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Impact Assessment of Frontline Demonstrations on Field Bean Grown under Rainfed and Irrigated Condition in Karnataka

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Abstract

Frontline demonstration was conducted to reveal the potential of improved field bean variety HA 4 in 32 farmers holdings of Ramanagara district of Karnataka for three years (2015-16 to 2017-18) during summer season (2015-16) and *kharif* (2016-17 & 2017-18). The crop was grown with improved management practices and compared with the farmer's practice. The improved crop management practices included introduction of new variety *i.e.,* HA 4, seed treatment with rhizobium and phosphorus solubilising bacteria, foliar spray of multi nutrient mixture-pulse wonder @ 5 kg ha^{-1} at 50 per cent flowering stage and improved pest management strategies for pod borer. The results of the demonstration indicated that the demonstration of improved crop management practices recorded higher number of pods per plant (147) and seed yield (4.7 q/ha). Farmers practice recorded lower number of pods per plant (66) and seed yield (4.1 q/ha). The per cent increase in yield under demonstration over farmer's practice was 18.9. Higher mean net income of Rs.33895/ha with an incremental Benefit: Cost ratio of 6.2 was obtained with improved technologies in comparison to farmer's practices (Rs.25575/ha). The frontline demonstrations conducted on field bean at the farmers' field revealed that the adoption of improved technologies significantly increased the yield as well as yield attributing traits of crop and also the net returns higher than the farmers' practices. Hence, there is a need to disseminate the improved technologies among the farmers with effective extension methods like training and demonstrations. Farmers' should be encouraged to adopt the recommended package of practices for realizing higher returns.

Keywords: Adoption, Frontline demonstration, Field bean, Productivity, Net income, Benefit cost ratio

In India, pulses are grown annually on 25.51 lakh ha contributing to a production of 7328 lakh tonnes. In Karnataka, it is about 2.70 lakh ha contributing to a production of 16.17 lakh tonnes (Anon., 2010a). In India, field bean is grown annually on 6.03 lakh ha area contributing to a production of 9.0 lakh tonnes with an average productivity of 15 quintals per ha of green pod yield (Anon., 2010b). It is mainly grown in the states of Karnataka, Tamil Nadu, Andhra Pradesh, Madhya Pradesh, Uttar Pradesh, Maharashtra and Gujarat. Field bean is being grown commercially on large scale in India particularly in Karnataka to meet the domestic demand for its green pod and dry pulse. Karnataka contributes nearly 90 per cent both in terms of area and production in the country (Sultan Singh *et al.,* 2010). In Karnataka, it is grown annually in an area of 79,462 ha (66,976 ha in *kharif* and 12,486 in *rabi* / summer) with a production of 68014 tonnes (64,215 in *kharif* and 3,799 tonnes *rabi* / summer) and the productivity of about 901 kg/ha (1009 kg/ha in *kharif* and 320 kg / ha in *rabi* / summer) (Anon., 2010a). In Karnataka, it is grown mainly in Bangalore, Ramanagara, Kolar, Mysore, Hassan, Dharwad, Belgaum and Bidar Districts. Although, several improved and high yielding, short duration and photo insensitive varieties are available for commercial cultivation, its average productivity has remained static at 24 q/ha of green pod and 9 q/ha of seed yield in Karnataka state (Anon., 1990, Anon.,1999 and Shrikanth, 2007)

Field bean (*Lablab purpureus* L. *Sweet*) is a multipurpose crop grown for pulse, vegetable and forage. It serves as a good source of vegetable proteins and its seeds contain 20-28 per cent protein. Being a legume, it can fix atmospheric nitrogen to the

extent of 170 kg/ha besides it enrich the soil fertility through addition of crop residues. It is a drought tolerant crop and grows well in dry lands with limited rainfall. Field bean is being cultivated in 4000 hectares in Ramangara district. Farmers used to cultivate the crop under rain fed condition especially during *kharif* season immediately after receiving rainfall without any preparatory tillage and addition of manures.

In the last few years due to several constraints such as lack of awareness about high yielding photo insensitive varieties, inadequate knowledge on improved crop production activities such as imbalanced and indiscriminate use of inputs such as fertilizers and pesticides. Farmers use the seeds that are locally available. These seeds are poor quality due to non replacement and crop is infested with pest and disease, resulting in low yield and income. Hence, the frontline demonstration was taken up by Krishi Vigyan Kendra, Ramanagara with an objective to create awareness among the farmers about the new high yielding photo insensitive varieties and to demonstrate the impact of improved crop management practices on increasing the yield and income.

METHODOLOGY

Frontline demonstration on improved crop management practices on Field bean was conducted by Krishi Vigyan Kendra, Ramanagara, Karnataka for three consecutive years from 2015-16 to 2017-18.

The Front Line Demonstration is an important method of transferring the latest package of practices in totality to farmers. By which, farmers learn latest technologies of pulse production under real farming situation at his own field. Further, these demonstrations are designed carefully where provisions are made for speedy dissemination of demonstrated technology among farming community through organization of other supportive extension activities, such as field days and farmers convention. The main objective of the Front Line Demonstration is to demonstrate newly released crop production and protection technologies and management practices at the farmers' field.

The variety HA 4 introduced under demonstration was released from University of Agricultural Sciences, Bangalore during 2007. It is a cross derivative of HA 3 and Magadi local. It is photo-insensitive, non viny compact with determinate growth habit. It is suitable for cultivation throughout the year. The technological interventions followed in farmers practice and demonstration is given in Table 1. Before initiating the demonstration, the beneficiary farmers were given skill training on various technological interventions to be followed in field bean cultivation. The performance of crop was periodically observed by the scientists of Krishi Vigyan Kendra and advisory recommendations were advocated. During harvest, yield data was collected from both the demonstration and farmers practice. At the end, cost of cultivation, net income and incremental benefit cost ratio were worked out.

While demonstrating the technologies at the farmer's field, the scientists are required to study, the factors contributing to higher crop production, field constraints of production and thereby generating production factor and feed-back information. Demonstrations was conducted on an area of 0.4 ha, and 1.0 ha adjacent to the demonstration plot, farmers practice was kept.

In the demonstration, improved variety HA 4, photo in-sensitive variety was introduced along with improved crop management practices in farmer's field. The improved technology was compared with farmers practice. The improved crop management practices demonstrated were introduction of new variety *i.e.,* HA 4, seed treatment with rhizobium and phosphorus solubilising bacteria, foliar spray of pulse wonder @ 5 kg ha^{-1} at 50 per cent flowering stage and improved pest management strategies. In case of local check plots, existing practices followed by farmers were tabulated (Table 1). Data with respect to seed yield from FLD plots and from fields cultivated following local practices adopted by the farmers of the area were collected and evaluated. Potential yield was taken in to consideration as mentioned in Package of Practices. Different parameters as suggested by Yadav *et al.* (2004) was used for gap analysis, technology index and calculating the economics parameters of field bean. The details of different

TABLE 1

Details of the technological interventions followed under farmers practice and demonstration on field bean

Technological interventions	Farmers practice	Demonstration (Recommended integrated crop management practices)
Farming situation	Rainfed	Rainfed
Variety	Local (Photo sensitive)	HA 4 (Photo-insensitive)
Time of sowing	Third week of July	First week of June
Seed treatment	Seed treatment practice not followed	Seed treatment with *Rhizobium* and *Phospho solubilising bacteria* @ 25g/kg seed
Method of sowing	Hand dibbling	Hand dibbling on ridges by following a spacing of 45 x 15 cm
Nipping	Nipping of terminal bud not followed	Nipping of terminal bud at 30 days after sowing
Fertilizer application	Non authentic method of Basal application of fertilizers No addition of micronutrient mixtures	Recommended INM practices, Soil application of FYM @ 12 t/ha and recommended dose of NPKS fertilizers *i.e.,* 25:50:25:20 kg /ha Foliar micronutrient mixture - spray - pulse wonder @ 5 kg/ha at 50 % flowering
Weed management	Not practiced	One hand weeding at critical crop weed competition on 20-25 days after sowing or intercultivation with Cycle weeder
Plant protection	Spraying of irrelevant pesticides without proper dose	Need based usage of plant protection chemicals

parameters and formula adopted for analysis are as under:

Extension gap = Demonstration yield - Farmers' practice yield

Technology gap = Potential yield - Demonstration yield

Technology index = Potential yield - Demonstration yield/ Potential yield x 100

Additional cost (Rs.) = Demonstration Cost (Rs.) - Farmers' Practice Cost (Rs.)

Effective gain = Additional Returns (Rs.) - Additional cost (Rs.)

Additional returns = Demonstration returns (Rs.) - Farmers' practice returns (Rs.)

Incremental B: C ratio = Additional Returns/ Additional Cost

RESULTS AND DISCUSSION

Growth and Yield Attributes

The performance of field bean under demonstration and farmers practice was recorded (Table 2). Results indicated that, demonstration of field bean variety HA 4 with improved crop management practices recorded highest number of branches (11), spikes per plant (17) and pods per plant (188). Lower number of branches (5), spikes per plant (7) and pods per plant (50) were recorded in farmers practice. Average damage incidence of pod borer for three years was lower in demonstration plot (4%) and higher in farmer's practice (16%). The lower pod borer damage in demonstration might be due to the adoption of improved pest management strategies *viz*., placing pheromone traps and need based usage of pesticides. Demonstration of Improved crop management practices (Table 4) average of three years recorded higher seed yield (466 kg/ha) and farmers practice recorded lower seed yield (411 kg/ha). The per cent increase in the pod yield of

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TABLE 2

Performance of improved crop management practices in summer (2015-16) and *kharif* 2016-season (2016-17 & 2017-18) on yield and economics of Field Bean

Parameter	Check-Farmers practice	Demo*	Check-Farmers practice	Demo*	Check-Farmers practice	Demo*
	2015-16 (summer)		2016-17 (*kharif*)		2017-18 (*kharif*)	
Plant Height (cm)	61.26	53.58	67.3	56.8	61.55	58.88
Number of branches per plant	6	11	8	10	5.45	5.91
No. of days for 50 % flowering	42	48	82	47	48	81
Number of Spikes per plant	7	13	10	17	7	9
Number of pods/spike	6	14	9	10	9	11
Number of pods per plant	50	173	84	188	63	81
Pod borer incidence (%)	18	4	18	4	12	3
Seed Yield (q/ha)	5.1	6.2	5.2	6.9	1.5	1.9
% increase in Seed yield over FP		21.5	-	31.3	-	26
Gross cost (Rs./ha)	11330	10725	14861	15361	10500	11354
Gross income (Rs./ha)	30703	37659	34313	48451	11709	15575
Net income (Rs./ha)	19373	26934	19452	33090	1209	4221
BC Ratio	2.72	3.52	2.31	3.16	1.11	1.36

* Demonstration plot (Recommended integrated crop management practices)

TABLE 3

Performance of improved crop management practices on yield attributing traits in Field Bean

Year	Number of Spikes per plant			Number of pods/spike			Number of pods per plant		
	FP	Demo	% increase	FP	Demo	% increase	FP	Demo	% increase
2015-16	7	13	85.7	6	14	133	50	173	246
2016-17	10	17	133.3	9	10	11	84	188	123
2017-18	7	17	246.0	9	11	22	63	81	28
Average	8	13	155.0	8	12	55.5	66	147	132

TABLE 4
Seed yield of Field Bean as affected by improved and farmer practices in farmers' fields

Year	Number of FLD	No. of ha	Yield (kg/ha)		Additional yield (kg/ha) over farmers field	% increased in yield over farmers practice
			Demo	FP		
2015-16	8	1.6	620	510	110	21.5
2016-17	10	1.6	629	527	102	19.35
2017-18	14	2.4	150	198	48	16.11
Average	32	5.6	466.3	411	86.6	18.98

TABLE 5
Technological gap analysis of Field Bean

Year	Number of FLD	No. of Acre	Potential yield (q/ha)		FLD-Demo Plot (kg/ha)	FP (kg/ha)	% Increase	EG*	TG	TI
			Seed	Pod						
2015-16	8	4			620	510	21.5	110	180	22.5
2016-17	10	4	7.5 – 10	30-38	629	527	19.35	102	171	21.3
2017-18	14	6			150	198	16.11	48	650	81.2
Total	32	14	8	30	466.3	411	18.98	86.6	333#(175)	41.6#(21.9)

*EG= Extension gap; TG= Technology gap; TI= Technology index; FP= Farmers practices
#- Average of 2015-16 & 16-17, Values of 2017-18 was not considered due to failure of rains at crop growth period as explained in Fig.1

demonstration over farmers practice was 18.9. The yield improvement in the demonstration might be due to the combined effect of high yielding ability of variety and adoption of improved nutrient, pest and disease management practices. The findings confirm with the findings of Yadav *et al.* (2007), Meena & Singh (2016) and Meena & Singh (2017) who found more yield in pulses under FLD plots than the existing practices.

Gap analysis

Evaluation of findings of the study (Table 5) stated that an extension gap of 48 to 110 kg/ha was found between demonstrated technology and farmers' practice and on average basis the extension gap was 86.6 kg/ha. The extension gap was highest (110 kg/ha) during 2015-16 and lowest (48 kg/ha) during 2017-18. The extension gap emphasizes that there is a need to educate farmers for adoption of improved production technologies that results in higher seed yield than the traditional farmers' practices. In the present contest the wide extension gap 110 kg/ha during 2015-16 was not due to the failure of extension services by the scientist of KVK in introducing new short duration variety HA 4, which can be grown throughout the year and also preferably during summer with protected irrigation. During the year (2015-16) crop was grown during summer under protective irrigation, few FLD farmers' where demonstration was taken up, tube well failed, resulted in partial yield loss, that led to increase in extension gap of 110 kg/ha (reduction in yield) compared to other years. The demonstration of growing field bean during summer was demonstrated and awareness was created to the farmers. Being a short duration variety, it is found to be economically viable rather than keeping land fallow during summer.

With reference to technology gap during different years, it was lowest (171 kg/ha) during 2016-17 and

highest (650 kg/ha) during 2017-18. The technology gap observed may be attributed to dissimilarities in the physical, chemical and biological soil status, agronomic practices adopted by farmers and local climatic conditions prevailed in the respective locations where FLD's were taken. Lower the value of the technology gap, more is the feasibility of the technologies which could be easily adopted by the farmers as they are user friendly. The average technology gap of all the three consecutive years was 333 kg/ha. Lowest technology gap was 175 kg/ha for initial two years (2015-16 and 2016-17), where the situation was not erratic. The wide difference in Technology Gap during the third year was 650 kg/ha (2017-18) not due to the difficulty in adopting the technology but due to the failure of rains during the critical condition of crop (Fig.1) that had drastic effect

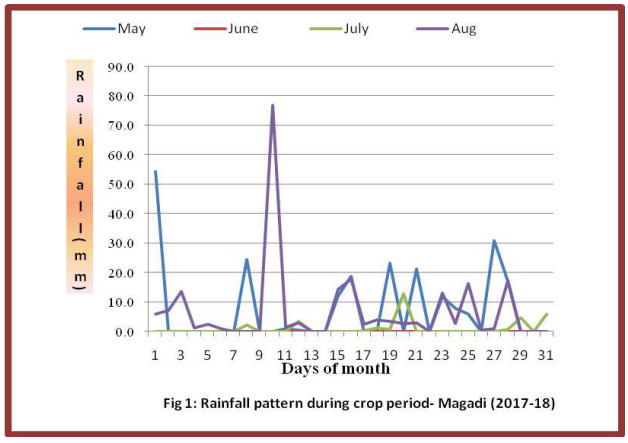

Fig 1: Rainfall pattern during crop period- Magadi (2017-18)

on growth and yield which recorded higher Technology Gap (650 kg/ha).The difference in technology gap in different years is due to better performance of variety with different interventions and more feasibility of recommended technologies during the course of study.

The Technology Index shows the feasibility of evolved technology at the farmer's fields. Lower the value of Technology Index more is the practicability of the technology. Higher Technology Index reflected the inadequate transfer of proven technology to growers and insufficient extension services for transfer of technology. The Technology Index for all demonstrations in the study was in accordance with Technology Gap.

The higher Technology Index (81.2), in the study, is not due to the practicability of technology nor the interventions of scientist of KVK, the reason is the local climatic condition that prevailed during the year (2017-18) as mentioned in the Technology Gap, which had bad impact on the production of field bean due to failure of rains during crop critical stages like flowering and pod formation (Fig.1), where the variety was unable to express its potential yield. While in earlier two years the Technology Index was 22.5 and 21.3 which indicted the feasibility of the technology that can be easily adopted in farmer's field.

On the basis of three years study, overall 41.6 per cent Technology Index was recorded. The wide Technology Index was observed due to failure of rains during 2017-18. Nevertheless, Technology Index for two years (2015-16 and 2016-17) noticed was 21.9. The Technology Index has reduced from 22.5 per cent to 21.3 per cent from 2015-16 to 2016-17, respectively. Hence, it can be inferred that awareness and adoption of improved varieties with recommended scientific package of practices have increased as study period advanced. These findings are in conformity with the results carried out by Meena & Singh (2016), Meena & Singh (2017) and Rajni *et al.* (2014).

Economics

Different variables like seed, fertilizers, bio-fertilizers and pesticides were considered as cash input for the demonstrations as well as farmers practice and on an average additional investment of Rs.1342 per ha was made under demonstrations. Economic returns as a function of gain yield and Minimum Support Price (MSP) sale price (an average of Rs.7000/q) was considered for calculation. The maximum returns (Rs.48451) during the year 2016-17 was obtained due to high seed yield with almost same MSP sale rates as declared by GOI. The higher additional returns and effective gain obtained under demonstrations could be due to improved technology, non-monetary factors, timely operations of crop cultivation and scientific monitoring. The lowest and highest incremental benefit cost ratio (IBCR) were 10.81 and 2.74 in 2016-17

TABLE 6

Cost of cultivation (Rs./ha), net return (Rs./ha) and benefit: cost-ratio of Field bean a affected by improved and farmers' practice

Year	Cost of cash input (Rs./ha)		Additional cost of Demo (Rs./ha)	Sale (MSP) of seed (Rs./q)	Total returns (Rs./ha)		Additional returns of Demo (Rs./ha)	Effective gain (Rs./ha)	INC B:C ratio (IBCR)
	Demo	FP			Demo	FP			
2015-16	5302	3992	1310	7000	37659	30703	6956	5646	5.31
2016-17	6200	4892	1308	7000	48451	34313	14138	12830	10.81
2017-18	5987	4578	1409	7000	15575	11709	3866	2457	2.74
Average	5829	4487	1342	7000	33895	25575	8320	6977.67	6.29

and 2017-18, respectively (Table 6) depends on produced seed yield and market price. Overall, average IBCR was found 6.29. The results confirm with the findings of front line demonstrations on pulses by Meena & Dudi (2012) and Meena & Singh (2017).

It is concluded that Front Line Demonstrations (FLD) is an effective tool for increasing the productivity of field bean. Frontline Demonstrations conducted on field bean at the farmers' field revealed that, adoption of improved technologies significantly increased the yield and yield attributing traits of the crop and net returns to the farmers. Further, FLD farmers inferred, variety introduced being short duration (90 -100 days) will help to take double crop (Early *kharif*-April-May (field bean) followed by late *kharif* (Aug-September (Ragi), Though the variety may not compete with the flavour of the local field bean variety-Magadi avare, still the farmers prefer HA-4 because of its short duration, more yield attributing characters, attractive pods and good aroma that fetched better prices.

From the experience, there is a need to disseminate the improved technologies among the farmers through effective extension tools like training,kisan ghosthies, field days, exposure visits and method demonstrations. Farmers' should be encouraged to adopt the recommended package of practices for realizing higher returns. This created greater curiosity and motivation among other farmers who do not adopt improved practices of field bean cultivation. These demonstrations built the relationship and confidence between farmers and scientists of KVK. It is also concluded that besides these, other practices on weed management and water management have to be given due attention to enhance field bean production in the area. This will subsequently increase the income as well as improve livelihood of the farming community.

REFERENCES

ANONYMOUS, 1990, All India co-ordinated research project on under-utilized and under exploited plants, Ann. Prog. Rept., NBPGR, Pusa Campus, New Delhi, pp : 1-41.

ANONYMOUS, 1999, All India co-ordinated research project on Spices, Ann. Rept., Indian Institute of Spices Research, Calicut, Kerala, India, pp : 97.

ANONYMOUS, 2010a, Fully revised estimates of principle crops in Karnataka for the year of 2007-08. Directorate of Economies and Statitics. Government of Karnataka, pp : 170.

ANONYMOUS, 2010 b, www.indiastat.com.

MEENA, M. L. AND DUDI, A., 2012, On farm testing of chickpea cultivars for site specific assessment under rainfed condition of western Rajasthan. *Indian Journal of Extension Education*, **48** (3&4): 93-97.

MEENA, M. L. AND SINGH, D., 2016, Productivity enhancement and gap analysis of moth bean [*Vigna accontifolia* (Jacq.)] through improved production technologies on farmer's participatory mode. *Indian*

Journal of Dryland Agricultural Research and Development, **31**(1) : 68-71.

MEENA, M. L. AND SINGH, D., 2017, Technological and extension yield gaps in greengram in Pali district of Rajasthan, *India Legume Research,* **40**(1):187-190.

RAJNI, SINGH, N. P. AND SINGH, P., 2014, Evaluation of frontline Demonstrations on yield and economic analysis of summer mungbean in Amritsar district of Punjab. *Indian Journal of Extension Education,* **50** (1&2) : 87-89.

SHRIKANTH, 2007, Effect of spacings and fertilizer levels on crop growth, seed yield and quality in Lablab bean (*Lablab purpureus* L.). *M.Sc.(Agri.) Thesis,* Univ. Agric. Sci., Dharwad, Karnataka, India, pp : 135.

SULTAN SINGH, KUNDU, S. S., NEGI, A. S. AND PACHOURI, V. C., 2010, Performance of growing kids on rations with Lablab (*Lablab purpureus*) grains as protein source. Livestock Reasearch for Rural Development (LRRD Newsletter), **22** (5) : 1-11.

YADAV, V. P. S., KUMAR, R., DESHWAL, A. K., RAMAN, R. S., SHARMA, B. K. AND BHELA, S. L., 2007, Boosting pulse production through frontline demonstration. *Indian J. Extension Education,* **7** (2):12-14.

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