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Research Article

UPSCALING OF BENGALGRAM YIELD BY CLUSTER FRONTLINE DEMONSTRATIONS IN RAIN SHADOW ANANTAPURAMU DISTRICT

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Abstract: The cluster frontline demonstration (CFLDs) on chickpea was conducted by Krishi Vigyan Kendra, Reddipalli. It was performed in three cluster villages namely Peddavuduguru, Regadikothur and Kondepalli during *rabi* season of 2017-18. The results revealed that improved high yielding variety (NBeG-47) + seed treatment + improved practices recorded highest yield 15.90 q/ha compared to farmer's practices (13.78 q/ha). The same trend was followed in gross returns and net returns of Rs 63600/- and Rs 39300/- for demonstration and Rs 55120/- and Rs 33120/- for farmers practice, respectively. The extension gap was 2.12 q/ha, whereas technology gap was 9.1 q/ha and technology index were 36.4. Returns per rupee of expenditure for demonstration and farmers practice were 2.6 and 2.5 respectively. It can be concluded that pulse production is enhanced by cluster front line demonstrations with the technologies followed by farmer. Chickpea crop responds to supplemental irrigation at flowering or pod formation stage, gives higher yield and yield attributes compared to rainfed crop. The combined effect of supplemental irrigation and demonstration reported higher pod yield, ranged from 38.2 to 47.6 % over rainfed cum farmers practice. Further reported that t Stat > t Critical, it means cluster front line demonstration is significantly superior with the farmers practice.

Keywords: *Cluster frontline demonstration, Chickpea crop*

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Introduction

Anantapuramu is the southern-most district of the Rayalseema region located in the rain-shadow region of Andhra Pradesh. In the district, red Alfisol soils are predominant, accounting for 78 percent, while black soils are found in 20 percent of the total geographical area. In the black soils of the Ananthapuramu district chickpea is the major crop. The area sown in Anantapuramu district is 73917 ha over a normal area of 68442 ha. Average chickpea yield remains low in the major chickpea producing countries due mainly to inadequate water supply. Over a period of time, a number of improved bengalgram varieties and production technologies have been developed, but full potential of these varieties as well as technologies could not be exploited due to lack of awareness on varieties, low rate of adoption and low yields. The Government of India had established a "Technology Mission on Pulses" in the year 1991-92 with the objective to enhance the pulse production and productivity. The concept of first line demonstrations was put forth under this mission. Front line demonstration programme was an effective tool for transfer latest package of practices to farmers. The main objective of this programme is to demonstrate newly released varieties and propagate newer technologies to farmers. The present study has been undertaken to study the difference between demonstration package and farmer's practices of bengalgram and to assess effect of CFLDs technology on increasing the productivity of bengalgram.

Materials and Methods

The present investigation of cluster front line demonstration was conducted in farmer's fields to popularize the effect of improved production technology on growth, yield attributes, pod yield and economics of chickpea in three cluster *viz*., Peddavuduguru, Regadikothur of Singanamala mandal and Kondepalli of Tadipatri mandal. It involves 50 farmers with an area of 1 acre each. The treatments consist of T1: improved production technology included newly released high yielding bengalgram variety NBeG-47, seed treatment with carbendazim @ 3g/kg and soil test-based fertilizer application. T2: farmers practice (JG 11 variety, no seed treatment, application of complex fertilizers and indiscriminate use of pesticides). Plot size for each treatment of cluster frontline demonstration was one hectare (10000 m2). The soil samples were collected from selected farmer's fields and analyzed at Krishi Vigyan Kendra, Reddipalli (Ananthapuramu district). Pre sowing trainings were organized involving the selected farmers to follow the package and practices for chickpea cultivation as recommended by the State Agricultural Universities and need based input materials provided to the farmers. Critical inputs for the technologies to be demonstrated were distributed to the farmers [Table-1].

Soils of the study area are mostly deep black Vertisols. The soil analysis revealed that pH varied from 7.8 to 8.2, EC ranged from 0.11 to 0.45 d S/m, organic carbon was 0.21 to 0.39 percent, available nitrogen was low in all the samples ranged from 137 to 222 kg/ha, available phosphorus was low to high (18 to 66 kg/ha) and available potassium was medium to high (158 to 357 kg/ha). The nutrient index indicates a general indication of the likely crop response to the particular soils and therefore a guide to the need for additional nutrient supplementation. The nutrient index can be calculated by the following formulae:

$$NI = \frac{\text{No of samples (low) X 1 + No of samples (medium) X 2 + No. of samples (high) X 3}}{\text{Total number of samples}}$$

Table-1 *Difference between technology interventions and farmers practice of under CFLD of chickpea*

SN	Particulars	Demonstration package	Farmers Practice
1	Variety	NBeG-47	JG-11
2	Seed rate	100-110 kg/ha	88-100 kg/ha
3	Seed treatment	Carbendazim 3g/kg seed	No seed treatment
4	Sowing method	Line with seed drill	Line with seed drill
5	Spacing	30x10 cm	30x10 cm
6	Fertilizer doses	Recommended dose of fertilizers (20kg N, 50 Kg P)	DAP (18-46-0) and neem cake @ 75 kg/ha
7	Plant protection measures	IPM module (Pheromone traps (10)+ Bird percher 50/ha+One spray of need based insecticides and fungicides (Carbendazim and Acephate or Quinolphos	Indiscriminate use of pesticides (Flubendamide and chlorontrinilipole)
8	Weed management	Application of glyphosate	Application of glyphosate

Table-2 *Rainfall data of study area during crop growth period (rabi, 2017)*

Mandal	Rainfall (mm)				
	Oct, 2017 (mm)	Nov, 2017 (mm)	Dec, 2017 (mm)	Jan, 2018 (mm)	Total Rainfall (mm)
Peddavadugur	126.9	0.7	0.0	0.0	127.6
Regadikothur	106.7	1.6	0.0	0.0	108.3
Kondepalli	142.5	5.8	0.0	0.0	148.3

Table-3 Mandal wise Overall performance of the Chickpea variety during *rabi*, 2017

Particulars	Regadikothur		Peddavadugur		Kondepalli	
	NBeG-47	JG-11	NBeG-47	JG-11	NBeG-47	JG-11
Sowing window	12.10.17	12.10.17	15.10.17	15.10.17	13.10.17	13.10.17
Harvesting window	21.01.18	21.01.18	28.01.18	28.01.18	26.01.18	26.01.18
Amount of rainfall received during crop growth period	109	109	128	128	149	149
Crop duration (days)	110	105	110	105	110	105
No. of rainy days during the crop period	4	4	5	5	4	4
Yield (kg/ha)	1410	1240	1650	1390	1720	1490

Table-4 *Yield and economics of NBeG-47 and JG-11 during rabi, 2017*

Practice	Plant height (cm)	No. of pods per plant	Grain yield (q/ha)	Cost of cultivation (Rs/ha)	Gross returns (Rs/ha)	Net returns (Rs/ha)	Returns per rupee of expenditure
NBeG-47	56.8	35	1590	24300	63600	39300	2.61
JG-11	36.5	29	1378	22000	55120	33120	2.50
% increase in yield			15.4%				

The soils of cluster villages studied were low in available nitrogen (<1.67) with value of 1.0. Medium in available phosphorus and available potassium (1.67-2.33) with a value of 1.81 and 2.0 respectively.

Extension gap= Demonstration Yield-Local check yield

Technology gap= Potential Yield-Demonstration yield

$$Technology\ index = \frac{Potential\ Yield - Demonstration\ Yield}{Potential\ Yield} \times 100$$

The yield data were collected from both the demonstration and farmers practice by random crop cutting method and analyzed by using simple statistical tools. In farmers practice 125 kg complex (14-35-14) fertilizers per hectare was applied. The crop was harvested at 95-100 days after sowing (DAS). At harvest ten plants were randomly selected from each treatment for recording growth parameters such as plant height (cm), number of pods/plant, 100 pod weight and 100 seed weight. At harvest in each treatment grain yield from the net plot (5x5 m) was recorded. Labour charges, cost of inputs was worked out to compute the cost of cultivation. Gross returns were calculated based on local market prices of chickpea and net returns by subtracting the total cost of cultivation from gross returns. Returns per rupee of expenditure was computed by dividing gross returns with cost of cultivation.

Results and Discussion

Weather condition

Monthly rainfall data during crop period of the experimental years are presented in [Table-2] & [Table-3]. Total rainfall in the three blocks *i.e.*, Peddavaduguru, Redgadikotturu, Kondepalli are 127.6mm, 108.3 and 148.3 distributed in 5, 4 and 4 rainy days respectively in the entire crop growth period. It is likely that the variation in temporal and spatial distribution of rainfall and its amount differentiated the crop growth and yields of the chickpea in the experimental blocks. The sowing window ranged from 9th to 13th during October, 2017 with a variation of 3 days in the experimental blocks, harvesting window varied from 21st to 28th of January, 2018 with a variation of a 7 days. The crop duration was 3-5 days long in NBeG-47 variety it might be due to plant takes 3-5 days long for flowering and pod development compared to JG-11 in all experimental clusters. The assessment from the above [Table-2] shows that most of the rainfall received in the 3 experimental blocks *viz.*, Peddavaduguru, Redgadikotturu, Kondepalli mostly during the seedling stage followed by the frequent dry spells. Growth and yield attributes: The performance of demonstration during *rabi* 2017 in different clusters is depicted in [Table-4]. The results revealed that plant height, no. of pods per plant and pod yield (q/ha) was higher in improved practices compared to farmers practice in rainfed and irrigated situations. From the fifty demonstration in all clusters, higher plant height of 56.8 cm was recorded with improved production technology compared to farmers practice (36.5 cm). This might be due to bengalgram variety NBeG-47 has character of comparable height than farmers practice. There was a greater number of pods per plant (35.0) in improved production technology as compared to farmer's practice (29.0), similarly higher test weight (28.5 g) than farmers practice (21.5 g).

Table-5 *Statistical analysis of yield data of chickpea practices*

	Demonstration	Farmers practice
Mean	16.00	12.33
Variance	7.26	5.56
Observations	49	49
Pooled Variance	6.41	
Hypothesized Mean Difference	0	
Df	96	
t Stat	7.186	
P(T<=t) one-tail	0.000	
t Critical one-tail	1.661	
P(T<=t) two-tail	0.000	
t Critical two-tail	1.985	

Table-6 *Plant parameters and pod yield of NBeG-47 and JG-11 under irrigated and rainfed conditions during rabi, 2017*

	Improved practices (NBeG-47)			Farmers practice (JG-11)		
Particulars	Supplemental Irrigation	Rainfed	% increase over rainfed	Supplemental Irrigation	Rainfed situations	% increase over rainfed
Plant height (cm)	68.1	47.2	30.7	44.2	34	23.1
No. of pods per plant	48	15	69	37	14	63
Grain yield (kg/ha)	2100	1100	4760	1700	1050	3820

Seed Yield

The seed yield of CFLD's plots was higher as compared to local check, which might be due to high yielding variety and package of practices followed under CFLD. The average seed yield was higher (15.90 q/ha) in demo plot compared to farmers practice (13.78 q/ha), which was 15.4 percent higher over farmers practice. The results clearly indicated that the higher average seed yield in demonstration plots as compared to farmers practice was due to knowledge and adoption of full package of practices improved variety (NBeG-47), The better yield of chickpea was observed might be due to the adoption of appropriate variety like NBeG-47, soil test based fertilizers application and seed treatment with carbendazim 3g/kg of seed. Need based plant protection measures effectively increased the chickpea yield compared to the yield observed under farmer's practices. Higher number of pods per plant, test weight might be the reason behind the yield increase in improved production technology. The lesser yield of chickpea at farmer's practices over CFLD may be due to the use old-age varieties instead of the recommended high yielding varieties, unavailability of seed in time and lack of awareness. Fluctuations in technology gap as observed may be due to several biotic and abiotic factors. These results are in close conformity with the findings of Hrish Kumar Rachhoya *et al*., 2018 [1]. Technological gap, which is the difference between potential and demonstration yield was 9.1 q/ha. Similarly, extension gap was 2.12 q/ha. Extension gap indicates that there was a tremendous scope of extension activities in the region. Mass awareness through print media (folder, leaflets and handbills) is the need of the hour. Package of practices for the chickpea crop as devised need to be followed strictly particularly seed rate, optimum application of nutrients and other management practices. The recommended packages of practices will definitely increase the yield and subsequently reduce the extension gap. Technology index was 36.4, it shows the feasibility of evolved technology at the farmer's field and lower the value of technology more is the feasibility of the technology [2,3].

Economical Assessment

Since grain yield as well as straw yield is more in the demonstration under front line demonstrations, but the cost of cultivation in demonstration was comparatively higher (Rs.24300/-) as compared to farmers' practice (Rs. 22000/-) because of additional input applied in demonstration. The gross return (Rs.55120/-) and net returns (Rs.33120) in farmer practice were lower than the gross return (Rs.63600/-) and net returns (Rs. 39300/-) of demonstration. A return per rupee of expenditure is following gross returns and net returns trend too which was found to be 2.6 in improved technology followed by farmers practice (2.5). The results reported [Table-5] that t Stat is > t Critical, it means cluster front line demonstration is significantly superior with the farmers practice. The mean of demonstration and farmers practice was 16.00 and 12.33 q/ha respectively.

Effect of irrigation

The occurrences of dry spell length and its consequence increase in evapotranspiration as well as loss of soil moisture. As a result, the chickpea crop water requirement increased and supplementary irrigation will require. Chickpea crop responds to irrigation during crop growth period and it gives higher yield and yield attributes compared to rainfed crop. One or two irrigation at flowering stage or pod formation stage showed higher yield than rainfed situations. The results showed that [Table-3] higher percent increase in plant height, no. of pods and pod yield over rainfed situation in both demonstration and farmers practice. The increase in pod yield is 38.2 to 47.6 % due to improved practices and demonstration. This might be due to greater absorption of nutrients from soil to root under moisture availability and their translocation to active plant parts and results in highest grain yield too this is in conformity with results of

Conclusion

It was concluded that new varieties under demonstration performed better with an average grain yield of 15.9 q/ha that was 15.4 percent higher yield over farmers practice. The practice of improved varieties and technologies has created greater awareness and motivated the other farmers to adopt suitable production technology of chickpea. However, the highest increase in chickpea grain yield can be achieved through combined application of suitable cultivars, seed treatment, soil test based fertilizer application and supplemental irrigation.

Application of research: Technological and extension gaps existed which can be bridged by popularizing package of practices with emphasis on use of proper seed rate and balanced nutrient application. Replacement of local variety with the released variety would increase the production and productivity.

Research Category: Agriculture Extension

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Study area / Sample Collection: Peddavuduguru, Regadikothur of Singanamala mandal and Kondepalli of Tadipatri mandal

Cultivar / Variety name: Bengalgram NBeG-47

Conflict of Interest: None declared

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.
Ethical Committee Approval Number: Nil

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