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EVALUATION OF DIFFERENT COWPEAS (*VIGNA UNGUICULATA* L. WALP.) GENOTYPES PERFORMANCE UNDER PRAYAGRAJ AGRO-CLIMATIC CONDITIONS

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ABSTRACT

Cowpea (*Vigna unguiculata* L. Walp) is an important leguminous vegetable crop valued for its high protein content and adaptability to diverse agro-climatic conditions. The present study aimed to evaluate the growth and yield performance of 40 cowpea genotypes under the agro-climatic conditions of Prayagraj, Uttar Pradesh, during the 2019-2020 growing season at the Sam Higginbottom University of Agriculture, Technology & Sciences, Prayagraj, Uttar Pradesh. The experiment utilized a randomized block design with three replications. Key traits were analyzed, including plant height, days to flowering, number of pods, and pod yield. Results demonstrated significant variation among genotypes for all evaluated parameters. The genotype "Kashi Unnati" exhibited superior performance across most growth and yield traits, including the highest plant height (125.75 cm), maximum number of pods per plant (28.47), and highest pod yield (118.48 q/ha). Conversely, the genotype "IC 20514" showed the lowest performance in these traits. Notable variations in flowering and picking periods indicated that genetic makeup and adaptability to environmental conditions play critical roles in cowpea productivity. Traits such as pod length and weight significantly influenced yield, with Kashi Unnati producing the longest pods (42.04 cm) and the highest pod weight (11.24 g). Yield-related traits like seed count and 100-seed weight were also crucial contributors to productivity. The findings highlight the importance of selecting genotypes with favorable growth and yield characteristics for regional adaptation. This study provides valuable insights into the genetic variability and yield potential of cowpea genotypes, offering critical information for breeders and farmers to improve crop productivity and profitability. Further research should focus on enhancing cowpea's resilience to biotic and abiotic stresses to meet rising demand and ensure food security.

Keywords **:** Cowpea genotypes, growth and yield performance, Genetic variability.

Introduction

Cowpea [*Vigna unguiculata* (L.) Walp.] is an important annual, autogamous leguminous vegetable crop in India, belonging to the family Leguminosae with a chromosome number of 2n=2x=22. Cowpea is also known as black-eyed pea, kaf fir pea, China pea, southern bean, asparagus bean, snake bean, yard long bean, lobia, niebe cowpea, or frijol, and catjang bean. It originates in India, while tropical and central Africa are also regarded as secondary points of origin where wild varieties exist. It is an annual herb with a wide range of growth habits and responses to photoperiod. Cowpea is widely cultivated for forage, green pods, and grain purposes (Ali *et al*., 2004). The protein content of cowpea seed is the highest among cultivated legumes (Dangi *et al.,* 2020) and can serve as an excellent source of dietary protein in animal feeds. The mature grain contains 20 to 25% of protein, 1.3 to 1.5% lipid, and 5.1 to 5.8% crude fiber. Cowpea can be grown under a wide range of soil moisture

conditions, and once established, it is fairly drought tolerant (Onuh and Donald, 2009). Cowpea is usually better adapted to drought, high temperature, and other biotic stresses compared with other crops (Marsh *et al.,* 2006; Boukar *et al.,* 2013. Cowpea has high demand in the Indian market due to its multipurpose uses and high nutritive value, its adaptability in varying climatic conditions, and its ability to improve soil fertility through nitrogen fixation make it suitable to cultivate in many regions.

The price of cowpea typically remains high during the dry season when production is lower due to unfavorable weather conditions. This scarcity drives up prices, benefiting farmers who can sell their produce at a premium price. Cowpea cultivation is benefitted to farmers due to facts like a relatively short growing cycle allowing for multiple harvests within a year, which helps meet the continuous demand and supports food security, but cowpea productivity is highly influenced by the genetic characteristics of the cultivar, and selection of faulty varieties can lead to reduced yield and quality hence selection of the suitable variety of cowpea is crucial for maximizing productivity.

Different states, universities, and ICAR institutes release several superior cowpea varieties. Still, meager work has been done concerning the suitability of a specific variety of cowpeas for specific country regions. So, there is an urgent need to evaluate the cowpea varieties released from state and national levels and make a certain recommendation to generate research evidence of different varieties concerning their suitability under certain conditions and can be utilized in crop improvement crop for increasing yield and quality of cowpea, which ultimately leads to benefits the cowpea growers of Allahabad.

Materials and Methods

The present experiment was conducted at Horticulture Research Farm, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology & Sciences, Prayagraj (U.P.) during the year 2019-2020. The experiment was laid out in a randomized block design with three replications. Experimental materials comprised 40 genotypes of cowpea, which were collected from NBPGR- New Delhi and ICAR-IIVR – Varanasi. The sowing was done on the raised bed method with a spacing of 1.0 m and 1.5m, plant to plant and row to row, respectively, each plot with 6 plants. Recommended packages and practices were adopted for raising a healthy crop, and the trellis system training was used for vine climbing. The observations were recorded include plant height (cm), number of branches per plant, days to first flowering, days to first picking, number of pods per plant, number of nodes per plant on the main stem, pod length (cm), number of seeds per pod, number of seeds per plant, 100-seed weight (gm), pod weight (gm), pod yield per plant (gm), pod yield per plot (kg), and pod yield per hectare (q/ha). Analysis of variance was done by partitioning the total variance into total variations due to the treatments and replications according to the procedure of Panse and Sukhatme (1978).

Results and Discussion

The present investigation, entitled Evaluation of different cowpea genotypes' performance in Agro-Climatic condition of Prayagraj (U.P.), was carried out to estimate the growth and yield attributes and direct and indirect effect of yield components on fruit yield q ha^{-1}. The results obtained in the present work. Through this study, an attempt was made to assess the mean performance and extent of variability in 40 genotypes of cowpeas. The mean performance of 40 genotypes of cowpea for seventeen growth, quantitative, and qualitative characters, along with the standard error of difference and critical difference, is elaborated individually here as under

Growth Parameters: According to the studied genotypes, the mean values of various growth parameters are displayed in Table 1. This suggests that there is enough variation among genotypes for yield and its contributing parameters.

Plant height is an important characteristic parameter in achieving high pod yield. Among the forty genotypes, plant height (cm), number of branches per plant ranged from 89.04 to 125.75 cm and 6.36 to 12.49, with a grand mean of (108.48 cm) and (8.96, respectively. The maximum plant height and the highest number of branches per plant were recorded in the genotype Kashi Unnati, whereas the minimum plant height and number of branches per plant were recorded in the genotype IC 20514. The results of the present experiment are in line with the findings of Singh *et al.* (2020), Mali *et al. (*2021), and *Da Costa et al.* (2017 in cowpea. Wide variation in plant height was due to genetic characteristics of the genotypes and might be influenced by agronomical and environmental conditions. The number of primary branches determines ultimately the pod-bearing ability of the plant, which will, intern contribute to the yield; hence, identification and selection of genotypes with more branching ability is necessary. Flowering is dependent on the interaction of many complex processes, which are influenced by both genetic and

environmental factors (Ukpene and Isibor, 2022). Days to first flowering and Days to first picking ranged from 31.89 to 49.69 with a grand mean of (43.72) and 45.81 to 59.57 with a grand mean of 54.66), respectively. Genotype Kashi Unnati has taken the minimum days to first flowering and Days to first picking, while maximum days for the same characters were recorded in the genotype IC 20514. Variation in days taken for first picking among different varieties could be attributed to their inherent genetic setup and or adaptability to the climate and soil conditions of this region. Such a type of varietal difference was also reported by Dipikaben *et al.* (2018 in cowpea, Singh (2000) in cluster bean, Amin *et al.* (2014), and Jogdhande *et al.* (2017) in cowpea. The number of nodes per plant and the number of nodes per plant on the main stem are essential growth parameters reflecting vegetative Vigor and the plant's capacity to support pod formation. The number of nodes per plant ranged from 13.53 to 28.47, with a grand mean of 20.20, while the number of nodes per plant on the main stem ranged from 2.05 to 4.20, with a grand mean of 3.29. Among all genotypes, Kashi Unnati exhibited the highest values for both parameters, with 28.47 pods per plant and 4.20 nodes per plant on the main stem. Conversely, IC 20514 showed the lowest values, with 13.53 pods per plant and 2.05 nodes per plant on the main stem. Both parameters are crucial for understanding the genetic potential and productivity of cowpea genotypes, aiding in selecting high-yielding varieties like Kashhi Unnati for breeding and cultivation.

Yield and yield contributing Characters.

Yield is a complex characteristic that is influenced by a number of other characteristics. Since pod length, width, number of pods per plant, and number of seeds per pod all have a significant influence on yield, the ideal genotypes for selection should exhibit a greater number of pods per plant and other yield-attributing characteristics. Data presented in Table 1 shows that the length of the pod directly affects the pod weight because longer pods have more space to accommodate a greater number of seeds, leading to a higher overall pod weight. In the genotype Kashi Unnati, the longest pods (42.04 cm) and the heaviest pod weight (11.24 g) were recorded, indicating that the ability of the genotype to produce larger pods contributes to increased pod mass. In contrast, the genotype IC 20514 had shorter pod length (20.44 cm) and consequently lower pod weight (6.45 g), showing that shorter pods tend to result in lighter pods due to fewer seeds or less seed mass. Similar results for the above yield contributing characteristics have also been recorded by Trivedi *et al.* (2024) in cowpea. The number of seeds per pod influences the 100-seed weight because as the number of seeds increases, the overall mass of seeds per pod also tends to increase, thus leading to a higher total weight for 100 seeds. In the genotype Kashi Unnati, the highest number of seeds per pod (19.46) and 100-seed weight (16.50 g). On the other hand, genotype IC 20514 produces minimum seeds per pod (10.96) and 100-seed weight (10.29 g). The present experiment findings are in line with the findings of Goud *et al*. (2020) in cowpea. The number of seeds per plant is a significant factor affecting pod yield per plant because more seeds per plant contribute to a higher total pod mass, which leads to greater pod yield. The genotype Kashi Unnati, which exhibited the highest number of seeds per plant (553.93), also had the highest pod yield per plant (319.91 g), showing that the ability to produce a greater number of seeds is directly linked to higher overall yield. The increased seed number enhances reproductive success, leading to greater pod weight and overall yield. In contrast, the genotype IC 20514 had the lowest number of seeds per plant (147.90) and, therefore, a lower pod yield per plant (87.21 g), demonstrating that fewer seeds per plant limit the total yield. A similar result was also recorded by Diwakar *et al.* (2017) in cowpea. Cowpea yield per hectare is an important quantitative characteristic, and it has having highest significance for farmers or breeders. The Pod yield per plot influences pod yield per hectare because pod yield per hectare depends on the yield achieved in each plot and the area covered by the crop. Higher pod yield per plot usually correlates with higher pod yield per hectare when planting density and plot size are standardized. The genotype Kashi Unnati, which produces the highest pod yield per plot (4.48 kg), also showed the highest pod yield per hectare (118.48 q/ha), indicating that greater yield per plant contributes to higher total yield in a given area. In contrast, the genotype IC 20514's lower pod yield per plot (1.22 kg) resulted in a lower pod yield per hectare (32.30 q/ha), showing how lower yield per plant limits overall field productivity. Similar results of yield in cowpea were also recorded by Mal *et al.* (2020.

Conclusion

The evaluation of 40 cowpea genotypes under the agro-climatic conditions of Prayagraj revealed significant genetic variability, offering opportunities for selecting superior varieties. Among the genotypes, Kashi Unnati emerged as the most promising, demonstrating exceptional performance in key growth and yield attributes, including plant height, number of

pods per plant, pod weight, and overall pod yield per hectare. Conversely, "IC 20514" recorded the lowest values, underscoring the importance of genotype selection for maximizing productivity. Key traits such as pod length, number of seeds per pod, and 100-seed weight were identified as major contributors to yield, emphasizing their role in breeding programs. The study underscores the adaptability of specific genotypes to regional conditions and highlights the critical influence of genetic and environmental factors on cowpea productivity. Continued research and targeted breeding efforts are essential to enhance cowpea's resilience, productivity, and profitability for sustainable agriculture.

Table 1: Mean performances of 40 genotypes of cowpea.

S. No.	Genotypes	Plant height (cm)	Number of branches of plant^{-1}	Days to first flowering	Days to first picking	Number of pods plant^{-1}	Number of nodes per plant on the main stem	Length of the pod (cm)	Number of seeds per pod	Number of seeds per plant	100 Seed weight	Pod weight (g)	Pod yield (gm) plant^{-1}	Pod yield plot^{-1} (kg)	Pod yield (q/ ha)
1	IC 370499	98.83	9.35	41.23	56.52	17.59	3.15	28.46	14.28	251.17	15.02	8.46	148.76	2.08	55.09
2	IC 253277	97.08	8.38	43.60	52.49	16.52	3.22	32.57	16.47	272.03	14.31	9.32	153.97	2.16	57.02
3	IC 259106	91.80	9.34	41.48	58.42	17.42	3.21	35.73	13.43	233.95	14.27	9.22	160.66	2.25	59.50
4	IC 333208	93.67	9.69	42.44	57.51	19.57	3.22	36.42	13.48	263.83	12.66	8.97	175.50	2.46	65.00
5	IC 259104	92.28	9.24	42.27	56.49	20.33	3.62	37.64	13.21	268.53	13.29	8.26	167.82	2.35	62.15
6	IC 259085	104.01	8.30	41.43	54.72	21.57	2.88	36.73	13.40	288.92	13.99	7.45	160.68	2.25	59.51
7	IC 259083	102.73	9.49	43.60	53.43	22.46	2.92	35.50	14.27	320.38	12.59	7.38	165.66	2.32	61.36
8	IC 259071	105.44	7.31	44.63	53.29	23.50	2.80	36.05	15.30	359.68	11.48	7.41	174.23	2.44	64.53
9	IC 259063	103.97	7.49	43.52	54.49	21.52	2.77	34.78	16.36	351.93	11.41	8.52	183.38	2.57	67.92
10	IC 257446	102.89	8.21	48.32	58.46	23.51	3.21	38.40	16.62	390.80	10.34	7.26	170.71	2.39	63.23
11	IC 257407	111.95	9.78	47.30	52.56	21.24	3.23	37.33	14.02	297.86	10.68	7.30	155.09	2.17	57.44
12	IC 253281	116.34	9.72	43.64	53.39	18.57	3.28	39.56	15.73	292.01	14.32	7.38	137.03	1.92	50.75
13	IC 253276	116.46	9.30	46.72	56.78	17.29	3.26	34.46	14.85	256.70	15.33	7.27	125.76	1.76	46.58
14	IC 253273	107.47	9.70	43.68	54.55	20.19	3.50	36.21	13.38	270.16	15.29	7.44	150.19	2.10	55.62
15	IC 243501	107.61	7.24	41.51	56.28	20.30	3.25	36.11	13.98	283.70	14.48	8.25	167.47	2.35	62.03
16	IC 219594	109.75	9.74	47.28	58.36	15.43	3.56	28.57	15.46	238.30	14.78	7.31	112.79	1.58	41.77
17	IC 219574	107.77	9.82	46.63	57.53	16.72	3.16	26.65	15.63	261.41	14.31	8.32	139.19	1.95	51.55
18	IC 214833	113.53	7.82	43.49	57.35	20.29	3.18	27.37	14.46	293.38	14.27	9.26	187.92	2.63	69.60
19	IC 214757	110.60	8.64	46.73	56.35	17.51	3.23	29.74	13.46	235.68	12.86	9.13	159.94	2.24	59.23
20	IC 202918	101.75	9.27	42.38	53.32	18.53	3.55	27.47	13.95	258.47	13.30	9.50	176.09	2.46	65.22
21	IC 202926	105.60	8.49	48.60	58.52	16.64	3.46	29.55	13.88	230.94	14.27	9.36	155.78	2.18	57.69
22	IC 214751	106.84	8.23	48.22	56.62	19.53	3.35	30.20	12.53	244.67	13.59	9.28	181.14	2.54	67.09
23	IC 202718	107.64	9.53	47.02	51.70	20.30	3.24	31.53	13.19	267.72	13.73	9.36	190.05	2.66	70.39
24	IC 202709	109.75	8.90	43.60	53.37	21.39	3.27	28.59	14.73	315.05	13.43	9.50	203.31	2.85	75.30
25	IC 202707	117.44	9.12	46.09	52.51	21.29	3.24	26.63	13.47	286.66	12.57	9.73	207.19	2.90	76.74
26	IC 252705	116.74	7.30	44.63	57.39	22.52	3.27	28.52	14.68	330.53	13.51	9.02	203.12	2.84	75.23
27	IC 201095	117.29	8.30	44.44	56.83	20.51	3.26	36.61	16.42	336.83	12.78	9.50	194.79	2.73	72.15
28	IC 199701	113.49	7.46	46.63	57.38	18.60	3.61	37.68	12.43	231.30	12.34	9.19	171.03	2.39	63.34
29	IC 58905	111.43	8.00	47.50	55.55	16.68	3.01	36.49	12.76	212.93	13.28	8.22	137.12	1.92	50.78
30	IC 52094	110.39	8.33	43.46	56.25	20.43	3.23	37.50	13.76	281.12	13.54	8.69	177.37	2.48	65.69
31	IC 39911	108.82	8.38	41.31	58.30	19.50	3.28	36.71	13.46	262.45	13.39	8.69	169.53	2.37	62.78
32	IC 39853	108.75	9.36	43.72	53.37	20.43	3.23	37.50	13.61	278.08	13.42	7.35	150.14	2.10	55.61
33	IC 20561	106.77	7.28	42.57	52.63	17.47	3.08	36.53	13.55	236.72	13.33	7.66	133.80	1.87	49.55
34	IC 20514	89.04	6.36	49.69	59.57	13.53	2.05	20.44	10.96	147.90	10.29	6.45	87.21	1.22	32.30
35	IC 202821	106.96	9.77	45.66	53.46	21.66	3.27	38.50	15.39	333.41	13.53	9.77	211.59	2.96	78.37
36	IC 202803	110.12	9.46	46.94	51.43	20.83	3.44	34.38	14.38	299.66	13.50	9.27	192.84	2.70	71.42
37	Kashi Unnati	125.75	12.49	31.89	45.81	28.47	4.20	42.04	19.46	553.93	16.50	11.24	319.91	4.48	118.48
38	K. Shyamal	124.68	11.69	34.09	46.68	27.32	4.10	40.47	18.66	509.83	15.57	10.68	291.70	4.08	108.04
39	Kashi Nidhi	123.49	11.22	35.14	47.37	25.93	3.90	39.88	18.22	472.30	15.54	10.41	269.99	3.78	100.00
40	Kashi Gauri	122.15	10.91	35.74	49.50	25.03	3.85	39.46	17.43	436.12	15.15	11.01	275.91	3.86	102.19
	Mean	108.48	8.96	43.72	54.66	20.20	3.29	34.12	14.62	298.93	13.56	8.70	177.41	2.48	65.71
	C.V.	0.63	3.27	0.73	0.31	2.20	3.85	0.66	3.81	3.89	1.64	4.33	4.96	4.95	4.96

	S.E.	0.40	0.17	0.18	0.10	0.26	0.07	0.13	0.32	6.72	0.13	0.22	5.08	0.07	1.88
	C.D. 5%	1.11	0.48	0.52	0.27	0.72	0.21	0.37	0.91	18.91	0.36	0.61	14.29	0.20	5.29
Range	Min	89.04	6.36	31.89	45.81	13.53	2.05	20.44	10.96	147.90	10.29	6.45	87.21	1.22	32.30
	Max.	125.75	12.49	49.69	59.57	28.47	4.20	42.04	19.46	553.93	16.50	11.24	319.91	4.48	118.48

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