

## Original Research Article

### Study on the growth of seedlings and establishment of Bael varieties under Prayagraj agro climatic conditions

#### Abstract

The objective of the experiment was to work out the Studies on the growth of seedlings and the establishment of Bael varieties under Prayagraj agro climatic conditions. So, a field experiment was conducted during session 2023-2024 at, the Department of Horticulture, Sam Higginbottom University Agriculture, Technology and Sciences, (SHUATS), Prayagraj (U.P). The experiment was conducted in a Randomized Block Design with 6 Variety Varieties (treatment) replicated thrice. The treatments were V<sub>1</sub> Narendra Bael-7, V<sub>2</sub> Narendra Bael-6, V<sub>3</sub> Narendra Bael-4, V<sub>4</sub> Narendra Bael-5, V<sub>5</sub> Narendra Bael-9, V<sub>6</sub> Banarashi. V<sub>6</sub> was found to be superior in the term of Survival Percentage (94.60%), Mortality percentage (5.40 %) Plant height (71.29 cm), length (13.50 cm), width (9.80 cm), Number of leaves plant<sup>-1</sup> (81.52), Number of branches plant<sup>-1</sup> (8.76), leaf area (85.00 cm<sup>2</sup>) leaf area index (106.20), Plant spread (7.27 cm<sup>2</sup>), Chlorophyll content (68.33). The research conduct will help the farmers to select superior variety of Bael under Prayagraj agro-climatic condition.

**Keyword:** Bael, Varieties, Different, Planting, Banarashi

#### 1. INTRODUCTION

Bael (*Aegle marmelos*) is important underutilized indigenous fruit crop of India, belongs to family Rutaceae. It is a subtropical and deciduous tree, which is very hardy and can thrive well under diverse agro-climatic conditions (Singh *et al.*, 2020) [x]. The fruit is very hardy and can grow even under adverse agro-climatic conditions. Most of the tropical and subtropical fruits have a poor keeping quality but bael fruit can be kept for a longer period because of its hard outer shell and as, it can easily withstand transport and marketing hazards

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(Singh *et al.*, 2018) [x]. It can easily be grown on eroded soil and adverse climatic conditions where most of the other fruits cannot be grown easily. It is a sacred tree in Hinduism, and is offered in prayers of Hindu deities Lord Shiva and Parvati and thus, the tree is also known by the name 'Shivaduma' (The Tree of Shiva).

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Farmers are experiencing the challenges of identifying the cultivars as they are unfamiliar with the characteristics of many varieties of bael. In order to identify distinct characters of various bael cultivars, the morphological characters are equally important to the fruit characters. In the absence of a suitable genotype, desirable growth, flowering, and fruit set has not been accomplished. Identification of suitable genotype for the region is necessary for promoting its productivity, production, and quality of the fruits under semi-arid conditions. However, enormous variability in bael still remains unexploited and awaits proper attention on exploration, collection and maintenance of germplasms for conserving them from the available genetic diversity of bael in the nature.

Traditionally, morphological characters have been used to identify and characterize the bael. However, there is a high level of genetic variability which can sometimes be used accurately to distinguish each tree. When the morphological traits are used for determining diversity and relationships among plant species, they are not sufficient because of environmental influences. Thus, the usefulness of molecular markers has been investigated as a means of characterizing and discriminating against different species more precisely (Benharrat *et al.*, 2002) [x]. The degree of similarity between the banding patterns provides information about genetic similarity and relationships between the samples studied. The application largely depends on the type of markers employed, distribution of markers in the genome, type of loci they amplify, level of polymorphism, and reproducibility of the products. Among the molecular markers, RAPD and ISSR markers have been extensively used to study genetic diversity and relationship. These markers can detect polymorphism in a single reaction (Mahantheshkumar *et al.*, 2020) [x]. Therefore, the objective of this paper.....

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## 2. MATERIALS AND METHODS

This experiment was laid out during the July 2023 to January 2024 at Horticulture Research Farm, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (U.P.). The horticulture

research farm is situated at 25° 39' 42" N latitude, 81° 67' 56" E longitude and at an altitude of 98 m above mean sea level. The treatment consisted of V<sub>1</sub> Narendra Bael-7, V<sub>2</sub> Narendra Bael-6, V<sub>3</sub> Narendra Bael-4, V<sub>4</sub> Narendra Bael-5, V<sub>5</sub> Narendra Bael-9, V<sub>6</sub> Banarashi. The experiment was laid out in a Randomized Block Design with 6 treatments and replicated thrice. Data recorded on different aspects of fruit crop, viz., growth and establishment were subjected to statistical analysis by analysis of variance method.

(Gomez and Gomez, 1984) [x] and economic data analysis mathematical method.

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### 3. RESULTS AND DISCUSSION

#### 3.1 Survival percentage

The data survival percentage of Bael as the growth of seedlings of different bael varieties in Prayagraj agro climatic region are summarized in table-Table 1.

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The data reveals that the Survival percentage of Bael increased significantly by the application of different bael varieties essence under experiment over the control. The maximum survival percentage of Bael of V<sub>6</sub> (94.60) was recorded with treatments V<sub>1</sub> (NB7) recorded, while the minimum (66.67) was recorded treatment V<sub>5</sub>. Further, the interaction effect of varieties significantly influenced the Survival percentage of Bael.

Variation in survival percentage may be due to the genetic makeup of the genotypes, environment and edaphic factor also. These lines are in conformity with the results of Dhaker et al. (2019) and Parihar and Pandey (2019). Who reported ???

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#### 3.2 Mortality percentage

The data Mortality percentage of Bael as the growth of seedlings of different bael varieties in Prayagraj agro climatic region are summarized in table-Table 1.

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The data reveals that the Mortality percentage of Bael increased significantly by the application of different bael varieties essence under experiment over the control. The maximum Mortality percentage of Bael of (33.33) was recorded with treatments V<sub>5</sub> (NB9) recorded, while the minimum (5.40) was recorded treatment V<sub>6</sub>. Further, the interaction effect of varieties significantly influenced the Mortality percentage of Bael.

This variation in mortality percentage might be governed by genomic character associated with the genotypes and also favourable climatic condition. Similarly results are also findings with Uddin et al., (2016) [x]. Who reported what???

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#### 3.3 Bud breaks

The data Bud breaks of Bael as growth of seedlings of different bael varieties in Prayagraj agro climatic region are summarized in ~~table-Table~~ Table 1.

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The data reveals that the Bud breaks of Bael increased significantly by the application of different bael varieties essence under experiment over the control. The maximum Bud breaks of Bael length and width (13.50 and 9.80) was recorded with treatments V6 (Banarashi) recorded, while the minimum length and width (11.50 and 7.00) was recorded treatment V5. Further, the interaction effect of *varieties* significantly influenced the Bud breaks of Bael.

This variation in length and width might be due to genotypic and phenotypic character associated with the genotypes and also due to existing environmental condition. The result was in agreement with previous author **Parihar and Pandey (2019)** [x].

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### **3.4 Leaf area (cm<sup>2</sup>)**

The data Leaf area unit of Bael as ~~the~~ the growth of seedlings of different bael varieties in Prayagraj agro climatic region are summarized in ~~table-Table~~ Table 1.

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The data reveals that the Leaf area unit of Bael increased significantly by the application of different bael varieties essence under experiment over the control. The maximum Leaf area unit of Bael with (85) was recorded with ~~treatments-treatment~~ V6 (Banarashi) recorded, while the minimum (67) was recorded treatment V5. Further, the interaction effect of *varieties* significantly influenced the Leaf area unit of Bael.

Variation in leaf area may be due to their genetic variability and also might be due to physiological and metabolic changes in the growth and development of tree. This study is also in accordance with the result of **Parihar and Pandey (2019)** [x].

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### **3.5 Leaf area index**

The data Leaf area index of Bael as ~~the~~ the growth of seedlings of different bael varieties in Prayagraj ~~agro-climatic~~ agro-climatic region are summarized in Table 1.

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The data reveals that the Leaf area index of Bael increased significantly by the application of different bael varieties essence under experiment over the control. The maximum Leaf area index of Bael with (106.20) was recorded with ~~treatments-treatment~~ V6 (Banarashi) recorded, while the minimum (76.52) was recorded treatment V2. Further, the interaction effect of *varieties* significantly influenced the Leaf area index of Bael.

The difference in leaf area index might be due to the varietal character associated with the genotypes. Similar results have been reported by **Bhawna and Misra (2011)** [x].

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### **3.6 Chlorophyll content (SPAD value).**

The data Chlorophyll content (SPAD value) as growth of seedlings of different bael varieties in Prayagraj agro climatic region are summarized in Table 1.

The data reveals that the Chlorophyll content (SPAD value) of Bael increased significantly by the application of different bael varieties essence under experiment over the control. The maximum Chlorophyll content (SPAD value) of Bael (68.17) was recorded with treatments V6 (Banarashi) recorded, while the minimum (55.54) was recorded treatment V4. Further, the interaction effect of *varieties* significantly influenced the Chlorophyll content (SPAD value) of Bael.

Increase in chlorophyll content could have positively associated it's negatively associated with leaf area. Similar variation in chlorophyll content could be due to inherit genetic makeup of the genotypes. The findings are in agreement with findings of Nagar *et al.*, (2018) [x].

### **Plant spread area (cm<sup>2</sup>)**

The data on Plant spread area of Bael as the growth of seedlings of different bael varieties in Prayagraj agro-climatic region are summarized in Table 2.

The data reveals that the Plant spread area of Bael increased significantly by the application of different bael varieties essence under experiment over the control. The maximum Plant spread area of Bael (7.27 cm<sup>2</sup>) was recorded with treatments V6 (BANARASHI) at 180 DAP recorded, while the minimum (4.34 cm<sup>2</sup>) at 180 DAP of recorded treatment V5. Further, the interaction effect of *varieties* significantly influenced the Plant spread area of Bael.

Difference in plant spread area may be due to ~~it's inherit~~ it's inherited genetic character and also might be due to physiological and metabolic changes like chlorophyll and photosynthetic activity involved in colour variation of the leaf. The observations were in agreement with the result of Abhilash *et al.*, (2018) [x].

### **3.7 Number of branches**

The data Numbers of branches of Bael as the growth of seedlings of different bael varieties in Prayagraj agro climatic region are summarized in Table 2.

The data reveals that the Numbers of branches of Bael increased significantly by the application of different bael varieties essence under experiment over the control. The maximum Numbers of branches of Bael (8.76) was recorded with treatments V6

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(BANARASHI) at 180 DAP recorded, while the minimum (6.44) at 180 DAP of recorded treatment V5. Further, the interaction effect of *varieties* significantly influenced the Numbers of branches of Bael.

A greater variation in numbers of branches among the genotypes might be due to the presence of abundant genetic variability associated with their genotypes. These observations were in conformity with the result of **Parihar and Pandey (2019) [x]**.

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### **3.8 Numbers of leaves**

The data Numbers of leaves of Baelas the growth of seedlings of different bael varieties in the Prayagraj agro climatic region are summarized in Table 2.

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The data reveals that the ~~Numbers-Number of leaves of Bael increased significantly by the application of~~ Bael leaves increased significantly by applying different bael varieties essence under experiment over the control. The maximum ~~Numbers-Number~~ of leaves of Bael (81.52) was recorded with treatments V6 (BANARASHI) at 180 DAP recorded, while the minimum (56.50) at 180 DAP of recorded treatment V5. Further, the interaction effect of *varieties* significantly influenced the ~~Numbers-Number~~ of leaves of Bael.

Such variation in numbers of leaves may be due to ~~it's better photosynthetic activity and their utilization for building up of new cells and also might be~~ its better photosynthetic activity and their utilization for building up new cells and also due to the genomic constitution of individual ~~genotype~~ genotypes. Such variation in leaf shape was previously reported by **Jana et al., (2014)**.

### **3.9 Plant height after transplanting**

The data on Plant height after transplanting of Baelas the growth of seedlings of different bael varieties in Prayagraj ~~agro-climatic~~ agro-climatic region are summarized in Table 2.

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The data reveals that the Plant height after transplanting ~~gof Bael increased significantly by the application of~~ Bael increased significantly by applying different bael varieties essence under experiment over the control. The maximum Plant height after transplanting of Bael of (71.29 cm) was recorded with treatments V6 (Banarashi) at 180 DAP recorded, while the minimum (57.70 cm) at 180 DAP of recorded treatment V5. Further, the interaction effect of *varieties* significantly influenced the Plant height after transplanting of Bael.

This variation in plant height might be due to its inherit genetic character and existing climatic condition. Similar findings are in agreement with the results of Singh *et al.*, (2018).

#### **4. CONCLUSION**

From the present investigation it may be concluded that Bael (*Aegle marmelos*) Variety Banarashi resulted in highest survival percentage and vegetative growth parameters like plant height, number of leaves/plant, number of branches/plant, plant spread (e-w), plant spread (n-s), leaf area, leaf area index and chlorophyll content (SPAD value).

What \_\_\_\_\_ you \_\_\_\_\_ recommend???

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**Table 1. Study on establishment of seedlings of Bael varieties under Prayagraj agro climatic conditions”.**

Varieties Notation	Varieties Name	Bud Break						
		Survival Percentage	Mortality percentage	Length (cm)	Width (cm)	Leaf area (cm <sup>2</sup> )	Leaf area index	Chlorophyll content (SPAD value)
T <sub>1</sub>	NB7	91.89	8.11	13.20	9.60	82.00	105.42	68.17
T <sub>2</sub>	NB6	91.40	8.60	11.60	9.50	76.00	79.58	56.54
T <sub>3</sub>	NB4	90.79	9.30	11.50	8.00	79.00	94.34	64.42
T <sub>4</sub>	NB5	88.89	11.11	12.10	9.50	75.00	98.67	60.22
T <sub>5</sub>	NB9	66.67	33.33	11.50	7.00	67.00	76.52	55.54
T <sub>6</sub>	BANARASHI	94.60	5.40	13.50	9.80	85.00	106.20	68.33
	F-test	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>
	SEm(±)	2.17	2.17	0.53	0.39	3.36	4.22	0.15
	CD (p=0.05)	7.64	3.47	1.09	0.80	6.92	8.69	0.34

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		Plant spread area (cm <sup>2</sup> ) 180 DAT	Number of branches 180 DAT	Number of leaves 180 DAT	Plant height (cm) 180 DAT
T <sub>1</sub>	NB7	6.83	8.53	76.55	70.07
T <sub>2</sub>	NB6	5.83	8.35	74.30	69.38
T <sub>3</sub>	NB4	5.69	8.43	73.37	65.11
T <sub>4</sub>	NB5	4.60	7.56	56.55	60.53
T <sub>5</sub>	NB9	4.34	6.44	56.50	57.70
T <sub>6</sub>	BANARASHI	7.27	8.76	81.52	71.29
	F-test	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>
	SEm(±)	0.26	0.31	3.02	2.60
	CD (p=0.05)	0.53	0.64	6.22	5.36

**Table 2 Study on growth of seedlings of Bael varieties under Prayagraj agro climatic conditions**

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