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Impact of on-farm frontline demonstration technologies for enhancement of productivity and profitability of sunflower in North-Eastern Karnataka

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Abstract
Series of on-farm sunflower frontline demonstrations (FLDs) were conducted in *Kharif* and winter seasons in five districts of North-Eastern Karnataka from 2007 to 2019. These demonstrations were conducted over 419 farmer fields each having minimum of one acre of sunflower production. Collected data of FLD's and farmers practice were analyzed in terms of yield advantage, monetary benefits and assessed the yield gap and extension gaps. Results indicated that there was huge gap in grain yield gain (11.0 to 35.2%) across improved components demonstrated over existing farmers practice. It was also resulted additional monetary benefits (Rs. 2300 to 6800/ha) in both the seasons. Maximum yield improvement was noticed by weed management, intercropping with pigeonpea and groundnut, management of pests, alternaria, necrosis and powdery mildew. It was indicated that sunflower yield improvement possible by implementation of improved technologies.

Keywords: Extension gap, economic advantage, frontline demonstrations

Introduction
Several efforts were made to measure the different yield gaps in oilseeds including sunflower. In this regard, the standard terminologies have been identified and defined. For example, potential yield is the yield of a crop cultivar when grown with water and nutrients non-limiting and biotic stresses are effectively controlled (Evans and Fischer 1999). Attainable yield is the best yield achieved through skillful use of the best available technology. Whereas, average yield is defined as the yield actually achieved in a farmer's field. Rao *et al*. (2010) had stated that the main challenges for research and development are to bridge the gap between actual and attainable yield by enhancing farmers' access to quality inputs, improved technologies and information.

Frontline demonstration of improved technologies may be the important supplementary tool in this regard as the new technologies demonstrated have the greater potential to yield more. Chaudhary *et al*. (2014) reported that the front line demonstrations have given a good impact over the farming community of Narmada district as they were motivated by the new agricultural technologies applied in the FLD plots. Raj *et al*. (2013) emphasized the need to educate the farmers through various means for the adoption of improved agricultural production technologies to reverse this trend of wide extension gap. The new technologies will eventually lead to the farmers to discontinue the old technology and to adopt new technology (Hiremath and Nagaraju 2010). Demonstrations are one of the practical approaches to maximize the production by display of relevant technologies at farmers' field under strict supervision of agricultural experts helped to narrow down the extension and technological gaps to a considerable extent. The main objective of sunflower FLD's was to demonstrate the performance of recommended high yield hybrids of sunflower with complete package of practices of as a component under different agro-climatic regions and farming situations. It was also to assess the performance of FLD fields with local check and to analyze the economic feasibility of new technologies.

Materials and Methods
The study is part of frontline demonstration being implemented by all India Coordinated Research Project on sunflower, Raichur center, Karnataka. It has followed the concept of FLD in true spirit and conducted large number of demonstrations in different villages of Raichur, Ballari, Koppal, Kalaburagi and Yadgir districts of North-Eastern Karnataka. Selected districts are predominant sunflower growing districts wherein it is sown in *Kharif* (June-July), winter (September-October) and summer (January) seasons. Over decades, 419 demonstrations were conducted over an area of 419 acres each farmer is having one acre. Comparisons of improved hybrids and high yielding varieties, application of balanced fertilizers, intercropping, integrated weed management, thinning, management of powdery mildew, Alternaria, Necrosis, defoliators and also whole package in rainfed and irrigated condition were made with farmer's practice. The demonstrations were laid out under the close supervision of sunflower scientists.

Before implementation a list of farmers was prepared from group meeting and identified research problems associated with sunflower production. In case of farmers practice existing practices being used by farmers were followed without technical intervention. In general, soils of the selected districts and villages were deep to medium black soil (*Vertisol*) rich in potassium and clay content. In demonstration plots, use of quality seeds of improved sunflower hybrids RSFH-130, RSFH-1887, KBSH 53, RSFH-1, KBSH-44, DRSH-1. In case of local checks popular

privates were used for comparison. Visit of farmers and the extension functionaries was organized at demonstration plots, field days to transfer the technology at large scale. Due attention was taken to select farmers in traditional sunflower area. The yield data of demonstration plots as well as control plots were collected immediately after harvesting to assess the impact of FLDs intervention on the yield of Sunflower. Primary yield data from farmers was used to calculate yield advantage. For improved production practice seeds were hand dibbled in ridges and furrows, at 15 DAS thinning of excess seedling maintaining single plant in each spot. Application of recommended dose of fertilizers @ 90:90:60 kg NPK/ha, foliar spray of Borax @ 0.2% at ray floret stage. These are compared with local practice adopted by sunflower farmers.

For management of necrosis and alternaria diseases seed treatment with Imidacloprid 60 FS @ 5 g/kg of seed and also spray @ 0.3 ml/l at 30 and 45 DAS or Confider spray @ 0.5 ml/l @ 30 & 45 DAS border crop with sorghum at all the selected farmers. For management of alternaria disease two sprays of Hexaconazole @ 1.0 ml/l, Imidacloprid 17.8 SL + Quintal @ 0.2% was at the onset of disease. For management of powdery mildew Difenoconozole @ 0.5ml/l was recommended for demonstrated farmers. For leaf defoliators and other pests management Spinosad @ 75ml/ha and for thrips management Confider spray @ 0.5 ml/l was recommended.

Primary data on yield in both FLD's plots and farmers practice was collected from beneficiary farmers. The yield increase in demonstrations over farmers practice was calculated by using the following formula:

$$\% \text{ yield increase} = \frac{\text{Avg. yield in FLD's Plot- Farmers practice plot average yield}}{\text{Farmers practice plot average yield}} \times 100$$

Cost of cultivation of improved and farmers practice demonstrations were workout by considering cost of inputs like seeds, fertilizers, pesticides etc. purchased by the farmers (in farmers practice)/supplied by the research center (in demonstration plots) as well as hired labour, sowing charges by bullocks/tractor and post harvest operation charges paid by the farmers. The farmers' family labour was not taken into consideration in the present study. The gross and net returns were worked out accordingly by taking cost of cultivation and price of grain yield of sunflower. Additional costs in FLD's include expenditure on improved technological inputs in FLD's over farmers' practice. Similarly, the benefit-cost ratio (BCR) was worked out as a ratio of gross returns and costs as followed by Choudhary *et al.* (2009) [2]. Extension gap is calculated based on difference ion average demonstration plot yield and farmers practice average yield.

Results and Discussion

Yield advantage

The grain yields of sunflower crop in demonstration plots under FLD's were invariably higher than the farmers practice over years. Data collected over 2007-2013 and 2014-2019 indicated similar response to improved production package as compared to farmers practice. During 20107-2012, nutrient management, weed management, intercropping with groundnut and pigeonpea were played vital role in yield improvement (Table 1). It also indicated in terms of extension gap values. Whereas in 2014-2019, greater sunflower grain yield was obtained by intercropping with Pigeonpea (453 kg/ha), whole package in irrigated (340 kg/ha), management of pests (232 kg/ha). While, lower yield improvement was observed in management of necrosis and thinning practices (Table 2). Extension gap indication of yield advantage was greater in management of pests, necrosis, alternaria, weed management. It is attributed to the adoption of recommended agro-techniques ion FLD's during the study period. Data reveals that yield improvement was 11.0 to 32.5% over farmers practice. Meanwhile impact of component wise was varied over years. It was higher with application of recommended dose of fertilizers, management of weeds, pest and diseases. Whereas, adoption of whole package has resulted in increased yield potential was upto 32.5%. Similar yield difference and percent yield improvement was observed in both *kharif* and rabi seasons (Fig.2). Similar results on yield improvement in FLD plots over existing farmers practice was reported by Dubey *et al*. (2018) [4], Anand Naik *et al.,* (2016) [1], Anuj Kumar Singh *et al*. (2014) [3].

Economic advantage

Besides, yield advantage FLD's were shown economic advantages at all the locations over years (Table 2 and 3). The economic analysis indicated that use of improved technologies in sunflower could substantially increase the income as well as livelihood of the farming community. The economics of technology intervention has resulted in huge monetary benefit for the selected farmers over years. The additional income generated through enhancement of seed yield with same cost of production. However economic gain was varied among the components (Table 1 and 2). It was greater with intercropping with groundnut, pigeonpea followed by application of fertilizers and adoption of whole package. Similar advantages in all FLD's were observed at five years interval (2007-12 and 2013-09) as compared to existing farmers practices and it keeps on increased every year. Greater economic advantage was observed in intercropping system followed by whole package in irrigated agriculture and nutrient management. Sagar and Chandra (2004), Poonia *et al.* (2017), Wasdkar *et al*. (2018), Anuj Kumar Singh *et al.* (2014) [3], Dubey *et al*. (2018) [4] were also reported economic benefits realized in FLD's plots over existing farmers practice.

Conclusion

The above findings inferred that the usage of recommended package of practices leads to adoption of improved production techniques, pests and disease management. At all the demonstration units it was indicated that yield and economic advantage over conventional farmers practice. To reduce the technological and yield gap in sunflower need to emphasize adoption of improved technologies, since each component has contributed at greater extent. Further these improved technologies helpful for larger adoption and enhance productivity of sunflower at larger scale.

Table 1: Demonstration package and farmers practice under FLD's in sunflower in selected districts of N-E Karnataka

Good management practice	Farmer's Practice
Improved public Hybrids	Private hybrids
Intra row spacing: 30 cm	Intra row spacing: Uneven
Seed dibbling in ridges and furrows	Line sowing in flat beds
Seed hardening with $CaCl_2$	No seed hardening
Intercropping with Pigeonpea, groundnut	Monocropping
Use of pre emergent herbicide Pendimethalin 38.7 CS @ 1.5 ml/l	Hand weeding at 20 DAS
Application of post emergent herbicide Propaquizafop @ 62 g a.i. /ha at 20 DAS	No post emergent application of herbicide
Thinning	Non-thinning
Crop nutrition based on soil test results	Blanket recommendation
Integrated pest management	Chemical based pest management
Integrated disease management	Chemical based disease management
Soil application of $ZnSO_4$ @ 10 kg/ha	No $ZnSO_4$ application
Foliar spray of Cow urine @ 5% at 45 DAS and 19:19:19@ 1.0%	No foliar spray
Boron spray @0.2% at ray floret stage	No Boron spray
Need based plant protection	Need based Plant protection
Threshing by mechanical thresher	Manual threshing or partially mechanized thresher
Incorporation of thalamus into the soil after harvest	Thalamus was not incorporated

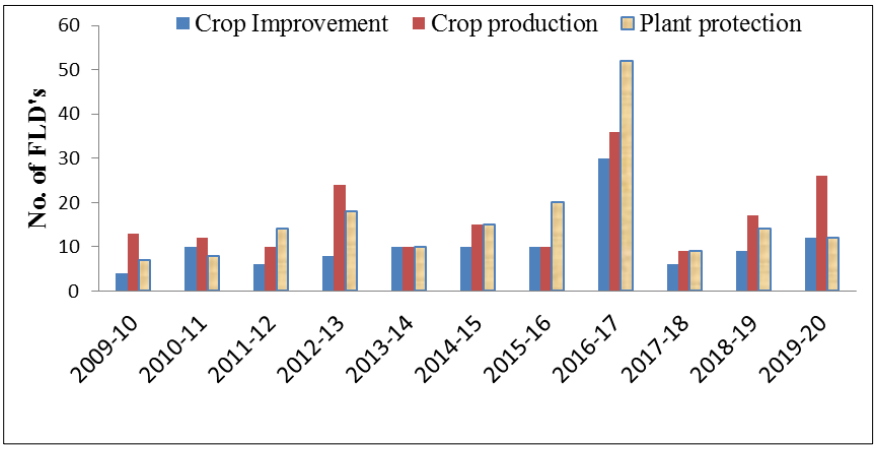


Fig 1: Details of number of hybrids, crop production and protection frontline demonstrations conducted over years (2009-10 to 2019-20).

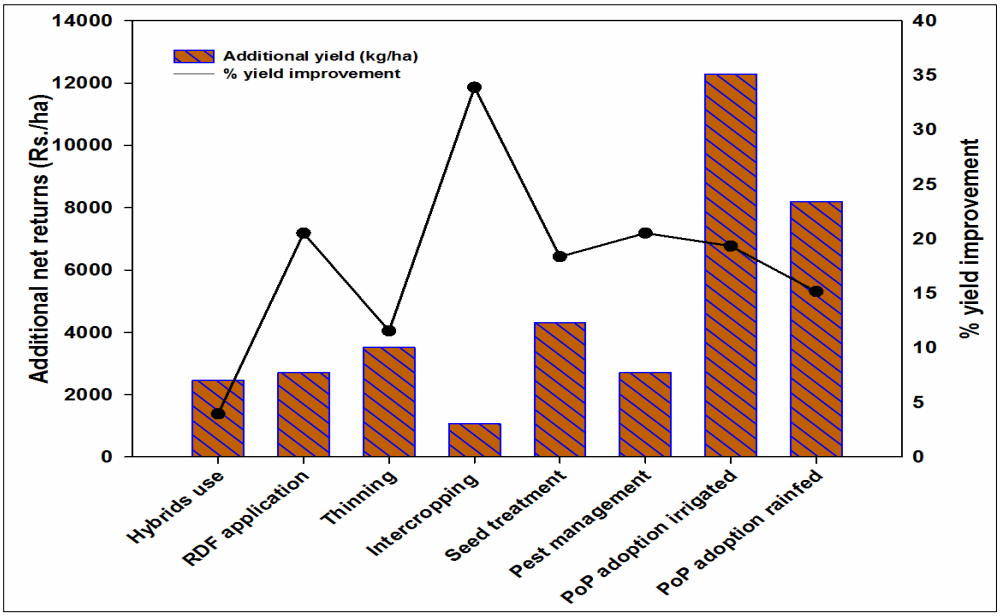
Table 2: Yield and economic advantage of adoption of improved technologies through sunflower front line demonstrations (FLD's) conducted during 2007-2012

S. No.	Technology demonstrated	No. of Demonstrations	Average yield (q/ha)		Yield Increase (%)	Additional Returns (Rs./ha)	Extension gap (kg/ha)
			IP	FP			
1	RDF	36	11.87	9.56	28.5±7.5	3250±750	231
2	Intercropping with Groundnut	09	11.03	9.55	26.5±8.5	4800±2000	148
3	Intercropping with Pigeon pea	23	13.57	11.54	27.0±12.0	4100±2300	203
4	Thinning	27	9.45	8.13	20.0±8.0	2150±850	132
5	Herbicide spray	02	10.63	7.63	28.0±2.0	2850±350	300
6	Varietal comparison	45	12.21	10.95	11.0±3.0	1850±650	126
7	Management of Powdery Mildew	28	11.42	9.58	20.5±8.5	2150±650	184
8	Management of Alternaria	10	9.98	6.88	16.0±6.0	1650±650	310
9	Management of Necrosis	12	11.55	7.33	21.5±4.5	2400±800	422
10	Management of Pests / Defoliators	25	11.34	4.88	19.0+5.0	1750+550	646
11	Whole Package	03	17.2	13.6	32.5+7.5	4000+1000	360
	Total	220					

Table 3: Yield and economic advantage of adoption of improved technologies through sunflower front line demonstrations (FLD's) conducted during 2013-2018

S. No.	Technology demonstrated	No. of Demonstrations	Average yield (q/ha)		Increased yield (%)	Additional Returns (Rs./ha)	Extension gap (kg/ha)
			IP	FP			
1	RDF	9	16.00	13.45	21.0+8.0	2735+2300	255
2	Intercropping with Pigeonpea	7	17.89	13.36	35.1+15.2	4225+2587	453
3	Thinning	8	14.22	12.6	11.0+3.3	3575+1275	162
4	Varietal comparison	8	16.27	14.21	6.95+2.15	3463+839	206
5	Management of Powdery Mildew	4	15.13	13.25	21.5+10.5	3675+825	188
6	Management of Alternaria	2	12.75	10.6	29.0+8.0	5700+800	215
7	Management of Necrosis	8	10.05	8.45	9.45+5.15	2338+1734	160
8	Management of Pests / Defoliators	4	16.00	13.68	25.0+8.0	2350+850	232
9	Whole package irrigated sunflower	78	19.36	15.96	19.85+6.95	12547+6364	340
10	Whole package rainfed	71	14.89	12.57	10.9+3.1	6808+2673	232
	Total	199					

Kharif



Rabi

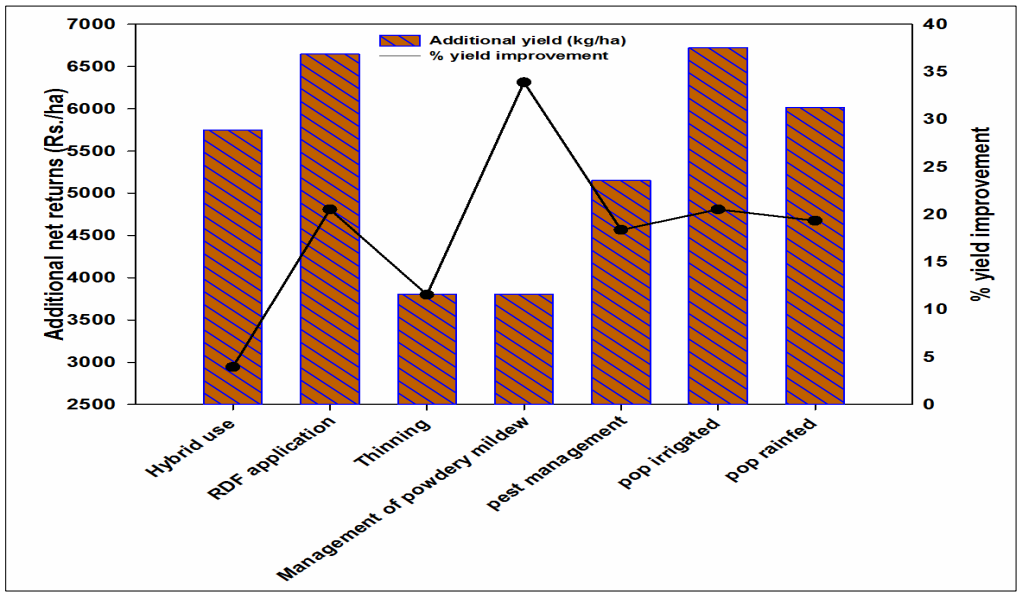


Fig 2: Seasonal variation in impact of front line demonstrations of various technologies in sunflower

References

1. Anand Naik DH, Patil RG, Teggelli, Zaheer Ahamed B. Performance of front line demonstrations on sunflower (*Helianthis annuus* L.) in Kalaburagi region of Northern Karnataka. Indian J Eco. 2016, 43(1).
2. Choudhary AK, Yadav DS, Amar Singh. Technological and extension yield gaps in oilseeds in Mandi district of Himachal Pradesh. Indian J Soil Cons. 2009; 37(3):224-229.
3. Anuj Kumar Singh, Kinjulck Singh C, Singh YP, Singh DK. Impact of frontline demonstration on adoption of improved practices of oilseed crops. Indian Res. J Ext. Edu. 2014; 14(3):75-77.
4. Dubey SK, Gautam US, Singh AK, Singh Atar, Chahal VP, Singh AK, *et al*. Quantifying the yield gap minimization in lentil (*Lens culinaris*) under cluster frontline demonstrations (CFLD) conducted in Uttar Pradesh. Indian J Agril. Sci. 2018; 88(6): 851-859.
5. Hall AJ, Feoli C, Ingaramo J, Balzarini M. Gaps between farmer and attainable yields across rainfed sunflower growing regions of Argentine. Field Crop Res. 2013; 143:119-29.
6. Kiresur VR, Ramana Rao SV, Hegde DM. Improved technologies in oilseed production- an assessment of the economic potentials in India. Agric. Econ. Res. Rev 2001; 14:95-108.
7. Samui SK, Maitra S, Roy DK Mondal AK, Saha D. Evaluation of frontline demonstration on groundnut (*Arachis hypogaea* L.) in sunderbans. J Indian Soc. Coastal Agril. Res. 2000; 18(2):180-183.
8. Sandeep Suresh Patil, Mahesh Mavanjee Mahale, Sudeshkumar Shivajorao Chavan. Impact of frontline demonstrations (FLDs) on oilseed crops in South Konkan Coastal Zone of Maharashtra. Curr. Agri. Res. J. 2018; 6(3):355-364.
9. Saravanakumar S. Impact of frontline demonstration technologies on groundnut yield in Erode District. Indian J Dryland Agric. Res. & Dev. 2019; 34(1):63-65.
10. Shantanu Kumar Dubey, Gautam US, Singh AK, Atar Singh, Chahal VP, Avnish Kumar Singh *et al*. Quantifying the yield gap minimization in lentil (*Lens culinaris*) under cluster frontline demonstrations (CFLD) conducted in Uttar Pradesh. Indian J Agril. Sci. 2018; 88(6):851-859.