Impact of Frontline Demonstrations on Oilseed Crops in Konkan Region of Maharashtra

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ABSTRACT

Frontline demonstration (FLD) is the long-term educational activity conducted by agricultural scientists in a systematic manner on farmers' field to show the worth of new practice/technology. The Krishi Vigyan Kendra (KVK)-Agriculture Science Centre, Ratnagiri has conducted FLDs during 2008 to 2012. The KVK has organized 93 FLDs on Groundnut (Arachis hypogaea) and 26 FLDs on Niger (Guizotia abyssinica) in two villages. This study aimed to determine the impact of frontline demonstrations (FLDs) on yield, adoption, varietal replacement and horizontal spread of oilseed crops. All 119 FLDs beneficiary farmers were selected purposively as sample. The study conducted in experimental designs (Before-After and Control-Treatment) of social research. The findings showed that significant increase in the average yield of demonstration plot (20.57qha^{-1}) over the control plot (13.75 qha^{-1}) of groundnut. Average yield of niger was 2.75 qha^{-1} in 2008-09, which increased to 3.11 qha^{-1} in demonstration year. The 'Local' and 'SB-11' variety of groundnut were replaced by improved varieties such as 'Konkan Trombay Tapora' 'TG 26' and 'Konkan Gaurav'. Similarly, improved 'IGP-76' and 'Phule Karala' varieties of niger had replaced the 'Local' low yielding varieties. The FLDs made a positive impact on the adoption of groundnut and niger crop production technologies.

***Key words:** Impact; Frontline demonstrations; Oilseed crops;*

Indian Council of Agricultural Research (ICAR) had established Krishi Vigyan Kendras (KVKs)-'Agriculture Science Centre' across the India which is an institutional innovation for application of agricultural technologies on the farmer's field with the help of multi-disciplinary team. The first KVK of the country was established in 1974 at erstwhile Pondicherry with mandate of imparting vocational trainings. The Krishi Vigyan Kendras actually originated as one of the Frontline Extension Systems of Indian Council of Agricultural Research (ICAR) that included National Demonstration (1966), Operational Research Projects (1974-75) and Lab to Land Programme (1979). All the first line extension services were merged with the KVKs during the 1990s with new structural and organizational arrangements. There is need of close interaction between farmers, extension personnel and researchers in the participatory diagnosis of problems and developing location specific technologies. Therefore, the network of Krishi Vigyan Kendras has spread enormously in the country for promoting the extension educational approach rather than transfer of fixed package of recommendations. There are immense policy reforms in mandates and activities of KVK over a period of time. With a decision of establishing KVKs in all the rural districts of the country in Xth five-year plans, the KVK revised mandate. There is a wide network of 690 KVKs in the country (*ICAR, 2018*). Therefore, the main mandate of the KVK is to plan and carry out on-farm trials (OFTs) to verify, test, validate and refine location-specific technologies developed by the National Agricultural Research System (NARS). The purpose is to have an appropriate technology which may be economically profitable, ecologically sustainable, technically feasible and culturally compatible. Another vital activity of KVK is to conduct the frontline demonstrations (FLDs) on flagship technologies developed by NARS on farmer's field (*Kokate et. al.2016*). The frontline demonstration is a long-term educational activity conducted by the KVK scientists in a systematic manner on farmers' field under his close supervision to show the worthiness of technology. Besides, KVK are building capacity of different stakeholders on niche areas of agricultural and allied sciences, and also acting as a Knowledge and Resource Center at district level.

India holds a significant share in world oilseed production. India is the second largest producer of groundnut after China and third largest producer of rapeseed after China and Canada (*Directorate of Economics and Statistics, 2015*). The area under major oilseeds viz., groundnut, sesamum, rapeseed, mustard, linseed, castor, soybean, cottonseed, sunflower, safflower and nigerseed occupied 20% net area sown across India (*Ministry of Agriculture, 2014*). It must, however, be noted that the production of oilseeds has always fallen short of national demand and overwhelm import of oilseeds has been ultimate option. The total oilseeds production in the country recorded during 2016-17 was about 35.40 Million Metric Tonne. There is limited scope for bringing an additional area under oilseeds in India. Therefore, increasing the oilseeds production is only option to meet the national requirement and which is primarily based on adoption of improved production technologies. Further, a wide regional variation in area, production and productivity of oilseeds is persists in India. Though, few states including Haryana, Madhya Pradesh, Rajasthan and West Bengal revealed increase in oilseed production through area expansion and productivity enhancement. The states like Maharashtra, Tamil Nadu and Himachal Pradesh holds potential to raise oilseed production through productivity improvement. Therefore, in these states KVKs were initiated with aim of organizing large scale FLD programs on oilseed crops for harnessing its potential. It is imperative to assess the effectiveness of front line demonstrations. Hence, present study was undertaken to assess the impact of frontline demonstrations organized by the KVK with specific objectives; to study the impact of FLDs on yield and adoption of oilseed crops; and to know the varietal replacement of oilseed crops and its horizontal spread due to FLDs.

METHODOLOGY

The study was conducted in Lanja block of Ratnagiri district in Maharashtra State. To make crop diversification, Krishi Vigyan Kendra, Ratnagiri had conducted the FLDs on oilseeds during 2008 to 2012. The present investigation was carried out in two adopted villages purposively. The FLDs had organized on farmers' field according to a package of practices recommended by Dr. Balasaheb Sawant Konkan Agricultural University, Dapoli. The farmer practice was considered as control plot/local check in demonstration cluster. These control plots were maintained by the farmers according to their own traditional practices. Total 119 farmers were selected for the organization of FLDs on Groundnut and Niger crop in Asage and Gawane village. Therefore 119 beneficiary farmers were selected purposively as the samples for present investigation. The study was conducted in experimental designs ('Control-Treatment' and 'Before-After') of social research.

The yield data of demonstration plots as well as control plots was collected immediately after harvesting to assess the impact of FLD intervention on the yield of oilseeds (2008-12). However, structured and pre-tested interview schedule was used to elicit the information from beneficiary farmers about adoption, varietal replacement and horizontal spread of oilseed crop technologies in adopted villages. The personal interview was conducted with the beneficiary farmers in the year 2013-14. Collected data was subjected to descriptive statistical analysis using SPSS software. The following formulas were used to assess the impact of FLDs on the different parameter of oilseed crops.

$$IY = \frac{A - B}{B} \times 100$$

$$IA = \frac{C - D}{D} \times 100$$

$$IHS = \frac{E - F}{F} \times 100$$

Where

IY= Impact on yield (% Change)
A=Yield of demonstration plot (ha^{-1})
B=Yield of control plot (ha^{-1})
IA=Impact on Adoption (% Change)
C=No. of adopters after demonstration
D=No. of adopters before demonstration
IHS=Impact on horizontal spread (% Change)
E=Area after demonstration (ha)
F=Area before demonstration (ha)

Table 1. Impact of frontline demonstrations (FLDs) on yield of groundnut crop

Season & year	Technology interventions	No. of Demo.	Demo. area (ha) (qha^{-1})	Average yield (qha^{-1}) Control plot	Demo. plot (qha^{-1})	Impact (% Change)
Winter -2007-08	A	25	10.00	14.04	22.70	+61.00
Rainy -2008-09	B	13	5.00	13.90	21.30	+ 53.00
Rainy -2009-10	C	20	7.00	13.24	19.51	+ 47.00
Winter -2009-10	D	25	10.00	15.81	23.17	+ 46.00
Rainy -2012-13	E	10	2.50	9.26	16.20	+ 74.00
Total		93	34.50	13.25	20.57	+ 56.20

Technology interventions:
A=TG-26 variety + Seed treatment +Rhizobium, PSB *& Trichoderma* + Earthling up operation after one month
B=TG-26 variety + Seed treatment +Rhizobium, PSB *& Trichoderma* + Earthling up operation after one month
C=Konkan Gaurav variety+ Seed treatment + Rhizobium, PSB *& Trichoderma* before sowing
D=Konkan Gaurav variety + Seed treatment + Rhizobium, PSB *& Trichoderma* before sowing
E=Konkan Trombay Tapora + seed treatment + Rhizobium, PSB &*Trichoderma* before sowing

Table 2. Impact of frontline demonstrations (FLDs) on yield of Niger crop

Season & year	Technology interventions	No. of Demo.	Demo. area (ha) (qha^{-1})	Average yield (qha^{-1}) Control plot	Demo. plot (qha^{-1})	Impact (% Change)
Rainy -2008-09	A	13	5.00	1.80	2.75	+52.00
Rainy -2009-10	B	13	5.00	2.17	3.11	+43.00
Total		26	10.00	1.98	2.93	+47.50

Technology interventions:
A=IGP 76 varierty + seed treatment with fungicide
B=Phule Karala varierty + seed treatment with fungicide

Table 3. Impact of frontline demonstrations (FLDs) on adoption of groundnut production technologies

Technology	Number of adopters (N=93) Before demo.	After demo.	Change in no. of adopter	Impact (% Change)
Land preparation and application of 10 T FYM	75(80.64)	93(100.00)	+ 18	24.00
Imp. vari.(TG26/Konkan Tapora/Konkan Gaurav)	13(13.97)	87(93.54)	+ 74	569.23
Seed rate (100-125 Kg/ha)	34(36.55)	66(70.96)	+ 32	94.12
Seed treatment + Rhizobium, PSB &*Trochoderma*	19(20.43)	71(76.34)	+ 52	273.68
Sowing time and spacing (30×15 cm)	67(72.04)	81(87.09)	+ 14	20.90
Fertilizer management NPK (25:50:00)	44(47.31)	91(97.84)	+ 47	106.82
Weed management(Use of *Flucloraline*/*Butaclore*)	69(74.19)	93(100.00)	+ 24	34.78
Earthling up operation 30 DAS	20(21.50)	51(54.83)	+ 31	155.00
Drum rolling during peg formation stage	11(11.82)	58(62.36)	+ 47	336.36
Recommended yield	24(25.80)	71(76.34)	+ 47	195.83
Overall impact				181.72

* Figures in parentheses indicate percentage

RESULTS AND DISCUSSION

Impact on yield of oilseed crops : The findings of the impact of frontline demonstrations (FLDs) on yield of oilseed crops viz., groundnut and niger are presented in this part. It is evident from Table 1 that the average pod yield of demonstration plot of groundnut 'TG-26' variety was 22.70 qha^{1} in rainy 2007-08 and 21.30 qha^{-1} in winter 2008-09. However, the average pod yield of control plot was 14.04 qha^{-1} and 13.90 qha^{-1} in rainy 2007-08 and winter 2008-09, respectively. A similar trend was observed during subsequent years with 'Konkan Gaurav' variety of groundnut. Average pod yield of groundnut demonstration plot of 'Konkan Gaurav' variety was increased to 19.51 qha^{-1} in rainy 2009-10 and 23.17 qha^{-1} in winter 2009-10 over farmer practice i.e. control plot yield 13.24 qha^{-1} in rainy 2009-10 and 15.81 qha^{-1} in winter2009-10. As regards to 'Konkan Trombay Tapora' variety, the significant increase in the average pod yield of groundnut demonstration plot 16.20 qha^{-1} over the control plot yield 9.26 qha^{-1} in rainy 2012-13. This shows that there was a positive and significant increase in the mean yield of groundnut demonstration plots over the farmer practice by 60.15, 53.23, 47.00, 46.00 and 74.00 per cent for the year 2007-08, 2008-09, 2009-10 and 2012-13, respectively. Findings are similar to those of *Singh, et al. (2014)* where they observed that the farmers yield before FLD was 2.1, 9.5 and 5.96 $qha^{-1}$for sesame, soybean, and mustard while after FLD production was elevated to 6.2, 15.67 and 14.01 qha^{-1}. Groundnut in control plots reflected poor production. Poor production was subject to use of poor quality seeds and traditional cultivation methods followed by poor nutrient and weed management practices. On contrary, KVK scientists adopted improved varieties of groundnut, seed treatment with *Rhizobium*, use of *PSB and Trichoderma*, adopted scientific cultivation practices like mulching and timely sowing, recommended spacing, balanced use of manure and fertilizers with time to time weed management. Resultantly, demonstration plot recorded 56.20 per cent higher average yield as compared to control plot. *Dogra et. al. (2016)* found a positive impact of NFSM-Pulses on lentil yield through selection of improved variety and application of scientific package of practices.

Data from Table 2 revealed that the average yield of niger was increased from 1.80 qha^{-1} (control plot) to 2.75 qha^{-1} (demonstration plot) in rainy 2008-09. Similarly, the demonstration plots gave higher yield 3.11 qha^{-1} over control plots average yield 2.17 qha^{-1} in the rainy season of 2009-10. It means there was a consequent increase in the average yield of niger by 47.50 per cent during two years. This shows a positive impact of FLD on the yield of niger crop. The farmers used low yielding local varieties, improper doses of fertilizers, no intercultural operation and improper plant population measures might be the reasons for low yield of control plots. However, in the case of demonstration plots, the factors leading to enhancing the yield of the crop are timely sowing, use of recommended varieties, seed treatment, and balanced nutrient management. Similar observations were noted by *Singh (2003)* at KVK Chitrakoot during 1998-2002 with the introduction of crop production technologies through frontline demonstrations. The increase in lentil crop yield was varied from 55-65 per cent over the traditional practices. *Afzal et al. (2013)* reported that the average yield of improved varieties of lentil (Barimasur) was 1073 $kgha^{1}$ and which was increased up to 25 per cent in the demonstration plot. ICAR (2009-10) reported that 23.14 per cent increase in yield of lentil due to front line demonstrations. The above findings are in agreement with the results of *Khadda B.S. et al. (2014), Sheikh, F. A. et al. (2013), Haque (2000), Tiwari et al. (2001), Tiwari et al. (2003), Tomer et al. (2003),* Kirar, B. S. et al. (2005) and *Mishra et. al. (2009)* reported enhancement of crop yield due to frontline demonstrations. Intensification of crop yield by using technological interventions in FLD plots was reported by *Sagar and Chandra (2004)* in sesame, *Hiremath et al. (2009)* in onion and by *Ali et al. (2012)* in pulses.

It was found that a number of adopters for land preparation and application of FYM to groundnut were 80.64 per cent before demonstrations, which were increased to 100.00 per cent after frontline demonstrations in adopted villages. A similar trend was also observed in the case of weed management practices as an increase in the percentage of adopters from 74.19 to 100 per cent. The number of adopters for application of NPK (25:50:00) fertilizers and use of improved varieties of groundnut viz., 'TG 26/Konkan Tapora/ Konkan Gaurav' were increased significantly during pre and post-demonstration period from 47.31 to 97.84 per cent and from 13.97 to 93.54 per cent, respectively. These results are in accordance with *Singh et al. (2014)* reported that adoption of improved varieties of oilseeds crops was increased after FLDs activities. The FLD intervention made highly positive impact on adoption of important intercultural operation of groundnut i.e. drum rolling practice during peg formation stage (336.36%) and earthing up 30 DAS (155.0%), and, seed treatment with *Thirum*, *Rhizobium*, *PSB culture* and *Trichoderma* (273.68%) in study area. Besides, the percentage of adopters for the use of recommended seed rate were also increased from 36.55 per cent before to 70.96 per

Table 4. Impact of frontline demonstrations (FLDs) on adoption of niger production technologies

Technology	Number of adopters (N=93) Before demo.	After demo.	Change in no. of adopter	Impact (% Change)
Land preparation and application of 10 tonne FYM	4(15.38)	11(42.30)	+7	175.00
Improved varieties (IGP 76/ Phule Karala)	00(0.00)	11(42.30)	+11	1100
Seed rate(3-4Kg/ha)	5(19.23)	9(34.61)	+4	80.00
Seed treatment	00(0.00)	4(15.38)	+4	400
Sowing time	8(30.76)	10(38.46)	+2	25.00
Spacing (30 cm)	7(26.92)	11(42.30)	+4	57.14
Fertilizer management	6(23.07)	9(34.61)	+3	50.00
Weed management	3(11.53)	7(26.92)	+4	133.34
Recommended yield	5(19.23)	9(34.61)	+4	80.00
Overall impact				233.38

* Figures in parentheses indicate percentage

cent after frontline demonstrations in Asage and Gawane village. In this line, *Shaikhet al. (2013)* reported that majority of the participant farmers in FLD program had full adoption of improved practices viz., land preparation, use of high yielding varieties, sowing time, pre-sowing irrigation and application of manures and fertilizers. However, he observed that non-participating farmers had low adoption in the case of above improved practices of Brown Sarson. The mean adoption level of groundnut production technologies was increased by 181.72 per cent due to FLDs organized by the KVK in adopted villages. These results are in close conformity with findings recorded by *Chapke (2010)* in the case of jute crop. *Dour et al. (2015)* observed asignificant difference between the adoption of FLD beneficiary farmers and non-beneficiary farmers towards soybean production technology.

Impact on adoption of Niger crop production technologies : The FLDs made a greater impact on the adoption of recommended varieties 'IGP 76' and 'Phule Karala' of niger crop in the study area. Before the frontline demonstrations, 100 per cent farmers in adopted villages had used to 'Local' varieties, however; farmers were started to use improved varieties viz., 'IGP 76' and 'Phule Karala' of niger crop after exposure to the demonstrations. The number of adopters for land preparation and application of FYM were raised from 15.38 to 42.30 per cent, use of recommended seed rate from 19.23 to 34.61 per cent and fertilizer management from 23.07 to 34.61 per cent in demonstration cluster. In other words, FLDs made a positive impact on the adoption of seed treatment with fungicides (400%), land preparation and application of FYM (175%), weed management (133.34%), use of recommended seed rate (80%) and maintaining 30 cm plant spacing (57.14%). In all, FLD had created 233.38 per cent change in the adoption of recommended niger production technologies in both villages. Most of the farmers in adopted villages were marginal and small holders, cultivating niger as subsistence oilseed crop and unaware about improved oilseed technologies. But after exposure to frontline demonstrations, they motivated to use improved varieties and realized the potential of niger as principle oilseed crop. *Teggelli et al. (2015)* indicated that the higher average grain yield in demonstration plots of pigeonpea over the local check due to adoption of improved varieties such as TS3R, timely sowing, seed treatment with Biofertilizers, Rhizobium and PSB, *Trichoderma*, use of balanced dose of fertilizer, method and time of sowing, weed management and need-based plant protection measures.

Table 5. Impact of frontline demonstrations (FLDs) on varietal replacement of oilseed crops

Crop	Previously grown varieties	Newly introduced varieties
Groundnut	SB-11, Local	KonkanTrombayTapora, KonkanGaurav, TG 26
Niger	Local	IGP 76 and Phule Karala

Data depicted in Table 5 indicated that previously grown varieties of groundnut such as 'SB-11' and 'Local' were replaced by improved varieties viz., 'Konkan Trombay Tapora', 'TG 26' and 'Konkan Gaurav' on a large scale in adopted villages. The 'Local' varieties' of niger were replaced by high-yielding 'IGP 76' and 'Phule Karala' varieties in demonstration cluster. The FLD beneficiary farmers had received good yield in

Table 6. Impact of frontline demonstrations (FLDs) on horizontal spread of varieties of oilseed crops in demonstration cluster

Technology		Area (ha) Before demo.	After demo.	Change in of area (ha.)	Impact (% Change)
Groundnut	KonkanTrombayTapora	1.00	7.60	+6.60	660.00
	KonkanGaurav	2.00	9.00	+7.00	350.00
	TG 26	4.00	6.00	+2.00	50.00
Niger	IGP 76	0.40	2.00	+1.60	400.00

demonstration plot by the adoption of improved varieties of these oilseed crops. Therefore they have motivated and continued the adoption of improved varieties of oilseeds on a large scale for succeeding years. The replacement of local varieties with improved varieties of maize, paddy and wheat due to FLD was reported by *Balaiet al. (2013)*. Further, *Tiwari et al. (2013)* brought out the result of frontline demonstration and reported that the yield of soybean was increased with the intervention on varietal replacement i.e. JS-97-52 in the Umaria district.

It was observed from Table 6 that FLDs organized on oilseed crops helped to increase the area under improved varieties in adopted villages. There was a significant increase in area from 1.00 to 7.60 ha under 'Konkan Trombay Tapora', from 2.00 to 9.00 ha area under 'Konkan Gaurav' and from 4.00 to 6.00 ha area under 'TG 26' variety of groundnut crop in demonstration clusters. The maximum area was expanded under 'Konkan Trombay Tapora' and 'Konkan Gaurav' varieties of groundnut. The reasons might be their agronomical attributes such as high yielding nature, semi-spreading type of varieties, less maturity duration (120 days) and especially both varieties are recommended for rainy as well as winter season in Maharashtra state. Similarly, the area under niger crop was also increased from 0.40 to 2.00 ha under 'IGP 76' variety in demonstration cluster due to the organization of FLDs. It can be concluded that FLDs organized by KVK made a significant impact on horizontal spread of oilseed crop varieties in adopted villages.

CONCLUSION

Frontline demonstration (FLDs) organized by the KVK had enhanced the yield of oilseed crops vertically and ensured rapid horizontal expansion of recommended technologies of oilseed crops. The FLDs made a positive and significant increase in yield of groundnut by 56.20 per cent and Niger by 47.50 per cent. The FLDs made a great impact on the use of improved varieties, intercultural operation viz., earthing-up & drum rolling and adoption of other recommended practices of oilseed crops under study. In a nutshell, the overall trend in adoption of groundnut production technologies was increased by 181.72 per cent and Niger crop production technologies by 233.38 per cent in adopted villages. The 'Local' varieties of oilseed crops were replaced by improved cultivars like 'Konkan Tapora', 'Konkan Gaurav', 'TG-26' and 'IGP 76' on a large scale in demonstration cluster. The area under 'Konkan Trombay Tapora' variety of groundnut was raised from 1.00 to 7.60 ha and 'Konkan Gaurav' from 2.00 to 9.00 ha. This leads to conclude that FLD is proven extension intervention to demonstrate the production potential of oilseed crops varieties on farmers' field. Study recommends that extension agencies engaged in transfer and application of agricultural technologies on farmers' field should give priority to organize frontline demonstrations (FLDs) on large scale by adopting cluster approach for harnessing the productivity potential of oilseed crops and to ensure rapid spread of flagship technologies developed by National Agricultural Research System (NARS). Furthermore, policy maker may provide adequate financial support to frontline extension system for organizing FLDs under the close supervision of agricultural scientists and extension professionals. This varietal replacement strategy through FLDs may help to increase the oilseed crops productivity at micro, meso and macro level.

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