

Performance of Cowpea (*Vigna anguiculata*) Germplasm IC 0650821 in the Rajasthan

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Abstract

The cowpea germplasm IC 0650821 is developing through pure line selection method at Agricultural Research Station, Fatehpur-Shekhawati, Sikar (SKN Agriculture University, Jobner) Rajasthan. This IC 0650821 evaluated with four checks under randomized block design (RBD) with four replications at ARS, Fatehpur during *kharif*, 2022 to *kharif*, 2024 under rainfed condition in the Rajasthan. This IC 0650821 data was recorded for yield and its attributes under rainfed conditions. The results show that the cowpea best check TC-901 (1182 kg/ha, 781 kg/ha and 996 kg/ha) seed yield and pooled mean of three year is 986 kg/ha seed yield during *kharif*, 2022, 2023 and 2024 and IC-0650821 (1064 kg/ha, 859 kg/ha and 1022 kg/ha) seed yield and pooled mean of three year is 982 kg/ha seed yield were found significantly superior over the checks.

Key words: *Vigna anguiculata*, Germplasm IC 0650821, Pure line selection, Rajasthan

Cowpea (*Vigna unguiculata* (L.) Walp.), a diploid legume with $2n=2x=22$ chromosomes belonging to the economically vital Fabaceae family, is a highly significant and versatile crop, reflecting its global cultivation and cultural importance [1]. This remarkable plant is primarily grown in tropical regions for its tender green pods and shelled immature seeds, consumed as vegetables, and its dry seeds, used as a pulse, serving as a crucial source of plant-based protein and fiber, especially in areas where animal protein is scarce. Beyond direct human consumption, cowpea haulms (plant residues) are valuable livestock feed, contributing to animal nutrition and waste reduction, while its application as a green manure enriches soil with nitrogen through its symbiotic relationship with *Rhizobium* bacteria, enhancing fertility and promoting sustainable agriculture [2]. Furthermore, cowpea's renowned drought-hardy nature, characterized by wide, droopy leaves that conserve soil moisture through shading, makes it an indispensable and reliable crop for food security in arid and semi-arid regions, thus embodying a resilient, multi-functional, and environmentally beneficial solution for diverse agricultural systems worldwide [3].

Cowpea is known as drought hardy nature, its wide and droopy leaves keeps soils and soil moisture conserved due to shading effect [4]. It has multiple uses like food, feed, forage, fodder, green manuring and vegetable. It is a cultivated in arid and semi-arid area in the Rajasthan. Cowpea is a highly resilient and versatile crop, as evidenced by its strong performance in arid and semi-arid regions like Rajasthan. Its "drought hardy nature" is crucial, with wide, droopy leaves conserving soil moisture through shading, a characteristic confirmed by research highlighting its adaptation to stress conditions and

ability to withstand significant drought [5]. This tolerance, coupled with its ground-covering "smothering nature," effectively reduces soil erosion and enhances moisture retention, making it ideal for challenging environments. Beyond its environmental benefits, cowpea boasts "multiple uses," serving as a valuable pulse and vegetable for human consumption, a nutritious fodder and forage for livestock, and a beneficial green manure that enriches soil through nitrogen fixation, a "soil restoring property" vital for sustainable agriculture [6].

Its cultivation in Rajasthan, one of India's major cowpea-growing states, is consistently supported by agricultural research, underscoring its inherent adaptability to the region's water scarcity and high temperatures. While specific germplasm "IC 0650821" was not directly found, broader research on cowpea varieties in Rajasthan reinforces the crop's importance and adaptability, with studies often focusing on optimizing nutrient management and identifying high-performing varieties to maximize yield and quality in these challenging agro-climatic conditions [7]. The comprehensive three-year data indicates that cowpea germplasm IC 0650821 is well-suited for cultivation in Rajasthan. Its desirable traits, including early flowering and maturity, coupled with its high and stable seed yield that rivals the best available controls and significantly outperforms others, make it a promising candidate for farmers in arid and semi-arid regions. Its inherent drought-hardy nature, along with its wide and droopy leaves contributing to soil and moisture conservation through shading, further reinforces its suitability for these challenging environments, offering multiple uses as food, feed, forage, fodder, green manuring, and vegetable [8].

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MATERIALS AND METHODS

The IC 0650821 is developing through pure line selection method at Agricultural Research Station, Fatehpur-Shekhawati, Sikar (SKN Agriculture University, Jobner) Rajasthan. It is collected under Zone-IIa of Rajasthan. The important trait of this IC No. is as:

1. IC 0650821 is cultivated under rainfed area
2. Seed colour is light brown.
3. Non shattering pods.
4. Pod colour is brown at maturity.
5. Medium seed size.
6. Fast growth with dark green leaves.
7. Synchronous maturity
8. Multiple disease and Insect tolerance.
9. Determinate growth habit.
10. Purple colour flower

RESULTS AND DISCUSSION

The three-year (Kharif, 2022-2024) performance evaluation of cowpea germplasm IC 0650821 in Rajasthan,

compared against four control varieties, reveals its favorable phenological and growth characteristics, supported by pooled averages, overall means, Critical Difference (CD at 5%), and Coefficient of Variation (CV%). IC 0650821 consistently demonstrates early flowering, with its pooled average of 41 days being comparable to RC-101 (C) and significantly earlier than CPD-119 (C) (48 days), a crucial advantage in rainfed conditions due to its statistically significant difference (7 days > CD of 2.67). Similarly, its pooled maturity period of 65 days is early, comparable to RC-101 (C) and RC-19 (C), and significantly earlier than the late-maturing CPD-119 (C) (73 days), a desirable trait for escaping terminal drought stress in arid and semi-arid regions given the 8-day difference exceeds the CD of 5.36. Regarding plant height, IC 0650821's pooled average of 53 cm is shorter than TC-901 (C) and significantly shorter than CPD-119 (C) (65 cm), with a statistically significant difference of 12 cm exceeding the CD of 6.96, which, while potentially impacting biomass, might offer lodging resistance; however, a complete assessment requires yield data. The CD at 5% values across all parameters confirm the statistical significance of observed varietal differences, while the CV values indicate reasonable experimental precision and reliability, collectively suggesting IC 0650821's strong potential for cultivation in Rajasthan due to its earliness [9-10].

Table 1 Seed yield and its related data from *Kharif*, 2022 to 2024 (3 year) in cowpea germplasm IC 0650821 in the Rajasthan

Varieties	Days to 50% flowering			Pooled	Days to Maturity			Pooled	Plant height (cm)			Pooled
	2022	2023	2024		2022	2023	2024		2022	2023	2024	
IC 0650821	46	41	37	41	66	63	65	65	55	48	56	53
TC-901 (C)	47	45	42	45	67	69	70	69	67	46	59	57
CPD-119 (C)	51	47	47	48	76	71	72	73	70	61	64	65
RC-19 (C)	49	44	41	45	67	65	67	66	53	45	54	51
RC-101 (C)	43	41	40	41	64	66	63	64	58	39	52	50
Mean	47.2	43.6	41.4	44	68	66.8	67.4	67	60.6	47.8	56.8	55.1
CD at 5%	4.3	1.84	4.25	2.67	7.56	3.3	4.25	5.36	8.64	7.93	6.46	6.96
CV (%)	5.89	2.74	6.6	3.16	7.17	3.18	4.66	4.16	9.14	10.64	7.31	6.61

Table 2 Seed yield and its related data from *Kharif*, 2022 to 2024 (3 year) in cowpea germplasm IC 0650821 in the Rajasthan

Varieties	Pod length (cm)			Pooled	No. of seeds/pod			Pooled	Seed yield (Kg/ha)			Pooled
	2022	2023	2024		2022	2023	2024		2022	2023	2024	
IC 0650821	13.0	12.0	11.4	12.1	13	13	14	13	1064	859	1022	982
TC-901 (C)	14.0	13.0	14.4	13.8	14	10	12	12	1182	781	996	986
CPD-119 (C)	13.0	12.0	12.1	12.4	13	10	12	12	902	609	788	766
RC-19 (C)	12.0	12.0	11.1	11.7	12	11	12	12	1014	610	837	820
RC-101 (C)	11.0	13.0	12.0	12.0	11	11	11	11	708	606	669	661
Mean	12.6	12.4	12.3	12.4	12.6	11	12	12	974	693	862.5	843
CD at 5%	1.54	1.48	1.52	0.638	1.86	1.3	2.2	1.14	164.53	78.74	130.67	126.03
CV (%)	8.02	7.78	7.31	2.68	9.57	7.68	11.77	5.08	10.84	7.44	9.72	7.81

The three-year (Kharif, 2022-2024) evaluation of cowpea germplasm IC 0650821 in Rajasthan, encompassing pod length, seeds per pod, and seed yield, indicates its significant potential. While IC 0650821's pooled pod length of 12.1 cm is statistically shorter than TC-901 (C) (13.8 cm), it boasts the highest pooled average of 13 seeds per pod, a statistically significant advantage over RC-101 (C). Most importantly, IC 0650821 achieved a robust pooled seed yield of 982 Kg/ha, which is statistically comparable to the top-performing control TC-901 (C) and significantly higher than CPD-119 (C), RC-19 (C), and RC-101 (C), confirming its strong yield potential in Rajasthan's arid and semi-arid conditions, a crucial complement to its earlier observed early flowering and maturity traits [11-12].

During *Kharif*, 2022, 2023 and 2024, the cowpea variety TC-901 (1182 kg/ha, 781 kg/ha and 996 kg/ha) and pooled mean of three year is 986 kg/ha and IC-0650821 (1064 kg/ha, 859 kg/ha and 1022 kg/ha) and pooled mean of three year is 982 kg/ha were found significantly superior seed yield over the checks.

CONCLUSION

Based on the three-year (Kharif, 2022-2024) evaluation in Rajasthan, cowpea germplasm IC 0650821 consistently demonstrated favorable phenological and yield characteristics. Its early flowering (pooled 41 days) and early maturity (pooled 65 days) are significant advantages for drought-prone regions,

allowing it to escape terminal drought stress, with these traits being statistically superior to some control varieties like CPD-119 (C). While IC 0650821 exhibited a relatively shorter plant height and pod length compared to certain controls, its pooled average of 13 seeds per pod was the highest, contributing to its robust pooled seed yield of 982 Kg/ha. This yield is statistically

comparable to the highest-yielding control, TC-901 (C) (986 Kg/ha), and significantly superior to CPD-119 (C), RC-19 (C), and RC-101 (C). Therefore, IC 0650821 emerges as a promising cowpea germplasm for cultivation in the arid and semi-arid conditions of Rajasthan, combining desirable early-season traits with high and stable yield potential.



Fig 1 Field view of cowpea IC 0650821

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