

International Journal of Agriculture Extension and Social Development

Volume 9; Issue 3; March 2026; Page No. 34-40

Received: 20-01-2026
Accepted: 02-03-2026

Indexed Journal
Peer Reviewed Journal

Cluster Frontline Demonstrations (CFLDs) on chickpea under NFSM through KVKs in Karnataka: A pathway for bridging yield gap

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DOI: <https://www.doi.org/10.33545/26180723.2026.v9.i3a.3268>

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Abstract

Chickpea, also known as Bengal gram or Chana, is widely cultivated across the country in many states of which Karnataka is one. Although India contributes 26% in the international market of pulses, India's average productivity is still quite low (841 kg/ha) as compared to the international average of 1023 kg/ha. Towards increasing pulses productivity and production in the country, a project on Cluster Frontline Demonstrations (CFLDs) on pulses under National Food Security Mission (NFSM) is a noble initiative by the Ministry of Agriculture & Farmers' Welfare, Government of India, New Delhi. As a part of the project, field demonstrations on Chickpea were conducted in 427 ha by involving 1066 farmers through Eight KVKs in Karnataka during rabi 2020-21, 2021-22 and 2022-23. Results indicated that the average yield obtained in all three years 13.31 q/ha (2020-21), 13.76 q/ha (2021-22) and 13.73 q/ha (2022-23) was at par as well as high with demonstrations as compared to the existing local varieties (10.61 q/ha, 10.78 q/ha and 11.13 q/ha) with 25.17%, 27.89% and 23.67% yield increase, respectively. The average economic returns gained was high Rs.45619.75/ha (2020-21), Rs.34934.38/ha (2021-22) and Rs.41389.13/ha (2022-23) with BCR of 2.29, 2.32 and 2.65 in demonstration plots as compared to farmers' plots, which are in accordance with the yield obtained and selling price of the produce in their respective KVK districts. Thus, the average yields obtained from all three demonstrated varieties viz., BGD-103, JAKI-9218 and BGD-111-1 were on par in all three years individually and among themselves. It is pertinent to note that the average demonstration yield was high in all three years in all eight KVK districts as compared to checks and gained economic returns accordingly over the checks. Yield gap analysis indicates that the demonstrated technologies are feasible in the existing farming situations of all eight districts. CFLD Farmers expressed that the demonstrated varieties along with production technologies were effective and profitable. It clearly indicates that the productivity and production of pulses, especially in Chickpea, could be enhanced through CFLD project by educating the farmers on newly released varieties coupled with recommended production technologies. Further, large scale promotion of these demonstrated technologies may have to be taken up for wide dissemination so as to reap the technology benefit among more farmers.

Keywords: CFLDs, chickpea, yield, Net returns and KVK

Introduction

Chickpea (*Cicer arietinum* L.) is the largest produced food legume in South Asia and the third largest globally and is commonly appreciated as one of the most important pulses for human diet. It is a protein-rich supplement to cereal-based diets, especially to the poor in developing countries. In India, Chickpea occupies 10 million hectares during 2020- 21 producing 11.91 million tons with an average productivity of 11.92 quintals per hectare (Kumar, 2023) ^[9]. Chickpea, also known as Bengal gram or Chana, is widely cultivated across the country in many states of which Karnataka is one. In Karnataka, it is cultivated in rabi

season in an area of 4.18 lakh ha with a total production of 2.31 lakh tonnes and average productivity of 582 kg/ha. Chickpea is a significant rabi pulse crop with 18-22% protein, 62% carbohydrates and good amount of fat, lysine and tryptophan (Meena *et al.*, 2021) ^[12]. It is a very beneficial crop as it fixes nitrogen from the environment and contributes organic carbon to soil which ultimately improves soil productivity level. Although India contributes 26% in the international market of pulses, India's average productivity is still quite low i.e. 841 kg/ha, compared to the international average of 1023 kg/ha (DES, 2018). The per-person availability of pulses in India was 60.70 g/day per

person in 1951 which had declined sharply to 31.6 g/day/person in 2010 (Singh *et al.*, 2020 & Kumar & Singh, 2021) [20, 10]. This steep decline occurs because of exponential increase in population in combination with low production and productivity of chickpea because of less importance given to this crop followed by non-adoption of proper production technologies, severe incidence of pests and diseases, lack of irrigation, lack of knowledge about improved scientific cultivation practices and non-remunerative market price. However, to meet country's demand for pulses, still Indian government relies heavily on export from international market.

In this scenario, field demonstration as it implies 'seeing is believing' theory, is one of the means to demonstrate the production potential of the newly released varieties that have been introduced in combination with state-of-the-art technology. Matching to this, a project on Cluster Frontline Demonstrations (CFLDs) on pulses under National Food Security Mission (NFSM) is a noble initiative by the Ministry of Agriculture & Farmers' Welfare, Government of India, New Delhi which is conducted under close supervision of the scientists, towards increasing pulses production in the country. As a part of it, Department of Agriculture & Farmers Welfare (DA & FW), New Delhi sanctioned an ICAR Project entitled Cluster Frontline Demonstrations of Pulses under NFSM to be implemented by KVKs of ICAR-ATARI, Bengaluru in the years 2020-21, 2021-22 and 2022-23. As a part of the project, CFLDs were conducted on Chickpea under NFSM through KVKs of

Karnataka during Rabi season of 2020-21, 2021-22 and 2022-23 with an objective to demonstrate yield potential of latest chickpea varieties along with appropriate improved production technologies on the farmers' fields in a participatory manner so as to bridge the yield gap and thereby enhance productivity and production of Chickpea in Karnataka.

Materials and Methods

Operational definition of CFLD: It is a form of applied research through ICAR/SAUs system on latest notified/released varieties along with full package of practices which are of less than 10 years of release on selected farmers' fields in a cluster of villages to create better and visible impact of a technology demonstrated. Each cluster should be of at least 10 ha and one demonstration at individual farmer should never be less than 0.40 ha and not exceeding to one hectare.

Locale: The CFLDs were conducted in an area of 158 ha belonging to 395 farmers during rabi 2020-21, 114 ha belonging to 285 farmers during rabi 2021-22 and 155 ha belonging to 386 farmers during rabi 2022-23 in eight KVK districts of Karnataka viz., Bellari, Chamarajanagar, Davangere, Gadag, Kalburgi-I, Koppal, Vijayapura-I and Vijayapura-II. Thus, CFLDs were implemented in 427 ha by involving 1066 farmers by eight KVKs of Karnataka (Table 1).

Table 1: KVK wise CFLDs of Chickpea implemented during rabi season during 2020-21 to 2022-23

KVK	Rabi 2020-21		Rabi 2021-22		Rabi 2022-23		Total	
	Demo (No.)	Area (ha)	Demo (No.)	Area (ha)	Demo (No.)	Area (ha)	Demo (No.)	Area (ha)
Bellari	50	20	55	22	50	20	155	62
Chamarajanagar	50	20	55	22	50	20	155	62
Davangere	40	16	25	10	50	20	115	46
Gadag	50	20	25	10	50	20	125	50
Kalburgi-I	75	30	25	10	50	20	150	60
Koppal	50	20	25	10	50	20	125	50
Vijayapura-I	40	16	25	10	36	15	101	41
Vijayapura-II	40	16	50	20	50	20	140	56
Total	395	158	285	114	386	155	1066	427

Technologies demonstrated: As per the guidelines of NFSM, three improved varieties BGD-103, Jaki-9218 and BGD-111-1 along with other production technologies of University of Agricultural Sciences, Bangalore, University of Agricultural Sciences, Dharwad and University of Agricultural Sciences, Raichur which are of less than 10 years release were identified for demonstration. Integrated Crop Management with recommended agronomic practices like seed treatment with Bioagent *Trichoderma*, *Rhizobium* and PSB, foliar spray of chickpea magic @ 10 g/lit during peak flowering and pod formation, Integrated Pest and Disease Management practices were commonly chosen for demonstration by all the KVKs. Other need based recommended production technologies like Seed priming with CaCl₂ @ 2% (30 min soaking), use of micronutrient zinc sulphate @ 15 kg/ha, installation of pheromone traps @10 no/ha, 1st spray with ovicidal insecticides Profenophos

@ 2 ml/l, sorghum mixed cropping as bird perches and foliar spray of neem soap@ 5 ml/l were preferred for demonstration by the respective KVKs. Further, farmers cultivated existing varieties like Annigeri-1 and JG 11 along with traditional practices were considered as local checks across the KVKs.

Procedure: The necessary steps for the selection of site/field and farmers, layout of demonstration, etc. were followed as suggested by Chaudhary (1999) and CFLDs were implemented as per the guidelines laid out under NFSM. Timely critical inputs were made available to the participating farmers. Before conducting CFLDs, group meetings, training programmes and extension activities were conducted through KVKs during the period for creating awareness as well as popularization of demonstrated technologies of Chickpea among CFLD farmers,

neighboring farmers and other stakeholders. The CFLDs were monitored by KVK scientists through regular field visits thereby helped in use of need-based plant protection measures and other farm advisories from time to time.

Observations: The data were recorded on parameters like yield and net returns of demonstration and local check. Yield gap analysis was carried out with reference to technology gap, extension gap and technology index. Further, feedback about the technologies demonstrated was obtained from the CFLD farmers.

Statistical tools: Appropriate statistical techniques were used for computing the collected data. Further, the following formulae (Samui *et al.*, 2000) ^[18] have been used to estimate the technology gap, extension gap and technology index:

1. Technology gap = Potential yield - Demonstration yield
2. Extension gap = Demonstration yield - Farmers yield

$$a. \text{ Technology index} = \frac{\text{Potential yield} - \text{Demonstration yield}}{\text{Potential yield}} \times 100$$

Results and Discussion

The CFLDs on Chickpea were implemented by eight KVKs in their respective districts of Karnataka during rabi season of 2020-21, 2021-22 and 2022-23. Data were collected as per the specific format developed for the project, analysed and tabulated. The results are discussed here under:

KVK district wise yield and economic performance

(a) Yield performance: District wise yield performance of

Chickpea under CFLDs is presented in Table 2. Data indicates that the average demonstration yield of Chickpea was higher in all the years of rabi 2020-21 (13.31 q/ha), rabi 2021-22 (13.76 q/ha) and rabi 2022-23 (13.73 q/ha) as compared to checks of rabi of 2020-21 (10.61 q/ha), rabi 2021-22 (10.78 q/ha) and rabi 2022-23 (11.13 q/ha) and average yield increase of 25.17, 27.89 and 23.67% during 2020-21, 2021-22 and 2022-23, respectively. The highest average demonstration yield was obtained in Vijayapura-I (15.88 q/ha) with the variety BGD-111-1 during rabi 2020-21, whereas, it was in Gadag with JAKI-9218 during rabi 2021-22 (18.50 q/ha) and rabi 2022-23 (17.10 q/ha). Further, it was observed that the average demonstration yields were higher in all the years in all eight KVK districts as compared to checks. This was due to demonstration of high yielding varieties along with appropriate production technologies like timely sowing, improved soil health and adoption of site-specific improved management practices on the farmers' fields coupled with need based and timely supply of critical inputs. Results were similar to the data reported by Suman Kumari and Harinder Singh (2023) ^[21] that the results clearly revealed the importance of introduced interventions viz., improved cultivars, method of sowing, recommended seed rate, integrated nutrient management, seed treatment, weed control techniques, and appropriate plant protection measures over farmer practices as there was 21.03% increase in yield recorded in improved practices plots in comparison to local/check plot practices. The results of the study are further supported by the findings of other researchers Khedkar *et al.*, (2017) ^[8], Lakshmi *et al.*, (2017) ^[11], Rachhoya *et al.*, (2018) ^[16], Gireesh *et al.*, (2019) ^[6], Ojha & Bisht (2020) ^[13] and Biradar *et al.* (2020) ^[1].

Table 2: KVK wise yield performance of chickpea through CFLDs under NFSM during rabi season during 2020-21 to 2022-23

KVK	Demo variety	Rabi 2020-21			Rabi 2021-22			Rabi 2022-23		
		Average yield (q/ha)		Yield increase over check (%)	Average yield (q/ha)		Yield increase over check (%)	Average yield (q/ha)		Yield increase over check (%)
		Demo	Check		Demo	Check		Demo	Check	
Chamarajanagara	JAKI-9218	15.16	10.76	40.89	14.69	9.93	47.94	16.35	11.27	45.07
Davangere	JAKI-9218	12.25	10.90	12.39	14.15	10.49	34.89	10.84	8.98	20.71
Gadag	JAKI-9218	12.55	9.93	26.38	18.50	14.55	27.15	17.10	14.18	20.59
Bellari	BGD-103	13.70	10.45	31.10	12.40	9.70	27.84	14.70	13.00	13.00
Kalburgi-I	BGD-103	12.30	10.70	14.95	12.30	10.70	14.95	12.30	10.70	14.95
Koppal	BGD-103	10.55	9.13	15.55	11.90	10.10	17.82	14.64	11.44	27.97
Vijayapura-I	BGD-111-1	15.88	11.81	34.46	12.48	9.60	30.00	11.25	8.75	28.57
Vijayapura-II	BGD-111-1	14.13	11.24	25.71	13.70	11.18	22.54	12.73	10.74	18.53
Average		13.31	10.61	25.17	13.76	10.78	27.89	13.73	11.13	23.67

(b) Economic performance: District wise economic performance of Chickpea under CFLDs is presented in Table 3. Data from the Table 3 indicates that the average net returns obtained was high under demonstrations in all three years such as Rs.45619.75/ha, Rs.34934.38/ha and Rs.41389.13/ha as compared to check with Rs.33117.25/ha, Rs.23588.13/ha and 29159.13/ha through demo BCR of 2.29, 2.32 and 2.65 during rabi 2020-21, 2021-22 and 2022-23, respectively. Further, it shows that yield was increased significantly with demonstrations over check by 37.82%,

53.34% and 44.75% during rabi 2020-21, 2021-22 and 2022-23, respectively. Across the KVK districts, the variation in net returns gained, per cent yield increase over check and BCR in all three years is in accordance with the yield obtained and selling price of the produce in their respective KVK districts. Thus, it was clearly indicating that the demonstration of chickpea new varieties with recommended package of practices gave higher income to farmers than their traditional cultivation.

Table 3: District wise economic performance of chickpea through CFLDs under NFSM during rabi season of 2020-21 to 2022-23

KVK	Rabi 2020-21				Rabi 2021-22				Rabi 2022-23			
	Average net returns			BCR (Demo)	Average net returns			BCR (Demo)	Average net returns			BCR (Demo)
	Demo (Rs./ha)	Check (Rs./ha)	Increase over check (%)		Demo (Rs./ha)	Check (Rs./ha)	Increase over check (%)		Demo (Rs./ha)	Check (Rs./ha)	Increase over check (%)	
Chamarajanagara	42310	31238	32.30	2.07	41102	19537	110.38	2.27	45425	26054	74.35	2.48
Davangere	43985	33156	34.06	2.39	23314	12440	87.41	1.54	25568	18271	39.94	2.03
Gadag	42867	32290	34.41	2.20	52500	34535	52.02	2.52	61248	47308	29.47	3.60
Bellari	38252	26252	39.67	2.08	42384	35352	19.89	2.95	48307	39352	22.76	3.23
Kalburgi-I	40223	29448	42.99	2.41	26352	22434	17.46	2.46	28782	23553	22.20	2.86
Koppal	40409	28468	41.06	2.35	31045	20845	48.93	2.38	51774	33457	54.75	2.50
Vijayapura-I	56234	41290	37.01	2.28	31324	19773	58.42	2.30	35620	19885	79.13	2.35
Vijayapura-II	60678	42796	41.07	2.60	31454	23789	32.22	2.15	34389	25393	35.43	2.15
Average	45619.75	33117.25	37.82	2.29	34934.38	23588.13	53.34	2.32	41389.13	29159.13	44.75	2.65

These findings are on par with the results reported by Yadav M.P that the net return from Demonstration Plots was higher than the Farmers Plots. Further, the authors Hrish Kumar Rachhoya *et al* (2018) ^[16] also reported that the average of gross and net returns of demonstration was 45.72% and 63.50% higher than that of farmers' practice, respectively.

Variety wise yield and economic performance

(a) Yield performance: Variety wise yield performance of chickpea under CFLDs during rabi season of 2020-21 to 2022-23 is presented in Table 4. From the data, it was pertinent to note that the variety BGD-111-1 and JAKI-9218 recorded highest average yield of 15.01 q/ha and 15.96 q/ha during rabi seasons of 2020-21 and 2021-22, respectively. However, the average yields obtained from all three

demonstrated varieties BGD-103, JAKI-9218 and BGD-111-1 were on par in all three years individually and among themselves. Yet, the variation in average demonstration yields among varieties in all three years as well as its corresponding percentage yield increase over checks may be due to aberrations in climate. Recorded yield increases range from 18.64% to 31.71% is mainly due to the characteristics of varieties as these three varieties are resistant to fusarium wilt, high yielders and suitable for rainfed condition. These results are on par with the findings of Patil *et al.* (2016) ^[14] that the higher yields with improved varieties of Chickpea are attributed to better vegetative growth with greater total dry matter production and grain yield per plant over local variety (Annigeri-1) and Sangeetha *et al.* (2020) ^[19].

Table 4: Variety wise yield performance of chickpea under CFLDs during rabi season of 2020-21 to 2022-23

Variety	KVKs (No)	Rabi 2020-21			Rabi 2021-22			Rabi 2022-23		
		Average yield (q/ha)		Yield increase over check (%)	Average yield (q/ha)		Yield increase over check (%)	Average yield (q/ha)		Yield increase over check (%)
		Demo	Check		Demo	Check		Demo	Check	
BGD-103	3	12.18	10.09	20.54	12.20	10.17	20.20	13.88	11.71	18.64
JAKI-9218	4	13.88	11.46	22.20	15.96	12.27	31.71	15.01	11.29	29.52
BGD-111-1	2	15.01	11.53	30.09	13.09	10.39	26.27	11.99	9.74	23.10

(b) Economic performance: Variety wise economic performance of chickpea under CFLDs during rabi season of 2020-21, 2021-22 and 2022-23 is presented in Table 5. Data revealed that the variety BGD-103 recorded higher average net returns increase (54.62%) over check during rabi 2022-23 followed by BGD-111-1 (44.11%) and JAKI-9218 (43.43%) during rabi 2021-22. During all three years, the highest BCR obtained was 2.86 with the variety BGD-111-1 followed by JAKI-9218 (2.70) and rest were almost comparable to each other. However, the average net returns

obtained from all three demonstrated varieties BGD-103, JAKI-9218 and BGD-111-1 were on par in all three years individually and among themselves. The variation in average net returns of demonstrated varieties in all three years as well as its corresponding percentage net returns increase over checks are in accordance with their yield and sale price in the respective KVK districts. These results are similar to the findings of Patil *et al* (2016) ^[14] and Sangeetha *et al* (2020) ^[19].

Table 5: Variety wise economic performance of chickpea under CFLDs during rabi season of 2020-21 to 2022-23

Variety	Rabi 2020-21				Rabi 2021-22				Rabi 2022-23			
	Average net returns			BCR (Demo)	Average net returns			BCR (Demo)	Average net returns			BCR (Demo)
	Demo (Rs./ha)	Check (Rs./ha)	Increase over check (%)		Demo (Rs./ha)	Check (Rs./ha)	Increase over check (%)		Demo (Rs./ha)	Check (Rs./ha)	Increase over check (%)	
BGD-103	39628	28056	41.24	2.28	33260	26210	26.90	2.60	35005	22639	54.62	2.65
JAKI-9218	43054	32228	33.59	2.22	38972	27171	43.43	2.11	40401	30544	32.27	2.70
BGD-111-1	58456	42043	39.04	2.44	31389	21781	44.11	2.23	42954	32121	33.73	2.86

Yield gap analysis

It was computed with the help of three parameters viz., technology gap, extension gap and technology index, and their results are presented below.

(a) Technology gap: It was calculated by subtracting the demonstration yield from the reported potential yield of the variety when it was released and data is depicted in Fig. 1. Data indicates that the technology gap was low during rabi 2021-22 as compared to rabi 2020-21 and 2022-23. Further, among the eight KVK districts, the lowest technology gap was obtained at Vijayapura -I (112 kg/ha) and highest at Davangere (775 kg/ha) during rabi 2020-21, whereas, lowest at Gadag (150 kg/ha) and highest at Davangere (585 kg/ha) during rabi 2021-22 and lowest at Bellary (130 kg/ha) and highest at Davangere (916 kg/ha) during rabi 2022-23. Results clearly show that the demonstrated

technologies performed better during rabi 2021-22 with an average technology gap of 398.50 kg/ha as compared to rabi 2020-21 with 443.50 kg/ha and rabi 2022-23 (401.13). Further, the data revealed that the technology gap varied from district to district in each year. Thus, the lowest technology gap indicates that the demonstrated technologies are more feasible in its existing farming situation which may be due to the factors like rainfall, soil fertility, pests and diseases, feasibility of demonstrated technologies and other local climatic conditions. These findings are similar to that of study by Dwivedi *et al.* (2019) ^[5] that the technology gap reflects farmer's cooperation in carrying out such demonstration with encouraging results in both the years (2015-16 and 2016- 17). The technology gap observed may be attributed to dissimilarity in the soil fertility status, crop production practices and local climatic situation.

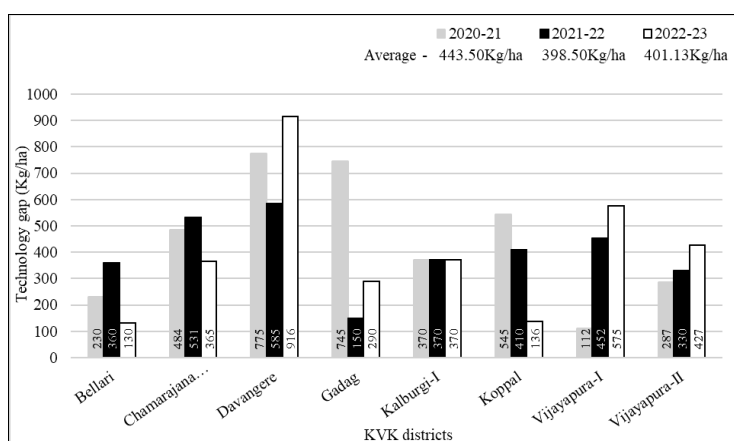


Fig 1: Technology gap under Chickpea CFLDs during rabi 2020-21 to 2022-23

(b) Extension gap: It was calculated by subtracting the check yield from the demonstration yield and data is depicted in Fig. 2. Data shows that extension gap was low during rabi 2022-23 as compared to rabi 2020-21 and rabi 2021-22. Further, among the eight KVK districts, the lowest extension gap was obtained at Davangere (135 kg/ha) and highest at Chamarajanagara (440 kg/ha) during rabi 2020-21, whereas, lowest was at Kalburgi-I (160 kg/ha) and highest at Chamarajanagara (476 kg/ha) during rabi 2021-22 and lowest (160 kg/ha) at Kalaburagi-I and highest (508 kg/ha) at Chamarajanagara. The varied extension gap among eight KVK districts may be due to the level of implementation of CFLDs with modern technologies

coupled with efforts on imparting knowledge, skill and monitoring crop progress at different stages, and therefore, still there is a need to educate the farmers through various means for the adoption of improved high yielding varieties and improved agro technologies. The new technologies will eventually encourage the farmers to discontinue the old technology and to adopt new technology (Hiremath and Nagaraju, 2010) ^[7]. These observations are in similarity with the findings of Poonia and Pithia (2011) ^[15] and Raj *et al* (2013) ^[17]. Dhakad *et al.* (2018) ^[4] reported that more and more use of latest production technologies with high yielding varieties will subsequently change this alarming trend of galloping extension gap.

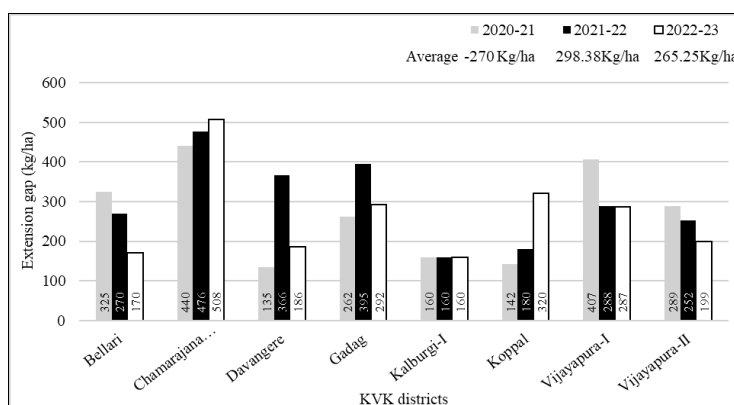


Fig 2: Extension gap under Chickpea CFLDs during rabi 2020-21 to 2022-23

(c) Technology index: It is calculated by subtracting the demonstration yield from the reported potential yield of the variety when it was released that was divided by potential yield and then it was multiplied with 100 and data is depicted in Fig. 3. Data indicates that the demonstrated varieties and production technologies were more feasible during rabi 2020-21 as the percentage of technology index was low as compared to rabi 2021-22 and 2022-23. This indicates that a gap existed between technology evolved and

technology adoption at farmer's field in the districts where technology index percentage was more. Therefore, efforts are needed to bridge the gap by educating the farmers through different activities like training, method demonstrations, farm advisories, field visits, group meetings, field days etc., for adopting the latest varieties along with all recommended production technologies so as to harvest the potential yield. These findings are on par with the findings of Dwivedi *et al* (2019) ^[5].

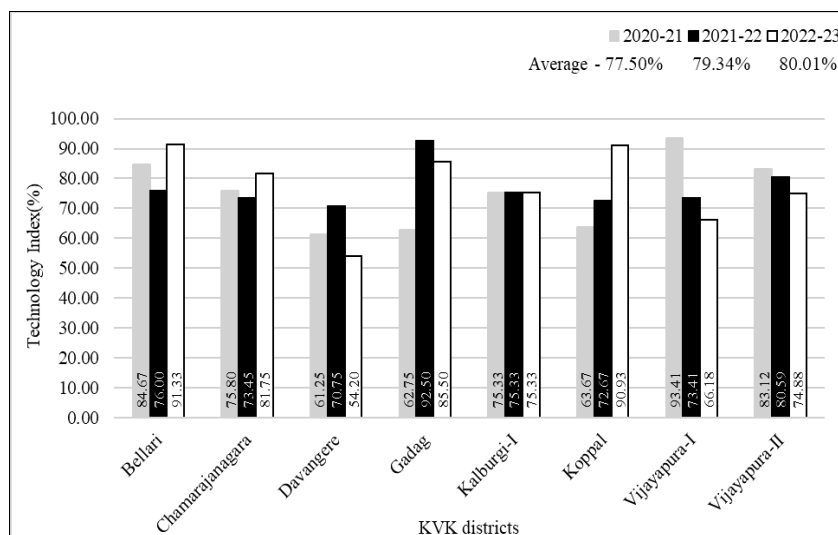


Fig 3: Technology index under Chickpea CFLDs during rabi 2020-21 to 2022-23

(d) Feedback: The responses of the CFLD farmers of eight KVKs during rabi seasons of 2020-21, 2021-22 and 2022-23 were obtained on the performance of demonstrated varieties and production technologies of Chickpea in particular and other constraints faced during crop period in general. Farmers anonymously expressed that the demonstrated varieties viz., BGD-103, JAKI-9218 and BGD-111-1 were resistant to Fusarium Wilt, gave high yield, and net returns as well as suitable for rainfed condition as compared to their existing varieties. They expressed that the production technologies demonstrated were effective and profitable. They felt that the foliar spray of chickpea magic during peak flowering and pod formation helped to obtain good yield. Further, they opined that the cluster FLD project has provided an opportunity for them to become aware of latest varieties and production technologies of Chickpea.

Conclusion

Implementation of CFLDs under NFSM on newly released varieties of Chickpea by 8 KVKs of Karnataka in 427 ha involving 1066 farmers has obviously increased the average yield in Karnataka during rabi season of 2020-21 (13.31 q/ha), 2021-22 (13.76 q/ha) and 2022-23 (13.73 q/ha) as compared to the existing local varieties (10.61 q/ha, 10.78 q/ha and 11.13 q/ha) with 25.17%, 27.89% and 23.67% yield increase, respectively and gained economic returns in accordance with the yield obtained and selling price of the produce in their respective KVK districts. The average yields obtained from all three demonstrated varieties were on par in all three years individually and among themselves. It is pertinent to note that the average demonstration yield was high in all three years in all 8 KVK districts as

compared to checks and gained economic returns accordingly over the checks. Technology gap and technology index percentages indicate that the demonstrated technologies are feasible in the existing farming situations of all 8 districts. Highest extension gap demands more awareness programmes for farmers to educate them on newly released varieties coupled with recommended production technologies. Farmers belonging to cluster villages under NFSM from eight districts anonymously expressed that the demonstrated varieties viz., BGD-103, JAKI-9218 and BGD-111-1 along with production technologies were effective and profitable. It was observed that higher yield can be achieved by providing need based critical inputs like quality seeds of newly released high yielding varieties along with production technologies like timely sowing, improved soil health and adoption of site-specific improved management practices on the farmers' fields coupled with capacity building, extension activities and on-farm advisories from time to time. Further, large scale promotion of these demonstrated technologies may have to be taken up for wide dissemination so as to reap the technology benefit among more farmers. Keeping these results in view, CFLDs on pulses especially on Chickpea in Karnataka may be promoted through synergetic efforts of research and developmental departments for harnessing higher productivity, income and prosperity among pulse growers.

Acknowledgement

The authors are highly thankful to the Division of Agricultural Extension, ICAR, New Delhi and NFSM, DAC & FW, Government of India, New Delhi for formulating

project and providing financial grant towards organizing CFLDs in Karnataka. Further, they extend thanks to all participating Scientists (Heads & Senior Scientists/Scientists/SMSs) from KVKs of Karnataka and their respective CFLD farmers for their active involvement in implementation of CFLDs as well as providing periodical data.

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