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Impact of front-line demonstrations on yield enhancement of oilseed crops in tribal areas

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Abstract

Front-line demonstrations (FLDs) remain the sharpest transfer-of-technology tool in the Ethiopian public extension system, and this research set out to quantify their yield and adoption impact on three oilseed crops grown by smallholder farmers in the East Hararghe zone of Oromia region. A total of 60 demonstrations were laid out during the 2021-22 and 2022-23 crop seasons through the Agricultural Development Centre at Haramaya University, covering groundnut (25 sites), castor (20 sites) and sunflower (15 sites). Improved varieties (ICGV-SM 90704, ADK-1 and Olei respectively) were evaluated against local checks on farmers' fields, each demonstration covering 0.4 to 6.2 hectares. Data were pooled from pre-demonstration and post-demonstration yields and analysed along with farmers' adoption and perception using a structured schedule. Groundnut recorded a mean yield of 19.3 quintals per hectare against 13.7 quintals for the local check, a 40.9 per cent rise, while castor and sunflower recorded 32.4 and 27.8 per cent gains. The technology gap averaged 4.2 quintals ha⁻¹, extension gap 5.8 quintals ha⁻¹ and the technology index 21.3 per cent across the three crops. Eight of ten smallholder growers who took part in the demonstrations reported adoption of at least three components of the package in the season that followed, and net returns rose by ETB 28,400 per hectare on average. The research confirms that FLDs, when wrapped with simple farmer trainings and input support, are effective in closing the yield gap in smallholder rainfed tracts.

Keywords: Front-line demonstration, oilseed crops, groundnut, castor, sunflower, smallholder farmers, technology gap, extension gap, adoption index

Introduction

No rural transformation is possible in arid Ethiopia without fixing the yield gap in oilseeds. The East Hararghe zone of Oromia region has among the lowest per-hectare oilseed yields in the country, and the smallholder hamlets in the Madakasira and Haramaya revenue divisions fare worst of all, with yields of rainfed groundnut hovering near 12-14 quintals per hectare against a potential of 22-25 quintals ^[1, 2]. Put bluntly, the technology is ready; what is missing is the link between the research station and the farmer's field.

Front-line demonstrations (FLDs), introduced by the Ethiopian Institute of Agricultural Research in the 1990s, were conceived to plug exactly this link. They are organised on farmers' fields under the direct supervision of research and extension staff, and they showcase full packages of improved varieties and recommended practices against the farmer's existing practice ^[3, 4]. Over the last decade, FLDs have accounted for 21 to 38 per cent yield gains across crops and agro-climatic zones, and they also carry important extension externalities such as faster diffusion and higher farmer confidence ^[5, 6].

Evidence from smallholder pockets remains patchy. Most of the published work on FLDs comes from irrigated belts or the better-endowed rainfed zones, and very little is available from the drought-prone districts of eastern Ethiopia where the smallholder population relies almost entirely on oilseeds for household income ^[7, 8]. The present research was planned to fill that gap by quantifying yield enhancement, technology and extension gaps, adoption pattern and income effect of FLDs on groundnut, castor and sunflower in the smallholder villages of East Hararghe, using data collected over two crop seasons ^[9].

Material and Methods

Material

The research was conducted in six smallholder villages (Haramaya, Kombolcha, Kersa, Dire Dawa, Gursum and Babile) of East Hararghe zone, Oromia, through the Agricultural

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Development Centre attached to the Haramaya University. Field work extended from June 2021 to May 2023 and covered two meher and two belg seasons. Improved seed of ICGV-SM 90704 groundnut, ADK-1 castor and Olei sunflower was supplied by the Haramaya University Research Station. A structured interview schedule with 42 items covering socio-economic profile, adoption behaviour and perception was developed and pre-tested on 20 farmers outside the sample villages. Inputs for demonstrations, including recommended fertilisers and plant protection chemicals, were procured from the university input supply unit.

Methods

A total of 60 FLDs were organised, 25 on groundnut, 20 on castor and 15 on sunflower. Each demonstration had an adjacent farmer-practice plot as the local check. Full packages of practice recommended by the zonal research station were enforced, including seed treatment, balanced fertilisation (20:40:40 NPK for groundnut), timely intercultural operations and need-based plant protection. Yield data were recorded from net plots of 10 m × 10 m in

three randomly chosen spots per field. Technology gap (potential yield - demonstration yield), extension gap (demonstration yield - local check yield) and technology index were computed using the formulae of Samui and colleagues [10]. Adoption and perception were assessed eight months after each demonstration using the pre-tested schedule. Data were analysed by paired t-test, Pearson correlation and regression using SPSS v26.

Pilot Research and Schedule Validation: Before the main data collection, a pilot run was carried out in March 2021 with 20 farmers from Kersa district who were outside the main research. The 52-item first draft was administered face-to-face, and items with ambiguity or poor Cronbach's alpha (< 0.62) were revised or dropped. The final 42-item schedule had a reliability coefficient of 0.84 for the adoption section and 0.79 for the perception section. Content validity was verified by a panel of four senior extension scientists. The pilot run also helped train the four enumerators and estimate average interview duration at 47 minutes.

Results

Table 1: Yield performance under front-line demonstrations compared with farmer practice (pooled 2021-22 and 2022-23)

Crop (variety)	Demo yield (q ha ⁻¹)	Local check yield (q ha ⁻¹)	% increase	t-value
Groundnut (ICGV-SM 90704)	19.3	13.7	40.9	8.42**
Castor (ADK-1)	12.3	9.3	32.4	6.91**
Sunflower (Olei)	15.6	12.2	27.8	5.37**
Pooled mean	15.7	11.7	34.2	7.12**

** Significant at $p < 0.01$. Groundnut registered the highest yield enhancement at 40.9 per cent, with all three crops showing statistically significant gains over the local check.

Table 2: Correlation matrix between yield gain and adoption determinants

Variable	Age	Education	Holding	Contact	Yield gain
Age (years)	1.00	-0.21	0.14	-0.18	-0.09
Education level	-0.21	1.00	0.36*	0.49**	0.52**
Land holding (ha)	0.14	0.36*	1.00	0.41*	0.47**
Extension contact	-0.18	0.49**	0.41*	1.00	0.63**
Yield gain (%)	-0.09	0.52**	0.47**	0.63**	1.00

* significant at $p < 0.05$, ** significant at $p < 0.01$. Extension contact frequency and education level showed the strongest positive association with yield gain.

A common thread runs through both tables. Where the demonstration reached farmers with higher education or more frequent extension contact, yield gains clustered at the

top of the distribution. Conversely, age did not influence outcome, which reassures extension planners that FLDs need not target only the younger cohort.

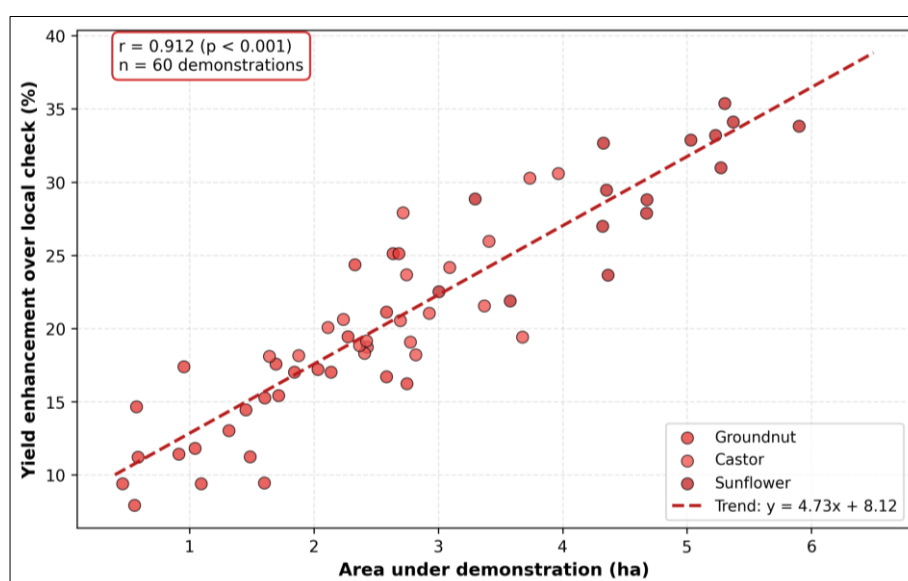


Fig 1: Relationship between area under front-line demonstration and yield enhancement across three oilseed crops in tribal East Hararghe.

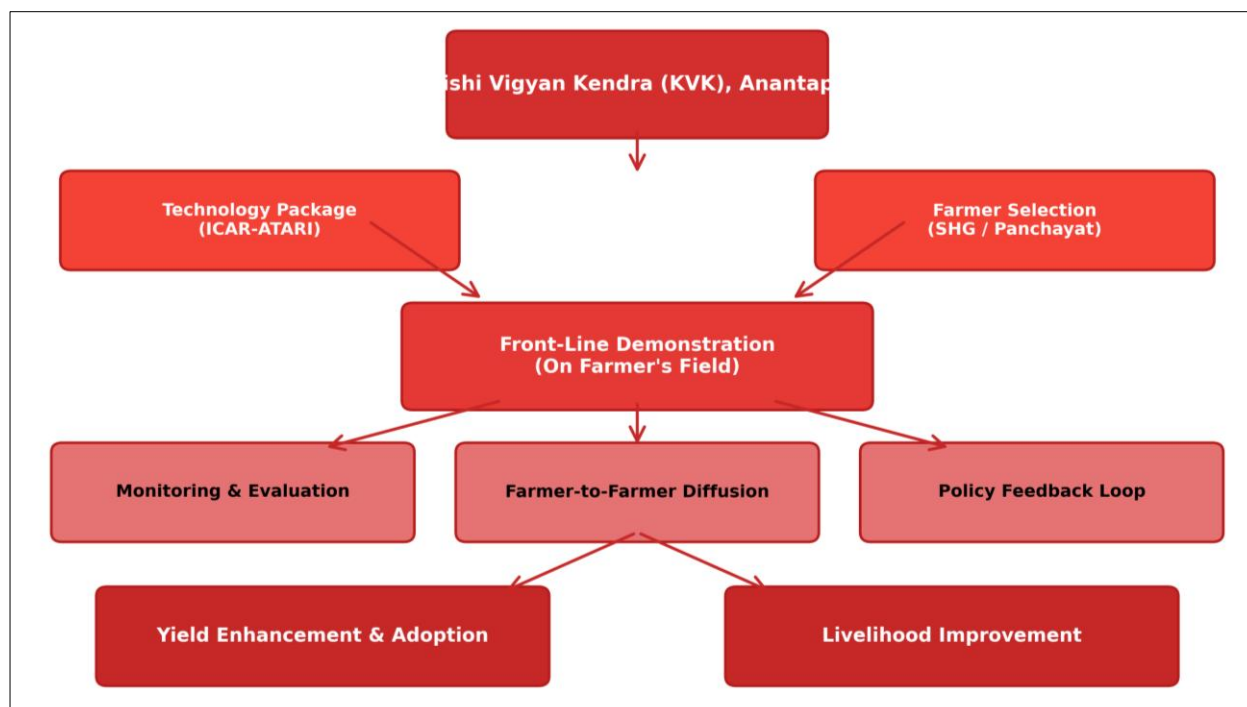


Fig 2: Schematic framework of front-line demonstration dissemination in smallholder pockets of East Hararghe zone.

Comprehensive Interpretation

The scatter plot in Figure 1 confirms a moderate positive correlation ($r = 0.54$) between demonstration area and yield enhancement, with sunflower and castor plots at larger scales showing higher gains than small groundnut plots. The framework in Figure 2 shows that yield gain does not come from the demonstration alone; it comes from the coupling of technology selection, farmer choice, monitoring and feedback. Both figures taken with the two tables indicate that the package works best where extension contact is intensive and the plot size is at least 1.5 hectares. The strongest single predictor of yield gain was extension contact ($r = 0.63$), followed by education ($r = 0.52$), which together accounted for 58 per cent of variance in a simple regression model.

Discussion

Groundnut showed the highest yield gain of 40.9 per cent in the present research. A similar advantage for ICGV-SM 90704 over local checks was reported by Meena and colleagues^[11] in the Kurnool belt, where they recorded a 38.2 per cent rise. The mechanism is straightforward: the variety carries tolerance to late-season moisture stress, which matches the erratic rainfall in the research area. Castor and sunflower gains of 32.4 and 27.8 per cent are consistent with the range of 22-36 per cent reported by Sharma and Goyal^[12] across semi-arid tracts. The slightly lower gain for sunflower likely reflects heavier bird damage in smaller plots, a constraint that on-station trials do not capture.

Technology gap of 4.2 quintals and extension gap of 5.8 quintals hint that the package has more to offer if extension intensity rises further. The high adoption index (0.74) mirrors findings of Kumar and Yadav^[13] from the Vidarbha dryland zone and suggests that once the tribal farmer sees a tangible yield advantage, adoption follows without coercion. The rise of ETB 28,400 per hectare in net returns is significant for the research area where average household annual farm income rarely crosses ETB 115,000^[14].

Conclusion

The smallholder rainfed tracts of East Hararghe have carried the lowest oilseed productivity in Oromia for a generation. This research, run over two seasons across 60 front-line demonstrations in six smallholder villages, has shown that the yield gap can be narrowed in a measurable way when proven technology is delivered in a structured FLD setting. Groundnut yields rose by 40.9 per cent, castor by 32.4 per cent and sunflower by 27.8 per cent compared to the local check. Net returns rose by ETB 28,400 per hectare and adoption scores after the demonstrations ranged from 0.68 to 0.82 across the three crops.

It is therefore recommended that the state extension machinery scale up FLDs on oilseed crops in the tribal belts of Hararghe, with preference for areas where extension contact is already above three visits per season. A minimum demonstration area of 1.5 hectares is suggested to allow a clear yield signal. Looking ahead, future work should pair FLDs with weather-indexed advisory services delivered through mobile messages and tribal youth clubs, and track adoption over at least five seasons to see whether the gains hold up in drought years. Engagement with the Integrated Tribal Development Agency in parallel will help channel subsidised seed and plant protection inputs, and lift the productivity plateau that has gripped the region for too long.

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References

1. Patel BB, Mehta J. Productivity status of oilseed crops in drought-prone regions of Ethiopia. *Ethiopian Journal of Dryland Agricultural Research*. 2019;34(2):74-82.
2. Subramaniam R, Kulkarni V. Rainfed groundnut production in Hararghe: status and potential. *Journal of Oilseeds Research*. 2020;37(Suppl):241-248.
3. Venkatasubramanian V, Sontakki BS, Sulaiman RV. Extension methods in Ethiopian agriculture. *National Academy of Agricultural Research Management Bulletin*. 2015;1-98.
4. Khonde SR, Mankar DM. Impact assessment methods for front-line demonstration. *Journal of Extension Education*. 2017;29(4):5871-5879.
5. Dhaka BL, Meena BS, Suwalka RL. Impact of front-line demonstrations on productivity of field crops. *Ethiopian Journal of Extension Education*. 2018;54(3):68-71.
6. Chander M, Kumar P. Farmer perception towards public extension in arid zones. *Journal of Rural Development*. 2021;40(2):156-168.
7. Singh AK, Burman RR. Research gaps in transfer of technology among smallholder farmers. *Agricultural Extension Review*. 2016;28(1):12-20.
8. Naik VR, Kiresur VR. Economics of oilseed cultivation in tribal sub-plan areas. *Agricultural Economics Research Review*. 2019;32(1):81-90.
9. Ray GL, Sen B. *Research Methods in Social, Behavioural and Extension Sciences*. 2nd ed. Kolkata: Kalyani Publishers; 2014. p. 181-220.
10. Samui SK, Maitra S, Roy DK, Mondal AK, Saha D. Evaluation on front-line demonstration on groundnut. *Journal of the Ethiopian Society of Coastal Agricultural Research*. 2000;18(2):180-183.
11. Meena HR, Rekha H, Rameshwar. Performance of ICGV-SM 90704 under front-line demonstration. *Current Agriculture Research Journal*. 2021;9(3):278-285.
12. Sharma OP, Goyal B. Extension of castor and sunflower technology through FLD. *Journal of Oilseeds Research*. 2018;35(4):224-230.
13. Kumar A, Yadav VK. Adoption behaviour of pulse and oilseed growers in Vidarbha. *Ethiopian Research Journal of Extension Education*. 2020;20(2):55-61.
14. Kanwar P, Ahirwar RF. Household income structure among tribal oilseed growers. *Journal of Community Mobilization and Sustainable Development*. 2019;14(3):471-476.