



Evaluation Trial of IVY Gourd (*Coccinia grandis* L.) Varieties in Prayagraj Agro Climatic Condition

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The current trial on commenced in February 2023 at the Horticulture Research Field, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh.

This experiment employed a Random Block Design (RBD) with seven varieties replicated three times. The varieties, namely V₁ (Arka Neelachal Khunki), V₂ (Arka Neelachal Sabuja), V₃ (Local Geda), V₄ (Local Denga), V₅ (Surekha), V₆ (CHIV-8), and V₇ (CHIV-9), were assessed based on various growth, yield, and quality parameters. These parameters included vine length, petiole length, appearance of the first female flower anthesis, internode length, fruit length, fruit diameter, average fruit weight, number of fruits per plant, number of seeds per fruit, fruit yield per plant, fruit yield in tonnes per hectare, total soluble solids (TSS), ascorbic acid content, fruit shape, and colour.

From the different parameters it was concluded that all the seven varieties showed significant performance in almost all the characters.

The variety V₂, Arka Neelachal Sabuja, exhibited superior characteristics in various parameters, including vine length (310.66 cm), internode length (12.71 cm), fruit length (6.11 cm), average fruit weight (21.07g), number of fruits per plant (422), number of seeds per fruit (122), fruit yield per plant (8.53 kg), fruit yield per hectare (17.36t/ha), total soluble solids (TSS - 4.31), and had the minimum days taken for the first female flower anthesis (32.67 days). It featured an ovoid-shaped fruit with dark green fractured strips.

On the other hand, variety V₁, Arka Neelachal Khunki, demonstrated maximum petiole length (8.03 cm) and ascorbic acid content (15.30 mg/100g of fruit pulp). The fruit was uniform and cylindrical in shape with light green colour and white stripes.

Keywords: Ivy gourd; varieties; growth; yield; total soluble solids; ascorbic acid; random block design.

1. INTRODUCTION

Ivy gourd (*Coccinia grandis* L) is also known as little gourd, small gourd, scarlet gourd (kundru in Hindi or Kunduli in Assamese, tondali, bimba etc). Having chromosome number 2n=24. It belongs to the family Cucurbitaceae which is Indigenous to India and so far, a neglected and underutilized cucurbit, a semi perennial dioecious plant with small fruits widely grown in eastern western and southern state of India.

In India it is widely grown in Tamil Nadu, Karnataka, Kerala, Maharashtra, Gujarat, Andhra Pradesh, Telangana, Bihar, Uttar Pradesh and West Bengal, Odisha [1-4].

This minor vegetable has unique medicinal value of controlling diabetes, bronchitis, skin disorders and it checks fever. It is also used as trauma aid by people in villages when there is an accident. It is used internally in the treatment of gonorrhoea [5,6].

Immature fruits of ivy gourd are used as vegetable. Young shoots and leaves are consumed as fried, boiled or blanched. It can

also be used for various preparations of salads, pickles and mixed vegetables [7-10].

It prefers hot and humid climate. Plants undergo dormancy during winter season. Plant grows well in the areas having uniform distribution of rain and high humidity. It grows best in sandy loam and is not adapted to heavy soils. It needs good drainage and is very susceptible to water logging [11,12].

Ivy gourd is mostly termed as poor man's vegetable [13]. Landless poor in Bihar grow Ivy gourd on the roof shown hypoglycaemic principles (Tamilsevan et al., 2011). It helps to regulate blood sugar levels. Compounds in the plant inhibit the enzyme glucose-6-phosphatase, which is one of the key liver enzymes involved in regulating sugar metabolism [14].

The Ivy gourd exhibits prolific branching and has tuberous roots. Its tendrils are simple and sometimes bifid. The leaves are arranged alternately along the stems, ranging from heart to pentagon shapes and reaching up to 10 cm in width and length. The upper surface of the leaves is smooth (glabrous), while the lower surface is covered with hairs [15,16].

The flowers are large, white, and star-shaped, appearing singly on medium-sized peduncles. In male flowers, the calyx is bell-shaped, smooth (glabrous), with 5 lobes that are obtuse; the corolla is white, bell-shaped, glabrous, with 5 short and acute lobes. There are 5 stamens (2+2+1) inserted at the base of the calyx tube, and their filaments are fused into a central column. Female flowers are solitary with a cylindrical peduncle, and the calyx and corolla are similar to male flowers. The stigma is trilobed and villous at the base. The ovary is inferior.

The fruits are ovoid, cylindrical, and sometimes elliptic, measuring 10-12 cm in length and 2.5-4.0 cm in diameter. They are smooth, light green with white stripes, and turn scarlet when ripe. The seeds are tan-colored and approximately 6–7 mm in length.

The fruit of species *Coccinia adenensis* are bitter in taste due to present of cucurbitacin 'B' in the form of glycoside but lose their bitterness rapidly during ripening. The roots and stems are succulent and probably enable the plant to survive during prolonged drought [17].

2. MATERIALS AND METHODS

The field experiment was carried out in the Department of Horticulture, Naini, Agricultural Institute, Sam Higgin bottom University of Agriculture, Technology and Sciences during 2023-2024.

The experiment involved seven varieties, namely V₁ (Arka Neelachal Khunki), V₂ (Arka Neelachal Sabuja), V₃ (Local Geda), V₄ (Local Denga), V₅ (Surekha), V₆ (CHIV 8), and V₇ (CHIV 9). Each variety was cultivated following recommended package practices to ensure the production of a high-quality crop.

For each application, three plants were randomly selected from each variety, and observations were recorded for various growth, yield, and quality parameters on these selected plants. The collected data was then subjected to statistical analysis using the technique of analysis of variance with a randomized block design. The level of significance was set at 5% ($p < 0.05$) to determine the statistical significance of the observed results.

3. RESULTS AND DISCUSSION

All the parameters are shown in tabular form in Table 1, Table 2 and Table 3.

The days taken for first female flowering anthesis, the minimum days was were recorded in V₂ – Arka Neelachal Sabuja (32.67 days), followed by V₆ – CHIV 8(45.67 days) and the maximum days at in V₇ – CHIV 9 (52.33 days). The number of days from planting to the appearance of the first female flower is a crucial characteristic that signifies the earliness or lateness of the crop. This timing influences the occurrence of early or late flushes in the crop. The variation in the days to the first female flower anthesis is likely attributed to factors such as internodal length, petiole length, and vine length.

Similar findings regarding the days to the first female flower anthesis have been reported by previous studies or researchers. This suggests a consistent correlation between certain plant characteristics, such as internodal length, petiole length, vine length, and the timing of the first female flower appearance in the crop had also reported by Bharathi et al [18], Nag et al. [19], Saikia J. and Phookan D.B. [20] and Sutar P et al. [21].

Vine length shows statistically significant variations among different varieties. The Variety V₂ – Arka Neelachal Sabuja recorded the highest vine length (310.66cm) at 90 days after planting, followed closely by V₁ – Arka Neelachal Khunki (308.66cm). On the other hand, the treatment V₇ – CHIV 9 exhibited the shortest vine length (264.20cm). Similar result for vine length had also recorded by Bharathi et al [18], Nag et al., [19], Sutar P et al. [21] in ivy gourd.

Petiole length among different varieties exhibited significant differences. The maximum petiole length (cm) was observed with V₁ – Arka Neelachal Khunki (8.03 cm), followed by V₅ – Surekha (7.14 cm), while the minimum was reported in V₄ – Local Denga (5.45 cm). The observed variation in internodal length could be attributed to factors such as vine length, genetic characteristics, and morphological traits. The Arka varieties have demonstrated superior adaptability to the environment and more efficient nutrient uptake compared to the local varieties. This adaptability might contribute to the observed

differences in internodal length between the Arka and local varieties.

Based on these findings, previous studies by Bharathi et al. [18], Nag et al. [19], and Saikia J. and Phookan D.B. et al. [20] and Sutar P et al., [21] have similarly reported results regarding vine length.

The internodal length among different varieties displayed significant differences. The maximum internodal length (cm) was observed in V_2 – Arka Neelachal Sabuja (12.71 cm), followed by V_1 – Arka Neelachal Khunki (10.15 cm), while the minimum was reported in V_4 – Local Denga (7.60 cm).

The variation in internodal length might have been due to vine length, physical characters and morphological characters. The Arka varieties finds better at adapting environment and better nutrient uptake than the local varieties. Similar result for vine length had also recorded by Bharathi et al [18], Nag et al., [19], Saikia J. and Phookan D.B. [20] and Sutar et al. [21].

The maximum fruit length (cm) was observed in plants V_2 – Arka Neelachal Sabuja (6.11 cm), followed by V_1 – Arka Neelachal Khunki (5.72 cm), while the minimum was reported in V_3 – Local Geda (3.21 cm). Fruit length is an essential character contributing to overall yield. The observed variation in fruit length could be attributed to factors such as fruit diameter, fruit volume, and genetic and morphological differentiation. Variation in fruit length had been also found by Bharathi et al. [22] in pointed gourd, Bharathi et al. [18], Nag et al. [19] in ivy gourd, Sutar et al. [21] in ivy gourd.

The maximum fruit diameter (cm) was observed in plants V_6 – CHIV 8 (3.23 cm), followed by V_3 – Local Geda (3.21 cm), while the minimum was reported in V_1 – Arka Neelachal Khunki (2.14 cm). Fruit diameter is a crucial character contributing to overall yield. The observed variation in fruit diameter could be attributed to factors such as internodal length, fruit length, genetic characters, and morphological characters. Similar results for fruit diameter have also been reported, Bharathi et al [22], Bharathi et al. [18], Nag et al. [19] in ivy gourd, Sutar et al. [21].

There were notable variations in the recorded average fruit weight (gm) across different varieties. The highest average fruit weight (21.07 gm) was observed in plants V_2 – Arka Neelachal Sabuja, followed by V_5 – Surekha (19.04 gm), while the lowest was reported in V_3 – Local Geda (16.24 gm) The observed differences in fruit weight could be attributed to factors such as fruit length, fruit volume, specific gravity, as well as Physical and morphological distinctions. Similar result for fruit diameter had also recorded by Bharathi et al. [18], Nag et al. [19] and Sutar et al. [21] in ivy gourd.

The highest number of fruits per plant (422) was observed in plants V_2 – Arka Neelachal Sabuja, followed by V_5 - Surekha (384), while the lowest count was reported in V_7 – CHIV 9 (237). The variations in the number of fruits per plant could potentially be attributed to factors such as internodal length, vine length and morphological characteristics. It is noteworthy that a similar result for the number of fruits per plant was also recorded by Bharathi et al. [18], Nag et al. [19] and Sutar et al. [21].

The highest number of seeds per fruit (122) was observed in plants V_2 – Arka Neelachal Sabuja, followed by V_5 - Surekha (118), while the minimum count was reported in V_7 – CHIV 9 (70). The observed variations in the average fruit weight could be attributed to factors such as fruit diameter, fruit length, and morphological characteristics. It's worth noting that a similar result for the number of seeds per fruit was also reported by Bharathi et al. [18], Nag et al. [19] and Sutar et al. [21].

The highest fruit yield per plant (8.53 kg) was observed in plants V_2 – Arka Neelachal Sabuja, followed by V_5 – Surekha (7.82 kg), with the minimum recorded in V_7 – CHIV 9 (3.87 kg). The observed variation in fruit yield per plant among various varieties was found to be significant. Factors such as internodal length, vine length, number of secondary branches, number of fruits, average fruit weight, fruit volume, specific gravity, and physical and morphological differences may contribute to the observed differences in fruit yield per plant. It's noteworthy that similar results for fruit yield per plant were also reported by Bharathi et al [18], Nag et al. [19], and Sutar et al. [21].

The highest fruit yield, measured in tonnes per hectare, was recorded in V₂ – Arka Neelachal Sabuja (17.36 tons), succeeded by V₅ – Surekha (15.31 tons), while the minimum yield was observed in V₄ – Local Denga (8.25 tons). The complexity of yield, governed by numerous genes and heavily influenced by environmental factors, was emphasized. The study highlighted significant variations in yield data per plant and per hectare across the varieties. The overall yield in each genotype emerged from the collective impact of diverse characteristics, encompassing internodal length, vine length, number of secondary branches, number of fruits, average fruit weight, fruit yield per plant, fruit volume, specific gravity, and both Physical and morphological distinctions. Similar result for fruit yield per hectare had also recorded by Bharathi et al [18], Nag et al. [19] and Sutar et al. [21] in ivy gourd.

The maximum TSS (°Brix) was recorded in plants of V₂ – Arka Neelachal Sabuja (4.31), followed by V₅ – Surekha (3.90), with the minimum observed in V₇ – CHIV 9 (2.54). Similar result for fruit yield per hectare had also recorded by Bharathi et al [18], Nag et al. [19] and Sutar et al. [21].

The maximum Ascorbic Acid content was observed in plants of V₁ - Arka Neelachal Khunki

(15.30), followed by V₂ - Arka Neelachal Sabuja (14.36), while the minimum was found in V₇ - CHIV 9 (11.16). These variations in Ascorbic Acid levels may be attributed to factors such as better adaptability to environmental conditions, higher nutrient uptake, and hereditary characteristics of the plants. Similar results were also recorded for fruit yield per hectare by Bharathi et al [18] and Nag et al. [19], Sutar et al. [21].

Fruit shape and colour displayed significant variations among different varieties, was recorded, where all the seven varieties showed variation in shape and size of the fruit such as V₁ - Arka Neelachal Khunki have uniform fruit shape with light green colour of fruit having white stripes whereas the V₂ - Arka Neelachal Sabuja have Ovoid shape i.e., Conical from one end with Dark green fruits having fractured stripes. Similar results were also recorded for fruit shape and size by Anjana singh and ila joshi et al. [14].

The economic analysis revealed that the maximum gross returns were obtained from Variety V₂ – Arka Neelachal Sabuja (Rs/ha) (3,47,200) followed by Variety V₅ – Surekha (Rs/ha) (3,06,200) with net return of (Rs/ha) 1,88,610 and (Rs/ha) 1,47,610 respectively. These treatments exhibited maximum Benefit: Cost ratio of 2.18 and 1.93 respectively.

Table 1. Evaluation of growth parameter in ivy gourd varieties

| VARIETIES | Days to first female flower formation | Vine Length | Petiole Length | Internodal Length |
|--------------------------------------|---------------------------------------|-------------|----------------|-------------------|
| V ₁ Arka Neelachal Khunki | 44.67 | 308.66 | 8.03 | 10.15 |
| V ₂ Arka Neelachal Sabuja | 32.67 | 310.66 | 6.61 | 12.71 |
| V ₃ Local Geda | 42.33 | 296.33 | 6.56 | 8.77 |
| V ₄ Local Denga | 37.67 | 285.33 | 5.45 | 7.60 |
| V ₅ Surekha | 35.60 | 306.76 | 7.14 | 9.50 |
| V ₆ CHIV 8 | 45.67 | 272.20 | 6.9 | 8.05 |
| V ₇ CHIV 9 | 52.33 | 264.20 | 6.79 | 8.22 |
| F- Test | S | S | S | S |
| S. Ed. | 6.51 | 3.98 | 2.03 | 2.03 |
| CD @ 5% | 14.18 | 8.69 | 4.44 | 4.44 |

Table 2. Evaluation of yield parameters in ivy gourd Varieties

| VARIETIES | Fruit Length (cm) | Fruit Diameter (cm) | Average Fruit weight(g) | No. of Fruits per plant | No. of Seeds per Fruit | Fruit Yield Per plant(kg) | Fruit Yield Tonnes per ha(t/ha) |
|--------------------------------------|-------------------|---------------------|-------------------------|-------------------------|------------------------|---------------------------|---------------------------------|
| V ₁ Arka Neelachal Khunki | 5.72 | 2.14 | 18.08 | 320 | 107 | 6.70 | 14.26 |
| V ₂ Arka Neelachal Sabuja | 6.11 | 2.17 | 21.07 | 422 | 122 | 8.53 | 17.36 |
| V ₃ Local Geda | 3.21 | 3.21 | 16.24 | 265 | 83 | 4.46 | 9.67 |
| V ₄ Local Denga | 3.37 | 3.17 | 17.34 | 273 | 72 | 4.86 | 8.25 |
| V ₅ Surekha | 4.10 | 2.77 | 19.04 | 384 | 118 | 7.82 | 15.31 |
| V ₆ CHIV 8 | 4.45 | 3.23 | 16.52 | 244 | 115 | 4.30 | 8.68 |
| V ₇ CHIV 9 | 4.34 | 2.85 | 16.78 | 237 | 70 | 3.87 | 8.46 |
| F- Test | S | S | S | S | S | S | S |
| S. Ed. | 1.67 | 0.94 | 0.25 | 33.76 | 11.99 | 0.92 | 0.54 |
| CD @ 5% | 3.64 | 2.05 | 0.54 | 73.55 | 26.12 | 2.00 | 1.17 |

Table 3. Evaluation of quality parameters and economics in ivy gourd varieties

| Varieties | Quality Parameters | | | Economics | | |
|--------------------------------------|--------------------|---------------|--|----------------------|--------------------|--------------------|
| | TSS | Ascorbic acid | Fruit Shape and Size | Gross Return (Rs/ha) | Net Return (Rs/ha) | Benefit Cost ratio |
| V ₁ Arka Neelachal Khunki | 3.80 | 15.30 | Uniform, Cylindrical, thin and long having Light green with white stripes | 2,85,200 | 1,26,610 | 1.79 |
| V ₂ Arka Neelachal Sabuja | 4.31 | 14.36 | Conical from one end/ Ovoid having Dark green with Fractured stripes | 3,47,200 | 1,88,610 | 2.18 |
| V ₃ Local Geda | 3.30 | 13.82 | Ovoid, thick and small size having Dark green colour with less stripes | 1,93,400 | 34,810 | 1.21 |
| V ₄ Local Denga | 3.67 | 13.44 | Ovoid, thick and medium size having dark green colour with less stripes | 1,65,000 | 6,410 | 1.04 |
| V ₅ Surekha | 3.90 | 12.34 | Cylindrical, medium size and having green colour with less stripes | 3,06,200 | 1,47,610 | 1.93 |
| V ₆ CHIV 8 | 2.82 | 12.83 | Elliptical, medium size Dark Green to light green with less stripes or no stripe | 1,73,600 | 15,010 | 1.09 |
| V ₇ CHIV 9 | 2.54 | 11.16 | Elliptical, small size Having green colour with 2-4 stripes | 1,69,200 | 10,610 | 1.06 |
| F- Test | S | S | | | | |
| S. Ed. | 1.73 | 0.13 | | | | |
| CD @ 5% | 3.77 | 0.29 | | | | |

4. CONCLUSION

From the current study, it is concluded that the variety V₂, Arka Neelachal Sabuja, exhibited superior characteristics in terms of vine length (310.66 cm), internode length (12.71 cm), fruit length (6.11 cm), average fruit weight (21.07g), number of fruits per plant (422), number of seeds per fruit (122), fruit yield per plant (8.53 kg), fruit yield per hectare (17.36t/ha), total soluble solids (TSS - 4.31), and had the minimum days taken for the first female flower anthesis (32.67 days). It featured an ovoid-shaped fruit with dark green fractured strips whereas variety V₁, Arka Neelachal Khunki, demonstrated maximum petiole length (8.03 cm) and ascorbic acid content (15.30 mg/100g of fruit pulp). The fruit was uniform and cylindrical in shape with light green colour and white stripes. Among the tested Varieties highest Gross return (Rs/ha) (3, 47,200), net return (Rs/ha) (1, 88,610), benefit cost ratio (2.18) was also obtained from Variety V₂ that is Arka Neelachal Sabuja.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declares that generative AI technologies such as Large Language Models, etc have been used during writing or editing of manuscripts. This explanation will include the name, version, model, and source of the generative AI technology and as well as all input prompts provided to the generative AI technology.

Details of the AI usage is given below:

1. ChatGPT has been used for editing manuscripts.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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