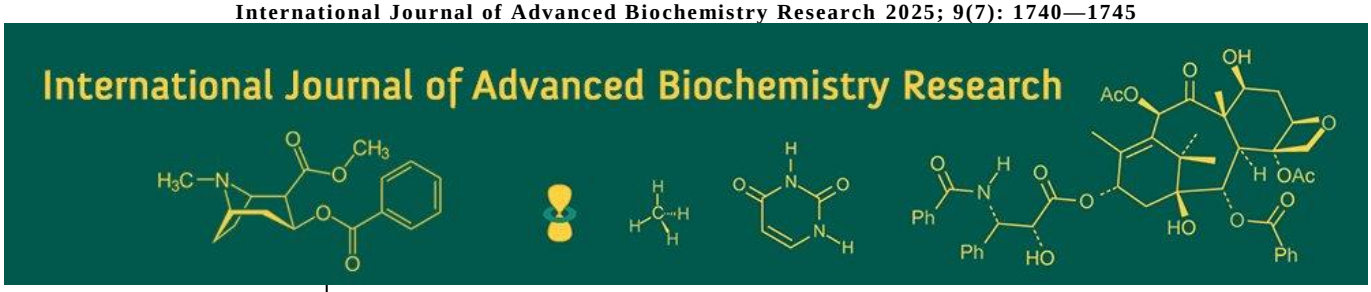

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Influence of planting dates on survival and growth parameters of two jamun (*Syzygium cumini*) cultivars: Goma Priyanka and CISH J-37

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Abstract
Jamun (*Syzygium cumini*), commonly known as Indian blackberry, is a tropical fruit tree of the Myrtaceae family, valued for its nutritional and medicinal properties. This study investigates the impact of different planting dates on the survival and growth parameters of two jamun cultivars, Goma Priyanka and CISH J-37, under the agro-climatic conditions of Prayagraj, India. The experiment was conducted at the Horticulture Research Farm, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences (SHUATS), using a Randomized Block Design with ten treatments combining five planting dates (2 July, 17 July, 2 August, 17 August, and 2 September) and two cultivars, replicated thrice. Key parameters assessed included survival percentage, mortality percentage, plant height, number of leaves, plant spread, leaf area, days to bud break, number of branches, leaf area index, and chlorophyll content. Results indicated that planting CISH J-37 on 2 September yielded the highest survival percentage (84.49%), plant height (1.39 m), number of leaves (12.45), plant spread (12.47 cm), leaf area (10.96 cmš), leaf area index (3.97), and chlorophyll content (62.29 SPAD), alongside the lowest mortality percentage (19.66%) and days to bud break (3.79 days). These outcomes were significantly superior to other treatments, particularly Goma Priyanka planted on 2 September. The findings suggest that CISH J-37 planted on 2 September is optimal for maximizing vegetative growth and survival under Prayagraj agro-climatic conditions, attributed to favorable moisture levels and reduced environmental stress during the late rainy season.

Keywords: Jamun, *Syzygium cumini*, planting dates, Goma Priyanka, CISH J-37, survival percentage, growth parameters, Prayagraj

Introduction
Jamun (*Syzygium cumini*), commonly known as Indian blackberry or Java plum, is a tropical evergreen fruit tree belonging to the Myrtaceae family, widely cultivated across the Indian subcontinent and Southeast Asia. Renowned for its nutritional and medicinal properties, jamun is a significant horticultural crop in India, contributing to both rural livelihoods and agro-based industries. The fruit is a rich source of vitamins (A and C), minerals, and bioactive compounds such as anthocyanins, flavonoids, and phenolic acids, which confer antioxidant, antidiabetic, anti-inflammatory, and antimicrobial properties. Beyond its fruit, jamuns seeds, bark, and leaves are utilized in traditional medicine, particularly in Ayurveda, for managing diabetes, digestive disorders, and cardiovascular health.

In India, jamun cultivation is concentrated in regions with tropical and subtropical climates, including Uttar Pradesh, where Prayagraj agro-climatic conditions characterized by hot summers, moderate monsoons, and mild winters offer a suitable environment for its growth. However, the success of jamun cultivation depends on several factors, including cultivar selection, soil management, and planting time, which significantly influence establishment, growth, and yield. The choice of planting date is particularly critical in tropical horticulture, as it affects seedling survival, root development, and adaptation to environmental stresses such as high temperatures, water scarcity, or excessive rainfall. Optimal planting during the monsoon season (July-September) ensures adequate soil moisture, reducing transplant shock and promoting vigorous vegetative growth. Conversely, untimely planting can lead to high mortality rates and stunted growth, impacting the economic viability of orchards.

This study focuses on two improved jamun cultivars: Goma Priyanka and CISH J-37, developed for their high yield potential, disease resistance, and adaptability to diverse agroclimatic conditions. Goma Priyanka is noted for its large fruit size, early bearing, and suitability for table purposes, while CISH J-37, developed by the Central Institute for Subtropical Horticulture (CISH), is valued for its precocity, uniform fruit quality, and resilience to biotic and abiotic stresses. These cultivars have shown promise in enhancing the commercial prospects of jamun cultivation, particularly in northern India, where demand for high-quality fruit is rising due to increasing consumer awareness of its health benefits.

Despite the potential of these cultivars, there is limited research on optimizing their planting schedules under specific regional conditions like those of Prayagraj, where seasonal variations in temperature, humidity, and rainfall can significantly affect establishment success. For instance, late monsoon planting (August-September) has been suggested to reduce water stress and enhance root establishment in jamun, but empirical data comparing cultivars across multiple planting dates are scarce. This gap in knowledge underscores the need for systematic experiments to identify the optimal planting time for Goma Priyanka and CISH J-37 in Prayagraj unique agro-climatic zone.

This research aims to evaluate the influence of different planting dates on the survival and growth parameters of Goma Priyanka and CISH J-37 under Prayagraj conditions, with the goal of identifying the most suitable planting time and cultivar for commercial cultivation. By examining parameters such as survival percentage, plant height, leaf area, and chlorophyll content, the study seeks to provide actionable insights for farmers and horticulturists to enhance orchard productivity and sustainability.

Objectives

- To study the growth and survival parameters of jamun across different planting dates.
- To determine the optimal planting date for jamun cultivars in Prayagraj.

Materials and Methods: The experiment was conducted at the Horticulture Research Farm, Naini Agricultural Institute, SHUATS, Prayagraj, India, during 2024. The soil was sandy loam with a pH of 6.9, electrical conductivity of 0.262 dSm^{-1}, and organic carbon content of 0.113%. The experiment followed a Randomized Block Design (RBD) with ten treatment combinations of two cultivars (Goma Priyanka and CISH J-37) and five planting dates (2 July, 17 July, 2 August, 17 August, and 2 September), replicated three times.

Treatments details

Table 1: The treatment combinations

Treatment symbol	Variety	Treatment combination
T_1	Goma Priyanka	2 July
T_2	Goma Priyanka	17 July
T_3	Goma Priyanka	2 August
T_4	Goma Priyanka	17August
T_5	Goma Priyanka	2 September
T_6	CISH J-37	2 July
T_7	CISH J-37	17 July
T_8	CISH J-37	2 August
T_9	CISH J-37	17August
T_{10}	CISH J-37	2 September

Management Practices

Seedlings were transplanted into well-prepared soil with basal doses of neem cake, vermicompost, bone meal, nitrogen, phosphorus, and potash. Irrigation was applied manually on 16 July, 23 July, 2 August, and 15 August 2024. Weeding and insecticide spraying were conducted on 16 July, 5 August, 30 August, and 18 July, 2 August, 18 August, respectively.

Observations

The following parameters were recorded at 30-day intervals up to 150 days after planting (DAP):

- **Survival percentage:** (Number of surviving plants / Total plants sown) × 100.
- **Mortality percentage:** [(Total plants sown - Surviving plants) / Total plants sown] × 100.
- **Plant height (m):** Measured from soil surface to the highest stem point.
- **Number of leaves:** Averaged from five selected plants.
- **Plant spread (cm):** Measured in east-west and north-south directions.
- **Leaf area (cmš):** Measured for five selected plants and averaged.
- **Days to bud break:** Counted manually for five plants.
- **Number of branches:** Counted for five plants.
- **Leaf area index (LAI):** Total leaf area / Ground area sampled.
- **Chlorophyll content (SPAD):** Measured using a spectrophotometer.

Results and Discussion

The results demonstrated significant effects of planting dates and cultivars on all measured parameters. The maximum Survivality % was observed in T_{10} (CISH J-37+ 2 September) with84.49%, respectively, followed by T_9 (CISH J-37+ 17 August) at 81.85% which were significantly superior to T_5 (Goma Priyanka + 2 September), which recorded a survival percentage of 53.05%. Late planting allows for establishment before harsh conditions, potentially increasing survival rates. Experimentation across varied planting dates and monitoring survival rates can provide insights into the optimal timing for jamun plantation, aiding in maximizing survival percentages and overall crop success.

The minimum Mortality % was observed in T_{10} (CISH J-37 + 2 September) with (19.66%) respectively, followed by T_9 (CISH J-37+ 17 August) with (22.33%) % which were

significantly superior over T_5 (Goma Priyanka + 2 September) with (31.66%). The influence of different planting dates on the Mortality percentage of jamun (*Syzygiumcumini*) varies due to climatic conditions, Soil moisture and growth stages. Planting during optimal conditions, such as the onset of the rainy season, typically results in higher Mortality rates due to favourable moisture levels and reduced stress.

The maximum Plant height was observed in T_{10} (CISH J-37 + 2 September) with (1.39) m followed by T_9 (CISH J-37+ 17 August) with (1.10) m which were significantly superior over T_5 (Goma Priyanka + 2 September) with (0.93) m. Late planting allows for establishment before harsh conditions, potentially increasing plant height. Experimentation across varied planting dates and monitoring plant height can provide insights into the optimal timing for jamun plantation, aiding in maximizing Plant height and overall crop success.

The maximum Number of leaves was observed in T_{10} (CISH J-37 + 2 September) with (12.45) cm followed by T_9 (CISH J-37+ 17 August) with (11.83) which were significantly superior over T_5 (Goma priyanka + 2 September) with (9.77). Planting during optimal conditions, such as the onset of the rainy season, typically results in higher Number of leaves due to favourable moisture levels and reduced stress.

Table 2: Influence of different planting date on Survivality percentage of jamun.

Symbol	Treatment	Survivality %
T_1	Goma Priyanka + 2 July	59.35%
T_2	Goma Priyanka + 17 July	73.29%
T_3	Goma Priyanka + 2 August	58.33%
T_4	Goma Priyanka + 17 August	71.18%
T_5	Goma Priyanka + 2September	53.03%
T_6	CISH J-37 + 2 July	77.48%
T_7	CISH J-37 + 17 July	63.48%
T_8	CISH J-37 + 2 August	67.41%
T_9	CISH J-37 + 17 August	81.85%
T_{10}	CISH J-37 + 2 September	84.49%
	F Test	S
	S.EM(±)	4.11
	CD @ 5%	12.2%
	CV	10.31

Table 3: Influence of different planting date on Mortality percentage of jamun.

Symbol	Treatment	Mortality%
T_1	Goma Priyanka + 2 July	29.45%
T_2	Goma Priyanka + 17 July	25.60%
T_3	Goma Priyanka + 2 August	23.33%
T_4	Goma Priyanka + 17 August	30.32%
T_5	Goma Priyanka + 2 September	31.66%
T_6	CISH J-37 + 2 July	23.44%
T_7	CISH J-37 + 17 July	27.66%
T_8	CISH J-37 + 2 August	26.83%
T_9	CISH J-37 + 17 August	22.33%
T_{10}	CISH J-37 + 2 September	19.66%
	F Test	S
	S.EM(±)	0.87
	CD @ 5%	2.57%
	CV	5.77

Table 4: Influence of different planting date on Plant height of jamun.

Plant Height (cm)						
Treatments	Initial	30Dap	60Dap	90Dap	120Dap	150Dap
T_1	0.43	0.55	0.59	0.67	0.77	0.93
T_2	0.41	0.56	0.6	0.69	0.82	0.99
T_3	0.43	0.55	0.61	0.71	0.83	1.05
T_4	0.46	0.57	0.63	0.75	0.79	1.07
T_5	0.38	0.53	0.59	0.74	0.84	0.93
T_6	0.47	0.55	0.65	0.76	0.86	0.96
T_7	0.47	0.57	0.67	0.78	0.92	0.93
T_8	0.43	0.64	0.75	0.82	0.95	1
T_9	0.53	0.69	0.83	0.93	1.09	1.1
T10	0.57	0.73	0.85	0.95	1.31	1.39
F-TEST	S	S	S	S	S	S
S.EM(±)	0.01	0.01	0.02	0.01	0.08	0.07
CD @ 5%	0.02	0.03	0.05	0.04	0.24	0.22
CV	2.66	2.78	4.1	2.68	15.45	12.24

Table 5: Influence of different planting date on Number of leaves of jamun.

Number of Leaves						
Treatments	Initial	30DAP	60DAP	90DAP	120DAP	150DAP
T_1	7.15	9.61	9.83	10.3	10.69	11.09
T_2	7.22	8.33	8.63	9.3	9.73	9.93
T_3	7.17	9.53	9.9	10.19	10.56	10.97
T_4	7.45	9.9	10.28	10.73	11.03	11.37
T_5	7.11	8.2	8.63	9.26	9.53	9.77
T_6	7.42	8.57	9.23	9.56	10.07	10.59
T_7	7.59	8.73	9.33	9.73	10.2	10.93
T_8	7.26	9.16	9.5	9.83	10.33	11.03
T_9	7.76	9.73	10.23	10.53	11.27	11.83
T10	7.86	9.87	10.33	10.67	11.52	12.45
F-TEST	S	S	S	S	S	S
S.EM(±)	0.05	0.06	0.12	0.1	0.07	0.07
CD @ 5%	0.14	0.19	0.36	0.29	0.21	0.2
CV	1.11	1.22	2.17	1.71	1.18	1.09

The maximum Plant spread was observed in T_{10} (CISH J-37 + 2September) with (12.47) cm followed by T_9(CISH J-37+17 August) with (12.24) cm which were significantly superior over T_5 (Goma Priyanka + 2 September) with (7.40) cm. Planting during optimal conditions, such as the onset of the rainy season, typically results in higher Number of leaves due to favourable moisture levels and reduced stress. The increase in number of leaves simultaneously increases the plant sp.

The maximum Leaf area was observed in T_{10} (CISH J-37 +2 September) with (10.96) cm^2 followed by T_9 (CISH J-37+ 17 August) with (10.73) cm^2 which were significantly superior over T_5 (Goma Priyanka +2 September) with (9.27) cm^2. Increase in somatic cell division of leaf increases the leaf area of the plant which also helps in the increasing he plant spread.

The minimum Days to Bud break was observed in T_{10} ((CISH J-37 + 2 September)) with (3.79) days respectively, followed by T_9(CISH J-37+ 17 August) with (4.49) days which were significantly superior over T_5 (Goma Priyanka+ 2 September) with (9.28).

The maximum Number of branches was observed in T_{10}(CISH J-37 + 2 September) with (10.75) respectively, followed by T_9 (CISH J-37+ 17 August) with (9.79) which were significantly superior over T_5 (Goma Priyanka+ 2 September) with (4.23). Increase in somatic cell division of branches, increases the bud of the plant which also helps in the initiation of leaf.

The maximum Leaf area index was observed in T_{10} (CISH J-37 + 2 September) with (3.97) respectively, followed by T_9(CISH J-37+ 17 August) with (3.80) which were significantly superior over T_5 (Goma Priyanka+ 2 September) with (1.69).

The maximum chlorophyll content was observed in T_{10} () with (65.87) respectively, followed by T_2 (Goma Priyanka + 15 February) with (61.45) which were significantly superior over T_{10} (Ra jamun + 30 CISH J-37 + 2 September march) with (62.29). Increasing chlorophyll content in plants enhances photosynthesis, the process crucial for converting light energy into chemical energy. This leads to improved growth, higher yields, and enhanced overall plant Vigor. Additionally, higher chlorophyll levels can contribute to better stress tolerance and improved resistance against environmental challenges.

Table 5: Influence of different planting date on Plant spread of jamun

Plant Spread (cm)						
Treatments	Initial	30DAP	60DAP	90DAP	120DAP	150DAP
T_1	3.67	5.90	6	6.4	6.77	7.37
T_2	3.53	5.36	5.5	5.83	6.2	6.77
T_3	3.85	5.93	6.23	6.57	7.2	7.77
T_4	3.68	6.80	7.07	7.37	8.13	8.87
T_5	3.44	5.72	5.89	6.17	6.7	7.4
T_6	3.92	6.85	7.17	7.53	8.23	8.9
T_7	3.78	7.50	7.73	8	8.43	9.24
T_8	3.79	7.51	8.1	8.5	8.97	9.5
T_9	4.02	9.09	9.47	10.57	11.33	12.24
T_{10}	4.25	9.80	10.4	10.93	11.6	12.47
F- TEST	S	S	S	S	S	S
S.EM(±)	0.05	0.33	0.32	0.34	0.31	0.33
CD @ 5%	0.16	0.99	0.96	1	0.91	0.99
CV	2.41	8.2	7.63	7.52	6.37	6.38

Table 7: Influence of different planting date on Leaf area of jamun

Leaf Area (cm^2)						
Treatments	Initial	30DAP	60DAP	90DAP	120DAP	150DAP
T_1	3.61	7.29	8.22	8.62	9.21	9.98
T_2	3.63	6.73	8.16	8.33	9.51	10.16
T_3	3.55	7.09	8.77	8.96	9.35	9.79
T_4	4.01	7.40	8.69	8.99	9.66	10.01
T_5	3.28	6.83	7.69	8.46	8.98	9.27
T_6	3.69	7.62	8.81	9.23	9.79	10.21
T_7	3.79	7.33	8.14	8.69	9.01	9.43
T_8	3.68	6.73	8.26	9.22	9.58	10.19
T_9	4.37	8.40	9.23	9.82	10.32	10.73
T_{10}	4.77	8.59	9.77	10.07	10.39	10.96
F- TEST	S	S	S	S	S	S
S.EM(±)	0.04	0.25	0.43	0.23	0.19	0.13
CD @ 5%	0.12	0.75	1.27	0.69	0.56	0.40
CV	1.79	5.91	8.16	4.48	3.42	2.30

Table 8: Influence of different planting date on Days to Bud break percentage of jamun.

Symbol	Treatment	Days to bud break
T_1	Goma Priyanka + 2 July	9.82
T_2	Goma Priyanka + 17 July	5.25
T_3	Goma Priyanka + 2 August	6.88
T_4	Goma Priyanka + 17 August	5.88
T_5	Goma Priyanka + 2 September	9.28
T_6	CISH J-37 + 2 July	9.09
T_7	CISH J-37 + 17 July	9.49
T_8	CISH J-37 + 2 August	7.95
T_9	CISH J-37 + 17 August	4.49
T10	CISH J-37 + 2 September	3.79
	F- Test	S
	S.EM(±)	0.32
	CD @ 5%	0.95
	CV	7.72

Table 9: Influence of different planting date on Number of branches percentage of jamun.

Symbol	Treatment	Number of branches
T_1	Goma Priyanka + 2 July	6.89
T_2	Goma Priyanka + 17 July	5.06
T3	Goma Priyanka + 2 August	6.88
T4	Goma Priyanka + 17 August	7.65
T5	Goma Priyanka + 2 September	4.23
T_6	CISH J-37 + 2 July	8.0
T_7	CISH J-37 + 17 July	5.43
T8	CISH J-37 + 2 August	8.22
T_9	CISH J-37 + 17 August	9.79
T_{10}	CISH J-37 + 2 September	10.75
	F- Test	S
	S.EM(±)	0.18
	CD @ 5%	0.55
	CV	4.36

Table 10: Influence of different planting date on Leaf area index percentage of jamun.

Symbol	Treatment	Leaf Area Index
T_1	Goma Priyanka + 2 July	2.17
T_2	Goma Priyanka + 17 July	2.10
T3	Goma Priyanka + 2 August	2.70
T_4	Goma Priyanka + 17 August	2.40
T_5	Goma Priyanka + 2 September	1.69
T_6	CISH J-37 + 2 July	2.50
T7	CISH J-37 + 17 July	2.42
T_8	CISH J-37 + 2 August	2.59
T_9	CISH J-37 + 17 August	3.80
T_{10}	CISH J-37 + 2 September	3.97
	F- Test	S
	S.EM(±)	0.09
	CD @ 5%	0.26
	CV	5.77

Table 11: Influence of different planting date on Chlorophyll Content percentage of jamun

Symbol	Treatment	Chlorophyll content SPAD value
T_1	Goma Priyanka + 2 July	43.80
T_2	Goma Priyanka + 17 July	42.93
T_3	Goma Priyanka + 2 August	43.96
T_4	Goma Priyanka + 17 August	50.50
T_5	Goma Priyanka + 2 September	45.73
T_6	CISH J-37 + 2 July	47.13
T_7	CISH J-37 + 17 July	49.07
T_8	CISH J-37 + 2 August	53.23
T_9	CISH J-37 + 17 August	61.7
T_{10}	CISH J-37 + 2 September	62.29
	F- Test	S
	S.EM(±)	1.42
	CD @ 5%	4.21
	CV	4.90

Key Findings

The highest survival percentage was recorded in T_{10} (CISH J-37, 2 September) at 84.49%, followed by T_9 (CISH J-37, 17 August) at 81.85%, significantly outperforming T_5 (Goma Priyanka, 2 September) at 53.03%. The lowest mortality percentage was observed in T_{10} (19.66%), followed by T_9 (22.33%). T_{10} also exhibited superior performance across all growth parameters:

- **Plant height:** 1.39 m (T_{10}) vs. 1.10 m (T_9) and 0.93 m (T_5).
- **Number of leaves:** 12.45 (T_{10}) vs. 11.83 (T_9) and 9.77 (T_5).
- **Plant spread:** 12.47 cm (T_{10}) vs. 12.24 cm (T_9) and 7.40 cm (T_5)
- **Leaf area:** 10.96 cm^2 (T_{10}) vs. 10.73 cm^2 (T_9) and 9.27 cm^2 (T_5).
- **Days to bud break:** 3.79 days (T_{10}) vs. 4.49 days (T_9) and 9.28 days (T_5).
- **Number of branches:** 10.75 (T_{10}) vs. 9.79 (T_9) and 4.23 (T_5).
- **Leaf area index:** 3.97 (T_{10}) vs. 3.80 (T_9) and 1.69 (T_5).
- Chlorophyll content: 62.29 SPAD (T_{10}) vs. 61.73 SPAD (T_9) and 45.73 SPAD (T_5).

Conclusion

The study concludes that planting CISH J-37 on 2 September is optimal for maximizing survival and vegetative growth of jamun under Prayagraj agro-climatic conditions. This planting date ensures favorable moisture and temperature conditions, enhancing root establishment and overall plant vigor. CISH J-37 outperformed Goma Priyanka across all measured parameters, making it a preferred cultivar for commercial cultivation in this region.

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