Effect of light and GA_3 on germination of Purple Passion Fruit (*Passiflora edulis* Sims*)* seeds

ABSTRACT

The present study was carried out to investigate the effect of light and GA_3on the germination of purple passion fruit (*Passiflora edulis* sims) under agro climatic condition of prayagraj. The perforated polythene bags of 4 x 5 cm size (150 gauges thickness) were used for sowing. The bags were filled with a mixture of farmyard manure (FYM), sand and soil in the ratio of 1:1:1. Pre-sowing-dip method was adopted for seed treatment. The treatments included application of [T_0: Shade net(light 20,100), T_1: $GA_3$200 ppm + light 24,500 lux,T_2:$GA_3$200 ppm + light 30,100 lux,T_3: $GA_3$250 ppm + light 24,500 lux,T_4:$GA_3$250 ppm + light 30,100 lux, T_5: $GA_3$300 ppm + light 24,500 lux,T_6: GA_3 300 ppm + light 30,100 lux,T_7:$GA_3$350 ppm + light 24,500 lux, T_8: $GA_3$350 ppm + light 30,100 lux]. The experiment was laid in completely randomized block design with nine treatments and was replicated three times. On the basis of our experimental finding it can be concluded that the best result was found in treatmentT_8 (GA_3 350 ppm + light 30100 lux) in term of seedling length,shoot length, number of leaves, germination percentage, root length, Germination vigour index, Chlorophyll content and shoot to root Ratio.

Key words:-Light, GA_3, germination, seed vigour index and seedling growth and Purple Passion Fruit

INTRODUCTION

Species within the Passifloraceae family are primarily native to regions with tropical climates. Passiflora is a large genus in the family Passifloraceae consisting of approximately 500 species, most of which are cultivated for edible fruits, pharmaceutical properties, and ornamental characteristics. Most species are herbaceous, perennial vines with a rapid growth rate. Some of them like maypop (P. incarnata) are considered weeds due to their rampant growth (**Amir and Eric 2018).** The germination of seeds of Passiflora is low possibly due to the exogenous dormancy, which could be a combination of mechanical andchemical dormancy, the last one due to the presenceof inhibitors in seeds **(Delanoy et al., 2006).**Inthis regard, studies on germination of *P. ligularis* are scarce. During germination, GA_3 induces the synthesis of hydrolytic enzymes, such as amylase and protease. These enzymes degrade the stored food reserves accumulated in the endosperm or embryo as the seed matured. This degradation of carbohydrate and storage protein provides nourishment and energy to support germination and seedling growth. Gibberellins (GA_3) activate the embryonic vegetative growth, weakens the endosperm layer that involves the embryo and restricts its growth, and mobilizes the energetic reserves from the endosperm of cereals **(Taiz and Zeiger, 2006) and Hota *et al*., (2018).** Light is an extremely important factor for seed germination. However, there is disagreement in the response from different species to the absence or presence of this condition. For some species, the influence of light is favorable for germination, and for others it is negative or indifferent. This is because the light is responsible for the activation of phytochrome, a soluble chromoprotein which in the inactive form (Fv),

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absorbs red (R) wavelength and is transformed into an active (Fve) one **(Taiz and Zeiger, 2013).**In view of several treatments in improving the seed germination this study was taken up to know the role of different concentration of GA_3 and light on seed germination of purple passion fruit.

MATERIALS AND METHODS

The experiment was conducted at Laboratory, Department of Horticulture, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, during the period August to October in the year 2023. The present experiment was carried out to study the effect of light and GA_3 on seed germination of Purple Passion Fruit (*Passiflora edulis* Sims*)*. The experimental design was CRD and there were nine treatmentswhich are replicated thrice. The treatment details are T_0Shade net(light 20,100), T_1-$GA_3$200 ppm + light 24,500 lux,T2-GA3200 ppm + light 30,100 lux,T3-GA3250 ppm + light 24,500 lux,T4-GA3250 ppm + light 30,100 lux,T5-GA3300 ppm + light 24,500 lux,T6-GA3 300 ppm + light 30,100 lux,T7-GA3350 ppm + light 24,500 lux and T_8-$GA_3$350 ppm + light 30,100 lux.The perforated polythene bags of 4 x 5 cm size (150 gauges thickness) were used for sowing. The bags were filled with a mixture of farmyard manure (FYM), sand and soil in the ratio of 1:1:1. Before sowing the seeds in the polythene bags, seeds were treated with GA_3. Two seeds were sown in each polythene bags. Regular watering with water-can was done gently in morning and evening. Pre-sowingdip method was adopted for seed treatment. Growth regulators of different concentrations were poured in required quantity into the labeled beakers. The observations were recorded for day to 1stgermination, 50 % germination,day to complete germination, germination percentage and seed vigour index, seedling height, number of leaves, shoot length, root length, shoot: root, stem girth, chlorophyll content, survivality percentage.The experimental data collected relating to different parameters were statistically analyzed by Completely Randomized Design (CRD) and results were analyzed as per the guide lines suggested by Panse and Sukhatme (1985).

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RESULTS AND DISCUSSION

The data are represented in the table 1. It was clear that the effect of light and GA_3 showed significant results on day to 1st germination, 50 % germination, day to complete germination, germination percentage, seed vigour index. Whereas, the minimum Day to 1st germination20.01 percentage recorded in $GA_3$350ppm + light 30,100 lux, While the maximum Day to 1st germination 38.05 percentage respectively were recorded in Shade net(light 20,100). However, $GA_3$350 ppm + light 24,500 luxare found statistically at par to $GA_3$350 ppm + light 30,100 lux.Whereas, the minimum 50 % Germination 26.68 percentage recorded in $GA_3$350 ppm + light 30,100 lux, While the maximum 50 % Germination 44.72 percentage respectively were recorded in Shade net(light 20,100). However, $GA_3$350 ppm + light 24,500 lux and$GA_3$200 ppm + light 30,100 luxare found statistically at par to $GA_3$350 ppm + light 30,100 lux. Whereas, the minimum Day to complete germination 35.25 percentage recorded in $GA_3$350 ppm + light 30,100 lux, While the maximum Day to complete germination 53.28 percentage respectively were recorded in Shade net (light 20,100). However,$GA_3$200 ppm + light 30,100 lux and$GA_3$350 ppm + light 24,500 lux are found statistically at par to $GA_3$350 ppm + light 30,100 lux. Whereas, the maximum Germination percentage 89.69 percentage recorded

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in $GA_3$350 ppm + light 30,100 lux, While the minimum Germination percentage 68.66 percentage respectively were recorded in Shade net(light 20,100). However, GA_3 300 ppm + light 30,100 lux and$GA_3$350 ppm + light 24,500 luxare found statistically at par to $GA_3$350 ppm + light 30,100 lux. GA_3 induces the denovo synthesis of proteolytic enzymes like α-amylase and ribonuclease. Amylases in turn hydrolyse starch in the endosperm, providing the essential sugars for the initiation of growth processes. GA_3 treatment is also known to overrule the photo dormancy, thermo-dormancy, dormancy imposed by incomplete embryo development, mechanical barriers, and presence of germination inhibitors. The result was in agreement with findings of **Praveen *et al.*, (2006)** in custard apple and **Muralidhara *et al.*, (2015)** in mango **Lalitha *et al.*, (2020).** The data are represented in the Table 1. It was clear that the effect of light and GA_3 showed significant results on seed vigour index. The maximum seed vigour index (1400.48) was recorded in $T_8GA_3$350 ppm + light 30,100 lux. Where as the minimum seed vigour index (701.93) was found recorded in Shade net(light 20,100) respectively. However, $GA_3$350 ppm + light 24,500 lux and $GA_3$300 ppm + light 24,500 luxare found statistically at par to $GA_3$350 ppm + light 30,100 lux. The remarkable effect of GA_3on minimum days required for germination might be due to it acts on the embryo and causes denova synthesis of hydrolyzing enzymes particularly amylase and protease and this hydrolyzed food is utilized for growth of embryo and thereby enhanced the germination. The effect of GA_3 on higher seed germination percentage might be due to the involvement of GA_3 in the activation of cytological enzymes along with increase in cell wall plasticity and better water absorption. These results are in agreement with the findings of **Vachhani et al. (2014) in khirni; Reshma and Simi (2019)** in mango.

It was clear in table 2 that the effect of light and GA_3 showed significantly results on seedling height (cm), number of leaves per plant and shoot length (cm) at 10, 20, 30 and 40 days after germination of Purple Passion Fruit (*Passiflora edulis* Sims*)*.The maximum seedling height was observed in $GA_3$350 ppm + light 30,100 lux with (10.37, 11.50,13.69 and 16.25 cm). While the minimum seedling height (5.60, 6.34,8.02 and 10.22 cm respectively were observed in Shade net(light 20,100) at 10, 20, 30 and 40 days after germination. However, $GA_3$300 ppm + light 30,100 lux,$GA_3$300 ppm + light 24,500 lux ,$GA_3$250 ppm + light 30,100 lux and $GA_3$350 ppm + light 24,500 luxare, $GA_3$200 ppm + light 30,100 lux and $GA_3$250 ppm + light 24,500 luxarefound statistically at par to $GA_3$350 ppm + light 30,100 lux. Where as the maximum number of leaves per seedling was observed in $GA_3$350 ppm + light 30,100 lux with (3.00, 4.78, 6.22 and9.45). While the minimum number of leaves per seedling (2.00, 2.56, 3.56 and 5.78) respectively were observed in Shade net(light 20,100)at 10, 20, 30 and 40days after germination.However, $GA_3$350 ppm + light 24,500 lux,$GA_3$300 ppm + light 30,100 lux,$GA_3$200 ppm + light 30,100 lux,$GA_3$250 ppm + light 24,500 lux,$GA_3$250 ppm + light 30,100 lux, $GA_3$250 ppm + light 30,100 and $GA_3$300 ppm + light 24,500 luxare found statistically at par to $GA_3$350 ppm + light 30,100 lux. While as maximum shoot length (cm) was observed in $GA_3$350 ppm + light 30,100 lux with (4.68, 4.97, 5.05 and 5.21. While the minimum shoot length (cm) (3.56, 4.01, 4.23 and 4.30) respectively were observed in Shade net(light 20,100)at 10, 20, 30 and 40days after germination. However, $GA_3$300 ppm + light 24,500 lux,$GA_3$250 ppm + light 24,500 lux, GA_3 300 ppm + light 30,100 lux, $GA_3$200 ppm + light 24,500 lux and $GA_3$200 ppm + light 30,100 are found statistically at par to $GA_3$350 ppm + light 30,100 lux.

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The data are represented in the table 3. It was clear that the effect of light and GA_3showed significant results on root length (cm), shoot : root, stem girth (mm), chlorophyll content and survivality % of Purple Passion Fruit (*Passiflora edulis* Sims*)* seeds. The maximum root length (10.66) was recorded in T_8 $GA_3$350 ppm + light 30,100 lux. whereas the minimum Root length (6.97) was found recorded in Shade net(light 20,100) respectively. However, $GA_3$350 ppm + light 24,500 lux and GA_3 300 ppm + light 30,100 luxare found statistically at par to $GA_3$350 ppm + light 30,100 lux. The maximum shoot : root (0.62) was recorded in T_8 $GA_3$350 ppm + light 30,100 lux. whereas the minimum shoot : root (0.49) was found recorded in Shade net(light 20,100) respectively. However, $GA_3$350 ppm + light 24,500 lux, $GA_3$300 ppm + light 30,100, $GA_3$300 ppm + light 24,500 lux, $GA_3$250 ppm + light 30,100 lux, $GA_3$200 ppm + light 30,100 lux and$GA_3$250 ppm + light 24,500 luxare found statistically at par to $GA_3$350 ppm + light 30,100 lux. The maximum stem girth(mm) (2.70) was recorded in T_8 $GA_3$350 ppm + light 30,100 lux. Where as the minimum stem girth(mm) (1.86) was found recorded in Shade net(light 20,100) respectively. However, $GA_3$350 ppm + light 24,500 lux, GA_3 300 ppm + light 30,100 lux and $GA_3$300 ppm + light 24,500 luxare found statistically at par to $GA_3$350 ppm + light 30,100 lux. The maximum Chlorophyll content (43.37) was recorded in T_8 $GA_3$350 ppm + light 30,100 lux. Where as the minimum Chlorophyll content (25.95) was found recorded in Shade net(light 20,100) respectively. However, $GA_3$300 ppm + light 30,100 lux, $GA_3$200 ppm + light 30,100 lux, $GA_3$250 ppm + light 24,500 lux and $GA_3$250 ppm + light 30,100 luxare found statistically at par to $GA_3$350 ppm + light 30,100 lux. The maximum Survivality % (83.65) was recorded in T_8 $GA_3$350 ppm + light 30,100 lux. Where as the minimum Survivality % (32.87) was found recorded in Shade net(light 20,100) respectively. However, $GA_3$300 ppm + light 24,500 luxare found statistically at par to $GA_3$350 ppm + light 30,100 lux.

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Table 1 Effect of light and GA_3 on Germination Parameters and seed vigour index of purple Passion fruit (*Passiflora edulis* sims)

Notion	Treatment details	Germination Parameters	Seed vigour

		Day to 1st germination	50 % Germination	Day to complete germination	Germination percentage	index
T_0	Shade net(light 20,100)	38.05	44.72	53.28	68.66	701.93
T_1	$GA_3$200 ppm + light 24,500 lux	31.32	41.84	50.40	71.76	824.51
T_2	$GA_3$200 ppm + light 30,100 lux	26.09	32.76	41.33	74.56	797.49
T_3	$GA_3$250 ppm + light 24,500 lux	31.25	37.92	46.48	74.25	820.22
T_4	$GA_3$250 ppm + light 30,100 lux	28.95	35.61	44.18	78.64	1079.78
T_5	$GA_3$300 ppm + light 24,500 lux	26.81	33.48	42.04	78.64	1198.02
T_6	GA_3 300 ppm + light 30,100 lux	24.64	37.99	46.56	80.59	1069.10
T_7	$GA_3$350 ppm + light 24,500 lux	35.17	31.30	39.87	84.08	1366.08
T_8	$GA_3$350 ppm + light 30,100 lux	20.01	26.68	35.25	89.09	1400.48
F Test		**S**	**S**	**S**	**S**	**S**
S.Ed(±)		**1.48**	**1.48**	**2.45**	**3.46**	**68.68**
CV		**5.98**	**5.28**	**6.76**	**5.45**	**246.98**
CD at 0.5%		**3.14**	**3.14**	**5.19**	**7.34**	**136.98**

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Table 2 Effect of light and GA_3 on seedling growth parameters of purple Passion fruit (*Passiflora edulis* sims)

Notion	Treatment	Seedling height(cm)				Number of leaves per plant				Shoot length (cm)			
		10 Days	20 Days	30 Days	40 Days	10 Days	20 Days	30 Days	40 Days	10 Days	20 Days	30 Days	40 Days
T_0	Shade net(light	5.60	6.34	6.83	10.22	2.00	2.56	3.56	5.78	3.56	4.01	4.23	4.30

	20,100)												
T_1	$GA_3$200 ppm + light 24,500 lux	5.72	6.70	8.02	11.49	2.11	3.11	4.00	6.44	3.76	4.11	4.59	4.63
T_2	$GA_3$200 ppm + light 30,100 lux	5.83	7.14	7.58	10.70	2.44	3.11	4.00	6.22	3.68	4.53	4.58	4.84
T_3	$GA_3$250 ppm + light 24,500 lux	5.95	7.19	8.08	11.05	2.22	3.22	4.00	6.78	3.82	4.71	4.78	5.05
T_4	$GA_3$250 ppm + light 30,100 lux	7.24	9.19	9.70	13.73	2.11	4.00	5.11	6.11	3.67	4.60	4.64	5.07
T_5	$GA_3$300 ppm + light 24,500 lux	7.28	9.46	9.50	15.23	2.11	3.11	5.11	8.78	3.88	4.49	4.97	5.08
T_6	GA_3 300 ppm + light 30,100 lux	8.14	8.49	11.29	13.27	2.45	4.11	5.89	8.33	3.97	4.59	4.98	5.19
T_7	$GA_3$350 ppm + light 24,500 lux	9.10	10.63	11.39	15.72	2.67	4.45	6.00	8.78	4.26	4.95	5.04	5.20
T_8	$GA_3$350 ppm + light 30,100 lux	10.37	11.50	13.69	16.25	3.00	4.78	6.22	9.45	4.68	4.97	5.05	5.21
	F Test	**S**	**S**	**S**	**S**	**NS**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
	S.Ed (±)	**0.72**	**1.90**	**1.06**	**1.17**	**0.22**	**0.24**	**0.32**	**0.55**	**0.37**	**0.39**	**0.53**	**0.31**
	CV	**12.11**	**25.05**	**14.93**	**10.94**	**11.86**	**8.24**	**8.03**	**9.11**	**11.71**	**10.41**	**13.71**	**7.83**
	CD at 5%	**1.53**	**4.03**	**2.26**	**2.48**	**0.47**	**0.51**	**0.68**	**1.17**	**0.79**	**0.82**	**1.13**	**0.66**

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Table 3 Effect of light and GA_3 on root length, shoot:root, stem girth(mm), chlorophyll content and Survivality % of purple Passion fruit (*Passiflora edulis* sims)

Notion	Treatment details	Root length (cm)	Shoot : root	Stem girth (mm)	Chlorophyll content	Survivality %

T_0	Shade net(light 20,100)	6.97	0.49	1.86	25.95	32.87
T_1	$GA_3$200 ppm + light 24,500 lux	7.60	0.54	2.00	28.4	45.98
T_2	$GA_3$200 ppm + light 30,100 lux	7.90	0.61	2.16	32.58	53.59
T_3	$GA_3$250 ppm + light 24,500 lux	8.20	0.58	2.19	32.44	61.84
T_4	$GA_3$250 ppm + light 30,100 lux	8.50	0.60	2.26	31.63	63.19
T_5	$GA_3$300 ppm + light 24,500 lux	8.90	0.57	2.43	35.16	71.49
T_6	GA_3 300 ppm + light 30,100 lux	9.50	0.55	2.54	35.29	81.59
T_7	$GA_3$350 ppm + light 24,500 lux	9.60	0.54	2.66	42.3	82.84
T_8	$GA_3$350 ppm + light 30,100 lux	10.66	0.62	2.70	43.37	83.65
F Test		**S**	**S**	**S**	**S**	**S**
S.Ed(±)		**0.548**	**0.012**	**0.032**	**4.73**	**2.345**
CV		**7.756**	**0.48**	**0.421**	**16.96**	**9.858**
CD at 0.5%		**1.161**	**0.023**	**0.065**	**10.02**	**4.681**

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CONCLUSION

On the basis of our experimental finding it can be concluded that the best result was found in treatmentT_8 (GA_3 350 ppm + light 30,100 lux) in term of seedling length,shoot length, number of leaves, germination percentage, root length, Germination vigour index, Chlorophyll content and shoot to root Ratio.The highest B:C ratio was found in T_8 (GA_3 350 ppm + light 30100 lux) with 2.76.

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