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Cluster Front Line Demonstrations on New Chickpea Varieties in Western Parts of Kurnool District of Andhra Pradesh

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ABSTRACT

Background: Cluster Front Line Demonstrations were conducted to study the comparative performance of new chickpea varieties in the western parts of Kurnool district, Andhra Pradesh. These demonstrations were conducted at twenty five locations during the *Rabi* season of two consecutive years (2019-20 and 2020-21).

Methods: Three improved chickpea varieties (Nandyal Gram-3, Nandyal Gram-49 and Nandyal Gram-452) were selected to implement these demonstrations and the improved varieties were compared with the locally grown JG-11 variety.

Result: During two years of assessment, the pooled results revealed that the highest mean number of pods (51.3) per plant and average pod yield (2234 kg ha^{-1}) were recorded in Nandyal Gram-452 compared to local variety JG-11 (41.2 pods per plant; 1862 kg ha^{-1}). The lowest incidence of fusarium wilt was recorded in Nandyal Gram 452 (6.14%) followed by Nandyal Gram 49 (9.73%) and Nandyal Gram 3 (12.04%) compared to JG-11 (15.83%). The lowest dry root rot was also observed with Nandyal Gram-452 variety (10.92%) compared to JG-11 (18.19%). The higher average net income (80486 Rs ha^{-1}) and benefit cost ratio (2.9) were realized in the demonstration with the improved Nandyal Gram-452 variety in comparison to lower net income (58370Rs ha^{-1}) and benefit cost ratio (2.3) with JG-11. These results clearly indicated that the improved chickpea variety Nandyal Gram 452 is the best alternative old variety JG-11 which is being cultivated since 2005.

Key words: Chickpea, Cluster front line demonstrations, Nandyal gram-452, Yield.

INTRODUCTION

Chickpea (*Cicer arietinum* L.) is the largest produced food legume in South Asia and it is the third largest produced food legume crop at globally. India ranked first in the production and consumption of chickpea in the world. The total chickpea production in India was 9.93 MT during 2019 with an average yield of 1041 kg ha^{-1} (FAOSTAT, 2020). In India, the major chickpea producing states are Madhya Pradesh, Rajasthan, Maharashtra, Uttar Pradesh, Karnataka and Andhra Pradesh, which together contribute 91% of the production and 90% of the area under chickpea in the country. Chickpea has emerged as a cash crop in the black cotton soils of Andhra Pradesh replacing different crops like cotton, sorghum, bajra, sugarcane, groundnut and tobacco. Farmers realized that crops like cotton are prone to various pests and diseases; moreover prices being subjected to high fluctuations. However, chickpea is a low risk crop and is well accepted on account of mechanization of farm practices, as a suitable alternative to varied dry land agro climatic conditions of the state (Suhasini *et al*., 2009). The farmers were interested to cultivate chickpea crop due to less pest and disease attack compared to other crops, storability and also due to comparatively less cost of cultivation.

In Andhra Pradesh, the farmers are growing chickpea cultivars like JG 11, JAKI 9218, KAK2 and Vihar. Among these varieties, JG-11 is the predominant *desi* type of chickpea variety grown in the state, particularly in Kurnool district. Of late, old varieties are exhibiting poor performance due to improper seed replacement and reduced levels of tolerance against major diseases. Hence the old variety should always replace with recently released location specific varieties bred for Andhra Pradesh to achieve maximum yields even under rainfed farming situation.

Keeping this in view, Krishi Vigyan Kendra, Banavasi located in Kurnool district of Andhra Pradesh has introduced three chickpea varieties *viz*., Nandyal Gram-3, Nandyal Gram-49 and Nandyal Gram-452 which are developed by

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Regional Agricultural Research Station, Nandyal of Acharya N G Ranga Agricultural University by conducting Cluster Front Line Demonstrations. As a part of demonstrations, improved/recommended package of practices like seed treatment, weedicide application, STBF (Soil test based Fertilizer Application) and real time pest and disease management practices were suggested and implemented. Cluster front line demonstrations (CFLDs) is a novel approach to provide a direct interface between researcher and farmer for the transfer of technologies developed by them and to get direct feedback from farming community. Cluster Frontline Demonstration project was started since 2015-16 under National Food Security Mission (NFSM) and National Mission on Oil seeds and oil Palm (NMOOP). Cluster Frontline Demonstrations on pulses project under NFSM was initiated by the Department of Ministry of Agriculture cooperation and Farmer's Welfare (DAC and FW) with cooperation of Division of Extension Education, ICAR, New Delhi during 2015. The scheme is implemented in a mission mode through a farmer centric approach. These demonstrations are conducted under the close supervision of scientists of Krishi Vigyan Kendra, SAUs and their Regional Research Stations.

MATERIALS AND METHODS

Cluster Front Line Demonstrations were conducted at four blocks (Pattikonda, Kodumuru,Adoni and Yemmiganur) in the western part of Kurnool district andhra Pradesh. These demonstrations were conducted at twenty five locations during *Rabi* season of two consecutive years (2019-20 and 2020-21). Kurnool District comprises three Revenue Divisions and 54 Revenue Mandals. Kurnool district falls under Scarce Rainfall Zone with an average annual rainfall of 670.6 mm (nor- mal). Major rainfall is received from the South-West monsoon (455.1 mm) and remaining during the North-East monsoon (149.6 mm), winter (4.7 mm) and summer (61.2 mm). The soils of demonstration fields are rainfed black soils.

The size of each FLD plot was 0.2 ha. Scientific interventions like improved varieties, seed treatment with carbendazim @3 g/kg of seed, integrated nutrient management, integrated pest management and integrated disease management practices were practiced in the demonstrated fields. Three improved chickpea varieties (Nandyal Gram-3, Nandyal Gram-49 and Nandyal Gram-452) were selected for these demonstrations and were distributed as critical inputs to the beneficiary farmers. The salient features of chickpea varieties are given in the Table 1.

The assessment was conducted to study the performance of improved varieties under recommended management practices in terms of its yield and cost economics. These varieties were compared with locally grown JG-11 variety. Apart from demonstrations, training programmes were also conducted to the farmers on integrated crop management practices. During two years of assessment the observations such as percent disease incidence of wilt and dry root rot (%), pods per plant (number), test weight (g), yield (kgha^{-1}), net returns and benefit cost ratio were recorded.

The results obtained during two years were analyzed using appropriate statistical tools *viz*., mean, standard deviation and the results were concluded at the respective levels of significances between means ($p<0.05$). The mean values of number of pods per plant, test weight and yield were calculated in 2019-20, 2020-21 and pooled data of two years. The technology gap, extension gap and technology index were calculated for Nandyal Gram 452 variety compared to locally grown variety JG-11 as per Samui *et al.* (2000).

Technology gap = Potential yield - Demonstration yield

Extension gap = Demonstration yield - Farmers practice yield

$$\text{Technology index (\%)} = \frac{\text{Technology gap}}{\text{Potential yield}} \times 100$$

RESULTS AND DISCUSSION

Yield attributes

During 2019-20, an average yield of 2258 Kg/ha was recorded with Nandyal Gram 452 and it was 9.72%, 13.41%, 20.75% higher than Nandyal Gram 49 (2058 kg ha^{-1}), Nandyal Gram-3 (1991 kg ha^{-1}) and JG-11(1870 kg ha^{-1}) respectively. During 2020-21, an average yield of 2210 kg ha^{-1} was recorded with Nandyal Gram 452 and it was 8.59%, 11.34%, 19.14% higher than Nandyal Gram 49 (2035 kg ha^{-1}), Nandyal Gram-3 (1985kg ha^{-1}) and JG-11(1855 kg ha^{-1}) respectively. (Table 2) and (Fig 1).

The pooled results of two consecutive years (2019-2021) revealed that significantly higher number of pods per plant (51.3) and high seed yield (2234 kg ha^{-1}) was

Table 1: Salient features of chickpea varieties.

Details	Variety	Type	Year of notification	Duration of variety (Days)	Specific features
Improved varieties	Nandyal gram 3	Desi	2013	90-100	Tolerant to drought, resistant to wilt and bold seeded
	Nandyal gram-49	Desi	2017	90-105	High yielding, tolerant to wilt with attractive seeds
	Nandyal gram-452	Desi	2020	90-105	High yielding, tolerant to wilt
Local variety	JG-11	Desi	1999	90-95	Locally adopted high yielding, variety

recorded in Nandyal Gram-452 followed by Nandyal Gram-49, Nandyal Gram-3 and JG-11, since the p-value was less than 0.05 in both the years as well as in pooled analysis (Table 2). But the high test weight was recorded in Nandyal Gram 3 (28.5 g) and Nandyal Gram 49 (27.5 g) as these two varieties produce bold seeds compared to Nandyal Gram 452 (25.65g) and JG-11 (24.05). Varieties with bold seeds (Nandyal Gram 3 and 49) can be grown as cash crop for selling green plants after the crop has attained grain filling. Higher economic returns can be obtained with such varieties when grown in and around towns. Hence it was concluded that there is significant difference among the chickpea varieties with regard to yield in which improved varieties significantly produced more yield than that of farmers' practice.

The improved varieties released from the RARS, Nandyal had shown their superior performance over locally grown variety under demonstrations conducted at farmer's field. Among the three improved varieties of chickpea, the Nandyal Gram-452 was proven its superiority in terms of yield and no.of pods per plant over other varieties. These results are in accordance with (Jayalakshmi *et al*., 2022 and Verma *et al*., 2019).

Disease reaction

As soil borne diseases are major limiting factors for chickpea production particularly in western part of Kurnool. Hence we introduced the improved chickpea varieties with tolerance to *fusarium* wilt to this area through these demonstrations. In the presented study, the incidence of *fusarium* wilt and dry root rot was recorded for two consecutive years during 2019-20 and 2020-21 in the demonstration fields (Table 3) in order to check its disease reaction. The results indicated that the mean per cent incidence of *fusarium* wilt (6.14%) and dry root rot (10.92%) was significantly low in Nandyal Gram-452 compared to JG-11 variety (15.83% of wilt and 18.19% of dry root rot). Jayalakshmi *et al*., 2022 also reported that Nandyal Gram 452 is moderately resistant to *Fusarium* wilt and recorded significantly less dry root rot incidence.

Cost economics

The highest net returns and benefit cost ratio was realized highest in Nandyal Gram-452 followed by Nandyal Gram-49 and Nandyal Gram-3 in both the years 2019-20 and 2020-21. The average higher net income (80486 Rs ha $^{-1}$) and benefit cost ratio (2.9) was realized in new improved

Table 2: Performance of chickpea varieties in 2019-20, 2020-21 and pooled.

Chickpea	No of pods/plant			Test weight (gm)			Seed yield kg ha^{-1}		
varieties	2019-20	2020-21	Pooled	2019-20	2020-21	Pooled	2019-20	2020-21	Pooled
JG-11	41.16	42.3	41.2	24.388	23.75	24.054	1870	1855	1862
Nandyal gram-3	44.72	45.5	45.1	28.16	28.85	28.50	1991	1985	1988
Nandyal gram-49	48.16	48.05	48.1	27.026	28.02	27.52	2058	2035	2046
Nandyal gram-452	50.88	51.75	51.3	25.52	25.79	25.65	2258	2210	2234
SD	0.521	0.68	0.61	1.87	1.47	1.67	61.2	60.5	60.8
t-Value	2.69	2.65	2.67	2.46	2.39	2..35	2.69	2.52	2.53
p-value	0.004*	0.001*	0.002*	0.004*	0.000*	0.001*	0.002*	0.002*	0.003*

*Significantly difference at 0.05% probability.

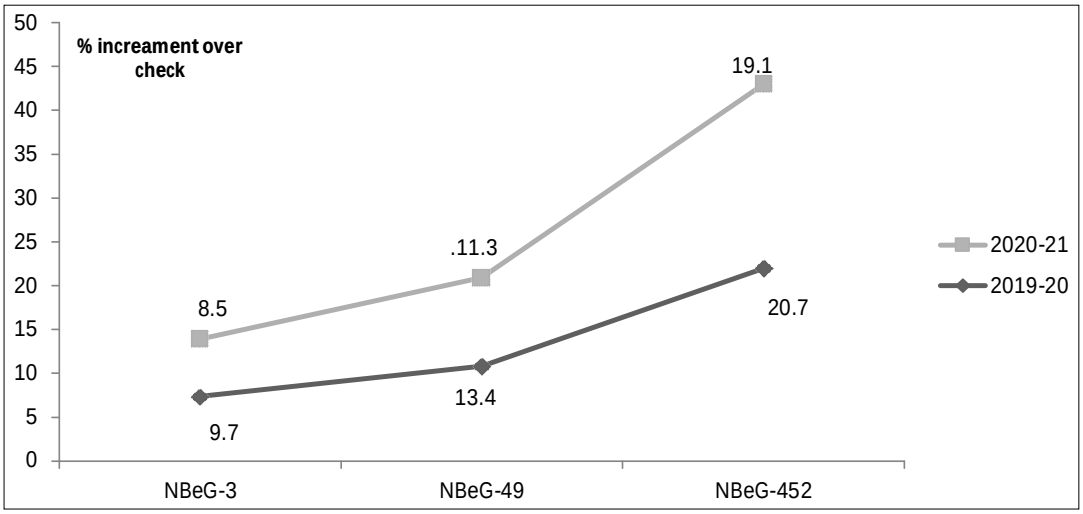

Fig 1: Per cent increase in yield of chickpea varieties over check in the years 2019-20 and 2020-21.

Table 3: The mean incidence of fusarium wilt and dry root rot in Nandyal gram 452 variety compared to other Nandyal gram varieties along with local cultivated variety (JG-11).

Chickpea varieties	Incidence of fusarium wilt (%)			Incidence of dry root rot (%)		
	2019-20	2020-21	Pooled	2019-20	2020-21	Pooled
JG-11	16.03	15.63	15.83	17.05	19.33	18.19
Nandyal gram-3	11.67	12.40	12.04	12.78	14.17	13.48
Nandyal gram-49	8.63	10.83	9.73	14.84	16.22	15.33
Nandyal gram-452	5.71	6.57	6.14	10.21	11.63	10.92
SD	4.41	3.77	4.07	2.92	3.26	3.06
t-Value	4.25	4.26	4.29	4.25	4.28	4.23
p-value	0.001*	0.002*	0.004*	0.001*	0.002*	0.003*

*Significantly difference at 0.05% probability.

Table 4: Economics of chickepea varieties in 2019-20, 2020-21 and pooled.

Years	2019-20			2020-21			Pooled		
Varieties	Gross returns	Net returns	BC ratio	Gross returns	Net returns	BC ratio	Gross returns	Net returns	BC ratio
JG-11	102190	58315	2.33	102850	58425	2.34	102520	58370	2.34
Nandyal gram-3	109670	65795	2.50	109505	65630	2.50	109588	65713	2.50
Nandyal gram-49	113190	69315	2.58	113190	69315	2.58	113190	69315	2.58
Nandyal gram-452	124487	80612	2.84	124234	80359	2.83	124361	80486	2.90

Nandyal Gram-452 variety. The average lower net income (58370 Rs ha $^{-1}$) and benefit cost ratio (2.3) was recorded in farmers' variety (Table 4). The highest net returns and benefit cost ratio in Nandyal Gram-452 variety is due to lowest incidence of pest and diseases and highest yields. The B:C ratio of 2.62 was reported with Nandyal Gram 49 and it was 1.99 with farmers practice JG-11 (Jayalakshmi *et al*., 2022) . The increased net returns were reported with JAKI 9218 variety in Madhya Pradesh (Singh *et al*., 2019).

In addition to cost economics, other parameters like technology gap, extension gap and technology index were calculated for the demonstration with Nandyal Gram 452 variety alone as it shown significant advantage over other two improved varieties (Nandyal Gram 3 and Nandyal Gram 49). The technology gap of demonstrated field (Nandyal Gram 452) was 142 kg ha^{-1} and 190 kg ha^{-1} during 2019-20 and 2020-21 respectively. This technology gap may be due to different management practices followed and different level of soil fertility present in the demonstrated fields. The extension gap of 388 kg ha^{-1} and 355 kg ha^{-1} was recorded during 2019-20 and 2020-21 respectively, this extension gap describes the need of create awareness among the farming community by implementing various extension programmes. An average technology index of 7.4% was observed with Nandyal Gram 452 demonstration fields during two consecutive years. Lower the technology index value indicates the feasibility of improved technology. The similar results were reported by Jayalakshmi *et al.* (2022); Singh *et al.* (2020) and Jadhav *et al.* (2022) in chickpea crop at different states of India.

CONCLUSION

In western parts of Kurnool district of Andhra Pradesh, three improved varieties of chickpea (Nandyal Gram 3, Nandyal Gram 49 and Nandyal Gram 452) released from RARS, Nandyal have shown better performance than locally grown variety JG-11. Among the three cultivars, Nandyal Gram-452 variety is a high yielding variety which has tolerance to wilt disease and gained attention of many farmers. It can be recommended as the best alternative to JG-11 in Kurnool district. The beneficiary farmers are playing a major role in transfer of technology to the neighbouring farmers. The CFLDs has shown greater impact on the adoption of high yielding improved varieties and adjoining farmers are adopting new varieties as well as other technology interventions.

Conflict of interest

All authors declare that they have no conflicts of interest.

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