



# Performance of Cowpea (*Vigna unguiculata* L. Walp.) Varieties in Prayagraj Agro Climatic Condition for Growth, Yield, and Quality

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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 present investigation was carried out at Horticultural Research Farm (CRF), Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences (SHUATS), Prayagraj during the *Kharif* season of 2022 to identify the best variety of cowpea that performed in the Prayagraj region. The varieties comprised of Kashi Kanchan, Kashi Gauri, Kashi Queen, C.P. 6, K-K- 25, Kaveri, Gomachi, Basant, Pusa Komal, Pusa Gaurav, Nirali, Gomati, Gayatri and Talvar. Based on results obtained during the present investigation it is concluded that for plant height at 60 DAS variety Basant had maximum plant height (191.32 cm),

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for number of primary branches per plant at 60 DAS variety Kaveri had maximum branches (34.32). In terms of early flowering and maturing, variety Gomati showed minimum days to first flowering (31.31 days), days to first pod setting (37.22 days) and days to first pod picking (48.77 days). For yield parameters like number of pods per plant variety C P-6 had highest number of pods per plant (108.12), pod weight (17.43 g), for pod length variety Kashi Queen showed maximum pod length (34.80 cm), while maximum pod diameter was found in variety Talvar (3.08 cm), maximum pod yield per plant was observed in variety C. P. 6 (1.88 g/plant). Variety Nirali was found to be best in the terms of quality parameters viz., TSS (4.86 °Brix) among different varieties of Cowpea.

**Keywords:** Varieties; T.S.S.; pods; cowpea.

## 1. INTRODUCTION

Cowpea (vernacular name: Lobia), [botanically known as *Vigna unguiculata* (L.) Walp.] is one of the well-known plants belonging to Fabaceae. It is a diploid self-pollinated dicot plant species with chromosome number  $2n=2x=22$  [1]. Cowpeas were originated and domesticated in Africa [2] and are one of the oldest crops to be farmed. A second domestication event probably occurred in Asia, before they spread into Europe and the Americas. The seeds are usually cooked and made into stews and curries, or ground into flour or paste. The plant is an annual crop that thrives in warm climates and is resistant to drought, making it suitable for cultivation in semi-arid regions. It is an important source of protein and other nutrients in many diets, especially in developing countries. Cowpea seeds come in different colors, including cream, red, brown, and black, with a characteristic black "eye" on one side. The seeds can be consumed in various forms, such as boiled, steamed, or ground into flour for use in soups, stews, and traditional dishes. They are also used in the production of snacks, desserts, and animal feed. In addition to its nutritional value, cowpea is beneficial to agricultural systems as it improves soil fertility through nitrogen fixation. The plant's ability to fix atmospheric nitrogen reduces the need for synthetic fertilizers, making it a sustainable crop choice for farmers. As per National Institute of Nutrition (NIN, 2008), nutritional composition of cowpea constituted Protein (23.52 g), Fat (1.26 g), Carbohydrates (60.03 g), Calories (336 Kcal), Calcium (110 mg/100g), Phosphorus (424 mg/100g), Magnesium (184 mg/100g), Zinc (3.37 mg/100g), and Iron (8.27 mg), Sodium (16 mg/100g), Potassium (1112 mg/100g), Vitamin A (3 µg.), Vitamin B3 (2.075 mg/100g), Vitamin C (1.5 mg) per 100 g edible [3]. Cowpeas are abundant across the country, with Nigeria and Niger being the primary cultivators, followed by other African nations in smaller quantities. According to FAOSTAT (2020), global production

of Cowpea in 2019-2020 reached 89.16 tons per hectare. Cowpeas are extensively cultivated in India, particularly in Uttar Pradesh, Andhra Pradesh, Karnataka, and Tamil Nadu. In 2022, India produced approximately 3.14 million metric tons of cowpeas [4]. Evaluation of varieties will let the farm community choose better varieties and maximize the profit. The findings of the research will help the farmers of Prayagraj region to enhance their farming practices and maximize the yield with better Varieties. The success of any breeding programme depends upon selection of a proper plant. The efficiency of selection depends on the magnitude and nature of genetic variation in a specific population for effective breeding program. Yield is polygenic character and influenced by environmental factors, which complicate the selection process thus, the knowledge of correlation of the traits is necessary for effective selection process.

## 2. MATERIALS AND METHODS

The present investigation was done to understand the plant growth, fruit yield and quality of fruit of different varieties of Cowpea. The details of the materials used, and the methods adopted in the investigation, which was carried out at Horticultural Research Farm (CRF), Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences (SHUATS), Prayagraj during the *Kharif* season of 2022. In the present investigation the design used for analysis of variables were Randomized Block Design (RBD) comprising 3 replications comprising fourteen varieties viz., Kashi Kanchan, Kashi Gauri, Kashi Queen, C.P. 6, K-K- 25, Kaveri, Gomachi, Basant, Pusa Komal, Pusa Gaurav, Nirali, Gomati, Gayatri and Talvar. Observations were recorded at different stages of growth like plant height, number of branches per plant, days to flowering and maturing, pod length, pod diameter, yield and TSS. The data were statistically analysed by the

method suggested by Fisher and Yates, [5]. The height of five randomly selected plants from each plot was measured in cm with of a 100 cm meter scale from ground level to tip of the shoot at 60 DAS stage. The numbers of branches per plant (plant) of five randomly selected plants arising from main shoot were counted and were averaged to represent numbers of primary branches per plant. Number of branches per plant basis was counted at 60 DAS stage. The numbers of days taken from the date of sowing to the date at which first flower appeared in plants or date at which plants start flowering in whole plot were recorded as days to first flowering, similarly, was taken for days to first pod setting and days to first pod picking. The percentage of total soluble solids of the fruit was determined with the help of Portable Hand Refractometer. The sample of juice for this purpose was taken from the strained juice. The observed value of T.S.S. was recorded from the scale of the instrument (0-32 range).

### 3. RESULTS AND DISCUSSION

#### 3.1 Growth Parameters

##### 3.1.1 Plant height (cm) and number of primary branches per plant [60 DAS]

The plant height significantly varied among different varieties sown. The mean Plant height at 60 DAS was observed to be 175.08 cm. The maximum Plant height (191.32 cm) at 60 DAS was observed with Basant followed by Pusa Komal with 188.62 cm. Minimum Plant height (154.90 cm) was observed in Kaveri. The number of primary branches per plant significantly varied among different varieties sown. The mean Number of primary branches per plant at 60 DAS was observed to be 30.14 branches. The C.V. for Number of primary branches per plant was observed to be 4.54, while S.E.(m) was 0.79. The maximum Number of primary branches per plant (34.32 branches) at 60 DAS was observed with Kaveri followed by Kashi Kanchan with 33.24 branches. Minimum Number of primary branches per plant (26.84) was observed in Pusa Gaurav. The observed superiority of a specific genotype of cowpea in terms of plant height and number of primary branches can be attributed to several factors. Firstly, genetic traits play a significant role. The superior genotype may possess genes that promote elongation of the main shoot and encourage branching, resulting in taller plants with more primary branches. Moreover, the

genotype could exhibit improved nutrient uptake and utilization mechanisms, allowing for efficient nutrient assimilation and allocation towards shoot growth and branch development. This genetic advantage ensures optimal plant growth and higher branch initiation. Furthermore, environmental adaptability and favourable agronomic practices also contribute to the superior performance of the genotype. If the genotype is well-suited to the local growing conditions, it can maximize its genetic potential for plant height and branch development. Adequate irrigation, nutrient management, and pest control measures can further enhance the expression of these traits. Overall, the combination of favourable genetic traits, efficient nutrient utilization, and optimized environmental conditions leads to the observed better plant height and number of primary branches in the chosen cowpea genotype compared to the others under study. Similar findings were reported by Abayomi et al., [6]; Pawar et al., [7]; Singh et al., [8]; Dangi et al., [9]; Mali et al., [10]; and Triveni et al., [11] in Cowpea.

#### 3.2 Earliness Parameter

##### 3.2.1 Days to first flowering, days first pod setting and days to first pod picking

The Kaveri variety showed the minimum days to 50% flowering at 35.33 days, followed closely by K-K-25 at 37.59 days, while Pusa Komal required the highest number of days to reach 50% flowering at 39.46 days. Early maturity and high yields are desirable traits in today's market, and among the varieties tested, the Gomati variety exhibited the shortest days to the first pod setting at 37.72 days, followed closely by Pusa Komal at 38.02 days. K-K-25 took the longest time to reach the first pod setting at 39.99 days. Proper nutrition and sunlight exposure contributed to photosynthetic processes and supported early reproductive phases of the plant. Gomati variety exhibited the minimum days to the first pod picking at 48.77 days, and Pusa Komal took 49.07 days. K-K-25 recorded the maximum days to the first pod picking at 51.04 days. The early flowering, pod setting, and first pod picking in a specific genotype of cowpea compared to other genotypes can be attributed to several factors. Firstly, genetic traits associated with early maturity and flowering play a significant role. The superior genotype may possess genes that accelerate flowering time and promote efficient pollination and pod development. Additionally, the genotype could exhibit traits such as self-

**Table 1. Performance of different varieties on growth and yield parameters studied for cowpea**

Variety	Plant height (cm) [60 DAS]	No of primary branches per plant [60 DAS]	Days to first flowering	Days to first pod setting	Days to first pod picking	Number pods per plant	Pod weight (g)	Pod length (cm)	Pod Diameter (mm)	Pod yield per plant (g/plant)	Number of nodules/plants	TSS [°Brix]
Kashi Kanchan	187.83	33.24	31.71	38.12	49.17	74.67	14.83	26.51	2.48	1.10	7.33	4.26
Kashi Gauri	180.68	30.90	32.11	38.52	49.57	77.65	12.50	28.37	2.54	0.97	6.33	4.07
Kashi Queen	162.09	31.44	32.31	38.72	49.77	45.99	12.13	34.80	2.98	0.56	3.33	3.38
C.P. 6	166.77	29.73	33.12	39.53	50.58	108.12	17.43	29.17	2.32	1.88	13.00	2.66
K-K -25	175.91	32.53	33.58	39.99	51.04	74.07	13.53	29.87	2.75	1.00	9.33	4.09
Kaveri	154.90	34.32	32.31	38.72	49.77	57.34	12.10	24.87	2.99	0.68	2.00	3.26
GOMACHI	177.13	27.88	32.51	38.92	49.97	54.95	11.47	30.07	2.57	0.63	3.33	3.36
Basant	191.32	29.62	31.71	38.12	49.17	51.37	12.70	32.33	2.57	0.65	7.00	3.66
Pusa Komal	188.62	28.01	31.61	38.02	49.07	43.90	8.77	24.33	2.39	0.38	2.00	3.46
Pusa Gaurav	171.48	26.84	32.31	38.72	49.77	59.14	9.03	25.13	2.71	0.53	6.67	4.34
Nirali	173.15	28.11	32.59	39.00	50.05	67.50	10.07	26.00	2.74	0.68	2.67	4.86
Gomati	172.61	29.08	31.31	37.72	48.77	54.36	11.87	23.87	2.51	0.64	3.67	3.86
Gayatri	176.93	28.27	32.11	38.52	49.57	78.85	14.27	23.93	3.06	1.12	3.00	4.15
Talvar	171.64	32.04	31.91	38.32	49.37	95.57	16.67	30.00	3.08	1.60	3.33	4.60
<b>'F' test</b>	S	S	S	S	S	S	S	S	S	S	S	S
<b>C.D. (5%)</b>	3.16	2.30	0.98	0.98	0.99	16.96	1.45	1.24	0.20	0.21	4.12	1.42
<b>S.E. (m) ±</b>	1.09	0.79	0.34	0.34	0.36	5.80	0.50	0.43	0.07	0.07	1.42	0.49
<b>C.V.</b>	1.07	4.54	1.80	1.50	1.17	14.92	6.84	2.66	4.48	14.59	47.13	21.96

pollination or increased pollen viability, enabling early and successful pod setting. This genotype may also have a shorter vegetative phase and faster reproductive development, leading to early pod initiation and maturation. These observations align with previous studies on cowpea by Abayomi et al., [6], Pawar et al., [7], Singh et al., [8], Dangi et al., [9], Mali et al., [10] and Triveni et al., [11].

### 3.3 Yield Parameter

#### 3.3.1 Number of pods per plant, fruit weight (g) and fruit diameter (cm)

C.P. 6 exhibited the highest number of pods per plant, recording 108.12, followed by Talvar with 95.57, while Pusa Komal had the lowest number of pods per plant at 43.90. The maximum pod weight was 17.43 grams for C.P. 6, followed by Talvar at 16.67 grams and the lowest pod weight (8.77 grams) was recorded in Pusa Komal. Kashi Queen had the longest pod length at 34.80 cm, followed by Basant at 32.33 cm; whereas Gomati had the shortest pod length at 23.87 cm. The maximum pod diameter (3.08 mm) was observed in Talvar, followed by Gayatri (3.06 mm); C. P. 6 had the lowest pod diameter (2.32 mm). C. P. 6 recorded the highest pod yield per plant at 1.88 grams, followed by Talvar at 1.60 grams, while Pusa Komal had the lowest pod yield per plant at 0.38 grams. C.P. 6 had the highest number of root nodules per plant (13.00), followed by Kashi Kanchan with 7.33, whereas Pusa Komal had the lowest number of root nodules per plant (2.00). The enhanced number of pods per plant, pod length, diameter, and pod yield in a specific genotype of cowpea compared to other genotypes can be attributed to several factors. Firstly, genetic traits associated with increased pod production and size contribute to the superior performance of the genotype. It may possess genes that promote prolific flowering, successful pollination, and pod development. Additionally, the genotype could exhibit traits such as longer and thicker pods, which result in larger pod size and higher yield potential. These genetic advantages lead to an increased number of pods per plant, longer and wider pods, and ultimately higher pod yield. Furthermore, environmental adaptability and favorable growing conditions play a crucial role. Adequate sunlight, temperature, moisture, and nutrient availability support optimal pod development, resulting in improved pod length, diameter, and yield. These findings are consistent with prior research by Agyeman et al. [12], Reddy et al. [13], Singh et

al. [8], Ramya et al. [14], Triveni et al. [11], Kumar and Topno [15], and Triveni et al. [16] on cowpea.

### 3.4 Quality Parameter

#### 3.4.1 TSS [<sup>o</sup>Brix]

The maximum T.S.S. (4.86 <sup>o</sup>Brix) was observed in Nirali followed by Talvar with 4.60 <sup>o</sup>Brix and minimum T.S.S. (2.66 <sup>o</sup>Brix) was noticed in variety C. P. 6. These results are in close conformity with the findings of Agyeman et al., [12]; Reddy et al., [13]; Singh et al., [8] Ramya et al., [14]; Triveni et al., [11]; Kumar and Topno [17] and Triveni et al., [16] in Cowpea i.e., they also found that variety with more yield had low TSS content [18].

## 4. SUMMARY AND CONCLUSION

Based on results obtained during the present investigation it is concluded that for plant height at 60 DAS variety Basant had maximum plant height (191.32 cm), for number of primary branches per plant at 60 DAS variety Kaveri had maximum branches (34.32). In terms of early flowering and maturing, variety Gomati showed minimum days to first flowering (31.31 days), days to first pod setting (37.22 days) and days to first pod picking (48.77 days). For yield parameters like number of pods per plant variety C P-6 had highest number of pods per plant (108.12), pod weight (17.43 g), for pod length variety Kashi Queen showed maximum pod length (34.80 cm), while maximum pod diameter was found in variety Talvar (3.08 cm), maximum pod yield per plant was observed in variety C. P. 6 (1.88 g/plant). Variety Nirali was found to be best in the terms of quality parameters viz., TSS (4.86 <sup>o</sup>Brix) among different varieties of Cowpea.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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