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Performance of Groundnut (*Arachis hypogaea* L.) Productivity Through Cluster Front Line Demonstration in Farmer's Field

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ABSTRACT

The cluster front line demonstration (CFLD) of groundnut were conducted during kharif season of 2017 and 2018 in 150 farmers holdings of Dharmapuri district, Tamil Nadu to demonstrate the production potential and monitoring returns of best management practices (BMPs). The higher pod yield and drought tolerant variety (TCGS 1043, TMV 14), seed treatment with biofertilizers and bio-fungicides, integrated nutrient management, integrated pest and disease management were demonstrated. The BMPs demonstrated registered mean yield of 18.2 q/ha, which was 31 percent higher than that obtained with farmer's practice. The incidence of insect pest and disease were lowest in the BMPs compare to FPs. The additional cost of Rs. 4276 to Rs. 6138 gave additional net return ranged from Rs. 11226 to Rs. 17718 per hectare with increased benefit: cost ratio of 1:2.63 to 1:2.89. Data on technology index increased from 21.6 per cent (2017) to 32.8 percent (2018), exhibited response of technology demonstration in this region.

Keywords: Best Management Practices (BMPs), CFLD, Economics, Extension gap, Farmers Practice (FP), Groundnut, Technology gap

INTRODUCTION

India is the largest producer of oilseeds in the world and oilseed sector occupies an important position in the country's economy (Undhad *et al*., 2019), where it provides 36 to 54 per cent of oil, 10 to 20 per cent of carbohydrates and 16 to 36 per cent of proteins (Bhauso *et al*., 2014; Lenka *et al*., 2018). As per FAOSTAT, 2013 estimates India accounts for 12 to 15 per cent of global oilseeds area, 6 to 7 per cent of vegetable oil production and 9 to 10 per cent of total edible oil consumption. Groundnut or peanut (*Arachis hypogaea* L.), is known as "King of Oilseeds", and it is the sixth most important oilseed crop of the world, fourth most important source of edible oil and third most important source of vegetable protein (Ayyadurai *et al*., 2018). It is mainly grown to produce oil for human and animal consumption. It is also called as "Wonder nut" and "Poor men's cashew nut" (Meena *et al*., 2018). The crop has multi-faceted benefits *viz*., fixation of biological nitrogen in the soil, haulm used for fodder in livestock and oilcake used for animal feed (Nautiyal *et al*., 2011). As a predominant oilseed crop groundnut was cultivated in 24.7 million hectares with the production and productivity of 40.4 million tones and 1.63 t/ha, respectively around the world. In India the area under groundnut cultivation is being carried out 5.53 million hectares with production of 7.40 million tones and productivity of 13.4q/ha (Anonymous, 2016). In Tamil Nadu it has been grown in 0.35 million hectares annually, producing 0.88 tones

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with average productivity of 2509 kg/ha. As far as the groundnut cultivation in Dharmapuri district of Tamil Nadu is concerned, it is grown on 0.15 lakh hectare annually producing 0.19 lakh tones with the average productivity of 16.29 q/ha. In Dharmapuri district average productivity of groundnut is very low (16.29 q/ha) compare to state average productivity (25.09 q/ha). This is because of low adoption of improved best management practices and lack of knowledge on high yielding and drought tolerant varieties. Major abiotic stress *viz*., low moisture content, terminal drought and biotic stresses are also responsible for low yield. Among the biotic stress, the *Spodoptera litura* is a major pest occurring for 42 per cent pod damage in the crop (Naidu *et al.*, 2016). Among the biotic stresses cutworm (*Spodoptera litura* Fabricius), aphid (*Aphis craccivora* Koch), leafhopper (*Empoasca kerri* Pruthi), thrips (*Scirtothrips dorsalis* Distant & *Frankliniella schultzei* Trybom) and leaf miner (*Aproaerema modicella* Dev.) are the major insect pests causes considerable yield loss in groundnut (Naidu *et al*., 2016; Reddy, 2001; Gadad *et al*., 2015; Gocher and Ahmad, 2019).

The demonstration of BMPs including high yielding drought tolerant varieties through CFLD will increase the production in unit area. Keeping this point in view, we attempted to demonstrate improved production technologies with the objective to increase productivity and gain confidence among farmer groups. There is positive indication of yield improvement due to industrious efforts of KVK scientists.

METHODOLOGY

The Cluster Front Line Demonstration was conducted in 75 farmers' fields / year (One acre / farmer) during 2017 and 2018 in different blocks of Dharmapuri district. The best management practices (BMPs) demonstrated *viz*., high yielding drought tolerant variety (TCGS 1043, TMV 14), seed treatment with biofertilizers (*Rhiziobium* & *Phosphobacteria* each @ 125 ml/ha of seeds) and bio-fungicides (*Trichoderma viride* @ 4 g/kg seed & *Pseudomonas fluorescens* @ 10 g/kg seed), integrated nutrient management (25:50:75 kg NPK/ha + 80 kg Sulphur as gypsum on 45 DAS) and spraying of groundnut rich @ 5 kg /ha in 500 lt. of water at 35 & 45 days after sowing and integrated pest and disease management. During April-May the summer ploughing was done. Crop was sown between second fort night of June to first fortnight of July with spacing and seed rate of 30×10 cm and 110 kg/ha respectively in all the locations. The seed drill sowing was demonstrated wherever possible to assure optimum plant population maintenance. The integrated nutrient management technologies *viz*., basal application of entire dose of nitrogen (urea 42% N), phosphorus (single super phosphate 16% P_2O_5) and potash (muriate of potash 60% K_2O), application of gypsum @ 400 kg/ha at 45 days after sowing and spraying of Tamil Nadu Agricultural University crop booster Groundnut rich @ 5 kg / ha in 500 lt. of water was done at 35 DAS and 45 DAS were demonstrated across all the CFLD fields. The integrated pest and disease management strategies demonstrated were installation of yellow sticky traps @ 25/ha to attract sucking pests, pheromone traps to monitor leaf miner *Aproaerema modicella* (Deventer) (Lepidoptera: Gelechiidae) @ 12/ha, soil application of *Trichoderma viride* & *Pseudomonas fluorescens* each @ 2.5 kg/ha to manage wilt, prophylactic spraying of *Pseudomonas fluorescens* @ 5 g/lt. to manage leaf spot diseases and need based insecticide spraying were the major components of integrated pest management.

The farmers practice consists of use of old seed variety (Co 7, TMV 3, JL 24 or local), sowing during second fortnight of July to first fortnight of August, with higher seed rate 150 kg/ha, imbalance use of fertilizers and plant protection measures. The seed treatment with bio-fungicides and bio-fertilizers, optimum plant population maintenance and integrated nutrient management practices were not followed in the farmers practice.

Before conducting CFLD, the farmers list was prepared to form groups and skill training was imparted to the selected farmers on the best management practices, benefits of drought tolerant varieties during dry spells, need of balanced application of fertilizers and integrated pest and disease management practices. All other procedure like site selection, farmer selection, layout of demonstration, farmers participation etc. were followed as suggested by Choudhary (1999) and Dubey *et al*. (2017). In total 150 farmers were associated with this cluster front line demonstrations implemented during 2017 and 2018. The total area covered through this CFLD was 60 hectares. In the demonstrations one control plot was maintained and the farmers were allowed to practice their regular cultivation practice.

The sucking pest population was counted on three leaves per plant from the randomly selected ten plants by visual count method at fortnight intervals. The leaf miner and tikka leaf disease were recorded by counting total number of plants and number of plants infested from randomly selected quadrants (1x1m size) at four places in each field. The collected data were converted in to percentage for mean comparison (Reddy, 2001). The yield data were collected from the demonstration and farmers practice plot. From the collected data technology gap, extension gap and technology index were a workout (Samui *et al*., 2000) as follows:

Technology gap = Potential yield - Demonstrated yield

Extension gap = Demonstrated yield - Yield under existing practice

Technology index = (Potential yield - Demonstrated yield) $\times$ 100 / Potential yield

RESULTS AND DISCUSSION

The gap between best management practices (BMPs) and existing farmers practice under groundnut CFLD found that in case of variety, seed rate, seed treatment, sowing method and foliar spray full gap was observed. The partial gap was observed in land preparation, fertilizer dose and plant protection.

The yield of groundnut obtained both the years under best management practices (BMP) as well as farmer's practice (FP) are presented in Table 1. The productivity of groundnut ranged from 16.8 to 19.6 q/ha with mean yield of 18.2 q/ha under BMPs. In the FPs the yield was ranged between 12.2 to 13.5 q/ha with a mean of 12.9 q/ha. The best management practices recorded higher productivity during both years in the farmer's field. The higher yield of groundnut under BMPs might be due to the use of latest drought tolerant high yielding variety, integrated nutrient management and pest management. Tomar *et al*. (1999) revealed that the adoption of improved technologies in chickpea (*Cicer arietinum* Linn.) recorded mean yield of 19.65 q/ha which was 71.88 per cent higher than that obtained with farmers practices of 11.44 q/ha. In chickpea the improved technologies recorded mean yield of 14.12 q/ha, which was 30 percent higher than that obtained with farmer's practices of 10.79 q/ha (Dubey *et al.*, 2017). The integrated crop management practices comprising introduction of drought tolerant short duration variety, seed treatment, integrated nutrient management and plant protection measures recorded higher pod yield of 1450 kg/ha in demonstration and the lower yield of 1240 kg/ha practice (Sangeetha *et al.*, 2016). In the present demonstrations also the best management practices recorded higher yield than the farmers practice which corroborate with the above findings.

Incidence of sucking pests, leaf miner and tikka leaf disease are presented in Figure 1-4 for the 2017 and 2018 crop period. The aphid, leaf hopper and thrip population per plant ranged between 1.26–2.96, 0.82–1.2 and 0.4–0.82 in best management practice and 5.42–7.82, 3.20–5.12 and 1.20–1.96 in farmers practice during *kharif* 2017 (Figure 1). During *kharif* 2018 the population of aphid, leaf hopper and thrips population /

Table 1: Productivity, extension gap, technology gap and technology index of groundnut as grown under CFLD and existing package of practices

Year	Area (ha)	Potential yield (q ha^{-1})	Yield q ha^{-1}		% increase over FP	Extension gap (q ha^{-1})	Technology gap (q ha^{-1})	Technology index (%)
			BMPs	FP				
2017	30	25.0	19.6	12.2	37.8	7.4	5.4	21.6
2018	30	25.0	16.8	13.5	24.4	3.3	8.5	32.8
Total/Mean	60	25.0	18.2	12.9	31.1	5.4	7.0	27.2

plant ranged between 1.67–2.33, 0.67–1.67 and 0.67 in best management practice and 6.33–7.33, 3.00–7.67 and 1.33–2.67 in farmers practice (Figure 2). Leaf miner incidence was lowest in best management practice during both the year of study compare to farmers practice (Figure 3). The tikka leaf disease was ranged between 9.77–14.55 and 10.65–13.29 respectively during 2017 and 218 respectively in BMPs, whereas it was ranged between 18.67–34.43 and 24.96–28.67 in farmers practice (Figure 4). Jasrotia *et al.* (2020) revealed that the synthesized integrated pest management (IPM) Modules significantly reduced insect-pest incidence on groundnut and enhanced the yield over farmers' practices. They recorded lowest thrips (0.46 to 1.09 thrips/plant) and leaf hoppers (0.47 to 4.0 leafhoppers/plant) in IPM module. In the present investigation also the BMP practices recorded lowest insect pest and disease incidence. The adoption of integrated pest and disease management strategies in the BMP apart from reducing pest and diseases reduces the cost involved in plant protection.

The input and output prices of commodities prevailed during both the years of demonstration were taken for calculating cost of cultivation, net return and benefit cost ratio (Table 2). The net return from the BMPs was Rs. 29,981 to 37,640 while the net return from farmers practice was Rs. 18,755 to 19,922. The additional cost of Rs. 4,276 to 6,138 incurred towards adoption of best management practices gave additional net return, it was ranged Rs. 11,226 to 17,718 per hectare. The benefit: cost ratio was ranged from 1:2.63 to 1:2.89. Sangeetha

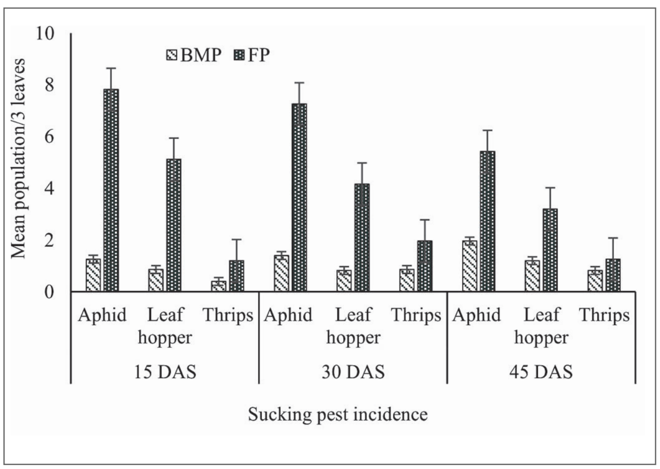

Figure 1: Incidence of Sucking pests in best management and farmers practice during *kharif* 2017

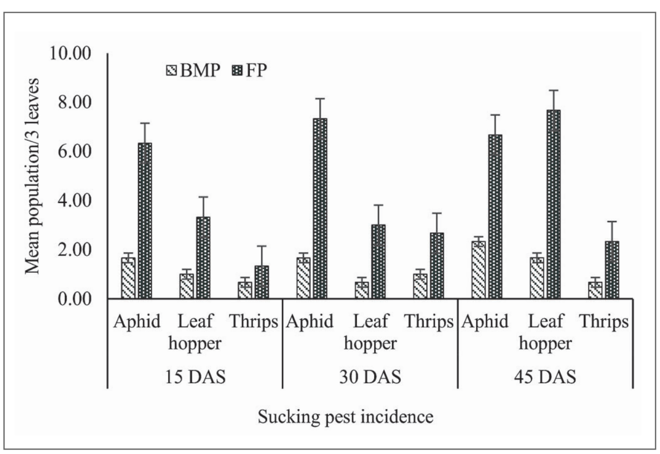

Figure 2: Incidence of Sucking pests in best management and farmers practice during *kharif* 2018

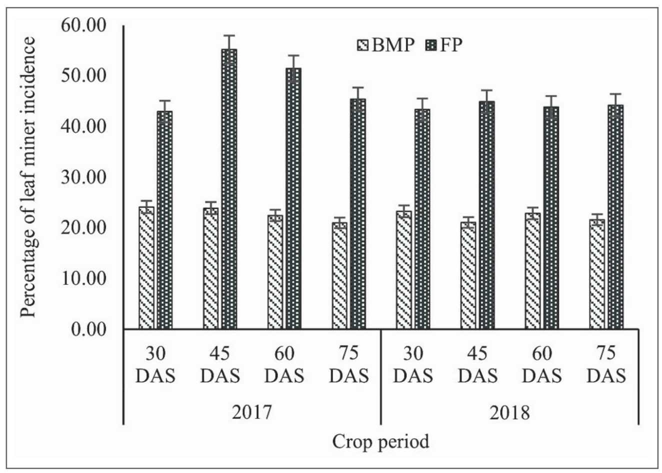

Figure 3: Incidence of leaf miner in best management and farmers practice during *kharif* 2017 & 2018

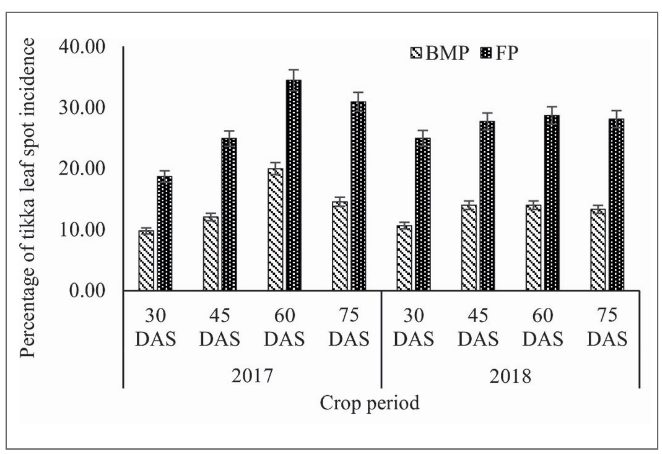

Figure 4: Incidence of tikka leaf spot in best management and farmers practice during *kharif* 2017 & 2018

Table 2: Economic analysis of best management practices and farmer practices

Year	Cost of cultivation (Rs./ha)		Gross Return (Rs./ha)		Net Return (Rs./ha)		Additional cost	Additional Net Return	BCR
	BMPs	FP	BMPs	FP	BMPs	FP	(Rs./ha)	(Rs./ha)	
2017	29560	35698	67200	55620	37640	19922	6138	17718	2.89
2018	30264	34540	61245	53295	29981	18755	4276	11226	2.63

et al. (2016) recorded higher net return of Rs 26,063/ ha and benefit: cost ratio of 1.81 in demonstration plots compared to farmers' practice in groundnut. Similar result has been exported by earlier by Tomar (2010) and Dubey *et al*. (2017) in chickpea. In the present demonstration also the best management practices gave higher return and benefit cost ratio across the locations.

The extension gap showed an increase trend. The extension gap ranging between 3.3 to 7.4 q/ha during both the years of study emphasizes the need to educate the farmers through various means for adoption of BMPs to reverse the trend wide extension gap. The trends of technology gap (ranging between 5.4 to 8.5 q/ ha) reflected to the farmer's cooperation in carrying out such demonstration with encouraging results in both the years. The difference in soil fertility and weather conditions may be the cause for technology gap. Sagar and Chandra (2004) revealed that in their study on front line demonstration of sesame varieties showed highest extension gap which requires immediate attention from the extension agencies. The technology index showed the feasibility of the evolved technology at the farmer's field. The lower value of technology index more is the feasibility of the technology demonstrated. In the present investigation the technology index was 21.6 per cent during 2017 to 32.8 per cent during 2018 which exhibits the feasibility of demonstrated technology in this region. The results confirm the findings of crop technology demonstration on oilseed and pulses crops by Yadav *et al*. (2004); Lathwal (2010) and Dubey *et al*. (2017).

CONCLUSION

The demonstration of best management practices through cluster front line demonstration reduced the technology gap and resulted in increased returns. The adoption of integrated nutrient and pest management tactics apart from contributing yield reduces the input cost. The active involvement of extension functionaries in delivering best management practices will reduce the extension gap.

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