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Effect of different PGRs and chemicals on seed germination of jackfruit (*Artocarpus heterophyllus* Lam.)

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Abstract
The current study entitled "Effect of different PGRs and chemicals on seed germination of Jackfruit (*Artocarpus heterophyllus* Lam.)'' was carried out at the research cum instructional farm of Department of Fruit Science, Pt. K.L.S. College of Horticulture and Research Station, Rajnandgaon (C.G.). during the kharif season of 2023-24 in completely randomized design and replicated thrice with a total of 13 treatments *viz*., T_0 direct sowing control, T_1 NAA @ 100 ppm seed soaking for 12 hr., T_2 NAA @ 150 ppm seed soaking for 12 hr., T_3 NAA @ 200 ppm seed soaking for 12 hr., T_4 GA_3 @ 100 ppm seed soaking for 12 hr., T_5 GA_3 @ 150 ppm seed soaking for 12 hr., T_6 GA_3 @ 200 ppm seed soaking for 12 hr., T_7 KNO_3 @ 0.5% seed soaking for 3 hr., T_8 KNO_3 @ 1% seed soaking for 3 hr., T_9 KNO_3 @ 1.5% seed soaking for 3 hr., T_{10} Thiourea @ 0.5% seed soaking for 1 hr., T_{11} Thiourea @ 1% seed soaking for 1 hr., T_{11} Thiourea @ 1.5% seed soaking for 12 hr. The various observations of different aspects recorded for the seed germination and growth of Jackfruit were as follows: Number of days taken for germination, germination percentage (%), height of plant (cm), plant girth (mm), Number of leaves per plant, length of root per seedling (cm) and vigour index-I. The results showed that minimum number of days taken for seed germination (9.93 days) and maximum germination percentage (28.73%, 41.71%, and 82.83%,) at 10, 20 and 30 DAS were recorded in treatment T_6-GA_3 @ 200 ppm seed soaking for 12 hr. Regarding seedling growth parameters, T_6 recorded significantly higher in plant height (59.39 cm), plant girth (10.13 mm), number of leaves (12.31), leaf area (63.45 cm^2), number of roots (42.71), root length (19.47 cm), vigour index-I (6560.80 cm). T_6 recorded the maximum among all the other treatments. The minimum values for all seedling growth parameters were recorded in T_0-direct seed sowing (control).

Keywords: Jackfruit (*Artocarpus heterophyllus* Lam.) germination, GA_3, NAA, KNO_3, thiourea, growth

1. Introduction

Jackfruit (*Artocarpus heterophyllus* Lam.) belongs to the family Moraceae and chromosome number is 56. The word *Artocarpus* is derived from the Greek words artos (bread) and carpos (fruit). Jackfruit occurs naturally in two textural forms; Ghila with soft and pulpy perianth while Khaja with firm perianth when ripe. The world's largest fruit is called by a variety of names *viz*., kathal, panasa, jaca, nangka, kanoon or mit. Jackfruit is popularly known as poor man's food in the eastern & southern parts of India. It is a native species of the rain forests of the Western Ghats of India and the Malaysian. It is widely grown commercially and in the home garden. The main jackfruit producer countries in world are Bangladesh, India, Myanmar, Indonesia, Sri Lanka and Malaysia. It is also grown in Brazil and parts of West Indies. Jackfruit is popularly known as poor man's food in the eastern & southern parts of India. In India it is widely distributed in Assam, Bihar, Kerala, Tamil Nadu, Madhya Pradesh, Chhattisgarh and the foothills of Himalaya in North India. It thrives well from sea level to an altitude of 1600 m above MSL (Hag, 2006) [18]. The statistics of exact area under cultivation of jackfruit in India, it is estimated that about 1, 89,000 ha. area is covered by this crop and production approximately 1835 MT. In Chhattisgarh, Jackfruit is cultivated as minor fruit, which has an area of about 10.483 ha. with production of 204.666 MT The leading area of Jackfruit production in Chhattisgarh are Raigarh, Bilaspur, Mahasamund, Kanker, Kondagaon and Ambikapur (Anon., 2022) [5].

It is evergreen tree stem of this plant is straight and rough whereas, bark is green or black, 1.25 cm thick and exudes milky latex; leaves broad obovate, elliptic, decurrent, glabrous, entire and 10-15 cm in length alternate glossy and dark green in colour. The juvenile leaves are lobed. The tree is monoecious producing male and female flowers. The male flower in pseudo-catkin and female in pseudo-heads and male inflorescence arises on axillary leafy twings or from the trunk and branches and is always found above female inflorescence. A sex ratio (male: female) of 4:1 in young tree and 2:1 in old tree has been reported. All produce a multiple fruit botanically called sorosis. The fruit, a gigantic syncarp, is the largest of all cultivated fruits reaching as much as 36 kg in weight, 36 inches in length and 20 inches in diameter. Jackfruit is eaten unripe at 25-50% of full size as a vegetable or ripe as a fruit. The ripe fruit significantly contributes to the nutrition of low-income families as it is a good source of vitamins, mineral and calories. The skin of the fruits and its leaves are excellent cattle feed. Its timber is valued for furniture making since it is rarely attacked by white ants. Pickels and dehydrated leather are its preserved delicacies. Canning of flakes can be done soft flesh type has a thin mucilaginous and soft pericarp when fully ripe. In firm flesh, pericarp is sweet, fleshy and crispy. The fruits are eaten as raw vegetable or processed as pickles and for other uses. The optimum stage of harvest maturity in raw Jackfruit has been reported to be 90-100 days after the appearance of spike. Jackfruit is of great importance because it gives more yield than any other fruit trees in this country. The average number of fruits varies from 200-800 fruits per tree each weighing between 5-20 kg per tree of the aged about 12 to 30 years annually. On an average, 50-80 tons of fruits can be harvested from a hectare of land. The Jackfruit is significantly contributing to nutrition of people as a source of calories. Ripe fruit contains 98 kilo calories energy, 1.3-1.9 (%) protein, 0.1-0.3 (%) total fat, 18.9-25.4 (%) and carbohydrate 1-1.1 (g) diatry fiber per 100 g edible portion.

Pre-sowing treatment of growth regulators could lead to increase seed germination and enhancement of seedling growth. A low concentration of plant growth regulator may be effective. On the other hand, higher concentration may inhibit the growth. Seed, without use of growth regulators showed poor response for germination and subsequent growth. Now a day's plant growth regulators are widely used for increasing the seed germination percentage for vigorous and healthy growth of seedling. Gibberellic acid is a natural occurring plant growth regulator which may cause a variety of effects including the stimulation of seed germination by overcoming dormancy and the mobilization of endosperm reserves. NAA (1-Naphthalene acetic acid) is synthetic plant hormone in the auxin family and is an ingredient in many commercial plants rooting in horticultural crops, which may cause a variety of effects including the stimulation of seed germination by overcoming dormancy. The chemical like KNO_3 are used to increase the seed germination or to break the dormancy of seed. Many freshly harvested dormant seeds respond to soaking in a KNO_3 solution. The significant role of chemical treatment in relation to breaking dormancy, seed germination and growth development of plants has been observed. Soaking the seeds in thiourea, gibberellic acid and potassium nitrate Seed propagation is practiced in most jackfruit growing countries. The viability of jackfruit seeds lost very quickly. Even one or two weeks delay in planting will lead to poor germination. Jackfruit seeds are considered being recalcitrant and cannot survive more than few days or weeks in storage at ambient temperature.

2. Materials and Methods

The current study entitled "Effect of different PGRs and chemicals on seed germination of Jackfruit (*Artocarpus heterophyllus* Lam.)'' was carried out at the research cum instructional farm of Department of Fruit Science, Pt. K.L.S. College of Horticulture and Research Station, Rajnandgaon (C.G.). during the kharif season of 2023-24 in completely randomized design and replicated thrice with a total of 13 treatments *viz*., T_0 direct sowing control, T_1 NAA @ 100 ppm seed soaking for 12 hr., T_2 NAA @ 150 ppm seed soaking for 12 hr., T_3 NAA @ 200 ppm seed soaking for 12 hr., T_4 GA_3 @ 100 ppm seed soaking for 12 hr., T_5 GA_3 @ 150 ppm seed soaking for 12 hr., T_6 GA_3 @ 200 ppm seed soaking for 12 hr., T_7 KNO_3 @ 0.5% seed soaking for 3 hr., T_8 KNO_3 @ 1% seed soaking for 3 hr., T_9 KNO_3 @ 1.5% seed soaking for 3 hr., T_{10} Thiourea @ 0.5% seed soaking for 1 hr., T_{11} Thiourea @ 1% seed soaking for 1 hr., T_{11} Thiourea @ 1.5% seed soaking for 12 hr.

3. Results and Discussion

3.1 Germination parameters

3.1.1 Number of days taken for germination

The experiment data presented in table 1 Treatment T_6 (GA_3 200 ppm) recorded significantly, minimum number of days (9.93 days) taken for germination, this was followed by with treatment T_4 (GA_3 100 ppm) *i.e*. (11.50) While, treatment T_0 (control) recorded maximum number of days (14.23) taken for germination. GA_3 was effective treatment and it was recorded minimum number of days taken for germination might be due to GA_3 increased the activities of hydrolyzing enzyme and α-amylase at initial stage of germination which convert starch into simple carbohydrate and chemical energy which is used in the activation of embryo and facilitated to germination process. Similar, results were also obtained by Barche *et al.* (2010) [7] in papaya, Singh *et al.* (2002) [25] and Prajapati *et al.* (2014) [26] in jackfruit and Panda *et al.* (2018) [27] in kagzi lime.

3.1.2 Germination percentage

The data pertaining to the Jackfruit seed germination percentage data at 10, 20, and 30 DAS was recorded in table 1 treatment T_6 (GA_3 @ 200 ppm seed soaking for 12 hr.) were recorded significantly, the maximum germination percentages were (28.73%, 41.71%, and 82.83%, respectively). Which was followed by treatment T_4 (GA_3 @ 100 ppm seed soaking for 12 hr.), which resulted in 31.04%, 37.28%, and 61.41%, respectively. The lowest germination percentages were obtained by treatment T_0 (control) 9.71%, 13.75%, and 41.25%, respectively. It could be that GA_3 treatment enhanced seed germination by promoting the diffusion of endogenous auxin and gibberellin-like substances. Singh *et al.* (2002) [25], Pandiyan *et al.* (2011), and Prajapati *et al.* (2014) [26] in jackfruit, Panda *et al.* (2018) [27] in kagzi lime, and Babu *et al.* (2010) [6] in papaya are all in concordance with these findings.

3.2 Seedling growth parameter

3.2.1 Plant height (cm)

The data recorded in table 1 to height of plant at 30, 60, 90 and 120 DAS (28.51, 38.51, 48.44 and 59.39 cm respectively) was recorded significantly highest in the treatment T_6 GA_3 200 ppm, this was followed by with treatment T_4 GA_3 100 ppm, (23.51, 38.08, 47.39 and 58.44 cm respectively). The lowest plant height (15.90, 20.42, 23.37 and 27.71cm respectively) this was recorded in the treatment T_0 direct seed sowing (control). The height of the seedling may have risen as a result of enhanced cell division and elongation carried on by GA_3 treatment of the seeds. Nimbalkar *et al.* (2012) [28] in Karonda and Prajapati *et al.* (2014) [26] in Jackfruit either reported similar results.

3.3 Plant girth (mm)

The treatment T_6 GA_3 200 ppm had the significantly highest data regarding the girth of the plant at 30, 60, 90, and 120 DAS (3.87, 5.90, 8.18, and 10.13 mm) respectively. Which was followed by Treatment T_4 GA_3 100 ppm. (3.47, 5.53, 7.53, and 9.10 mm respectively). The treatment T_0 direct seed sowing (control) had the minimum plant girth (2.07, 3.32, 4.07, and 5.44 mm respectively) in table 1. Early germination may have also led to higher vegetative growth of the seedling, which in turn increased the seedling's girth. It is possible that seed treatment with GA_3 enhanced the growth of the seedling by increasing cell enlargement and multiplication. These results are in accordance with Prajapati *et al.* (2014) [26] in Jackfruit, Nimbalkar *et al.* (2012) [28] in Karonda and Kumar *et al.* (2008) [29] in mango.

3.4 Number of leaves per plant

According to Table 1 the number of leaves per plant at 30, 60, 90, and 120 DAS, the treatment T_6 GA_3 @ 200 ppm had the largest number of leaves per plant (4.80, 7.26, 10.52, and 12.31, respectively). Which was followed by Treatment T_4 GA_3 100 ppm. (4.52, 6.37, 9.51, and 11.49 leaves per plant respectively). The treatment T_0 direct seed sowing (control) had the least number of leaves (2.03, 4.25, 6.51, and 8.42 respectively). It's possible that GA_3 stimulated growth by increasing cell expansion and multiplication, which led to strong plant development and eventually more leaves per seedling. Nimbalkar *et al.* (2012) [28] in karonda and Prajapati *et al.* (2014) [26] in jackfruit all reported similar findings.

3.5 Leaf Area (cm^2)

Results related to leaf area (cm^2) of Jackfruit seedlings at 30, 60, 90 and 120 DAS, the leaf area data (33.13, 41.41, 52.33, and 63.45 cm^2) were significantly highest in treatment T_6 GA_3 200 ppm in Table 2. Which was followed by Treatment T_4 GA_3 100 ppm (32.73, 39.50, 50.55, and 59.52 cm^2, respectively). Regarding leaf area, the treatment T_0 direct seed sowing (control) had the lowest values was recorded (22.12, 29.70, 35.59, and 41.54 cm, respectively). The length and width of the leaves may have expanded as a result of the accelerated cell division and cell elongation caused by GA_3 treatment of the seeds. Prajapati *et al.* (2014) [26] also noted similar outcomes in Jackfruit, respectively.

3.6 Number of roots of seedling

The number of roots per seedling (30, 60, 90, and 120 DAS) The treatment T_6 GA_3 200 ppm had the highest number of roots per seedling data at 30, 60, 90, and 120 DAS (9.67, 15.86, 23.31 and 42.71, respectively). Treatment T_4 GA_3 100 ppm had the next highest number of roots per seedling (9.05, 15.24, 22.59 and 36.49, respectively) in Table 2. T_0 direct seed sowing (control) had the lowest number of roots was recorded (5.91, 11.04, 16.95 and 21.43, respectively). The treatment with gibberellic acid might have resulted in more production of photo synthetes and their translocation through phloem to the root zone, resulting in more number of roots. Results are closely associated with the results of earlier worker Anjanwe *et al.* (2013) in papaya.

3.7 Length of roots per seedling (cm)

The data pertaining length of roots (30, 60, 90 and 120 DAS) is given in Table number 2. The treatment T_6 GA_3 200 ppm had the significantly highest data regarding the length of roots per seedling at 30, 60, 90, and 120 DAS (4.86, 7.24, 14.48 and 19.47 cm, respectively). Which was followed by Treatment T_4 GA_3 100 ppm (4.60, 6.90, 13.80 and 18.40 cm respectively). The treatment that had direct seed sowing (control) had the shortest lengths (3.16, 4.74, 9.48, and 12.67 cm, respectively). The improved root growth may have been caused by increased photosynthetic output and their transfer to the root zone through phloem. These findings are consistent with those of Panda *et al.* (2018) [27] in kagzi lime and Prajapati *et al.* (2014) [26] in jackfruit.

3.8 Vigour Index-I

The vigour index observations are presented in Table 2. The concentration of gibberellic acid showed a significant effect on vigour index. it was maximum in treatment T_6 at GA_3 @ 200 ppm with 6560.80 cm which was superior over rest of all the treatments. The minimum vigour index was recorded in treatment T_0 (Control) with 2509.77cm. Treatment T_4 was found to be followed by with (5599.88 cm) respectively. The reason may be due to the fact of increased dry matter accumulation in the desired treatments. Also the main reason behind the increase in vigour index-I may be because of direct influence on the better seedling growth that has directly promoted the mobilization of reserve food towards the root and shoot tips of the plant. These results agree with (Rajamanickam *et al.* 2004) [30].

Table 1: Effect of different of different PGRs and chemicals on seed germination of Jackfruit (*Artocarpus heterophyllus* Lam.)

Treatment details	Number of days taken for germination	Germination percentage DAS			Plant height (cm) DAS				Plant girth (mm) DAS				Number of leaves DAS			
		10	20	30	30	60	90	120	30	60	90	120	30	60	90	120
T_0 Direct seed sowing	14.23	9.71	13.76	41.25	15.90	20.42	23.37	27.71	2.07	3.32	4.07	5.44	2.03	4.25	6.51	8.42
T_1 NAA @ 100 ppm seed soaking for 12 hours.	12.33	18.68	23.75	65.46	18.64	30.74	42.88	49.29	2.93	3.82	5.40	7.27	3.05	5.11	7.41	9.45
T_2 NAA @ 150 PPM seed soaking for 12 Hr.	12.27	19.17	30.17	66.40	19.43	34.76	44.10	51.18	3.13	4.65	5.67	7.55	3.33	5.33	7.78	9.56
T_3 NAA @ 200 PPM seed soaking for 12 Hr.	11.68	20.67	34.42	72.33	18.78	37.45	45.20	53.36	3.25	5.10	6.94	8.23	3.46	6.16	8.71	10.73
T_4 GA_3 @ 100 PPM seed soaking for 12 Hr	10.48	26.60	36.71	77.13	23.51	38.08	47.39	58.44	3.47	5.53	7.53	9.10	4.52	6.37	9.51	11.49
T_5 GA_3 @ 150 PPM seed soaking for 12 Hr.	11.50	20.29	30.07	69.00	20.72	34.57	44.80	53.16	3.23	4.93	6.68	8.17	3.80	6.10	8.37	10.46
T_6 GA_3 @ 200 PPM seed soaking for 12 Hr.	9.93	28.73	41.71	82.83	28.51	38.51	48.44	59.39	3.87	5.90	8.18	10.13	4.80	7.26	10.52	12.31
T_7 KNO_3 @ 0.5% seed soaking for 3 Hr.	13.27	16.39	25.44	63.67	17.33	31.35	39.96	49.69	2.75	3.50	4.78	6.32	2.48	4.67	7.30	9.30
T_8 KNO_3 @ 1% seed soaking for 3Hr.	13.33	17.45	26.68	64.47	17.50	33.16	41.48	49.91	2.87	3.58	5.09	6.43	2.55	4.81	7.38	9.42
T_9 KNO_3 @ 1.5% seed soaking for 3Hr.	13.57	18.45	27.04	64.61	17.73	33.39	42.08	51.07	2.92	3.68	5.26	6.68	2.80	4.88	7.47	9.52
T_{10} Thiourea @ 0.5% seed soaking for 1 Hr.	13.67	15.48	24.40	58.47	16.37	24.23	37.28	42.51	2.59	3.40	4.19	6.15	2.17	4.47	7.21	9.15
T_{12} Thiourea @ 1% seed soaking for 1 Hr.	12.87	19.04	29.85	65.13	18.76	32.23	43.54	48.48	3.03	3.60	5.42	7.27	3.28	5.24	7.49	9.53
T_{13} Thiourea @ 1.5% seed soaking for 1 Hr.	13.60	15.72	24.87	55.13	16.90	26.50	37.54	44.39	2.53	3.53	4.38	6.10	2.40	4.54	7.11	9.19
SEm(±)	0.21	0.33	0.49	0.80	0.28	0.62	0.98	0.64	0.06	0.10	0.12	0.16	0.06	0.13	0.17	0.23
C.D.	0.60	0.96	1.44	2.34	0.82	1.79	2.86	1.85	0.17	0.29	0.35	0.46	0.17	0.37	0.51	0.67
C.V.	2.84	3.00	3.04	2.15	2.53	3.34	4.12	2.24	3.44	4.10	3.70	3.78	3.20	4.11	3.82	4.03

Table 2: Effect of different of different PGRs and chemicals on seed germination of Jackfruit (*Artocarpus heterophyllus* Lam.)

Treatment details	Leaf area cm^2 DAS				Number of roots DAS				Length of roots (cm) DAS				Vigour Index-I DAS
	30	60	90	120	30	60	90	120	30	60	90	120	120
T_0 Direct seed sowing	22.12	29.70	35.59	41.54	5.91	11.04	16.95	21.43	3.16	4.74	9.48	12.67	2509.77
T_1 NAA @ 100 ppm seed soaking for 12 hours.	24.33	31.74	41.50	48.32	7.56	14.25	20.85	25.68	3.58	5.37	10.74	14.34	4186.69
T_2 NAA @ 150 PPM seed soaking for 12 Hr.	24.97	32.81	42.72	49.50	7.76	14.69	21.53	26.84	3.86	5.79	11.58	15.44	4431.09
T_3 NAA @ 200 PPM seed soaking for 12 Hr.	25.83	33.60	44.53	51.59	8.44	14.87	21.91	30.76	4.21	6.31	12.62	16.87	4769.18
T_4 GA_3 @ 100 PPM seed soaking for 12 Hr	32.73	39.50	50.55	59.52	9.05	15.24	22.59	36.49	4.60	6.90	13.80	18.40	5599.88
T_5 GA_3 @ 150 PPM seed soaking for 12 Hr.	25.10	33.37	44.35	51.18	8.23	14.71	21.64	29.83	4.20	6.30	12.60	16.80	4682.80
T_6 GA_3 @ 200 PPM seed soaking for 12 Hr.	33.13	41.41	52.33	63.45	9.67	15.86	23.31	42.71	4.86	7.24	14.48	19.47	6560.80
T_7 KNO_3 @ 0.5% seed soaking for 3 Hr.	23.68	31.21	40.35	47.46	6.48	13.27	19.75	23.53	3.35	5.02	10.04	13.40	3906.01
T_8 KNO_3 @ 1% seed soaking for 3Hr.	23.75	31.53	40.64	48.24	6.56	13.79	20.22	23.89	3.45	5.17	10.34	13.80	3976.33
T_9 KNO_3 @ 1.5% seed soaking for 3Hr.	23.90	31.65	41.32	48.37	7.07	14.12	20.46	24.29	3.48	5.22	10.44	13.95	4055.23
T_{10} Thiourea @ 0.5% seed soaking for 1 Hr.	23.63	30.44	39.57	44.29	6.21	13.07	19.40	22.93	3.30	4.95	9.90	13.20	3317.01
T_{12} Thiourea @ 1% seed soaking for 1 Hr.	24.50	32.68	42.51	49.43	7.72	14.53	21.30	26.15	3.63	5.44	10.88	14.53	4226.43
T_{13} Thiourea @ 1.5% seed soaking for 1 Hr.	23.65	30.47	39.54	46.42	6.36	13.16	19.95	23.12	3.31	4.96	9.92	13.25	2863.26
SEm(±)	0.37	0.60	0.64	0.62	0.10	0.35	0.49	0.78	0.10	0.08	0.29	0.38	70.79
C.D.	1.08	1.74	1.86	1.81	0.30	1.03	1.43	2.27	0.29	0.25	0.84	1.13	205.79
C.V.	2.53	3.13	2.59	2.16	2.39	4.36	4.10	4.92	4.50	2.60	4.45	4.44	2.89

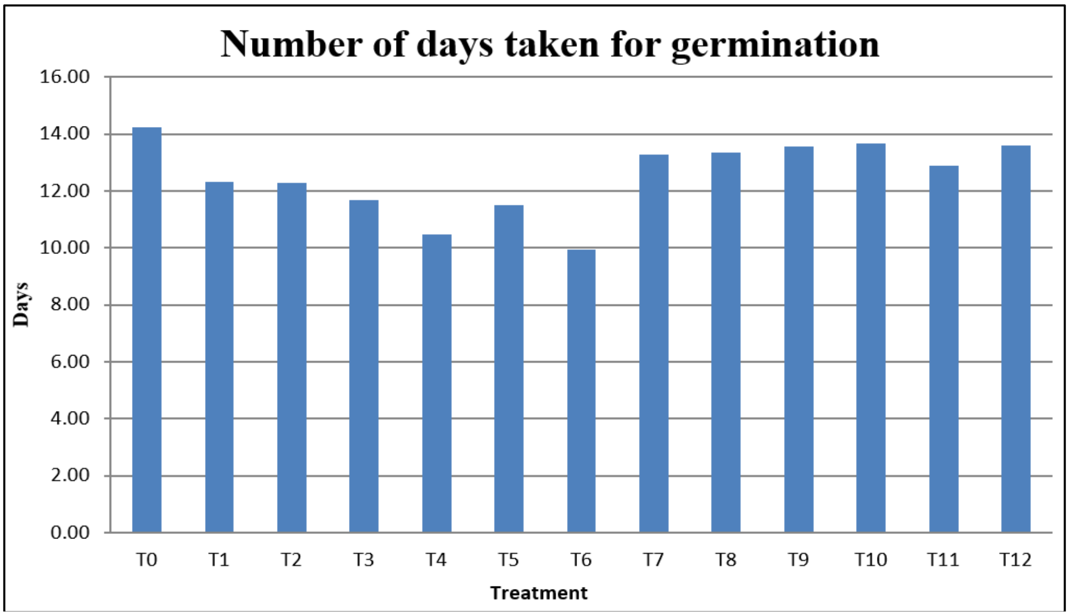

Fig 1: Effect of different PGRs and chemicals on number of days taken for germination of Jackfruit.

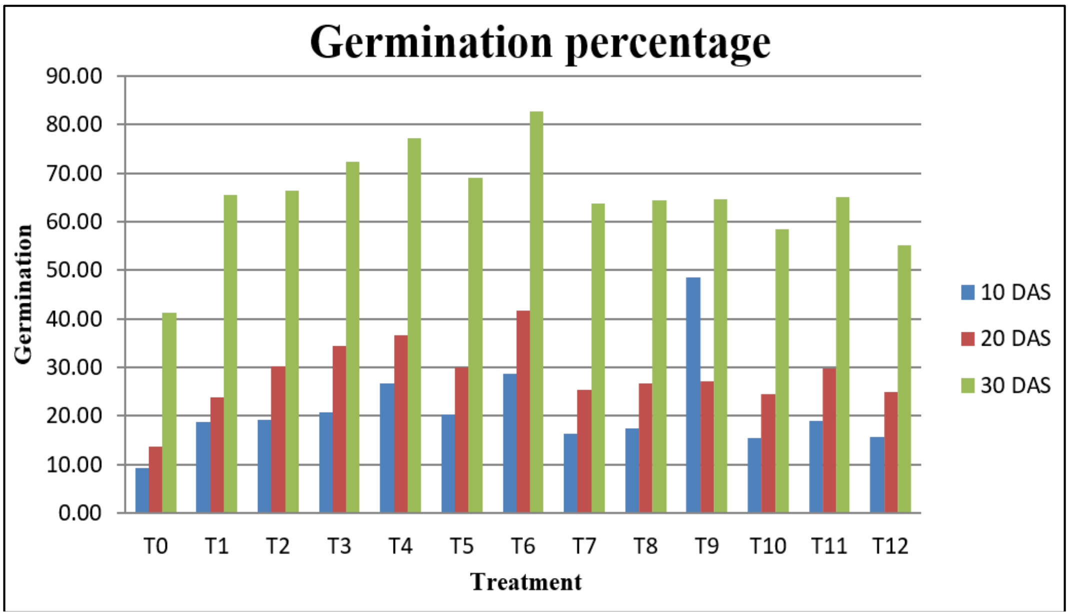

Fig 2: Effect of different PGRs and chemicals on germination percentage (10, 20 and 30 DAS) of Jackfruit

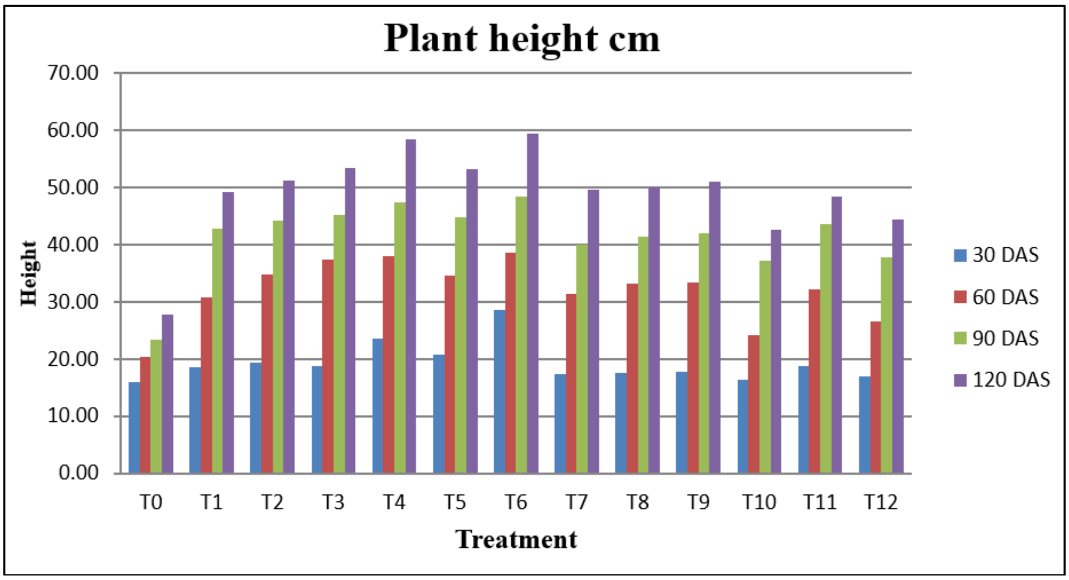

Fig 3: Effect of different PGRs and chemicals on plant height (cm) (30, 60, 90 and 120 DAS) of Jackfruit

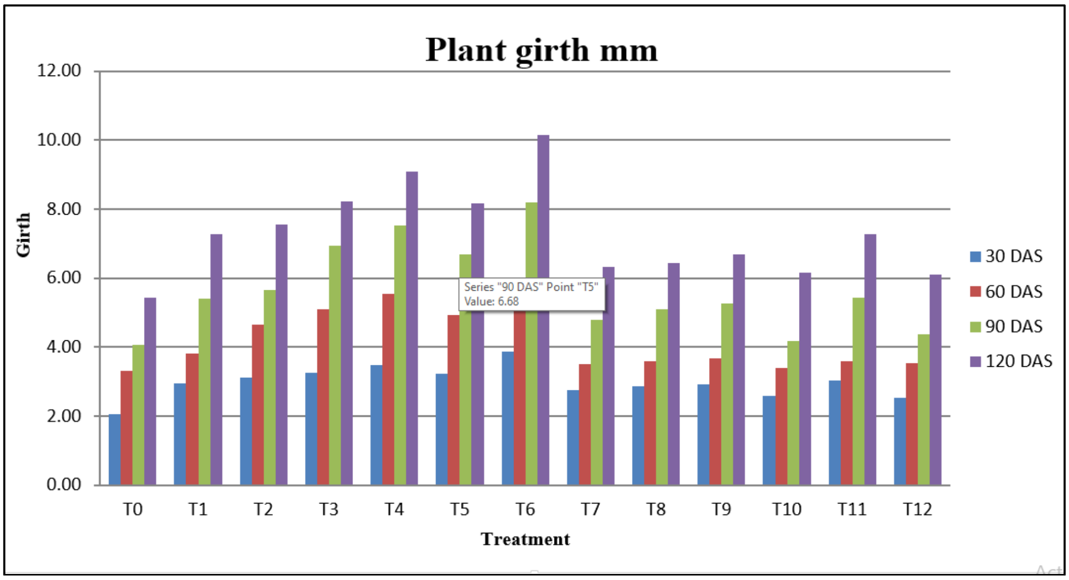

Fig 4: Effect of different PGRs and chemicals on plant girth (mm) (30, 60, 90 and 120 DAS) of Jackfruit

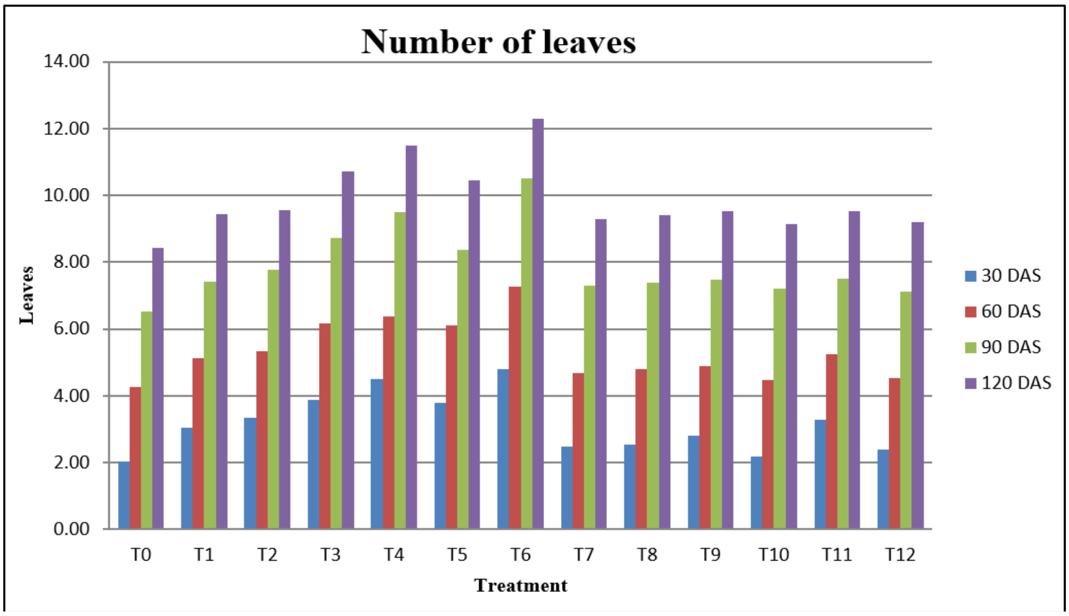

Fig 5: Effect of different PGRs and chemicals on number of leaves (30, 60, 90 and 120 DAS) of Jackfruit

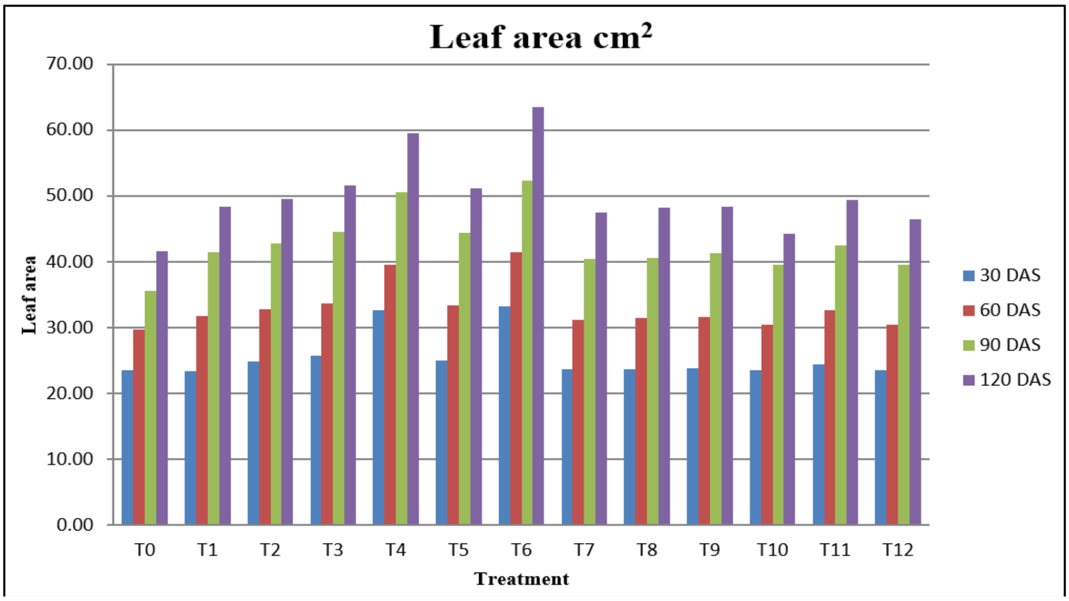

Fig 6: Effect of different PGRs and chemicals on leaf area (cm^2) (30, 60, 90 and 120 DAS) of Jackfruit

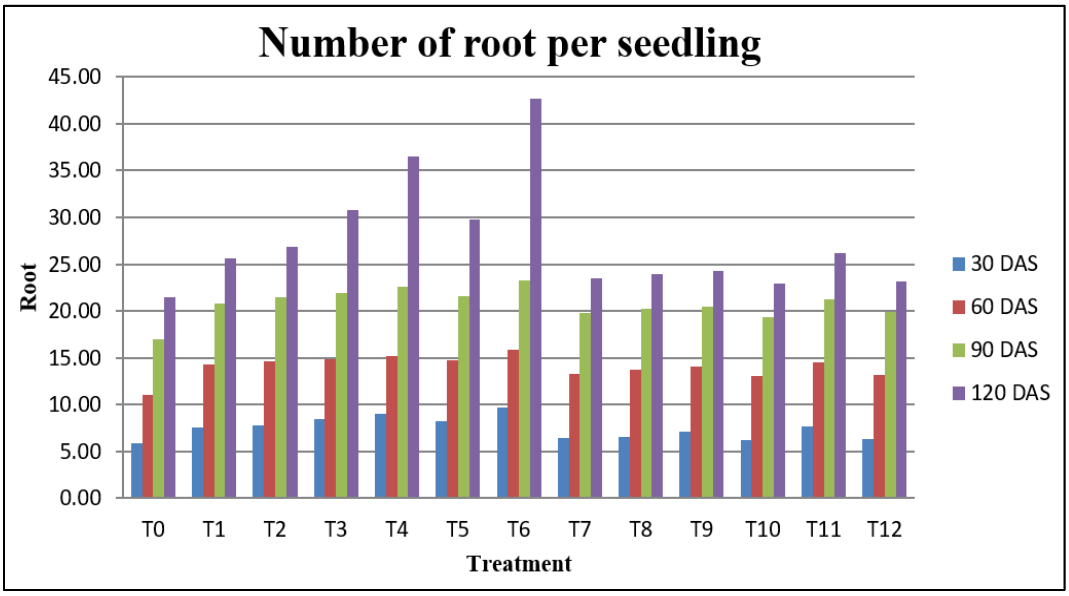

Fig 7: Effect of different PGRs and chemicals on number of roots (30, 60, 90 and 120 DAS) of Jackfruit

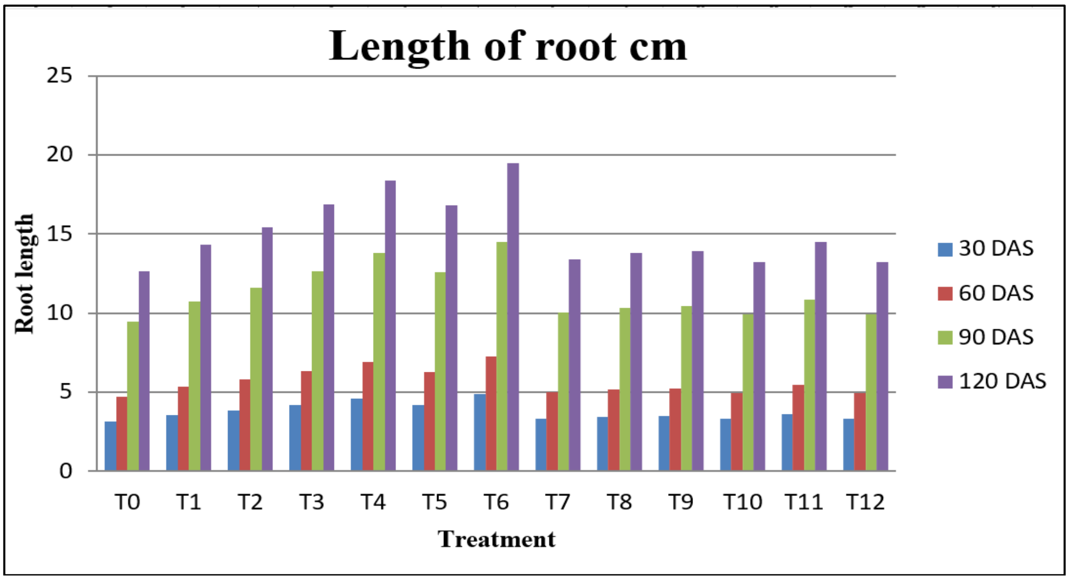

Fig 8: Effect of different PGRs and chemicals on length of roots (cm) (30, 60, 90 and 120 DAS) of Jackfruit

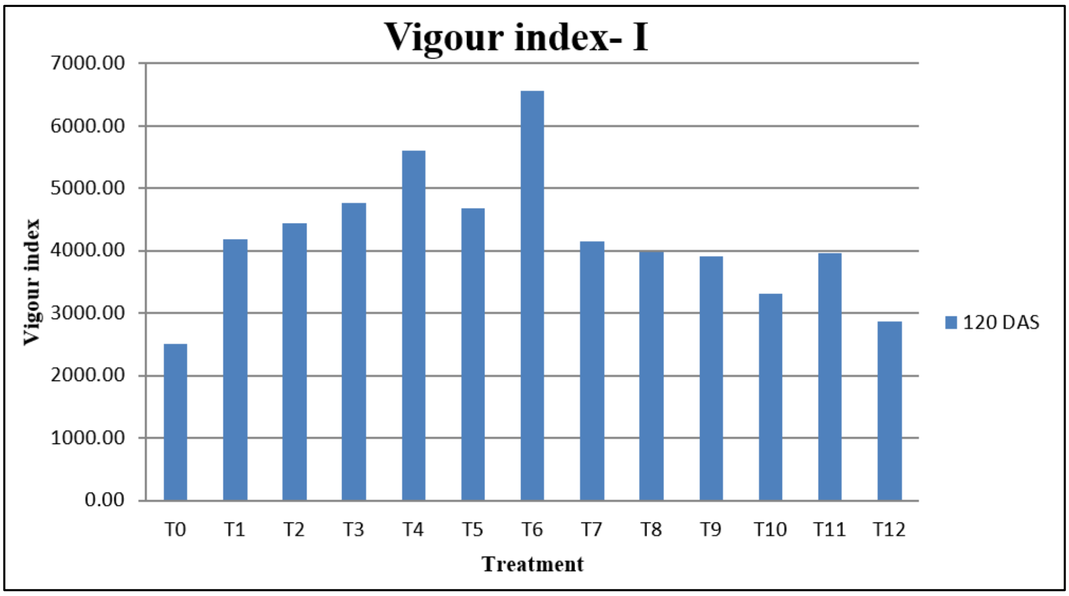

Fig 9: Effect of different PGRs and chemicals on vigour index-I (120 DAS) of Jackfruit.

4. Conclusion

In conclusion, PGRs and chemicals seed treatment shad significant influence on germination and seedling growth of Jackfruit compared to direct seed sowing. Among the Jackfruit seeds treated with GA_3 @ 200 ppm seed soaking for 12 hr. recorded the significantly minimum number of days taken for germination, higher in germination percentage, plant height, plant girth, number of leaves, leaf area cm^2, number of root, length of root and vigour index-I. Hence PGRs seed treatment with GA_3 @ 200 ppm seed soaking for 12 hr. may be recommended for quick germination and production of healthy seedling of Jackfruit.

5. References

1. Aatla HB, Srihari D. Influence of pre-sowing treatment on germination, growth and vigour of mango cv. Alphanso. Asian J Hort. 2013;8(1):122-125.
2. Anburani A, Shakila A. Influence of seed treatment on the enhancement of germination and seedling vigour of papaya. Acta Hortic. 2010;851:295-298.
3. Ajanawe SR, Kanpure RN, Kachouli BK, Mandloi DS. Effect of plant growth regulators and growth media on seed germination and growth vigour of papaya. Ann Plant Soil Res. 2012;15(1):31-34.
4. Anonymous. Area and production of horticulture crops (2nd Advance Estimates). National Horticulture Board. Ministry of Farmers and Welfare, Government of India. 2020;1-3.
5. Anonymous. Horticulture & Farm Forestry Nava Raipur, Atal Nagar (C.G.). 2022;1-2.
6. Babu K, Patel RK, Singh A, Yadav DS, De IC, Deka BC. Seed germination, seedling growth and vigour of papaya under North East Indian condition. Acta Hortic. 2010;851:299-306.
7. Barche S, Singh KK, Singh DB. Response of seed treatment on germination, growth, survivability and economics of different cultivars of papaya (*Carica papaya* L.). Acta Hortic. 2010;851:279-284.
8. Bhardwaj RL. Effect of growing media on seed germination and seedling growth of papaya cv. Red Lady. Afr J Plant Sci. 2014;8(4):178-184.
9. Carrillo Castaneda GM, Calles FB, Monter AV. Post-harvest seed treatments to improve the papaya seed germination and seedlings development. Trop Subtrop Agroecosyst. 2013;16:133-141.
10. Choudhary RC, Kanwar J, Chouhan GS, Sing P, Tanwar DR. Effect of GA3 and growing media on seedling growth of papaya (*Carica papaya* L.) cv. Pusa Nanha. Int J Chem Stud. 2018;6(6):1008-1012.
11. Chandore HD, Manekar RS, Bhor PB. Effect of various plant growth regulators on growth parameters of aonla (*Emblica officinalis* Gaern.) seedling after seed germination. Int J Curr Res. 2016;8(4):29161-29163.
12. Chaudhary K, Samir E, Topno, Annjoe VJ. Effect of potting media on seed germination and seedling growth of jackfruit (*Artocarpus heterophyllus* Lam.) under Prayagraj agro climatic condition. 2024;7:336-343.
13. Das A, Ghosh SK, Suresh CP. Improvement of seed germination and seedling growth of papaya (*Carica papaya* L.) through different pre-sowing seed treatments. Acta Hortic. 1999;851:313-316.
14. Dabhi ML. Effect of GA3, kinetin and thiourea on seed germination and seedling growth of aonla (*Emblica officinalis*) cv. 'Gujarat Aonla-1' [Doctoral dissertation]. Anand: AAU; 2000. Also reported for jamun (*Syzygium cumini* Skeels). Pharma Innov J. 2018;7(8):323-326.
15. Dhankhar DS, Shah PM, Joshi KI. Seed germination and seedling growth in aonla (*Phyllanthus emblica* Linn.) as influenced by gibberellic acid and thiourea. J Appl Hort (Navsari). 1997;3(1/2):93-97.
16. Gomez KA, Gomez AA. Statistical procedures for agricultural research. 2nd ed. New York: John Wiley & Sons; 1984. p. 1-680.
17. Gurung N, Swamy GSK, Sarkar SK, Ubale NB. Effect of chemicals and growth regulators on germination, vigour and growth of passion fruit (*Passiflora edulis* Sims.). Bioscan. 2014;9(1):155-157.
18. Hag N. Jackfruit (*Artocarpus heterophyllus* Lam.). Report on Underutilized Crops. Southampton: University of Southampton; 2006. p. 1-18.
19. Homeshwari, Kanpure RN, Sahu DK, Nagar BL. Effect of different chemical and physical treatments on germination and seedling vigour of chironji. Pharma Innov J. 2022;11(1):714-717.
20. Hota SN, Karna AK, Jain PK, Dhakad B. Effect of gibberellic acid on germination, growth and survival of jamun (*Syzygium cumini* L. Skeels). Pharma Innov J. 2018;7(8):323-326.
21. Harshavardhan A, Rajasekhar M. Effect of pre-sowing seed treatments on seedling growth of jackfruit (*Artocarpus heterophyllus* Lam.). J Res ANGRAU. 2012;40(4):87-89.
22. Jyoti I, Sabarad A, Jalawadi S, Patil RT, Masuthi DK, Prashantha A, Nataraja KH. Studies on seed storage and germination of jackfruit (*Artocarpus heterophyllus* Lam.). Pharma Innov J. 2022;11(7):309-314.
23. Joshi CJ, Sharma DK, Gotur M, Rajan R. Effect of different chemicals on seedling growth and biomass of chironji (*Buchanania lanzan* Spreng.). Int J Curr Microbiol App Sci. 2017;6(9):1819-1823.
24. Kumar A, Gurjar PKS, Kashyap A, Mandloi V, Parteti A. Response of pre-sowing seed treatments on growth of ber (*Ziziphus mauritiana* L.). Int J Chem Stud. 2020;8(2):2368-2371.
25. Singh HP, Batish DR, Kaur S, Ramezani H, Kohli RK. Comparative phytotoxicity of four monoterpenes against *Cassia occidentalis*. Annals of Applied Biology. 2002 Oct;141(2):111-116.
26. Prajapati SK, Kumar P, Malik A, Vijay VK. Bioconversion of algae to methane and subsequent utilization of digestate for algae cultivation: a closed loop bioenergy generation process. Bioresource technology. 2014 Apr 1;158:174-180.
27. Panda AC. Circular RNAs act as miRNA sponges. Circular RNAs: biogenesis and functions. 2018 Sep 28:67-79.
28. Nimbalkar MS, Pai SR, Pawar NV, Oulkar D, Dixit GB. Free amino acid profiling in grain Amaranth using LC–MS/MS. Food Chemistry. 2012 Oct 15;134(4):2565-2569.
29. Kumar R, Singh S, Singh OV. Bioconversion of lignocellulosic biomass: biochemical and molecular perspectives. Journal of industrial microbiology and biotechnology. 2008 May 1;35(5):377-391.
30. Rajamanickam S, Agarwal R. Natural products and colon cancer: current status and future prospects. Drug development research. 2008 Nov;69(7):460-471.
31. Anjani S, Hidayat R, Adlan YA, Suzianti A, Hapsari RT. Design of ergonomic stool (dingklik) for batik crafters. International Journal of Technology. 2013 Jul 2;4(3):299-305.