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Impact Analysis of Cluster Frontline Demonstrations on Groundnut in Nalgonda District, Telangana

Shankar Marlabeedu[1]*, Tejavath Bharath[2], Surapaka Pallavi[3], Tanguturi Himabindu[4], Mekala Shankaraiah[5] and Katragadda Sumalini[6]

[1]Subject Matter Specialist (Crop Protection), [2]Subject Matter Specialist (Crop Production), [3]Subject Matter Specialist (Extension), [4]Subject Matter Specialist (Horticulture), [5]Programme Coordinator, Krishi Vigyan Kendra, Kampasagar, Professor Jayashankar Telangana State Agricultural University, Nalgonda-508207, Telangana, India
[6]Senior Scientist, Agricultural Research Station, Kampasagar, Professor Jayashankar Telangana State Agricultural University, Nalgonda-508207, Telangana, India
*Corresponding author email id: shankar.ento2007@gmail.com

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ABSTRACT

The present study was conducted to analyze the yield gap between improved package of practices and farmers' practice during *rabi* 2016-17 to 2020-21 in CFLDs on groundnut. The highest average pod yield was obtained in CFLDs (2341.6 kg/ha), with 27 per cent more against farmers' practice (1843.6 kg/ha). The average extension gap, technology gap and technology index were 498.0 kg/ha, 658.4 kg/ha and 21.9 per cent, respectively. Sustainability yield index (0.78) and sustainability value index (0.84) averages were high in improved practice over the farmers' practice (0.76 and 0.75). The average gross returns (Rs. 1,28,283.0/ha), net returns (Rs. 71,934.0/ha) and benefit-cost ratio (2.6) were higher in improved practice when compared to farmers' practice. The mean of additional gross returns (Rs. 24,873.0/ha), cost of cultivation (Rs. 4,151.0/ha), net returns (Rs. 28,402.0/ha) with incremental benefit-cost ratio of 6.0 was observed in improved practice. The average yield gap percentages within district and state averages were 64.2 per cent and 45.6 per cent, respectively. The per cent increased horizontal spread of area under groundnut was 14.1 per cent, 23.9 per cent and 27.5 per cent during study period, whereas in 2016-17 and 2018-19 per cent horizontal spread area decreased -52.3 per cent and -15.9 per cent, respectively with cultivation of improved varieties i.e., K-9 and ICGV 3043 against cultivation of old traditional varieties.

INTRODUCTION

Groundnut (*Arachis hypogea* L.) is a major oilseed crop in India, cultivated under both rain-fed and irrigated conditions during *Kharif*, *Rabi* and *Summer* seasons. The groundnut crop contributing around 37 per cent of the total oilseed production in India. The acreage in the country is fluctuating over the years and the area is declined from 87 lakh ha to 47 lakh ha from the last two decades. The farmers are shifting from groundnut to other remunerative crops due to low minimum support price and fluctuations in market prices. The groundnut is cultivated in an area of 4.8 million ha with a production of 6.8 million tonnes with productivity of 1422.0 kg/ha. In Telangana, groundnut occupies an area of 1.0 lakh ha with production of 2.4 lakh tonnes and with an average productivity of 2350.0 kg/ha (Anonymous, 2020). In Nalgonda district, it is being cultivated in 47 per cent of the area under irrigation with 54 per cent production. Productivity of groundnut in Nalgonda under irrigated and rain-fed conditions were 1106.0 kg/ha and 885.0 kg/ha, respectively. Groundnut productive potential was high in Nalgonda due to cultivation in red sandy loams soils, assured irrigation facilities through the sprinkler system, availability of major and minor micronutrients like nitrogen and phosphorus and potash, sulphur, boron, iron and

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zinc (Srinivasarao et al., 2013). A wide yield gap between potential yield and actual yield was observed due to major production constraints *i.e.,* scarcity of labour, adoption of traditional cultivation practices like use of low yielding varieties (Rai et al., 2020 & Mahalae et al., 2014), broad casting method of sowing, poor plant population and no seed treatment (Saravanan et al., 2018), non usage of critical inputs, non adoption of recommended dose of fertilizers (Kumar et al., 2010; Nain et al., 2014; Patil et al., 2018), non- application of gypsum at peg formation (25 DAS), frequent irrigations favoring luxuriant crop growth and non-adoption of IPM and IDM practices (Rai et al., 2013; Tankodara et al., 2018 & Ayyadurai et al., 2021) and more fluctuations in minimum support price (Venkatreddy & Kumarprabhu, 2017).

The technology gap is a major constraint in increasing yield and sustainability due to poor knowledge on the latest improved technologies among farmers in groundnut cultivation (Venkatreddy & Kumarprabhu, 2017 & Pawar Yogesh et al., 2018). Cluster Frontline Demonstrations (CFLDs) is an unique approach with the main objective of conducting demonstration in larger area on the farmers' field and creating awareness on the latest crop production technologies among the farmers (Raghava & Punnarao, 2013; Shaktawat & Chundawat, 2021). In keeping view of this, KVK, Kampasagar had planned and executed Cluster Frontline Demonstrations with improved technologies in groundnut under different farming situations with closer supervision and monitoring of the KVK Scientists which helps in increasing productivity, economic returns, and sustainability and to analyze yield gap and technology gap and impact of technology in groundnut cultivation with the best management practices.

METHODOLOGY

Cluster Frontline Demonstrations (CFLDs) were conducted by Krishi Vigyan Kendra, Kampasagar, Nalgonda District, Telangana with the latest improved crop production technologies in groundnut during five consecutive *rabi* seasons *i.e.* from 2016-17 to 2020-21. The CFLDs were conducted in six selected clusters in Nalgonda district *i.e.* Nandivarigudem, Madugulapally, Indugula, Dindi, Jalthanda and Duggaepally of different farming situations under National Mission on Oilseeds and Oil Palm (NMOOP). The selection of beneficiaries was through Participatory Rural Appraisal (PRA) technique, baseline survey, later active meetings, group discussions, and field diagnostic visits. A total of 300 demonstrations were conducted in five consecutive *rabi* seasons i.e. from 2016-17 (50 No.), 2017-18 (100 No.), 2018-19 (50 No.), 2019-20 (50 No.) and 2020-21 (50 No.).

The improved technology was demonstrated in one acre area of selected farmers' field and adjacent one acre was considered as control plot of same the farmer. To study the yield gap between potential and actual yields, beneficiaries were selected through group discussions. The selected beneficiaries were given pre-seasonal training and briefed about the improved package of practices for successful implementation of CFLDs, and provided the need based critical inputs for an area of one acre *viz*., groundnut seed of K-6 and ICGV 3043, seed treatment with tebuconazole @ 1 g/kg seed, Imidacloprid @ 1 ml/7ml of water for one kg seed, *rhizobium* @ 10 g/kg seed and *Trichoderma viride* @ 10 g/kg seed, pheromone traps @ 10/ha for monitoring of *Spodoptera* moths, spraying of pre-emergence and post-emergence herbicides, and spraying of need based plant protection chemicals was done to control of pests and diseases.

The percent yield comparison of improved practice with local check, district and state averages were calculated and also assessed the yield impact, impact of adoption and horizontal area spread. The technology gap, extension gap, technology index, and economic parameters were compared with farmers' practice.

$$\text{Impact yield} = \frac{\text{Yield of Improved practice} - \text{Yield of Farmer's practice}}{\text{Yield of Farmers' practice}} \times 100$$

Extension gap = Improved practice Yield – Farmers' practice Yield

Technology Gap = Potential Yield – Improved practice Yield

$$\text{Technology Index} = \frac{\text{Potential Yield} - \text{Improved Practice Yield}}{\text{Potential Yield}} \times 100$$

$$\text{Impact on horizontal spread area (change \%)} = \frac{\text{Area after demonstration} - \text{Area before Demonstration}}{\text{Area before Demonstration}} \times 100$$

Sustainability indices were calculated through (Sustainability Yield Index and Sustainability value index) following formulae.

$$\text{SYI/SVI} = \frac{\text{Y-O}}{Y_{max.}}$$

Whereas, Y=Estimated average yield/Net return of practices over the year,

O= Standard deviation,

$Y_{max.}$= Maximum yield/Maximum net return

RESULTS AND DISCUSSION

Adoption gap

The adoption gap is an important factor influencing productivity of groundnut. The yield gap analysis was evaluated

Table 1. Performance of improved technology on pod yield, extension gap, technology gap and technology index in groundnut during *rabi* 2016-17 to 2020-21

Year	No. of Demos	Variety		Yield (kg/ha)		Increase of yield over the control (%)	Extension gap (kg/ha)	Technology gap (kg/ha)	Technology index (%)
		Improved practice	Farmers' practice	Improved practice	Farmers' practice				
2016-17	50	K-9	K-6	2284.0	1520.0	50.3	764.0	716.0	23.9
2017-18	100	ICGV 3043	K-6 & TAG 24	2210.0	1973.0	12.0	237.0	790.0	26.3
2018-19	50	K-9	K-6 & TAG 24	3334.0	2375.0	40.4	959.0	-334.0	-11.1
2019-20	50	K-9	K-6	2130.0	1950.0	9.2	180.0	870.0	29.0
2020-21	50	K-9	K-6	1750.0	1400.0	25.0	350.0	1250.0	41.7
Mean	300	Average		2341.6	1843.6	27.0	498.0	658.4	21.9

through extension gap, technology gap and technology index. The extension gap was ranged from 180.0 to 959.0 kg/ha during the investigation period with an average of 498.0 kg/ha during five consecutive years (Table 1). Need arisen to educate the farmers on adoption of improved technologies as a wide gap between improved practice *vs* farmers' practice was observed. The technology gap varied from -334.0 to 1250.0 kg/ha during the study period (Table 1). The technology gap was higher and reflecting on farmers' due to non cooperation on demonstration of improved technologies and poor extension activities. This might be attributed to different parameters, viz. soil fertility status, crop suitability, and variations among dates of sowing and weather parameters. Similar observations were reported by Kumbhare et al., (2014); Nain et al., (2015); Jyothi & Subbaiah (2019); Pawar et al., (2018) & Rai et al., (2020); Strengthening of extension programs and location-specific on-farm research, encouragement and adoption of the improved package of practices lower the technology gap.

The technology index is dependent on the technology gap, and it is expressed in percentage (%). The higher value of technology index shows lower adoption of improved technologies by the farmers. The technology index of five years in demonstrations ranged from -11.0 to 42.0 per cent with an average of 22.0 per cent (Table 1). The lower technology index was observed (-11.0%) during *rabi* 2018-19 due to the interventions of KVK Scientists, adoption of the improved practices by the farmers. Timely and need based suggestions by KVK scientists, extension personnel, favorable climatic conditions and low incidence of pests and diseases favoured lower technology index. These findings were in conformity with Reager et al., (2020); Pawar et al., (2017 & 2018) in groundnut, and Shaktawat & Chundawat, (2021) in oilseed crops and Singh (2022) in Wheat.

Economic returns

The economics returns mainly depend on yield, variable cost, and fluctuations between minimum support price and market price. The values of input cost and labour wages varied from time to time. The higher average cost of cultivation (Rs. 50,349.0/ha), gross returns (Rs. 1,28,283.0/ha) and net returns (Rs. 71,935.0/ha) were recorded in improved practices with an average benefit-cost ratio of 2.6 when compared to farmers' practice (Rs. 54,500.0, 1,03,410.0 and 43,532.0/ha, respectively) with an average benefit-cost ratio of 1.9. These results were at par with Venkatasubbaiah et al., (2019) & Ayyadurai et al., (2021) who reported the higher net returns and high benefit cost ratio in groundnut. Further, it was observed that on the average of five years, an additional gross returns of Rs. 24,873.0/ha, saving on cost of cultivation for Rs. 4,151.0/ha and net returns of Rs. 28,402.0/ha in improved practice were observed against farmer's practice with an incremental benefit-cost ratio of 6.0 (Table 2). These results were in conformity with that of PawarYogesh et al., (2017) & Saravanan et al., (2018); Reager et al., (2020); Rai et al., (2020); who observed higher benefit-cost ratio through improved technologies in groundnut and Leyak et al., (2021) in mustard and Saravankumar et al., (2020) in urd crop.

Yield sustainability

The higher values of the Sustainability Yield Index (SYI) and Sustainability Value Index (SVI) were observed in improved practice

Table 2. Impact of improved technologies on economics of groundnut during *rabi* 2016-17 to 2020-21

Year	Gross returns (Rs/ha)		Cost of cultivation (Rs/ha)		Net returns (Rs/ha)		B:C ratio		Additional returns in improved practice			
	Improved practice	Farmers practice	Improved practice	Farmers practice	Improved practice	Farmers practice	Improved practice	Farmers practice	Additional gross returns (Rs/ha)	Additional cost of cultivation (Rs/ha)	Additional net returns (Rs/ha)	Incremental B : C ratio
2016-17	111925.8	68400.0	39895.8	40900.0	42030.0	31500.0	2.8	1.7	43525.8	1004.2	10530.0	43.3
2017-18	93525.0	81880.0	49125.0	58125.0	44400.0	23755.0	1.9	1.4	11645.0	9000.0	20645.0	1.3
2018-19	153341.0	131567.0	52663.0	57026.0	100678.0	43652.0	2.9	2.3	21774.0	4363.0	57026.0	5.0
2019-20	133875.0	116204.0	54460.0	57930.0	79415.0	58273.5	2.5	2.0	17671.0	3470.0	21141.5	5.1
2020-21	148750.0	119000.0	55600.0	58520.0	93150.0	60480.0	2.7	2.0	29750.0	2920.0	32670.0	10.2
Average	128283.0	103410.0	50349.0	54500.0	71935.0	43532.0	2.6	1.9	24873.0	4151.0	28402.0	6.0

Table 3. Effect of production practices on Sustainability Yield Index (SYI) and Sustainability Value Index in groundnut during *rabi* 2016-17 to 2020-21

	2016-17		2017-18		2018-19		2019-20		2020-21		Mean	
	IP	FP	IP	FP	IP	FP	IP	FP	IP	FP	IP	FP
Max	2625.0	1830.0	2350.0	2180.0	3800.0	2950.0	2240.0	2140.0	2050.0	1800.0	2613.0	2160.0
Min	1969.0	1200.0	1950.0	1860.0	2625.0	2010.0	2000.0	1860.0	1450.0	1200.0	1998.8	1626.0
Av	2284.0	1520.0	2210.0	1973.0	3334.0	2375.0	2130.0	1950.0	1750.0	1400.0	2341.6	1843.6
SD	328.0	315.0	200.0	110.0	590.0	370.0	120.0	90.0	300.0	200.0	300.0	210.0
CV%	14.4	20.7	9.3	5.6	18.1	15.5	5.7	4.6	17.1	14.3	13.2	11.6
	IP	FP	IP	FP	IP	FP	IP	FP	IP	FP	IP	FP
Net returns Max	44625.0	34770.0	45120.0	35970.0	106400.0	50150.0	78400.0	56000.0	96350.0	75600.0	74179.0	50498.0
Net returns Min	32488.5	21600.0	36270.0	29388.0	77437.5	35376.0	66000.0	42780.0	69600.0	49200.0	56359.2	35668.8
Net returns Av.	42030.0	31500.0	44400.0	23755.0	100678.0	43652.0	79415.0	58274	93150.0	60480.0	71934.6	43532.1
SD	6391.0	5873.0	4915.0	1281.0	15338.0	5880.0	7470.0	7751.0	14608.0	9095.0	9705.0	5706.0
CV%	16.1	23.4	11.7	5.2	16.1	14.0	10.0	15.2	20	15.4	14.3	13.8
SYI	0.75	0.66	0.86	0.85	0.72	0.68	0.90	0.87	0.71	0.67	0.78	0.76
SVI	0.80	0.74	0.88	0.62	0.80	0.75	0.92	0.90	0.82	0.68	0.84	0.75

IP=Improved practice; FP=Farmers' practice

than the farmers' practice. The Sustainability Yield Index was ranged from 0.71 to 0.90 with an average 0.78 in improved practice whereas in farmers' practice ranged was from 0.66 to 0.91 with a mean of 0.79. The Sustainability Value Index in improved practice was ranged from 0.80 to 0.92 with an average 0.84, whereas in farmers' practice SVI ranged from 0.76 to 0.99 with an average of 0.84 (Table 3). The maximum standard deviation and coefficient of variance were observed in improved practice compared to farmer's practice. It might be due to yield variations in the improved practice in farmers' fields. This implies on resulted that the improved technology is more sustainable compared to farmer's practice. Similar results were reported by Reager et al., (2022) in groundnut and Reager et al., (2020) in moth bean.

Impact of horizontal spread of groundnut area through CFLDs

The efforts were made to increase horizontal spread of area through impact of CFLDs in groundnut (Table 4). The results revealed that, CFLDs on groundnut helped in increasing groundnut area with improved practices in cluster villages. The area increase was non-significant (4350.0 ha) during *rabi* 2016-17 and later that it gradually increased up to 6596.4 ha from *rabi* 2017-18 to *rabi* 2020-21 except during *rabi* 2018-19 where the area decreased by 15.9 per cent due to abnormal seasonal conditions and low minimum support price. The incremental increase in area year after year might be due to improved agronomical practices and cultivation of high yielding short duration varieties, and higher market prices to groundnut. The CFLDs organized with improved varieties i.e. K-9 and ICGV-3043 in 5 years slowly replaced the traditional old varieties K-6 and TAG-24 in the district. Similarly, Mahalae et al., (2014) & Patil et al., (2018) also expressed that adoption of HYV in groundnut replaced old varieties.

Table 4. Impact of cluster frontline demonstrations on horizontal spread of area in groundnut during *rabi* 2016-17 to 2020-21

Year	Pre demonstration (ha)	Post demonstration (ha)	Change in area (%)
2016-17	9123.0	4350.0	-52.3
2017-18	4350.0	4965.0	14.1
2018-19	4965.0	4176.0	-15.9
2019-20	4176.0	5175.2	23.9
2020-21	5175.2	6596.4	27.5

CONCLUSION

The Cluster Frontline Demonstrations organized by KVK, Kampasagar had significantly increased yield in groundnut and rapid horizontal spread of recommended improved technologies. The pod yield of groundnut was increased upto 27.0 per cent in improved practices over the farmers' practice. The improved practices showed higher sustainability yield index and sustainability value index. The gross returns, net returns and benefit-cost ratio were higher in demonstrations as compared to the farmers' practice. The additional gross returns, net returns, additional cost with incremental benefit-cost ratio were high in improved practice. The groundnut varieties K-6 and TAG 24 will be replaced by K-9 and ICGV 3043 through large scale demonstrations in long run. CFLDs have made a significant impact on horizontal spread of area under

groundnut in the district over the last 5 years. Integration of improved production technologies showed better yield, good economic returns, yield sustainability and horizontal spread of area in groundnut through demonstrations.

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