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Evaluation and impact of front line demonstrations on productivity of Niger in western ghat zone of Maharashtra

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Abstract
Niger (*Guizotia abyssinica* L. Cass.) is an important traditional minor oilseed crop of India, cultivated mainly in hilly and triable areas. Inspite of high oil content and a wide range of adaptability, little attention has been paid towards maximization of this oilseed crop. The agronomic practices *viz.* Fertilizer, thinning, weeding and plant protection plays important role in maximizing the grain yield as yield levels in most of the crop are stagnated. Keeping in view all facts, from Western Ghat Zone of Maharashtra, 150 respondents who had actually undertaken the Front Line Demonstration (FLD) with control trial were selected for the study. The evaluated data showed that, the technology gap was more except niger variety Phule Karala in whole package technology. The lowest technology index was observed in variety Phule Karala and thus found best for cultivation in western ghat zone for whole package technology.
The percent increase in yield was higher in whole package technology of niger (76.22 percent) followed by fertilizer application technology (43.31 percent) and line sowing technology (27.74 percent). The comparative profitability of different technologies of niger crop in demonstrated plots shows that the highest benefit: cost ratio was obtained in fertilizer application technology (0.97) followed by line sowing technology (0.93) and whole package technology (0.87). The factors responsible for low B:C ratio in local check plot was because of adopting traditional methods of cultivation.

Keywords: demonstration, impact, niger, technology, productivity

Introduction
Niger [*Guizotia abyssinica* (L. f.) Cass] is an important edible oilseed crop of Indian tribal communities, which contains edible oil 38–43%, protein 20% and sugar 12%. As because niger can be grown with minimum agro inputs, it is considered to be a crop for resources poor farmers particularly in developing countries like India. India is the chief producer of niger seeds which ranks second and fourth position in the world for its acreage and annual production respectively (Dalei *et al*., 2014) [1]. It is grown in the states of Madhya Pradesh, Chhattisgarh, Odisha and Maharashtra and to a lesser extent in Karnataka, Bihar, Jharkhand, Gujarat and Andhra Pradesh. Average yield of niger seed 320 kg/ha. and 218 kg/ha. national (India) and Maharashtra state (2016-17). The niger seed has nearly 40% of oil which is used in foods, paints, soft soaps, lighting, lubrication and cosmetics (DOR, 2013) [3]. In India about 75% of the harvested seeds are used for oil extraction and the rest is exported for bird food. Roasted or fried seeds are eaten as snacks or used as a condiment. The press cake after oil extraction contains 31–40% protein and is used as cattle feed.
Since, the crop is cultivated by poor tribal farmers in the interiors of villages in scattered fields, the extension agencies could not work efficiently in providing the necessary package of practices to the farmers besides quality seed and required inputs. Thus frontline demonstrations on farmers field are helpful to show the potential of full package of practices and the component technologies has been an efficient method of technology transfer to farmers (DOR, 2013) [3]. The major objective of frontline demonstrations is to show the production potential and profitability of improved technologies vis-a-vis farmers practice under real farm situations. The production of niger is very low in the state as compare to the national production.

Methodology
The present study was conducted in 15 villages from western ghat zone of Maharashtra. For selection of respondents, a total list of FLD farmers was collected from Zonal Agricultural Research Station, Igatpuri. By adopting systematic sampling design 150 respondents who had actually undertaken the demonstration with control trial were selected for the study.

The data was collected one year after FLD programme through personal interview technique with the help of interview schedule developed for the study.

The technology gap and technology index were calculated using the following formula as given by Samui *et al.,* (2000) [7].

Technology index = Potential Yield – Demonstration Yield/ Potential Yield x 100

Technology gap = Potential Yield - Demonstration Yield

Extension gap = Demonstration yield – Yield under Farmers Practices

B: C ratio = Net income (Rs. / ha) / cost of cultivation (Rs. / ha)

% increased over farmers practices = Improved practices – Farmers practices / farmers practices x 100

Impact of technology was calculated by considering percent increase in yield of demonstration plot over local check in percentages. Further, per hectare cost of oilseed crop was worked out by total sum of expenditures of land preparation, seeds, manures and fertilizers, plant protection measures and labour component.

Results and Discussion

The evaluation of front line demonstration programme is necessary for measuring effectiveness as well as to analyze the impact of demonstrations on productivity of oilseeds of demonstrator farmers.

Technology gap and extension gap

The technology gap was due to non-transferable technologies such as recommended plant population per hectares and environmental differences between Research station and village. The extension gap was due to resource-cum-management-cum-extension efforts. It is difference between the yield obtained due to adoption of technology in demonstration plot and yield obtained from traditional method of cultivation.

Table 1: Technological and extension yield gap and Technology Index for demonstrated niger crop in whole package technology

Year	Variety used	No. of Demo	Area (ha.)	Yield (kg/ha)			TG (kg/ha)	EG (kg/ha)	TI (%)
				Pot-ential	Demo	Local check			
2011-12	Sahyadri	10	04	500	403.5	212	96.5	191.5	19.3
2012-13	Phule Karala	10	04	500	422	223	78	199	15.6
2013-14	Phule Karala	10	04	500	445	226	55	219	11.0
2014-15	Phule Karala	10	04	500	253	163	247	90	49.4
2015-16	Phule Karala	21	8.40	500	241	152	259	89	51.8
	Phule Vaitrrna	04	1.60	500	46	29	454	17	90.8
2016-17	Phule Karala	18	7.20	500	191	113	309	78	61.8
	Phule Vaitrrna	07	2.80	500	74	44	426	30	85.2
2017-18	Phule Karala	12	4.80	500	230	132	270	98	54.0
	Phule Vaitrrna	03	1.20	500	58	33	442	25	88.4
Average		105	42	500	236.33	132.7	263.65	103.65	52.73

Data presented in Table 1 showed that, in kharif niger crop, the technology gap was highest in case of variety Phule Vaitrna (454 kg/ha) and lowest in variety Phule Karala (55 kg/ha). The extension gap was highest in Phule karala variety (219 kg/ha) and lowest in variety Phule Vaitrna (17 kg/ha). Regarding Phule Vaitrna variety it was observed that the technology gap was highest (454 kg/ha), whereas, extension gap was highest in Phule Karala varirty (219 kg/ha) respectively in Nashik district.

Table 2: Technological and extension yield gap and Technology index for demonstrated niger crop in fertilizer application technology

Year	Variety used	No. of Demo	Area (ha.)	Yield (kg/ha)			TG (kg/ha)	EG (kg/ha)	TI (%)
				Potential	Demo	Local check			
2011-12	Phule Karala	05	02	500	308	207	192	101	38.4
2012-13	Phule Karala	05	02	500	315	220	185	95	37
2013-14	Phule Karala	05	02	500	345	228	155	117	31
2014-15	Phule Karala	05	02	500	230	177	270	53	54
Average		20	08	500	300	208	201	92	40.1

It was observed from Table 2, that in niger crop fertilizer application technology gap in case of variety Phule Karala was highest (270 kg/ ha) in the year 2014-15 and lowest (155 kg/ha) in the year 2013-14. The extension gap was highest in case of Phule karala variety in the year 2013-14 (117 kg/ha) and lowest (53 kg/ha) in the year 2014-15.

The existence of extension gap was because of the demonstrator farmers in their local plot failed to adopt recommended package of practices. The findings are in line with the findings of Patil and Kunal (1998) [6] and Das *et al*. (2008) [2].

Table 3: Technological and Extension yield gap and Technology Index for demonstrated niger crop in line sowing technology

Year	Variety used	No. of Demo	Area (ha.)	Yield (kg/ha)			TG (kg/ha)	EG (kg/ha)	TI (%)
				Potential	Demo	Local check			
2011-12	Sahyadri	05	2.0	500	260	201	240	59	48
2012-13	Sahyadri	05	2.0	500	266	208	234	58	46.8
2013-14	Sahyadri	05	2.0	500	297	224	203	73	40.6
2014-15	Phule Karala	10	4.0	500	172	142	328	30	65.6
Average		25	10.0	500	249	194	251	55	50.25

A perusal of Table 3 enlightens the fact that, the technology gap was observed minimum i.e. 203 kg/ ha and maximum i.e. 328 kg/ha in niger variety Sahyadri (IGP-76) and Phule Karala respectively in the location Nashik and Thane districts. However, technology gap of these varieties was observed maximum in Thane district. This may be due to the soil fertility and weather conditions. The extension gap was ranged 30 kg/ha to 73 kg/ha in all the locations which emphasized the need to educate the farmers in adoption of improved technologies to narrow these extension gaps. The findings are in line with the findings of Goswami *et al*. (1996) [4].

Technology Index

For ascertaining feasibility of evolved oilseed technology at the farmer's field, technology index was calculated. The criteria is lower the value of technology index more is the feasibility of the technology. Technology index was observed highest (90.8 percent) in Phule Vaitrna variety of niger crop (Table 1) followed by Phule Karala (61.8 percent) and Sahyadri (19.3 percent) from Nashik location. Hence, according to criterion, Phule Vaitrna was found best in kharif season for whole package technology at Nashik location.

In *kharif* niger fertilizer application (Table 2) technology index was highest (54.00 percent) in variety Phule Karala in Thane district followed by 38.4 percent, 37.00 percent and 31.00 percent respectively in location Nashik district. Hence, according to the criterion, in *kharif* niger Phule Karala variety is best for fertilizer application technology.

It was observed from Table 3 that, the line sowing technology index was highest in niger variety Phule Karala (65.6 percent) and (48.00 percent) in Thane and Nashik districts. Hence, according to criterion variety Phule Karala and Sahyadri (IGP-76) performed best in Thane and Nashik districts for line sowing technology. The possible reason that could be attributed to the high feasibility of niger production technology was that the participant farmers were given opportunity to interact with the scientist and they were made to adopt recommended practices and skills during the process of demonstration.

Impact

The information regarding the impact of front line demonstrations on improvement of productivity of niger crop in various technology is presented in Table 4.

Table 4: Impact of Front Line Demonstrations on improvement of productivity of niger crop in various technology

Sr. No.	Technology Used	No. of Demo.	Area (ha.)	Average yield (kg/ha)		% increase in over local
				Demo.	Local check	
1.	Whole package	105	42	338	190	76.22
2.	Fertilizer Application	20	08	300	208	43.31
3.	Line sowing	25	10	249	194	27.74
	Average	150	60	296	197	49.09

The data indicated in Table 1 revealed that, there was 76.22 percent increase in yield of niger crop over local check in whole package technology followed by 43.31 percent in fertilizer application technology and 27.74 percent in line sowing technology.

The percent increase in yield was higher in whole package technology in niger crop (76.22 percent) followed by fertilizer application technology (43.31 percent), and 27.74 percent in line sowing technology. The key inputs which make the difference in the yield of demonstration and local check plot were seed treatment, spacing, manures and fertilizers and plant protection measures.

In this study the influence of the front line demonstration was also observed on the productivity of oilseed due to adoption of improved recommended practices. The FLD programme was effective in changing knowledge, attitude and skill of demonstrator farmers regarding improved recommended practices of oilseeds during adoption. This also improved the relationship between farmers, extension workers and scientists and built confidence between them.

Economic impact of demonstrated oilseed technology

In this study, the composite mean technology wise economic impact of demonstrated niger crop technology was worked out by calculating average total costs, gross return, net return and B:C ratio of demonstration and local check plot. Cost of niger crop cultivation in the present study was attempted by computing per hectare cost. Total operational cost was worked out by total sum of expenditures of land preparation, seeds, manures and fertilizers, plant protection measures and labour component.

The results in Table 5 shows that, in niger whole package technology in case of demonstration plot total average cost per hectare was ` 10151/-. gross return ` 18838/ - and B: C ratio 0.87, whereas in case of local check plot total average cost per hectare was ` 6851/-. Gross return ` 10714/- and B: C ratio 0.57 was found. In fertilizer application technology, it was found that demonstration plot total average cost per hectare was ` 7667/-. gross return ` 15066/- and B: C ratio 0.97, whereas in case of local check plot total average cost per hectare was ` 6395/-. gross return ` 10548/- and B: C ratio 0.64 was recorded. With regard to line sowing technology demonstration plot total average cost per hectare was ` 6468/-, gross return ` 12433/- and B:C ratio 0.93, whereas in case of local check plot total average cost per hectare was ` 6225/-, gross return ` 9770/- and B:C ratio 0.57 was found.

Table 5: Total costs, returns and comparison of B:C ratio of demonstrated and local check plot

Technology Used	Total cost (Rs./ha.)		Gross return (Rs./ha.)		Net return (Rs./ha.)		B:C Ratio	
	Demo	Local	Demo	Local	Demo	Local	Demo	Local
Whole package	10151	6851	18838	10714	8683	3863	0.87	0.57
Ferti. Application	7667	6395	15066	10548	7398	4153	0.97	0.64
Line sowing	6468	6225	12433	9770	5965	3495	0.93	0.57
Average	8095	6490	15446	10344	7349	3837	0.92	0.59

Total expenditure in the cultivation of niger crop by whole package technology was maximum than fertilizer application technology and line sowing technology. The comparative profitability of different technologies in demonstrated plots shows that the highest benefit: cost ratio was obtained in fertilizer application technology (0.97) followed by line sowing technology (0.93) and whole package technology (0.87). These findings are supported by the findings of Sharma and Sharma (2004) [8] and Trilochan *et al*. (2007) [9].

It was seen that, with respect to cost of cultivation nearly same amount have spent in demonstration and local check plot. It might be due to the fact that, the demonstrator farmers were not much aware about improved technology of crop cultivation before taking part in demonstration. The increase in net return from demonstration plot was much more than from local check plot was observed. The probable reason might be that, during the front line demonstration period, the demonstrator farmers undergone various method demonstrations, training programmes and gained more knowledge about new technological skills to carry out the farm operations.

It is clear from the results that, the average B:C ratio of demonstration plot was higher than local check plot in case of different technologies of niger crop. The factors responsible for low B: C ratio in local check plot was because of adopting traditional methods of cultivation i.e. no proper seed treatment, improper spacing, imbalance use of manures and fertilizers and not following plant protection measures. However, the high B:C ratio in demonstration plot may be due to the gain in knowledge of recommended practices of niger crop during the extension contact, extension participation and practicing it in the demonstration field under the close supervision of the scientists.

Conclusion

The evaluated data showed that, the technology gap was more except niger variety Phule Karala in whole package technology. The lowest technology index was observed in variety Phule Karala and thus found best for cultivation in western ghat zone for whole package technology.

The percent increase in yield was higher in whole package technology of niger (76.22 percent) followed by fertilizer application technology (43.31 percent) and line sowing technology (27.74 percent). The comparative profitability of different technologies of niger crop in demonstrated plots shows that the highest benefit: cost ratio was obtained in fertilizer application technology (0.97) followed by line sowing technology (0.93) and whole package technology (0.87). The factors responsible for low B:C ratio in local check plot was because of adopting traditional methods of cultivation.

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