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Yield Enhancement in Groundnut through Cluster Front Line Demonstrations in Farmers Fields of West Godavari District, A.P, India

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

The Krishi Vigyan Kendra, Undi has carried out Cluster Frontline Demonstrations (CFLD) with integrated crop management practices in Groundnut at Turputalla village in farmers fields of West Godavari disttict in Andhra Pradesh, India in 10 ha area during *Rabi*, 2024-25. The results revealed that higher number of pods/plant (28) were registered with CFLD plot when compared to farmers practice. The higher fresh pod yield i.e., 40.6 q/ha was realized with CFLD demonstrated plot, which was 6.7 % more compared to farmers practice with 38.05 q/ha R*abi*, 2024-25. The Gross returns and net returns of Rs. 203000, 96,870/- per ha and B:C ratio of 1.91were also higher with demonstration plot compared to farmers practice plot (Rs. 190250, 79500 per ha and 1.71). Yield enhancement and higher net returns were observed with improved varieties and production

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technology. An average technology gap of 4.4 q/ha extension gap of 2.55 q/ha was recorded during Rabi, 2024-25. The technology index was 9.70 per centwhich shows good performance of Cluster demonstrations in Turputalla conditions and this will accelerate the adoption of newer technologies to increase the productivity of groundnut in this area. Thus, the study resulted to convincing the farming community for adopting recommended improved package of practices in groundnut which in turn enhanced the yield and returns.

Keywords: CFLD; groundnut; extension gap; technology gap.

1. INTRODUCTION

Groundnut, scientifically known as *Arachis hypogea* L., an important oilseed crop cultivated in kharif, rabi and summer seasons, whether rain-fed or irrigated. worldwide, Groundnut cultivated in 32.7 million hectares area and produce 31.43 million tonnes with a production of 1648 kg per hectare (Groundnut crop outlook report 2023-24). Wheras in India it is grown in an area of 47 lakh ha with a production and productivity of 101.8 lakh t and 2163 kg/ha, respectively. Andhra Pradesh, Tamil Nadu, Gujarat, Karnataka and Maharashtra are the major groundnut producing states.

Given its abundance of protein, oil, and other beneficial nutrients, groundnuts are also known as "wonder nut" and "poor men's cashew nut. " Groundnut kernel contains 44- 56% oil and 22-30% protein on a dry mass basis. It contains essential vitamins (E, K, and B group) as well as calcium, magnesium, potassium, and phosphorus minerals (Ingale & Shrivastava, 2011). Groundnut provide about half of the 13 essential vitamins and seven of the 20 essential minerals required for human growth and development besides act as high quality fodder for animals.

A leguminous crop's inclusion in a cropping system guarantees food security, as well as a number of environmental, economic, and health advantages, in addition to addressing a number of agro-ecological issues.

In Andhra Pradesh it is cultivated in 3.1 lakh ha area with 3.23 lakh t production and 1038 kg/ha productivity. However, a number of limitations result in a significant yield gap between potential and actual production. These limatations include labour shortage, depending on traditional farming practices such as use of old, low-yielding varieties, broadcasting method for sowing and inadequate plant population along with a lack of seed treatment (Saravanan et al., 2018), not adopting crucial inputs application and recommended fertilizer doses (Patil et al., 2018). In addition to the above constraints, farmers are not applying gypsum during peg formation (25 DAS), and frequent irrigations have led to excessive growth without Integrated Pest Management (IPM) or Integrated Disease Management (IDM) practices result in a significant yield gap.

“Poor seed quality, poor nutrient management, and a lack of knowledge about pest and disease control are the main causes of Andhra Pradesh's low groundnut output. Groundnut output is majorly hampered by the "technology gap," i.e lack of awareness regarding recently released crop production and protection technologies and their management in farmers fields (Venkatreddy & Kumarprabhu, 2017).

The nation's per capita edible oil consumption has skyrocketed to 19.7 kg annually. Because domestic output has been far surpassed by this spike in demand, there is a large reliance on imports to meet industrial and home demands. India imported 16.5 million tonnes (MT) of edible oils in 2022–2023, with domestic production only meeting 40–45% of the nation's needs. This condition poses a significant obstacle to the nation's objective of becoming edible oil self-sufficient. In order to increase oilseed production and guarantee nutritional security in the nation, it is imperative that local resources be utilized.

The domestic market for vegetable fats and oils has been expanding at a rate of 6% annually, whereas our domestic production has been merely growing by around 2%. In comparison with other nations, India's average oilseed yield is incredibly low (Priyadarshini et al., 2025).

Lack of knowledge about scientific production technologies, such as novel varieties, seed treatment with fungicides, insecticides and biofertilizers, and soil test-based nutrient management are the major reasons for low productivity of groundnut in the district. Adoption of recommended scientific and sustainable

management production practices with improved high yielding varieties and other critical inputs through CFLDs could increase the groundnut productivity. Good quality seeds, timely sowing, applying the recommended fertilizer dosage at the appropriate time, appropriate method and putting in place need-based plant protection measures against insect pests and diseases are some strategies to overcome low productivity and boost groundnut productivity and profitability. To enhance sesame production, ICAR-ATARI, Zone-10, Hyderabad organized CFLDs on sesame crop in Andhra Pradesh, Tamil Nadu and Telangana states under National Food Security Mission (NFSM). The demonstration's main goal was to demonstrate and spread improved agricultural technology in farmers' fields so that farmers could acquire technological know-how in their own farms. Therefore, the Indian Council of Agriculture and Research (ICAR) introduced a program called “Cluster Frontline Demonstration” (CFLD) for Oilseeds in 2015-16 implemented through ICAR- ATARI by KVKs to improve production, productivity and profitability in oilseeds (Swami & Verma, 2022; Kumar et al., 2019). KVK scientists closely supervise and monitor CFLD plots to ensure its efficacy. The main objective of this approach is to increase productivity and economic returns besides promoting sustainability.

In light of this, Krishi Vigyan Kendra, Undi has started Cluster Front Line Demonstrations in Groundnut in farmers' fields in the West Godavari District to examine groundnut productivity over the course of seasons and harvests as well as the yield advantages with improved package of practices followed in CFLD plots.

2. MATERIALS AND METHODS

The present study was conducted by krishi Vigyan Kendra, Undi during Rabi, 2024-25. A total of 25 farmers were selected for conducting CFLDs on groundnut with an area of 10 hain farmers fields of Turputalla village of West Godavari district, Andhra Pradesh. The experimental soil was sandy loam in texture, neutral in reaction with low to medium in fertility. Farmers are cultivating groundnut for boiled nuts.

2.1 KVK Intervention

The Improved management practices (IMPs) demonstrated were TCGS 1694 variety (high yielding and tolerance to foliar diseases like early leaf spot, late leaf spot, and rust and also moderately tolerant to leaf miner and thrips), nutrient management @ 20:40:50 kg NPK/ha + 500 kg gypsum on 40- 45 DAS. Sowings were taken up between first fort night of November to Second fort night of November. The basal application of entire dose of nitrogen, phosphorus and potash, application of gypsum @ 500 kg/ha at 45 days after sowing were demonstrated across all the CFLD fields. The integrated pest and disease management strategies i.e installation of yellow sticky traps @ 25/ha to attract sucking pests, pheromone traps and timely need based management practices were taken. The farmers practice consists of use of old seed variety (Tag 24), imbalanced use of fertilizers and plant protection measures. Before conducting the demonstrations, group discussions and training programme on production technology of groundnut were conducted to create awareness among farmers about the demonstrated technology and how it differ from farmers practice.

The observations like no. of plants/m^2, number of pods/plant, no.of seeds/pod and yield were recorded at harvest from demonstrated as well as farmer’s practiced plot. Gross returns (Rs/ha) were calculated on the basis of the prevailing market price of the groundnut, Net return (Rs/ha) was calculated by deducting the cost of cultivation from gross return. B:C ratio was calculated by dividing the total cost of cultivation by gross return. Different parameters were used for analysing the “technology gap, technology index, extension gap and economic parameters in comparison with farmers’ practice, the percent yield comparison of enhance practice with local check, district and state averages was computed (Yadav et al., 2004). The details of different parameters and formula adopted for analysis are as under.

Extension gap = Demonstration yield - Farmers’ practice yield

Technology gap = Potential yield - Demonstration yield

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

2.2 Training

Pre-sowing trainings were organized by involving the selected farmers on groundnut crop to create awareness and improve the associated skill gap on improved agronomic practices of groundnut

Table 1. Particulars showing the details of groundnut grown under cluster based FLDs and farmers' practice

Operation	Farmers' practice	Improved practices demonstrated under Cluster based FLDs
Farming situation	Rainfed-sandy soils	Rainfed-sandy soils
Time of sowing	Second fortnight of November	Second fortnight of November
Sowing	Broad casting of seed	Dibbling
Use of variety	TAG 24	TCGS 1694
Early and late leaf spot tolerance	No tolerance	Tolerant variety
Rust tolerance	No tolerance	Modarately tolerant
Weed management	Hand weeding at 15 DAS	Weeds control by using herbicide Pendimethalin 1kg / acre in 200 litre of water as pre-emergence treatment for effective control of weeds within two days after sowing followed by hand weeding at 20 DAS
Nutrient management	Fertilizer application lower than recommended dose and no gypsum application	20:40:50 kg NPK/ha + 500 kg gypsum on 25- 30 DAS
Whole package	Farmers are cultivating the groundnut crop without adoption of any improved technology	All the crop (production and protection) management practices as per package of practices for groundnut crop by ANGRAU were followed for raising the crop

technology. Various awareness-raising initiatives were carried out at every stage of the groundnut production process with respect to seed treatment, fertilizer application, water and weed management and integrated pest and disease management etc.

3. RESULTS AND DISCUSSION

3.1 Monitoring and Evaluation

From the initial preparation of the field to the last harvest, monitoring was done. Throughout the monitoring process, regular contact was maintained with participating farmers in order to gather their input and offer technical guidance.

3.1.1 Field day

A field day was conducted in Turputalla village cluster at harvesting stage with involving demonstration holding farmers, neighbouring farmers, scientists from KVK, officials from Department of Agriculture and local extension functionaries to demonstrate the superiority of the technology. In addition to using pamphlets and local media to increase the technology's popularity, a discussion session was planned at the field day to raise awareness of demonstration farmers through experience sharing.

3.2 Practicing Farmers' Trait Preference of Improved Groundnut Production

"A cluster-based approach offers several benefits, including increasing beneficiaries' involvement in choosing technologies that meet their preferences for sustainable technology diffusion and facilitating experience sharing, collaboration, resource efficiency, and input access for yield maximization". Thus, practicing farmers identified six common preference parameters to compare improved variety (TCGS 1694) with TAG 24. The parameters were weighted according to their importance to be used as comparison, then technology with greater percentage from the total was selected as primary choice. The overall weighted ranking matrix result shows that improved groundnut variety (TCGS 1694) was the first choices of practicing farmers in all parameters. The production practice of groundnut is with irrigation by flooding irrigation system, practicing farmers' given high score for early maturation, disease resistance, high yielding and marketability of improved groundnut as compared to the locally available TAG 24 (Table 2). Farmers were not aware about recommended technologies. In general, farmers used local or age old varieties instead of the recommended high yielding and disease resistant varieties. Unavailability of seed

in time and lack of awareness were the main reasons.

3.3 Number of Pods/Plant and Pod Yield

Perusal of data from Table 3 revealed that the number of pods/plant (28) were higher in CFLD demonstrated plot compared to farmers practice plot (25). Adoption of improved package of practices under CFLD in Groundnut realized higher groundnut pod yield i.e., 40.60 q/ha which was 6.7 % more compared to farmers practice i.e., 38.05 q/ha during R*abi,* 2024-25. The more yield in demonstration plot was might be due to incorporation of high yielding, tolerance to early and late leaf spot, rust and integrated nutrient and pest management practices. The appropriate application of suggested technology packages, including the use of the enhanced variety, pesticides, seed rates, and sound management techniques, resulted in this larger yield benefit. Similar to present findings, the yield improvement through adoption of developed technology has also been reported in earlier studies of CFLD's (Pawar et al., 2018; Undhad et al., 2019).

3.4 Gross Returns, Net Returns and B:C Ratio

The cost of cultivation was less i.e., 106130 R./ha in CFLD demonstrated plot compared to farmers practice plot (110750 Rs. /ha). The higher gross returns (Rs. 203000/ha) were recorded with CFLD plot compared to farmers practice i.e., Rs.190250/ha. The net returns of Rs. 96870/- per ha and B:C ratio of 1.91 were also higher with demonstration plot compared to farmers practice plot (Rs. 79500 per ha and 1.71) during *Rabi* 2024-25. Lower cost of cultivation observed in CFLD demonstrated plot might be due to less pest and disease incidence. The CFLD plot showed higher returns due to enhanced technology, non-monetary variables, timely crop cultivation operations, scientific monitoring, and seed sales to other farmers. The increase in gross returns, net returns and B:C ratio were due to low cost of cultivation as the disease incidence was low, increase in yield and price of the produce was also more in demonstration plot due to bold nature of the seed (Ramesh et al., 2023; Venkatasubbaiah & Jyothi, 2019; Lakhani et al., 2020).

Table 2. Preference of practicing farmers on improved variety (TCGS 1694) and local variety (TAG 24)

	Improved Variety			Local variety		
Parameters	**Score**	**weight**	**Score*weight**	**Score**	**weight**	**Score*weight**
Oil content	3	1	3	2	1	2
Disease/pest/ resistance	3	2	6	1	2	2
Seed color	3	3	9	3	3	9
Yield	3	5	15	2	5	10
Marketability	3	4	12	2	4	8
Sum of Score *weight	45			31		
Rank	1			2		

Score = (1= low 2= medium 3= high) & weight = (1=early maturity 2=disease resistance 3=seed colour 4=marketability 5=yield 6=drought resistant

Table 3. Effect of Cluster Frontline Demonstrations on number of pods/plant, Yield and Economics of Groundnut

S. No.	Particulars	Rabi, 2024-25	
		CFLD plot	**Farmers practice**
1	No.of pods/plant	28	25
2	Average fresh pod yield (q/ha)	40.60	38.05
3	Increased yield (%)	6.70	-
4	Gross returns (Rs./ha)	203000	190250
5	Cost of cultivation (Rs./ha)	106130	110750
6	Net returns (Rs./ha)	96870	79500
7	B: C ratio	1. 91	1.71

Table 4 Impact of technological intervention on gap analysis in Groundnut during 2024-25

Season	Fresh Pod Yield (q/ha)			Technology gap (%)	Extension gap (%)	Technology Index (%)
	Potential	CFLD	Farmers practice			
Rabi	45	40.60	38.05	4.40	2.55	9.7

3.4.1 Technology gap

An average technology gap of 4.4 q/ha (Table 4) was calculated during the demonstration period. The data reflects that there is further potential for increasing yield by implementation of better technological interventions and ultimately lowering down technology index. The technological gap may be attributed to the dissimilarity in the soil fertility status and weather conditions.

3.4.2 Extension gap

An extension gap of 2.55 q/ha (Table 4) was recorded during Rabi, 2024-25. This emphasized the need to educate the farmers through various means for the adoption of improved agricultural production technologies to reduce the extension gap. Use of latest production technologies with high yielding variety will subsequently lower down the extension gap. Hence, there is a need to disseminate the improved technologies among the farmers with effective extension methods like training and demonstrations. The farmers' should be encouraged to adopt the recommended package of practices including HYV to revert the trend of wide extension gap and for realizing higher returns. This finding is in corroboration with earlier findings (Natarajan et al., 2024).

3.4.3 Technology index

Technology index is another important tool for judging the adoption and impact of different technologies. Farmers will gradually abandon older types in favour of the new technologies. The technology index illustrates how feasible the advanced technology is for farmers' fields. The technology index indicates if the advanced technology is practical for farmers. It is derived as the ratio between technology gap and potential yield in terms of percentage. Lower value of technology index means better performance of technological intervention. In the present study, technology index was 9.70 per cent which shows good performance of Cluster demonstrations in Turputalla conditions and this will accelerate the adoption of newer technologies to increase the productivity of groundnut in this area (Table 4). More variation in technology index might be due to variation in existing weather condition, soil fertility status and pest and disease infestation (Sasikumar & Rathika, 2023).

3.5 Farmers' Feedback

At the end of the demonstration, feedback was collected from participants to know their perception of the technology. Accordingly, they show their interest regarding the new groundnut variety in comparison with their local one as the TCGS 1694 variety tolerates early leaf spot, late leaf spot and rust and also moderately tolerates leaf miner and thrips. The criteria used to evaluate groundnut production technology was its oil content, early maturity, disease resistance, seed colour, marketability and overall yield relative to local.

4. CONCLUSION

Based on the study, it can be concluded that Cluster front line demonstrated plot recorded higher fresh pod yield, number of pods per plant, gross returns and net returns compared to farmers practice and farmers are convinced with new high yielding variety with improved production technologies in groundnut. As a result, it can be said that groundnut technology contributes to revenue and ought to be expanded. The beneficiary farmers of CFLD's also play an important role as source of information for wider dissemination of the high yielding varieties of groundnut for other nearby farmers. Krishi Vigyan Kendra, Undi had formed a considerable effect on the increase in yield and income of groundnut growers in the West Godavari district through new varieties introduction and yield maximizing technologies under CFLD.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image

generators have been used during writing or editing of this manuscript.

COMPETING INTERESTS

Authors have declared that they have no known competing financial interests or non-financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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