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Frontline demonstrations: Improved production technologies in enhancement of chickpea productivity in Bidar district of Karnataka State

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Abstract
Bengal gram (*Cicer arietinum* Linn.) is an important pulse crop & commercial crop of in Karnataka state. The production and productivity of Bengal gram very less in this region as compared to its potential yield. ICAR- Krishi Vigyan Kendra, Bidar during the last 8 years conducted 138 demonstrations in farmers field to showcase improved production technology of Bengal gram. It was observed that variation in the yields and was due to variation in agro-climatic parameters under rain fed condition. The highest yield in The Frontline demonstrations (FLD) plots of Bengal gram achieved by adopting improved production technology was 21.25q/ha compared to farmers' practice (10.69 q/ha). There was an average 48.98 per cent increased yield recorded by adoption of improved production technology. The average technological gap, extension gap and technological index were calculated as 11.16 q/ha, 6.14 q/ ha and 37.19 per cent, respectively. The FLD farmers have recorded the average net profit of Rs. 22491.47 per ha.

Keywords: bengal gram, technology gap, technology index, extension gap, yield, economics

Introduction
Bengal gram (*Cicer arietinum* L.) is one of the important legume crop. It is being grown in 44 countries across world. India is the largest producer of chickpea accounting to 75 per cent of world production. The major chickpea growing states in India are Maharashtra, Andhra Pradesh, Bihar, Karnataka, Madhya Pradesh, Rajasthan, Uttar Pradesh and Gujarat. It grows on a very light sandy loam to heavy textured clay soil. India is importing 3-4 million tones of pulses every year to meet out domestic demand. India achieved a record 19.38 MT pulse production in 2013-14 with pigeon pea (3.17 MT), chick pea (9.53 MT). Singh and Bajpai (1996) [7] reported that fertilizer and plant protection were most critical inputs for increasing seed yield of chickpea. Jadhav *et al.*, 1992 reported that plant protection and fertilizer application are most critical inputs for increasing seed yield of chickpea.

The aim of frontline demonstrations on integrated crop management (ICM) technology is to identify the production constraints, 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. The yield data were collected from both the ICM demonstration and native farmers practice by random crop cutting method. Qualitative data were converted into quantitative form and expressed in terms of per cent increase in yield. (Narasimha Rao *et al.*, 2007) [3].

Methodology
The Frontline demonstrations were organized on farmer's field to demonstrate the impact of Integrated crop management technology on Bengal gram productivity over eight years starting from *kharif* 2008-09. 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 The Frontline demonstrations on integrated crop management (ICM) compared with farmers practice. Those are the improved variety, 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).

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 and analyzed by using simple statistical tools. The technology gap, extension gap and technological index were calculated (Samui *et al*., 2000) [6].

Table 1: Improved production technology and Farmers practices of Bengal gram under FLD.

S. No.	Technology	Improved practices	Farmers practice	GAP (%)
1	Variety	JG- 11	Local Annigere-1	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	50 kg/ha	65 kg/ha	High seed rate
5	Sowing method	Line sowing	Line sowing	No gap
6	Seed treatment	Bio fertilizers and Trichoderma	No seed treatment	Full gap
7	Fertilizer dose (NPK kg/ha)	5:10:0	10:20:0	Partial gap
8	Plant protection	Integrated pest management	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 Discussions

Crop Performance and Yield

Frontline demonstrations (FLD) are effective tools in introducing various new technologies to the farmers and educational them and to increase the farmer's knowledge and confidence level by comparison of productivity levels between improved production technologies in demonstration trials. The performance of Bengal gram crop owing to the adoption of improved technologies is assessed over a period of eight years and is presented in table 1 and 2.

The integrated crop management demonstration practice fields have has recorded the average highest yield of 21.25q per ha as compared 12.50q per ha during 2010-11. However, the average lowest yield of 10.69q per ha was recorded during 2014-15 (Table 1). The results clearly indicated that the higher average seed yield in demonstration plots over the years compared to local check was due to knowledge and adoption of full package of practices viz., varieties Bengal gram variety JG11, timely sowing, integrated pest management. 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]. The increased yield of Bengal gram under improved technology was due to use of latest varieties, integrated nutrient management and integrated pest management

Technology Gap

The technology gap means the differences between potential yield and yield of demonstration plot. The technology gap of demonstration plots were 9.50, 8.94, 8.75, 10.75, 11.75, 11.72, 13.80 and 14.04q/ha during 2008-09, 2009-10, 2010-11, 2011-12, 2012-13, 2013-14, 2014-15 and 2016-17 (Table-3), respectively. On an average technology gap under eight year FLD programme was 11.16. 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 he differences between demonstration plot yield and farmers yield. Extension gap of 6.45, 6.06, 8.75, 5.75, 4.75, 7.41,5.51 and 4.40 q/ha during 2008-09, 2009-10, 2010-11, 2011-12, 2012-13, 2013-14, 2014-15 and 2016-17 (Table-3) respectively. On an average extension gap under eight year FLD programme was 6.41q/ha which emphasized the need to educate the farmers through various extension means 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

The feasibility of the evolved technology in the farmers' fields is indicated by technology index. Lower the value of technology index, higher is the feasibility of the improved technologies. The technology index varied from 29.17 to 46.80 per cent (Table-3). On an average technology index was observed 37.19 per cent during the eight 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 Bengal gram.

Economic return

The present demonstrations were taken for calculating gross return, cost of cultivation, net return and benefit: cost ratio (Table-3). The ICM demonstration of improved technologies over number of years gave net profit of chickpea was Rs. 26988, 24954,26588, 48100, 63140, 33240,44300 and 16700 whereas in farmers practice (Check) the net returns were Rs. 12690, 14750, 11050,30700, 45936.99, 32610, 42760 and 41384.80 respectively during 2008-09, 2009-10, 2010-11, 2011-12, 2012-13, 2013-14, 2014-15 and 2016-17. The benefit cost ratio of chickpea under improved technologies during the year 2008-09, 2009-10, 2010-11, 2011-12, 2012-13, 2013-14, 2014-15 and 2016-17 were 2.34, 2.23, 2.32, 3.27, 4.03, 2.54, 3.16 and 2.83 as compared to 1.65, 1.84, 1.67, 2.72, 3.84, 1.87, 2.40, and 2.48 respectively. This may be due to adoption of improved technologies under demonstration as compared to local check i.e., farmer practices. Similar

findings were reported by Singh *et al.,* (2014). The beneit cost ratio of chick pea cultivation under improved practices has higher than farmers' practices in all the years and this may be due to higher yield obtained under improved technologies compared to local check (farmers' practice). This finding was in corroboration with the findings of Mokidue *et al.,* (2011) [2] and Tomar (2010) [8].

Conclusion

The demonstration resulted that a wide gap between the potential and demonstration yields mainly due to technology and extension gaps and also due to the lack of awareness about new technology. The FLD produced a significant positive result and provided an opportunity to demonstrate the productivity potential and profitability of improved ICM technology (Intervention) under real farming situation, which they have been advocating for long time. The productivity gain under FLD over existing practices of bengal gram cultivation created greater awareness and motivated the other farmers to adopt suitable production technology of bengal gram. The technology was eco-friendly and farmer friendly also contributed to the economical yield and quality of the produce. The average percent increase in the yield of bengal gram was 48.98 per cent when compared with farmers practice (TO1).

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