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ROLE OF CLUSTER FRONTLINE DEMONSTRATIONS IN PROMOTING ADOPTION OF IMPROVED GROUNDNUT PRODUCTION TECHNOLOGIES

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Abstract
The present study was conducted to check the role of cluster frontline demonstrations in promoting adoption of improved groundnut production technologies among Cluster Frontline Demonstration (CFLD) beneficiaries and non-beneficiaries. The data was collected using a structured interview schedule covering major technological components, namely land preparation and sowing, weed management, plant protection and harvesting and post-harvest management. Adoption of individual recommended practices was categorized into full, partial and non-adoption. The findings indicated that CFLD beneficiaries generally exhibited higher levels of full adoption of several improved production practices compared with non-beneficiaries. Among beneficiaries, relatively higher full adoption was observed for cultivation of improved varieties (53.33%), appropriate sowing time (53.33%), manual or mechanical stripping of pods (56.67%), application of FYM (43.34%), and soil application of castor/neem cake (41.67%). In contrast, non-beneficiaries were predominantly concentrated under partial and non-adoption categories for most practices. Particularly large differences were observed for improved varieties, sowing time, FYM application, micronutrient application, biological control practices and harvesting/post-harvest practices. However, certain pest and disease management practices recorded relatively low full adoption among both groups. The findings suggest that CFLDs provided opportunities for farmers to gain practical exposure to improved groundnut technologies and may have contributed to greater adoption of several recommended practices. Strengthening follow-up extension support, demonstrations, farmer training and availability of recommended inputs may further improve adoption.

KEYWORDS: Groundnut, CFLD, beneficiaries, non-beneficiaries, adoption, improved technologies, frontline demonstrations

INTRODUCTION

Groundnut (*Arachis hypogaea* L.) is one of the major oilseed crops grown in India and is cultivated across a wide range of agro-ecological situations. The crop has considerable importance in agricultural livelihoods because it provides edible oil, dietary protein and additional income to farm households. Its productivity, however, depends on the timely and appropriate implementation of several crop-management practices. These include the selection of suitable varieties and quality seed, optimum sowing time and plant spacing, balanced nutrient management, effective weed control, integrated management of insect pests and diseases, and appropriate harvesting and post-harvest handling. Despite the availability of improved production technologies, their adoption by farmers varies considerably from one practice to another. While some farmers may completely follow recommended practices, others may adopt them only partially or continue with conventional practices. Differences in adoption can be associated with farmers' technical knowledge, accessibility and affordability of inputs, labour availability, perceived risk, previous experience, and contact with agricultural extension agencies. Consequently, identifying gaps in the adoption of individual technologies is important for designing appropriate extension interventions. Cluster Frontline Demonstrations (CFLDs) provide a field-based mechanism for promoting improved agricultural technologies among farming communities. Under CFLDs, recommended practices are demonstrated in farmers' fields, enabling participants to observe the application and performance of improved technologies under local conditions. The direct interaction of farmers with extension personnel and technical experts can also provide opportunities to clarify practical difficulties and understand the advantages of recommended practices. Such experiential exposure may facilitate the adoption of improved technologies. In groundnut production, adoption of recommended practices throughout the crop-production cycle is essential for achieving better crop management and productivity. Technologies related to improved varieties, seed treatment, optimum seed rate and spacing, nutrient management, weed control, pest and disease management,

and scientific harvesting and storage need to be considered as an integrated package rather than as isolated practices. Assessment of individual practices can therefore help identify areas where farmers require additional technical guidance and extension support. In this context, the present study was undertaken to assess and compare the adoption of improved groundnut production technologies among CFLD beneficiaries and non-beneficiaries and to identify the major gaps in adoption of individual recommended practices. The findings are expected to provide useful insights for strengthening future frontline demonstrations, farmer training programmes and follow-up extension activities related to improved groundnut production.

METHODOLOGY

The study was conducted using an ex-post facto research design, as the researcher did not manipulate the independent variable, i.e., participation in Cluster Frontline Demonstrations (CFLDs). The existing adoption behaviour of farmers was assessed and compared between CFLD beneficiaries and non-beneficiaries. A total of 120 groundnut farmers were selected for the study, comprising 60 CFLD beneficiaries and 60 non-beneficiaries. The beneficiaries were farmers who had participated in or received exposure to CFLDs on improved groundnut production technologies, whereas non-beneficiaries were groundnut farmers from the same or comparable production environment who had not received CFLD benefits. Primary data were collected through a structured interview schedule developed based on the recommended package of practices for groundnut cultivation. The respondents were personally interviewed to obtain information regarding their adoption of individual recommended production technologies. The adoption schedule covered four major components, namely land preparation to sowing, weed management, plant protection, and harvesting and post-harvest management. Adoption of each recommended practice was assessed under three categories, viz., full adoption, partial adoption and non-adoption. Full adoption referred to following the recommended practice according to the prescribed recommendation, while partial adoption indicated that the farmer followed the practice but not according to the complete recommended specification. Non-adoption indicated that the farmer did not follow the recommended practice. The data obtained were tabulated and analysed using frequency and percentage to determine the distribution of beneficiaries and non-beneficiaries across the three adoption categories. Comparative interpretation was made to identify differences in the adoption of individual improved groundnut production technologies between CFLD beneficiaries and non-beneficiaries.

RESULTS AND DISCUSSION

The adoption of improved groundnut production technologies among CFLD beneficiaries and non-beneficiaries is presented in the table. The technologies were grouped into land preparation and sowing, weed management, plant protection, and harvesting and post-harvest management.

Land preparation to sowing

The results revealed considerable variation between beneficiaries and non-beneficiaries in the adoption of land preparation and sowing practices. For land preparation involving one light ploughing followed by harrowing 3–4 times at 2–3-day intervals, 31.67 per cent of beneficiaries had fully adopted the practice, while 60.00 per cent had partially adopted it and 8.33 per cent had not adopted it. Among non-beneficiaries, only 1.67 per cent had fully adopted the practice, whereas 36.67 per cent had partially adopted it and 61.67 per cent had not adopted it. Regarding the use of well-drained and light-textured soils, 40.00 per cent of beneficiaries had fully adopted the recommendation compared with only 3.33 per cent of non-beneficiaries. Partial adoption was reported by 48.33 per cent of beneficiaries and 36.67 per cent of non-beneficiaries, while non-adoption was substantially higher among non-beneficiaries (61.67%). The use of improved varieties such as Kadiri-9, ICGS-91114 and K-6 recorded relatively high full adoption among both groups. However, beneficiaries recorded 53.33 per cent full adoption compared with 65.00 per cent among non-beneficiaries. This particular result indicates that the advantage of CFLD participation was not uniform across every individual practice, possibly because improved varieties had already become widely available or familiar to non-beneficiary farmers. For recommended sowing time during late June to early July, 53.33 per cent of beneficiaries fully adopted the practice compared with only 1.67 per cent of non-beneficiaries. Non-adoption was 60.00 per cent among non-beneficiaries, indicating a substantial adoption gap. The recommended seed rate of 95–110 kg ha^{-1} was fully adopted by 38.34 per cent of beneficiaries and 3.33 per cent of non-beneficiaries. Similarly, the recommended 30 × 10 cm spacing for bunch-type groundnut was fully adopted by 36.67 per cent of beneficiaries compared with 5.00 per cent of non-beneficiaries. For seed treatment, 38.33 per cent of beneficiaries fully adopted the practice, while none of the non-beneficiaries were categorized under full adoption. Similarly, FYM application, NPK application in the recommended ratio, and micronutrient application recorded considerably higher full adoption among beneficiaries than non-beneficiaries.

These findings suggest that CFLD exposure may have helped beneficiaries understand the importance of recommended sowing, nutrient and seed-treatment practices. Direct field demonstrations and interaction with extension personnel may have facilitated practical understanding of these technologies.

Table. Distribution of CFLD beneficiary and non-beneficiary farmers according to their level of adoption on CFLDs technologies of Groundnut

(n=120)

S. No	Statement	Beneficiaries (n=60)			Non-beneficiaries (n=60)		
		Full Adoption	Partial Adoption	Non-Adoption	Full Adoption	Partial Adoption	Non-Adoption
		F (%)	F (%)	F (%)	F (%)	F (%)	F (%)
A.	**Land preparation to sowing**						
1.	The land preparation done by one light ploughing followed by harrowing for 3 – 4 times at 2 – 3 days interval	19 31.67	36 60.00	5 8.33	1 1.67	22 36.67	37 61.67
2.	Well drained and light textured soils	24 40.00	29 48.33	7 11.67	2 3.33	22 36.67	36 61.67
3.	The cultivation of improved varieties like kadiri-9, ICGS-91114, K-6.	35 53.33	19 31.67	6 10.00	39 65.00	20 33.33	1 1.67
4.	The most appropriate time for sowing groundnut crop (kharif) is late June-early july	32 53.33	23 38.34	5 8.33	1 1.67	23 38.33	36 60.00
5.	The recommended seed rate is 95-110 kg/ha	23 38.34	34 56.67	3 5.00	2 3.33	20 33.34	38 63.33
6.	The spacing for bunch type is 30x10 cm	22 36.67	33 55.00	5 8.33	3 5.00	22 36.67	35 58.33
7.	The seed treatment is with imidacloprid 2ml/kg of seed, *Trichoderma viridae* 9(or) rhizobium 4g/kg of seed	23 38.33	32 53.33	5 8.33	0 0.00	16 26.67	44 73.33
8.	Application of FYM @10t/ha 21 days after sowing	26 43.34	29 48.33	5 8.33	3 5.00	17 28.34	40 66.66
9.	Application of NPK fertilizers in the ratio 20:40:20kg/ha	22 38.34	34 56.67	4 6.66	0 0.00	19 31.67	41 68.33
10.	The micronutrient application of copper @2kg /ha.	22 36.67	33 55.00	5 8.33	0 0.00	17 28.34	43 71.66
B.	**Weed Management**						
11.	Hand weeding is done at 35 DAS	21 35.00	36 60.00	3 5.00	2 3.33	25 41.67	35 55.00
12.	Application of Pendimethalin @1 kg/ha within 2-3 DAS	27 45.00	27 45.00	6 10.00	2 3.33	22 36.67	36 60.00
13.	Mixture of oxadiazon & Dinoseb each @ 1.7kg/ha control weeds besides reducing stem rot	9 15.00	27 45.00	24 40.00	0 0.00	11 18.34	49 81.66
C.	**Plant Protection**						
a.	**Cultural practices**						
14.	Crop rotation with non-leguminous crops to avoid out breaks of the pest	23 38.33	32 53.33	5 8.34	0 0.00	19 31.66	41 68.33
15.	Sunflower/castor used as trap crop	15 25.00	26 43.34	19 31.66	0 0.00	20 33.34	40 66.66
16.	Remove and destroy the infected plant debris	19 31.67	36 60.00	5 8.33	8 13.34	19 31.66	33 55.00
17.	Raising soyabean as trap crop against groundnut leaf miner	14 23.34	25 41.66	21 35.00	0 0.00	20 33.34	40 66.66

18.	Soil application of castor cake / neem cake @ 250kg/ha against stem rot, termite	25 41.67	30 60.00	5 8.33	2 3.33	21 35.00	37 61.67
b.	**Physical & Mechanical Methods**						
19.	Carbofuran @ 1.5 kg/ha to control root grub	26 43.33	29 48.33	5 8.33	0 0.00	12 20.00	48 80.00
20.	Setting light traps / Pheromone traps at least 5 per acre to monitor groundnut leaf miner	18 30.00	34 56.67	8 13.33	1 1.67	18 30.00	41 68.33
c.	**Biological & Chemical Control**						
21.	Seed treatment with *Trichoderma viridae* @ 10g/kg seed for controlling of root rot, stem rot	19 31.67	32 53.33	9 15.00	2 3.33	17 28.34	41 68.33
22.	Use of 5% NSKE against leaf miner and foliar diseases	19 31.67	35 58.33	6 10.00	3 5.00	18 30.00	39 65.00
23.	Seed treatment with chlorpyriphos 6 - 10 ml/kg seed is effective against root grubs	5 8.33	28 46.67	27 45.00	5 8.33	10 16.67	45 75.00
24.	Spray carbendazium @0.1% to manage tikka disease	15 25.00	20 33.34	25 41.66	0 0.00	13 21.66	47 78.34
25.	Foliar spray with chloropyriphos 2.5ml/l to control leaf miner	11 18.34	20 33.33	29 48.33	0 0.00	15 25.00	45 75.00
D.	**Harvesting and Post-harvest management**						
26.	Harvesting at 110-120 DAS when 70-80% of pods are fully matured	22 26.67	32 53.33	6 10.00	6 10.00	19 31.67	35 58.33
27.	Ensuring the seed moisture to be 9%	25 41.67	30 50.00	5 8.33	8 13.33	20 33.34	32 53.33
28.	Manual or mechanical stripping is used to remove pods from plant	34 56.67	20 33.33	6 10.00	10 16.67	24 40.00	26 43.33
29.	Drying should be done rapidly to prevent fungal moulding	18 30.00	34 56.67	8 13.33	12 20.00	22 36.67	26 43.33
30.	Pods for seed purpose are stored in earthen pots, mud bins or bamboo baskets or Gunny bags having polythene lining	19 31.67	35 58.33	6 10.00	26 43.33	11 18.34	23 38.33

Adoption of weed management practices

For hand weeding at 35 DAS, 35.00 per cent of beneficiaries fully adopted the recommendation, compared with 3.33 per cent of non-beneficiaries. Partial adoption was 60.00 per cent among beneficiaries and 41.67 per cent among non-beneficiaries. The recommended application of pendimethalin @ 1 kg ha^{-1} within 2–3 DAS was fully adopted by 45.00 per cent of beneficiaries compared with 3.33 per cent of non-beneficiaries. Non-adoption was considerably higher among non-beneficiaries (60.00%) than beneficiaries (10.00%). The practice involving oxadiazon and dinoseb recorded comparatively low full adoption among beneficiaries (15.00%) and zero full adoption among non-beneficiaries. Non-adoption was 40.00 per cent among beneficiaries and 81.66 per cent among non-beneficiaries. Overall, beneficiaries showed a greater tendency towards full adoption of recommended weed-management practices, whereas non-beneficiaries were largely concentrated in partial and non-adoption categories.

Adoption of plant protection practices

With respect to crop rotation with non-leguminous crops, 38.33 per cent of beneficiaries fully adopted the recommendation compared with none of the non-beneficiaries. Partial adoption was 53.33 per cent among beneficiaries and 31.66 per cent among non-beneficiaries. The use of sunflower/castor as trap crops recorded 25.00 per cent full adoption among beneficiaries, whereas none of the non-beneficiaries fully adopted the practice. However, 31.66 per cent of beneficiaries and 66.66 per cent of non-beneficiaries did not adopt the recommendation.

Similarly, removal and destruction of infected plant debris was fully adopted by 31.67 per cent of beneficiaries compared with 13.34 per cent of non-beneficiaries.

The practice of raising soybean as a trap crop against groundnut leaf miner recorded 23.34 per cent full adoption among beneficiaries and no full adoption among non-beneficiaries. Non-adoption was 35.00 per cent among beneficiaries compared with 66.66 per cent among non-beneficiaries. Soil application of castor/neem cake @ 250 kg ha^{-1} was fully adopted by 41.67 per cent of beneficiaries compared with 3.33 per cent of non-beneficiaries.

Physical and mechanical methods

For carbofuran application for control of root grub, 43.33 per cent of beneficiaries fully adopted the practice, while none of the non-beneficiaries did so. Partial adoption was 48.33 per cent among beneficiaries and 20.00 per cent among non-beneficiaries. For setting light or pheromone traps, 30.00 per cent of beneficiaries and only 1.67 per cent of non-beneficiaries fully adopted the recommendation. Non-adoption was 13.33 per cent among beneficiaries compared with 68.33 per cent among non-beneficiaries.

Biological and chemical control

The adoption of Trichoderma seed treatment was relatively higher among beneficiaries, with 31.67 per cent fully adopting the recommendation compared with 3.33 per cent among non-beneficiaries. For 5% NSKE application, 31.67 per cent of beneficiaries fully adopted the practice, compared with 5.00 per cent of non-beneficiaries. The adoption of chlorpyriphos seed treatment against root grub was relatively low in both groups. Only 8.33 per cent of beneficiaries and 8.33 per cent of non-beneficiaries fully adopted the recommendation, while non-adoption was 45.00 and 75.00 per cent, respectively.

Similarly, carbendazim spray for tikka disease recorded 25.00 per cent full adoption among beneficiaries and no full adoption among non-beneficiaries. The majority of non-beneficiaries (78.34%) were under the non-adoption category. The chlorpyriphos foliar spray for leaf miner also showed low full adoption, with 18.34 per cent of beneficiaries fully adopting it compared with none among non-beneficiaries. The comparatively low adoption of several plant-protection technologies may be associated with the technical complexity of these practices, uncertainty regarding pest and disease occurrence, cost and availability of inputs, and farmers' reliance on conventional pest-management practices.

Adoption of harvesting and post-harvest management practices

Regarding harvesting at 110–120 DAS when 70–80 per cent of pods are mature, 26.67 per cent of beneficiaries fully adopted the recommendation compared with 10.00 per cent of non-beneficiaries. Partial adoption was 53.33 per cent among beneficiaries and 31.67 per cent among non-beneficiaries. For maintaining seed moisture at 9 per cent, 41.67 per cent of beneficiaries fully adopted the practice compared with 13.33 per cent of non-beneficiaries. The practice of manual or mechanical stripping of pods from plants recorded the highest full adoption among beneficiaries in this component, at 56.67 per cent. Among non-beneficiaries, 16.67 per cent fully adopted the practice, while 43.33 per cent did not adopt it. For rapid drying of pods to prevent fungal moulding, 30.00 per cent of beneficiaries fully adopted the recommendation compared with 20.00 per cent of non-beneficiaries.

Regarding storage of seed pods in appropriate containers such as earthen pots, mud bins, bamboo baskets or lined gunny bags, 31.67 per cent of beneficiaries fully adopted the recommendation compared with 43.33 per cent of non-beneficiaries. Thus, as observed with improved varieties, non-beneficiaries recorded higher full adoption for this particular practice.

Overall comparison

Overall, the results demonstrate that CFLD beneficiaries generally recorded higher full adoption of several recommended groundnut production practices than non-beneficiaries, particularly with respect to sowing-time management, seed treatment, nutrient management, weed management, cultural plant-protection practices, biological control and certain harvesting practices. The largest differences were observed for practices such as recommended sowing time, seed treatment, FYM and fertilizer application, micronutrient application, crop rotation, trap-crop use, light/pheromone traps and selected disease-management practices. In many of these practices, non-beneficiaries showed considerably higher proportions of non-adoption. At the same time, the results also demonstrate that CFLD participation did not automatically result in complete adoption of every technology. Several practices had substantial partial adoption among beneficiaries, while certain technologies had relatively low full adoption in both groups. This indicates that adoption is influenced by multiple factors beyond exposure to demonstrations, including availability and affordability of inputs, labour requirements, perceived usefulness, complexity of technology, risk and farmers' previous experience. The relatively greater adoption among beneficiaries may be explained by the practical nature of CFLDs, through which farmers receive first-hand exposure to recommended technologies under local field conditions. Demonstrations can reduce uncertainty associated with new practices and provide opportunities for farmers to observe their application and interact with extension personnel. The findings therefore underline the importance of not only conducting CFLDs but also providing follow-up technical guidance, input support, repeated demonstrations and farmer-oriented training to convert partial adoption into full adoption.

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