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Transfer of green gram integrated crop management (ICM) technology through frontline demonstrations (FLDs) in Bidar district of north eastern transitional zone of Karnataka

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Abstract
A frontline demonstration on Integrated Crop Management Technology in green gram (Vigna radiate) is a new approach. Thus, a study was conducted by Krishi Vigyan Kendra, Bidar, Karataka India, on pulse productivity and profitability enhancement using proven Integrated Crop Management Technology in farmers field of Bidar district during the last 7 years i.e., from 2010-11 to 2016-17. The result showed that, the average technological gap, extension gap and technological index were noticed 12.78 q/ha, 3.39 q/ ha and 51.13 per cent respectively. The average net profit of Rs. 46484.26 per ha was recorded under FLDs plot over Rs 31743.07 per ha under farmer practice, on an average highest yield of FLDs plots of Green gram by adopting ICM technology was 15 q/ha compared to farmers practice (11.25 q/ha). Adoption of improved production technology increased the yield 39.82per cent per cent over farmer practices.

Keywords: front line demonstrations (FLD), technological gap, extension gap and technology index, integrated crop management (ICM)

Introduction
In India, frequency of pulses consumption is much higher than any other source of protein, which indicates the importance of pulses in their daily food habits. India is the largest producer, consumer and importer of pulses. Pulses are a good and chief source of protein for a majority of the Indian population. Pulses contribute 11% of the total intake of proteins in India (Reddy, 2010) [7]. Moong contains 24.7% protein, 0.6% fat, 0.9% fiber and 3.7% ash. Besides being a rich source of protein, it maintains soil fertility through biological nitrogen fixation in soil and thus plays a vital role in sustainable agriculture (Kannaiyan, 1999) [3]. The per capita availability of pulses in India has been continuously decreasing which is 32.5 gm/day against the minimum requirement of 80gm/ day per capita prescribed by Indian Council of Medical Research (ICMR). Conducting of front line demonstrations on farmer's field helps to identify the constraints and potential of the moong in specific area as well as it helps in improving the economic and social status of the farmers.

The aim of the front line demonstration is to convey the technical message to farmers that if they use recommended package they are sure to get higher yields, to know the technology gap between the potential yield and demonstrated yield, extension gap between demonstrated yield and yield under famers practice and technology index, through various extension methods including the Participatory Rural Appraisal (PRA) technologies to boost the production and productivity through transfer of technology.

Methdology
The Frontline demonstrations were organized on farmer's field to demonstrate the impact of Integrated crop management technology on Green gram productivity over seven years during *kharif* 2010-11 to 2016-17. Each frontline demonstration was laid out on 0.4 ha area, adjacent 0.4 ha was considered as control for comparison (farmer's practice). The integrated crop management (ICM) technology comprised the Improved variety BGS-9, proper tillage operations, recommended seed rate, pre-emergent weedicide application, seed treatment with bio agents, proper nutrient and pest management based on economic threshold level (Table 1). An area of 40 ha was covered with plot size 0.4ha under front line demonstration with active participation of 88 farmers.

The FLD was conducted to study the technology gap between the potential yield and demonstrated yield, extension gap between demonstrated yield and yield under existing practice and technology index. The yield data were collected from both the demonstration and farmers practice by random crop cutting method. Qualitative data was converted into quantitative form and expressed in terms of per cent increase in yield. (Narasimha Rao *et al.,* 2007) [2].

Table 1: Improved production technology and Farmers practices of chick pea under FLD

S. No.	Technology	Improved practices	Farmers practice	GAP (%)
1	Variety	BGS-9	Local	100
2	Land preparation	Ploughing and harrowing	Ploughing and harrowing	Nil
3	Pre-emergent herbicide	Pendimethalin (@ 2.5 l/ha)	No herbicide	Full gap
4	Seed rate	12 kg/ha	18 kg/ha	High seed rate
5	Sowing method	Line sowing	Line sowing	No gap
6	Seed treatment	Biofertilizers and Trichoderma	No seed treatment	Full gap
7	Fertilizer dose (NPK kg/ha)	5:10:0	10:20:0	Partial gap
8	Plant protection	IPM	Indiscriminate application	Full gap
9	Grading the produce	Grading followed	Not followed	Full gap

Technology gap = Potential yield – Demonstration
Yield Extension gap = Demonstration yield – Farmers yield
Technology index = {(Potential yield - Demonstration yield) / Potential yield} X 100

Results and Discussion

Green gram is the most important commercial pulse crop of Bidar district which is also known as pulse bowl of Karnataka. Due to continuous use of local varieties, injudicious use of fertilizers and pesticides has deteriorated the soil health. On the basis of soil testing data the area has been categorized under micro nutrient deficiency zone.

Crop performance and yield

Frontline demonstrations are effective educational tools in introducing various new technologies to the farmers to hasten the farmer's confidence level by comparison of productivity levels between improved production technologies in demonstration trials. The performance of Green gram crop owing to the adoption of improved technologies is assessed over a period of seven years and is presented in table 1 and 2.
From the demonstration it revealed that, the integrated crop management practice in green gram recorded 39.82 per cent increase in the yield as compared to the farmers practice (8.83q/ha) as against 12.22 q/ha in ICM practice, however, average highest yield (15.00 q/ha) were recorded during 2012-13.This may be attributed to sufficient and more than average rainfall distributed fairly during the pod setting to physiological maturity stage, better utilization of applied nutrients (Poonia and Pithia, 2011) [4] The above findings are in similarity with the findings of Raju Teggelli *et al.* (2015) [5] and Tomar (2010) [8]. The higher yield of chickpea under improved technology was due to use of latest high yielding varieties, integrated nutrient management and integrated pest management (Tomar *et al*., 1999) [9].

Technology Gap

The technology gap means the differences between potential yield and yield of demonstration plot. The technology gap of demonstration plots were 11.25, 11.88, 10.00, 11.83, 14.96, 16.25 and 13.30 q/ha during 2010-11, 2011-12, 2012-13, 2013-14, 2014-15, 2015-16 and 2016-17 (Table-3), respectively. On an average technology gap under seven year FLD programme was 12.78 q/ha. The technology gap observed may be attributed to dissimilarity in the soil fertility status, crop production, protection practices and local climatic situation.

Extension Gap

Extension gap means the differences between demonstration plot yield and farmers yield. Extension gap of 6.25,3.62,3.75,2.69,1.98,2.50 and 2.95 q/ha was noticed during 2010-11, 2011-12, 2012-13, 2013-14, 2014-15, 2015-16 and 2016-17 (Table-3), respectively. On an average extension gap under seven year FLD programme was 3.39 q/ha which emphasized the need to educate the farmers through various extension programs i.e. front line demonstration for adoption of improved production and protection technologies, to revert the trend of wide extension gap. More and more use of latest production technologies with high yielding varieties will subsequently change this alarming trend of galloping extension gap.

Technology Index

Technology Index indicates the feasibility of the evolved technology in the farmers' fields. Lower the value of technology index, higher is the feasibility of the improved technology. The technology index varied from 40.00 to 65.00 per cent (Table-3). On an average technology index was observed 51.13 per cent during the seven years of FLD programme, which shows the efficacy of good performance of technical interventions. This will accelerate the adoption of demonstrated technical intervention to increase the yield performance of green gram.

Economic Return

Data in table 4 reveals that the cost involved in the adoption of improved technology in green gram ICM varied and was more profitable. The cultivation of green gram under improved technologies gave higher net return of Rs. 34463, 35879,66438,45072,54900,50963 and 37675 per ha respectively, as compared to farmers practices (Rs 15350, 25300, 42375, 34996, 43368, 33625 and 27187.5 per ha in 2012-13, 2013-14 and 2014-15, 2015-16 and 2016-17 respectively). An average net return and B:C ratio of demonstration field is 46484.29 Rs/ha and 3.09 respectively as compared to farmers practice (Rs 31743.07 per ha and 2.75). Similar findings were reported by Singh *et al.* (2014) [7] and Raju Teggelli *et al.* (2015) [5] The benefit cost ratio of ICM of Green gram under ICM practices higher than farmer's practices in all the years and this may be due to higher yield obtained under improved technologies compared to local check (farmers practice). These finding are in line with the findings of Mokidue *et al.* (2011) [1].

Table 2: Impact of improved production technology on realization of productivity and potential of Green gram.

Year	Area(Ha)	Technological gap (q/ha)	Extension gap (q/ha)	Technological index (%)
2010-11	6	11.25	6.25	45.00
2011-12	5	11.88	3.62	47.52
2012-13	6	10.00	3.75	40.00
2013-14	5	11.83	2.69	47.32
2014-15	4	14.96	1.98	59.84
2015-16	4	16.25	2.5	65.00
2016-17	10	13.30	2.95	53.20
Average		12.78	3.39	51.33

Table 3: Technological gap Extension gap and Technological index of Green gram

Year	No. of Demonstrations	Area(Ha)	Yield Q/ha			% increase in yield over farmers practice
			Potential yields	Demonstration Yields	Farmers practice	
2010-11	15	6	25.00	13.75	7.50	83.33
2011-12	13	5	25.00	13.12	9.50	38.11
2012-13	10	6	25.00	15.00	11.25	33.33
2013-14	5	5	25.00	13.17	10.48	25.67
2014-15	10	4	25.00	10.04	8.06	24.57
2015-16	10	4	25.00	8.75	6.25	40.00
2016-17	25	10	25.00	11.70	8.75	33.71
Average		40	25.00	12.22	8.33	39.82
Total	88					

Table 4: Impact of improved production technology on economics of Green gram

Year	Cost of cultivation (Rs/ha)		Gross return (Rs/ha)		Net return (Rs/ha)		B:C Ratio	
	Demo	Farmer practice	Demo	Farmer practice	Demo	Farmer practice	Demo	Farmer practice
2010-11	17787.00	13150.00	52250.00	28500.00	34463.00	15350.00	2.93	2.17
2011-12	19225.00	14600.00	55104.00	39900.00	35879.00	25300.00	2.86	2.73
2012-13	23412.00	19500.00	89850.00	61875.00	66438.00	42375.00	3.83	3.17
2013-14	23412.00	19500.00	68484.00	54496.00	45072.00	34996.00	2.93	2.79
2014-15	23412.00	19500.00	78312.00	62868.00	54900.00	43368.00	3.34	3.22
2015-16	23412.00	19500.00	74375.00	53125.00	50963.00	33625.00	3.18	2.72
2016-17	23750.00	18750.00	61425.00	45937.50	37675.00	27187.50	2.59	2.45
Average	22058.57	17785.71	68542.86	49528.79	46484.29	31743.07	3.09	2.75

Conclusion

It is concluded from the study that there exists a wide gap between the potential and demonstration yields in green gram mainly due to technology and extension gaps and also due to the lack of awareness about new technology in green gram cultivation in Bidar district of Karnataka. The FLD produces a significant positive result and provided the researcher an opportunity to demonstrate the productivity potential and profitability of the latest technology in farmers, which they have been advocating for long time. This could be circumventing some of the constraints in the existing transfer of technology system in the Bidar district of Karnataka. The per cent increment in yield of green gram to the extent of 39.82 per cent in FLDs over the farmers practice created greater awareness and motivated the other farmers to adopt the improved package of practices of green gram and it is concluded that the FLD programme is a successful tool in enhancing the production and productivity of green gram crop through changing the knowledge, attitude and skill of farmers.

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