.50%), earliest attainment of 50 per cent germination (13.30 days), highest vigour index-I (2412.82) and survival percentage (92.13%). *GA*₃ at 500 ppm was particularly effective in increasing seedling height (20.97 cm) and number of leaves (15.57). Thus, under the experimental conditions, soaking yellow passion fruit seeds in *GA*₃ at 250 ppm for 20 minutes was found to be a promising treatment for improving germination, seedling vigour and survival.

Keywords: Nursery production, *Passiflora edulis* var. *edulis*, *P. edulis* var. *flavicarpa*, Plant growth substances

Introduction

Passion fruit (*Passiflora edulis* Sims.) belongs to the family Passifloraceae and is native to Brazil. It is an important tropical and subtropical perennial vine valued for its nutritional, medicinal and aromatic properties. It is commercially cultivated in countries such as Kenya, Australia, New Zealand, Hawaii, South Africa and Sri Lanka (Sema *et al.*, 2009) [1]. In India, it is grown in several parts of the Western Ghats, including Nilgiris, Wayanad, Kodaikanal, Coorg and Malabar, as well as in Himachal Pradesh and the north-eastern states. The area under passion fruit cultivation in India is reported as 9,000 ha, with production of 34,000 MT and productivity of 3.78 MT ha⁻¹ (Anonymous, 2025) [2]. The genus *Passiflora* comprises about 500 species, of which approximately 50 bear edible fruits. Two forms are commercially important: purple passion fruit (*P. edulis* var. *edulis*) and yellow passion fruit (*P. edulis* var. *flavicarpa*). Yellow passion fruit is characterized by vigorous growth, high yield potential and tolerance to certain soil-borne diseases, whereas cooler temperatures favour flower initiation and fruit set in purple passion fruit. Light to heavy sandy loam soils of medium texture with a pH of 6.5–7.5 are considered suitable for passion fruit production (Tripathi, 2018) [3]. Despite its economic importance, commercial production of passion fruit in India is constrained by poor seed germination and non-uniform seedling establishment. Seed propagation remains important for raising seedlings and rootstocks and germination is a critical stage because it directly influences seedling establishment and nursery efficiency. Slow, uneven or delayed germination may be associated with physical, chemical and physiological dormancy and embryo immaturity (Fávaris *et al.*, 2020) [4]. Pre-germination treatments, including gibberellic acid (*GA*₃), thiourea, potassium nitrate and organic preparations, have been investigated to improve germination and early seedling establishment. Therefore, the present study was undertaken to evaluate the effects of different growth substances on seed germination and seedling vigour of passion fruit.

and number of leaves (15.73). The present results are in agreement with Gurung *et al.* (2014) [9], reported that GA₃ at 500 ppm resulted in maximum seedling height in passion fruit. Comparable increases in plant height following GA₃ treatment were reported in guava by Manthri and Bharad (2017) [10] and Banyal *et al.* (2022) [11], in kokum by Deshmukh *et al.* (2023) [12] and in papaya by Jagtap *et al.*

(2024) [13]. The superiority of GA₃ at 500 ppm for height can be explained by the well-established role of gibberellins in cell elongation, increased cell-wall extensibility and enhanced internodal growth. Once emergence had occurred, the higher GA₃ dose produced a stronger elongation response than 250 ppm. (Table 2)

Table 2. Effect of plant growth substances on seedling height and number of leaves in passion fruit seedlings.

Treatment	Seedling height (cm)			Number of leaves		
	V ₁ ×P	V ₂ ×P	P Mean	V ₁ ×P	V ₂ ×P	P Mean
P ₁ : Control	9.42	10.02	9.72	9.26	9.58	9.42
P ₂ : Normal water	10.92	11.52	11.22	9.96	10.28	10.12
P ₃ : Hot water	8.65	9.20	8.95	7.59	7.91	7.75
P ₄ : Panchagavya (2 %)	16.15	16.75	16.45	11.59	11.91	11.75
P ₅ : Beejamrutha (2 %)	14.75	15.35	15.05	10.61	10.93	10.77
P ₆ : Cow urine	14.07	14.67	14.37	11.19	11.51	11.35
P ₇ : GA ₃ 250 ppm	19.50	20.10	19.80	14.19	14.51	14.35
P ₈ : GA ₃ 500 ppm	20.67	21.27	20.97	15.41	15.73	15.57
P ₉ : Thiourea (1 %)	16.87	17.47	17.17	12.34	12.66	12.50
P ₁₀ : Thiourea (2 %)	16.45	17.05	16.75	10.41	10.73	10.57
P ₁₁ : H ₂ SO ₄ (1 %)	12.32	12.92	12.62	9.36	9.68	9.52
P ₁₂ : H ₂ SO ₄ (2 %)	11.57	12.17	11.87	11.44	11.76	11.60
P ₁₃ : HCl (1 %)	11.87	12.47	12.17	10.26	10.58	10.42
P ₁₄ : HCl (2 %)	9.87	10.47	10.17	11.34	11.66	11.50
P ₁₅ : KNO ₃ (0.5 %)	17.12	17.72	17.42	11.69	12.01	11.85
P ₁₆ : KNO ₃ (1 %)	18.25	18.85	18.55	13.04	13.36	13.20
V Mean	14.28	14.88		11.23	11.55	

Source of variation	S. Em. ±		C.D. @ 5 %	
	Seedling height	Number of leaves	Seedling height	Number of leaves
V factor	0.13	0.08	0.39	0.25
P factor	0.36	0.24	1.05	0.71
Interaction (V x P)	0.51	0.34	NS	NS

Note: 1. DAS – Days after sowing.

2. V: Fruit type (V₁: Purple Type, V₂: Yellow Type)

3. P: Plant growth substances

4. NS: Non-significant

Yellow passion fruit recorded higher vigour index-I (1316.85) than purple passion fruit (1262.53). GA₃ 250 ppm recorded the highest (2354.92), whereas hot water recorded the lowest (320.46). V₂P₇ recorded the maximum interaction value (2412.82), followed by V₁P₇

(2297.03). The high vigour under GA₃ 250 ppm resulted from the combined effect of rapid germination, greater seedling growth. (Table 3).

Table 3. Effect of plant growth substances on vigour index-I in passion fruit seedlings

Treatments	Vigour index-I		
	V ₁ ×P	V ₂ ×P	P Mean
P ₁ : Control	641.37	697.29	669.33
P ₂ : Normal water	839.35	903.76	871.55
P ₃ : Hot water	293.11	347.816	320.46
P ₄ : Panchagavya (2 %)	1480.05	1531.70	1505.87
P ₅ : Beejamrutha (2 %)	1182.41	1233.08	1207.75
P ₆ : Cow urine	1133.76	1207.68	1170.72
P ₇ : GA ₃ 250 ppm	2297.03	2412.82	2354.92
P ₈ : GA ₃ 500 ppm	2065.73	2106.15	2085.94
P ₉ : Thiourea (1 %)	1902.39	1996.92	1949.66
P ₁₀ : Thiourea (2 %)	1428.48	1482.19	1455.33
P ₁₁ : H ₂ SO ₄ (1 %)	1028.55	1013.16	1020.86
P ₁₂ : H ₂ SO ₄ (2 %)	960.54	998.57	979.56

(continued on next page)

Treatments	Vigour index-I		
	V ₁ ×P	V ₂ ×P	P Mean
P ₁₃ : HCl (1 %)	891.42	925.23	908.32
P ₁₄ : HCl (2 %)	798.67	872.27	835.47
P ₁₅ : KNO ₃ (0.5 %)	1468.11	1493.86	1480.98
P ₁₆ : KNO ₃ (1 %)	1789.54	1847.06	1818.30
V Mean	1262.53	1316.85	

Source of variation	S. Em. ±	C.D. @ 5 %
V factor	14.98	43.17
P factor	42.39	122.11
Interaction (V x P)	59.94	172.69

Note: 1. DAS – Days after sowing.

2. V: Fruit type (V₁: Purple Type, V₂: Yellow Type)

3. P: Plant growth substances

4. NS: Non-significant

Yellow passion fruit recorded significantly higher survival per cent (72.59 %) than the purple passion fruit (71.09 %). Seeds treated with GA₃ 250 ppm recorded the highest survival rate (91.25 %), whereas the control recorded the lowest (58.01 %). The interaction V₂P₇ recorded the highest survival rate (92.13 %), followed by V₁P₇ (90.50 %), while V₁P₁ recorded the minimum (57.50 %). (Fig 1). The im-

proved survival under GA₃ 250 ppm was associated with earlier emergence, stronger roots, greater biomass and higher seedling vigour. Improved survival and establishment of seedlings when treated with GA₃ has been reported in guava by Dinesh *et al.* (2019) [14], khirni by Bajaniya *et al.* (2018) [15], jamun by Hota *et al.* (2018) [16] and papaya by Jagtap *et al.* (2024) [13].

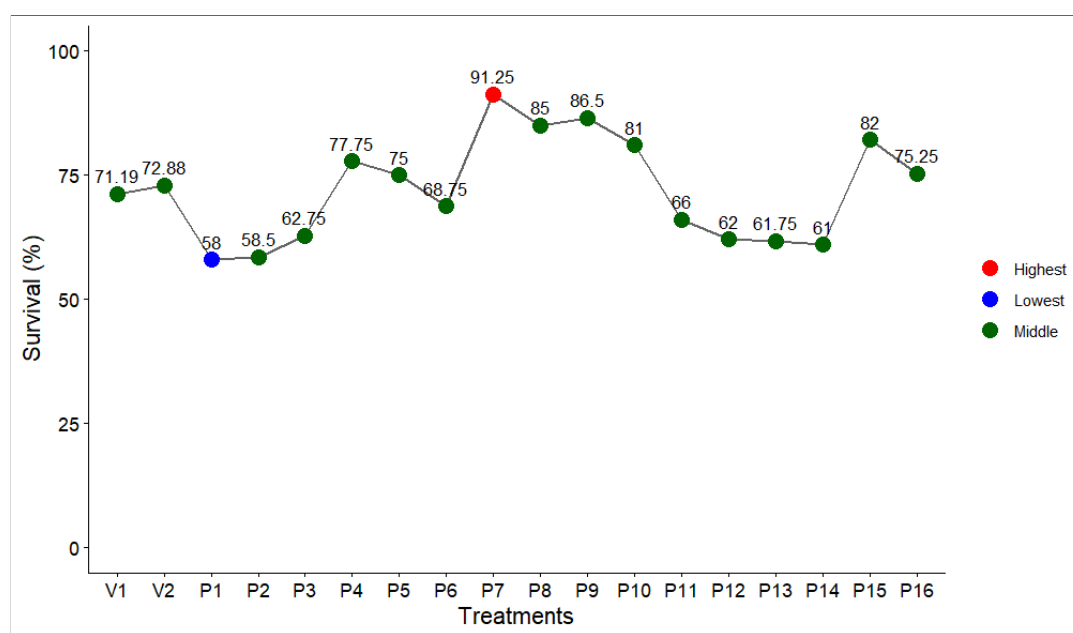


Figure 1. Effect of plant growth substances on survival per cent in passion fruit seedlings at 120 DAS

Conclusion

Under the conditions of the present investigation, yellow passion fruit generally showed superior seedling performance compared with purple passion fruit. GA₃ 250 ppm was the most consistent treatment for rapid and high germination, seedling vigour and survival, while GA₃ 500 ppm was particularly effective for seedling height, leaf number. Therefore, GA₃ at 250 ppm can be considered a promising seed treatment for improving germination, vigour and survival of purple and yellow passion fruit seedlings under the experimental conditions.

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