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Evaluation of the different varieties of Lotus *(Nelumbo nucifera)* in Prayagraj agroclimatic condition, Uttar Pradesh

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Abstract— *The experiment was conducted in the Department of Horticulture, Sam Higginbottom University of Agriculture Technology and Science, Prayagraj, during 2024-2025. The experiment was laid out in Randomized Block Design (RBD) with 07 Lotus varieties and each variety was replicated 4 times. The different varieties used in the experiment were 108, Akhila, Fong Hu, Sai thung sui, Super lotus 14, Allahabad local lotus-1, Allahabad local lotus-2. The result obtained showed that the variety V3: Fong Hu showed significantly better performance in parameters like plant height (41.85 cm), leaf length (14.94 cm), leaf width (21.04 cm), number of buds per plant (18.37), number of days for emergence of flower bud (20.95), flower diameter (14.64 cm), flower length (20.56 cm), duration of flowering (10.90), vase life (6.88), total number of flowers/plant (38.41), yield of rhizome/plant (1.65 kg), yield of rhizome/ha (30400.25), and which was found to be at par with variety V4: Sai Thung Sui in plant height (40.49 cm), leaf length (14.14 cm), leaf width (20.31 cm), number of buds per plant (17.89), number of days for emergence of flower bud (12.01), flower diameter (13.33 cm), flower length (14.49 cm), vase life (6.24) and number of leaf was found maximum in variety V5: Super lotus 14 (37.07) followed by V3: Fong Hu (35.89) Hence, variety V3 and V4 is excellent in terms of performance and plant growth under Prayagraj agroclimatic conditions.*

Keywords— *Lotus, plant growth, varieties, vase life.*

I. INTRODUCTION

Nelumbo nucifera Gaertn. (Lotus), a perennial aquatic macrophyte species, belongs to the genus Nelumbo in the family Nelumbonaceae. Cultivation of lotus dates long back in history as an ornamental and vegetable in several Asian countries [6,27,30]. N. nucifera is mainly distributed in Asia and Australia [7], and has also been utilized for its economic importance [28]. The lotus (Nelumbo nucifera), known as the sacred lotus, water lily, or Indian lotus, is a flowering plant revered for its symbolism, beauty, and diverse culinary and medicinal applications. It is classified as an aquatic perennial flower and belongs to the genus Nelumbo, which encompasses both the cultivated Nelumbo nucifera and Nelumbo lutea. Geographically, the genus is widespread across Asia (including China, India, and Russia), as well as in the northern regions of Australia and North America. Native to tropical and temperate regions of Asia, the lotus has been cultivated for centuries for its edible and therapeutic properties. Lotus has been used as a food for about 7,000 years in Asia, and it is cultivated for its edible rhizomes/stems, seeds and leaves. Various lotus plant parts like buds, flowers, anthers, stamens, fruits, leaves, stalks, rhizomes and roots have been used as herbal medicines for treatment of many diseases including cancer, depression, diarrhoea, heart problems, hypertension and insomnia [21,2]. However, the lotus flowers, floral parts or their extracts have also been used against many diseases like hypertension, cancer, weakness, body heat imbalance, consolidation of kidney function, male sexual disorders, syphilis, stopping bleeding and to eliminate the stagnated blood [20]. In China, for example, N. nucifera seeds are widely used for the preparation of Chinese herbal medicine [3,11] and the rhizome of this species is a common vegetable [25,8]. N. nucifera flowers are the main

traditional flowers in China, while in India and Vietnam, they are regarded as the national flowers [3,25]. Lotus flowers are protogynous and usually out-crossed by insects [10]. This species can be propagated either by seeds or rhizomes [4,18]. Lotus is capable of producing new hybrids through hybridization between wild and domesticated varieties [12]. So far, a sizable number of cultivars have been developed from N. nucifera [13]. Notably, the wild lotus populations have served as essential germplasm sources for breeding purposes [26,7] and varied agroclimatic conditions have contributed to the existence of diverse genotypes of wild lotus in China [12]. Recently, morphological features, ecological adaptation, and genetic studies in lotus indicated that the Southeastern Asia lotus is distinct from Chinese lotus [11]. [29] grouped the N. nucifera populations into two distinct ecotypes based on the geographical location where the genotypes are adapted, i.e., tropical lotus and temperate lotus. These ecotypes have shown differences in the duration of flowering, growth, and rhizome morphology. The temperate lotus has annual growth habits and big rhizome, whereas the tropical lotus is perennial, has a small rhizome and long flowering period [29]. Lotus grown in East and North-east Asian countries belong to the temperate group, whereas the lotus grown in South-east Asian countries and Australia are considered as tropical ecotype [29,11]. A previous study revealed that the Thailand lotus, one of the tropical lotus groups, had 2 to 3 months longer flowering periods than the Chinese cultivars [13,28]. Tropical lotus is often used for enhancing the ornamental value of temperate lotus by providing valuable traits for developing varieties with a more extended flowering period [11,12,28].

The plant can grow in water depths ranging from 30 cm to 2.5 meters. Lotus root system consists of long, tuberous rhizomes that extend horizontally in the substrate, anchoring the plant and facilitating nutrient uptake and storage [14,24]. These roots contain aerenchyma, specialized tissue that enhances gas exchange and regulation in aquatic environments. The morphology of the Lotus reflects its adaptations to an aquatic habitat, enabling it to thrive in diverse freshwater ecosystems worldwide [15,16]. Native to Asia, Nelumbo nucifera predominantly grows in warm temperate and tropical regions, preferring temperatures between 25 ºC and 30 ºC. The plant requires full sunlight, needing at least six hours of direct sunlight daily. In winter, the Lotus goes dormant, with rhizomes surviving underwater until warmer temperatures return. Lotus plants grown from rhizomes develop more quickly than those grown from seeds. At the time of harvesting, lotus flowers are cut at an angle to maximize water absorption and then placed into natural water to maintain their freshness [17,26]. With proper handling of water and harvesting the flowers at right time extends the lifespan of these exquisite blooms. In India, commercial cultivation of the Lotus has great potential due to its multifaceted uses and cultural significance. Significant commercial production occurs in states such as Bihar, West Bengal, Uttar Pradesh, Odisha, and Kerala. The purpose of this research is to evaluate different varieties of lotus on basis of their growth, yield and blooming duration in Prayagraj agroclimatic conditions.

II. MATERIALS AND METHODS

The details of the various materials used and methods adopted in carrying out the experiment are presented below:

DATA ANALYSIS:

The data was analyzed using STAR.

EXPERIMENTAL SITE:

The present investigation entitled **"Evaluation of the different varieties of Lotus *(Nelumbo nucifera)* in Prayagraj agroclimatic condition**" was carried out during the year 2024-2025 in the Department of Horticulture, Sam Higginbottom University of Agriculture Technology & Sciences Prayagraj in the months of October 2024 to February 2025. The experiment was conducted on different cultivars of lotus. All the facilities necessary for cultivation, including labor were made in the department.

Varieties and Notations

Study on different varieties of lotus during 2024-25 at Horticulture Research Farm of Naini Agricultural Institute, SHUATS, Prayagraj, (Uttar Pradesh). The experiment was laid out in RBD, with 4 replications of 7 different varieties viz. V1: 108, V2: Akhila, V3: Fong Hu, V4: Sai Thung Sui, V5: Super Lotus 14, V6: Allahabad Local Lotus-1, V7: Allahabad Local Lotus-2. The transplanting was done on 28/10/2024 in field condition.

CLIMATE:

The Prayagraj District comes under subtropical belt in the southeast of U.P. which experience extremely hot summer and fairly cold winter. During the winter months (Dec.-Jan) temperature falls 2-5^{0}C or even low, while in summer months (May-June) it reaches as high as 49^{0}C. Hot blowing winds are regular feature during the summers and an occasional spell of frost may be during winters. Most of the rainfall is received in the middle of July to end of September after which the intensity of rainfall decreases. The mean annual rainfall is about 850-1100mm. However, occasional precipitation is also not uncommon during winter months.

RUNNING STATUS -

Growth parameter

1. Plant height (cm)
2. Number of Leaves
3. Leaf Length (cm)
4. Leaf width (cm)

Floral parameter

5. Number of buds per plant
6. Number of days for emergence of flower buds
7. Flower diameter (cm)
8. Flower length (cm)

Quality parameter

9. Vase life (days)

III. RESULT AND DISCUSSION

The experiment entitled "EVALUATION OF THE VARIETIES OF LOTUS *(Nelumbo nucifera)* IN PRAYAGRAJ AGROCLIMATIC CONDITION, UTTAR-PRADESH" was carried in the polyhouse, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agricultural, Technology and Sciences, Prayagraj. The tabulated data were statistically analyzed with a view to find out. The data present in the tabular forms shows the relevant standard error of mean deviation S (±) and the critical difference (C.D) at 5% level of significance, wherever necessary. The results emanating from the present studies are presented under appropriate heading:

Table 1: Plant height (cm) of different varieties of lotus (Nelumbo nucifera) at monthly time interval.

VARIETIES	30DAP *	60DAP *	90DAP *	120DAP *
V1	10.81	18.92	28.78	31.51
V2	13.39	21.09	32.97	34.92
V3	18.40	25.58	39.82	41.85
V4	16.94	24.11	37.01	40.49
V5	14.50	22.14	35.95	38.16
V6	9.97	15.36	26.83	29.90
V7	7.96	10.65	22.58	25.61
F-Test	S	S	S	S
SE(d) ±	0.888	1.914	3.326	2.315
CD	1.879	4.053	7.042	4.902
CV	9.553	13.745	14.702	9.47

* Days after planting

Significantly, higher plant height was observed in the lotus cultivar V3: Fong Hu (41.85 cm), which was found to be at par with cultivar V4: Sai Thung Sui (40.49 cm), while lesser plant height was observed in the cultivar V7: Allahabad Local Lotus-2 (25.18 cm).

Variation in plant height could be influenced by the parental genotypes, their genetic makeup as well as prevailing temperature during the growing period. Similar results are recorded in lotus by **Pinto *et al.* (2009), JieFu *et al.* (2011), Gond *et al.* (2020) and Srijika (2024).**

Table 4.2: Number of leaves of different varieties of lotus (Nelumbo nucifera) at monthly time interval.

VARIETIES	30DAP	60DAP	90DAP	120DAP
V1	12.25	24.59	28.99	29.41
V2	13.43	26.63	31.99	33.18
V3	17.05	30.04	33.97	35.89
V4	16.01	28.87	33.30	34.18
V5	17.21	32.74	35.59	37.07
V6	10.80	24.27	25.97	26.95
V7	9.17	23.91	24.10	25.08
F-Test	S	S	S	S
SE(d) ±	1.496	2.693	2.067	1.716
CD	3.166	5.701	4.376	3.634
CV	15.428	13.952	9.564	7.661

Significantly, higher number of leaves was observed in the lotus cultivar V5: Super Lotus 14 (37.07), which was found to be at par with cultivar V3: Fong Hu (35.89), while lesser number of leaves was observed in the cultivar V7: Allahabad Local Lotus-2 (25.08).

Variation in number of leaves could be influenced by the parental genotypes, their genetic makeup as well as prevailing temperature during the growing period. Similar results are recorded in lotus by **Pinto *et al.* (2009), JieFu *et al.* (2011), Gond *et al.* (2020) and Srijika (2024).**

Table 4.3: Leaf length (cm) of different varieties of lotus (Nelumbo nucifera) at monthly time interval.

VARIETIES	30DAP	60DAP	90DAP	120DAP
V1	6.32	10.02	12.37	12.97
V2	6.87	11.70	12.59	13.58
V3	8.81	13.38	14.60	14.94
V4	7.87	13.20	14.07	14.41
V5	7.10	12.02	13.12	13.81
V6	5.91	9.64	11.14	11.73
V7	5.43	9.43	9.96	10.65
F-Test	S	S	S	S

SE(d) ±	1.414	0.982	1.088	1.141
CD	2.141	2.08	2.304	2.416
CV	28.959	12.243	12.256	12.266

Significantly, higher leaf length was observed in the lotus cultivar V3: Fong Hu (14.94 cm), which was found to be at par with cultivar V4: Sai Thung Sui (14.41 cm), while lesser leaf length was observed in the cultivar V7: Allahabad Local Lotus-2 (10.65 cm).

Variation in leaf length could be influenced by the parental genotypes, their genetic makeup as well as prevailing temperature during the growing period. Similar results are recorded in lotus by **Pinto *et al.* (2009), JieFu *et al.* (2011), and Gond *et al.* (2020).**

Table 4.4: Leaf width (cm) of different varieties of lotus (Nelumbo nucifera) at monthly time interval.

VARIETIES	30DAP	60DAP	90DAP	120DAP
V1	13.28	14.28	17.70	18.71
V2	13.64	16.51	19.33	19.70
V3	14.83	17.64	20.99	21.04
V4	14.55	17.42	20.26	20.31
V5	14.03	16.80	19.41	20.29
V6	12.88	14.03	17.37	17.50
V7	12.62	13.25	16.25	16.87
F-Test	S	S	S	S
SE(d) ±	0.513	1.081	0.846	1.176
CD	1.087	2.29	1.791	2.491
CV	5.299	9.735	6.378	8.661

Significantly, higher leaf width was observed in the lotus cultivar V3: Fong Hu (21.04 cm), which was found to be at par with cultivar V4: Sai Thung Sui (20.31 cm), while lesser leaf width was observed in the cultivar V7: Allahabad Local Lotus-2 (16.87 cm).

Variation in leaf width could be influenced by the parental genotypes, their genetic makeup as well as prevailing temperature during the growing period. Similar results are recorded in lotus by **Pinto *et al.* (2009), JieFu *et al.* (2011), and Gond *et al.* (2020).**

Table 4.5: Number of buds per plant of different varieties of lotus (Nelumbo nucifera) at monthly time interval.

VARIETIES	30DAP	60DAP	90DAP	120DAP
V1	3.70	8.21	11.57	14.50
V2	4.09	8.62	12.66	15.98
V3	4.92	10.16	14.03	18.37
V4	4.84	9.94	13.86	17.89
V5	4.43	9.38	12.91	16.92
V6	3.29	7.57	9.63	12.54
V7	3.11	6.56	9.33	12.48
F-Test	S	S	S	S
SE(d) ±	0.516	0.915	1.168	1.857
CD	1.093	1.937	2.472	3.932
CV	17.982	14.98	13.759	16.91

Significantly, higher number of buds per plant was observed in the lotus cultivar V3: Fong Hu (18.37), which was found to be at par with cultivar V4: Sai Thung Sui (17.89), while lesser number of buds per plant was observed in the cultivar V7: Allahabad Local Lotus-2 (12.48).

Variation in number of buds per plant could be influenced by the parental genotypes, their genetic makeup as well as prevailing temperature during the growing period. Similar results are recorded in lotus by **Pinto *et al.* (2009), Shubhashree *et al.* (2015) and Ashoka *et al.* (2023).**

Table 4.6: Days for emergence of flower bud, Flower Diameter(cm), Flower Length (cm), Duration of flower (Days), Vase life (Days) of different varieties of lotus (Nelumbo nucifera).

VARIETIES	Days for emergence of flower bud	Flower Diameter(cm)	Flower Length (cm)	Duration of flower (Days)	Vase life (Days)
V1	22.06	12.09	17.48	6.36	5.07
V2	21.62	12.39	18.09	6.73	5.55
V3	20.95	14.64	20.56	10.9	6.88
V4	21.01	13.33	19.49	9.51	6.24
V5	21.12	13.64	19.91	9.28	5.6
V6	23.06	10.85	15.03	5.97	4.71
V7	24.02	9.6	12.08	5.78	4.52
F-Test	S	S	S	S	S

SE(d) ±	0.912	0.503	0.755	0.539	0.533
CD	1.93	1.065	1.598	1.14	1.129
CV	5.865	5.75	6.092	9.77	13.683

The increase in days for emergence of flower bud, flower diameter, Flower Length, duration of flower, vase life be influenced by the parental genotypes, their genetic makeup as well as prevailing temperature during the growing period. Similar results are recorded in lotus by **Pinto *et al.* (2009)**, **Shubhashree *et al.* (2015), Ashoka *et al.* (2023) and Srijika (2024).**

IV. CONCLUSION

From the present investigation it is concluded that the variety V3 (Fong Hu) is found to be best in terms of Growth parameters: plant height, number of leaves, leaf length, leaf width, number of buds per plant, Floral parameter: days for emergence of flower bud, vase life.

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