TECHNOLOGY GAP ASSESSMENT AND PRODUCTIVITY GAIN THROUGH FRONT LINE DEMONSTRATIONS IN GREENGRAM

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ABSTRACT

KVK, Chandgothi, Churu (Rajasthan) conducted total 147 Front Line Demonstrations on greengram at farmers field in Churu District (Rajasthan) during six consecutive kharif seasons from 2012 to 2017. The farming situation was rainfed and soil was sandy loam low in nitrogen, medium in phosphorus and medium to high in potash. Assessment of gap was done and on basis of gap assessment, improved recommended technologies were demonstrated. On overall average basis, 20.07 % higher grain yield was recorded under demonstrations than the farmer's traditional practices (Local check). The extension gap, technology gap and technology index were 179 kg/ha, -2.33 kg/ha and -0.76%, respectively. An additional investments of Rs 1268 per ha consist with scientific monitoring of demonstration and non–monetary factors resulted in additional return of Rs. 9401 per ha. On six year average basis incremental benefit : cost ratio was found 7.51.

Keywords: *greengram, grain yield, economics, technology gap, extension gap*

INTRODUCTION

Pulse or 'Daal' are an integral part of the average Indian meal. A large population of the Indian population is vegetarian and pulses form the main source of protein. The protein content in pulses is about 18-25 per cent. This makes pulses one of the cheapest sources of protein for human consumption (Dayanand *et al.,* 2014). Pulse has been grown since millennium and has been a vital ingredient of the human diet in India. Pulse and milk provide the full complement of proteins to people who avoid eating meat. Pulse is the second most important groups after cereals (Dash and Rautaray, 2017). India is the largest producer and consumer of pulse in the world, accounting for 25 percent of global production and 15 percent consumption (Saraswati *et al.,* 2004). Pulse crops are primarily grown under rainfed condition and a low fertility neglected soil in India. It can be grown on a variety of soil and climatic conditions as it is tolerant to drought (Malik *et al.,* 2006). The per capita availability of pulses has declined from 60.55 g/day in 1951 to 41.64 g/day in 2012. The productivity of pulses is very low in India is 588 kg/ha, as compared to highest 2034 kg/ha in USA during 2016 (Anonymous, 2018).

Among the pulses, greengram (*Vigna radiata* L. Wilczek) is one of the most important and extensively cultivated crop. It is grown during rainy and summer season. Greengram is an important pulse crop for the state of Rajasthan. It is drought tolerant and has ability to grow under harsh climate, low rainfall and poor to medium soil conditions. Rapid growth and early maturing characteristics and ability to restore the soil fertility by fixing atmospheric nitrogen and enhance soil productivity (Sharar *et al.,* 2001) makes it valuable crop in various cropping systems. It is grown as sole crop or mixed/intercropped with cereals like pearl millet, sorghum, maize, etc. and also intercropped with woody perennials under agroforestry system (Sharma, 2010). The crop covers shields soil from solar heat, retain soil moisture and prevent losses of organic matter and retards soil erosion as well. Greengram is primarily used for food purpose in the form of *Dal* and sprouts and also in sweet and several confectionary items of day to day use (Sharma, 2014). It is a rich source of protein (24.3%), fats (0.67%) (Lee *et al*., 1997) and essential amino acids especially lysine and can thus supplement cereal based human diet.

Greengram grown in all parts of Rajasthan but major area has been covered by district Nagaur, Jodhpur, Pali, Churu, Jaipur, Jalore, Ajmer and Tonk. In Rajasthan state, the total area under greengram cultivation is 24.66 lac hectares with production of 12.22 lac tones. The average productivity of greengram in Rajasthan ranged between 56 kg/ha in Barmer to 694 kg/ha in Ajmer with the state average of 496 kg/ha. So far, as Churu district of Rajasthan is concerned total area under greengram cultivation is 2.45 lac hectare with productivity of 362 kg/ha (Anonymous 2018-

19), which is much lower than the potential. The shortfall of pulses which is to be minimized either by increasing the area or by increasing the productivity levels of pulses was also mentioned by Gupta *et al.* (2004). At present the productivity of pulses is not sufficient due to several biotic and abiotic stresses besides unavailability of quality seeds of improved varieties in time and poor crop management practices due to unawareness and non adoption of recommended production and plant protection technologies. Agricultural Universities and Research Centers developed so many production technologies but the productivity of greengram is still low due to poor transfer of technology from the points of its development to the points of its utilization hence a wide gap has been observed between knowledge of production and knowledge of utilization (Dayanand *et al*., 2014).

To enhance the productivity of greengram, it is necessary to cultivate greengram in scientific manner and brought the newly developed production technologies at farmer's field. Therefore, Front Line Demonstration (FLD) on pulses at farmer's field may be helpful to establish the technology at farming community. The basic objective of this programme is to demonstrate improve proven technologies of recently released, short duration, high yielding disease resistant varieties in compact block with INM, IWM and IPM at farmer's field (table 1) through Krishi Vigyan Kendras to enhanced adoption of modern technologies to generate yield data with farmers feedback. Keeping this in view, KVK, Chandgothi, Churu conducted 147 demonstrations on greengram crop at farmer's field during *kharif* 2012 to *kharif* 2017.

Table 1 : Comparison between technological intervention and local check and gap analysis under FLDs on greengram

Sr. No.	Particulars	Technological intervention (Demonstration practices)	Farmers practices (Local check)	Technological gap
1	**Farming situation**	Rainfed	Rainfed	No gap
2	**Variety**	Improved varieties i.e. RMG 492, RMG 344 and IMP 02-03	Locally available	Full gap (100 %)
3	**Seed rate**	15 kg/ha	10 kg/ha	33 % less then recommendation
4	**Seed inoculation**	*Rhizobium* and PSB	No Seed Inoculation	Full gap (100 %)
5	**Sowing method**	Line Sowing (30 cm x10 cm)	Line sowing (45x15 cm) & Broadcasting	Full gap (100 %)
6	**Fertilizer**	15 kg N, 40 kg P_2O_5	No use of fertilizer	Full gap (100 %)
7	**Micro-nutrients**	Use of micro nutrients for balance fertilizer (75 gm/15 liters of water as foliar spray)	No use of Micronutrients	Full gap (100 %)
8	**Weed control**	Herbicide application (Imazethapyr @ 500 ml/ha at 15-20 DAS)	Hand weeding at 25 DAS	No herbicide use Full gap (100 %)
9	**Plant protection**	Need based spray of Insecticides and fungicides	No spray	Full gap (100 %)

OBJECTIVES

(1) To find out the performance of recognized and recommended high yielding varieties of greengram with full recommended package of practices.

(2) To compare the yield of FLD organized by KVK with local check (farmer's practices).

(3) To collect and consider the feedback information from farmers for further improvement in research

METHODOLOGY

KVK, Chandgothi, Churu conducted total 147 Front Line Demonstration on greengram varieties i.e. RMG 492, RMG 344 and IPM 02-03 at 147 selected farmer's field in a compact block in Churu District (Rajasthan) during *kharif* 2012 to *kharif* 2017. The selection of villages was done on basis of non adoption of improved and recommended varieties (RMG 492, RMG 344 and IPM 02-03). After the selection of villages, most approachable side of farmer's field was selected, so that the performance of demonstrated technology can be seen by other farmers. The farming situation was rainfed and soil was sandy loam low in nitrogen, medium in phosphorus and medium to high in potash. The area for demonstration in 2012, 2013 & 2016 was 0.33 ha while in 2014, 2015 & 2017 was 0.4 ha each and were conducted by using recommended package of practices. The KVK provided high quality seed of greengram verities i.e. RMG 492, RMG 344 and IPM 02-03 @ 15 kg/ha and other critical input like DAP, micro-nutrients, bio fertilizers, herbicide and pesticides were parched by the farmers and used (table 2) with the guidance of KVK during all the years.

Table 2 : Critical Inputs used to demonstrate the technologies in demonstration plot

Sr. No.	Input	Quantity	
		Demonstrated by the KVK	Used by the farmer
1	**Seed**	15 kg/ha	-
2	**DAP**	-	87 kg/ha
3	**Micro nutrients**	-	5 g/ li. water
4	**Biofertilizer**	-	*Rhizobium* & PSB @ 600 g/ha each
5	**Herbicide**	-	Imazethapyr @ 500 ml /ha
6	**Pesticides**	-	Dimethoate 30 EC @ 1li./ha

The sowing of crops was done on the onset of monsoon, most of time it was mid July and harvested during second fortnight of September. The scientist of KVK, Chandgothi, Churu regularly visited and monitored demonstrations on farmers fields from sowing to harvesting. The grain yield of demonstration and local check was recorded and analyzed. Other parameters as suggested by Yadav *et al.* (2004) were used for calculating gap analysis, cost and returns. The details of different parameters are as follows:

(a) Extension gap = Demonstration yield (D_1) - Farmers practices yield (F_1)

(b) Technology gap = Potential yield (P_1) - Demonstration yield (D_1)

(c) Technology index = $\frac{\text{Potential yield } (P_1) - \text{Demonstration yield } (D_1)}{\text{Potential yield } (P_1)} \times 100$

(d) Additional return = Demonstration return (D_r) - Farmers practices return (F_r)

(e) Effective gain = Additional return (A_r) – Additional cost (D_c)

(f) Incremental B:C ratio = $\frac{\text{Additional return } (A_r)}{\text{Additional cost } (D_c)}$

RESULTS AND DISCUSSION

Grain Yield

The grain yield of greengram under demonstration plot was ranged from 1023 kg/ha to 1112 kg/ha with an average (Year 2012 to 2017) of 1069 kg/ha, while, in farmer's local practices plot it ranged from 812 kg/ha to 983 kg/ha with an average (Year 2012 to 2017) of 890 kg/ha (table 3 & Fig. 1). The grain yield was increased from 11.59 to 25.98 per cent over farmer's practices (local check) during all the years. On average basis, 20.07 per cent increase in yield was recorded under demonstrations plot as compared to farmer's local cultivation practices of greengram. While it was 129.24 %, 150.55 %, 218.47 % and 0.22 % higher as compared to country, state, district and potential yield, respectively (table 3 & fig. 2).

Table 3 : Comparison of yields of greengram (Average of 2012 to 2017) (n=147)

	Country*	State**	District**	Potential	Demonstration	Farmers practices
Yield (kg/ha)	466	427	336	1067	1069	890
% increased	129.24	150.55	218.47	0.22	-	20.07

*Anonymous (2018) **Anonymous (2012-13 to 2017-18)

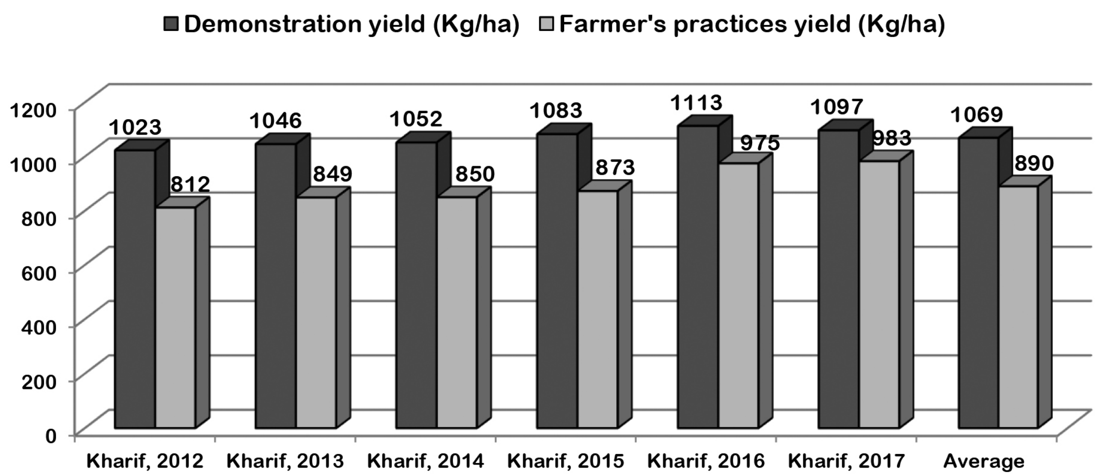

Fig. 1 : Grain yield of greengram in demonstration and farmer's practices plot

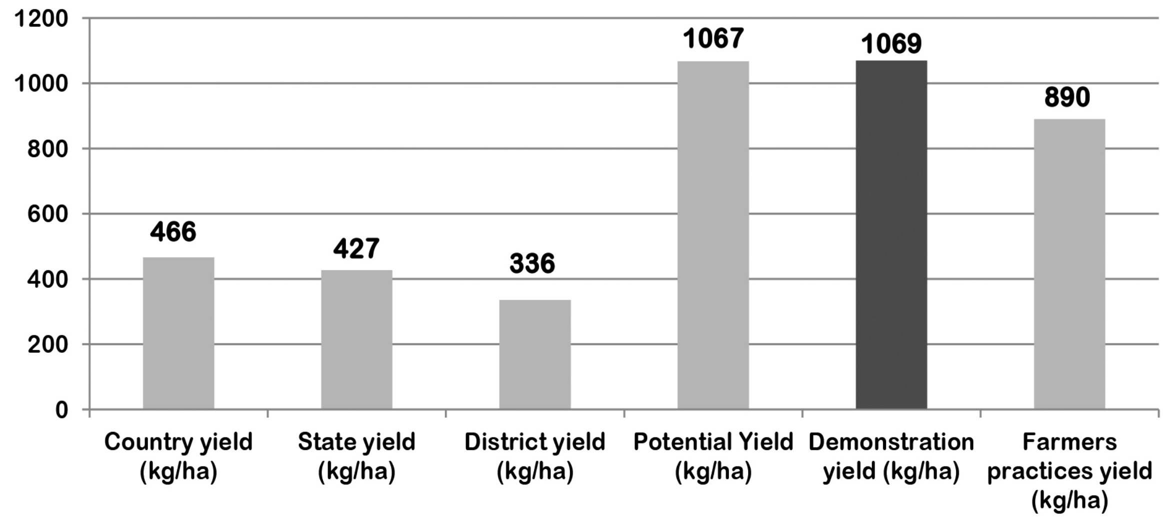

Fig. 2 :Comparison of yield of greengram (Average of 2012 to 2017)

Gap analysis

An extension gap between demonstrated technology and farmer's practices was ranged from 114 kg/ha to 211 kg/ha during all the year. On six year average basis, extension gap of total 147 demonstration was observed 179 kg/ha (table 4). Such big gap might be attributed to adoption of improved technology in demonstration which resulted in higher grain yield than the traditional farmer's practices. Wide technology gap of -83 to +103 kg/ha in yield was observed during the demonstration years. Average technology gap of 147 demonstration was -2.33 kg/ha. This less technology gap during all the years indicated more feasibility of recommended technologies during study periods. Minus data in technology gap showed (table 4) that combination of improved varieties with recommended package of practices perform better than the potential yield of varieties. Similarly, the technology index for all the demonstrations during the study period were in accordance with technology gap. Technology index were ranged from -8.30 % to + 8.58 % with an average of -0.76 %. Lower technology index (-8.30 % during year 2015 and -0.76 % average of six years) reflected the adequate proven technology for transferring to farmers and sufficient extension services for transfer of technology.

Table 4 : Grain Yield and gap analysis and technology index of Front Line Demonstration on greengram at farmer's field (n=147)

Year of demons-tration	No. of Demons-tration	Variety	Potential yield (kg/ha)	Demons-tration yield (Kg/ha)	Farmers practices yield (kg/ha)	Increased over farmers practices (%)	Extension gap (kg/ha)	Technology gap (kg/ha)	Technology index (%)
Kharif, 2012	12	RMG 492	1000	1023	812	25.98	211	-23	-2.30
Kharif, 2013	30	RMG 492	1000	1046	849	23.20	197	-46	-4.60
Kharif, 2014	25	RMG 344	1000	1052	850	23.76	202	-52	-5.20
Kharif, 2015	25	RMG 344	1000	1083	873	21.76	210	-83	-8.30
Kharif, 2016	30	IPM 02-03	1200	1113	975	14.15	138	87	7.25
Kharif, 2017	25	IPM 02-03	1200	1097	983	11.59	114	103	8.58
Average	**-**	**-**	**1067**	**1069**	**890**	**20.07**	**179**	**-2.33**	**-0.76**

Economics analysis

Improved variety seed, fertilizers, bio fertilizers, herbicides and pesticides were considered as cash inputs for the demonstrations as well as farmers practices. On an average additional investment of ₹ 1,268 per hectare was made under demonstration resulted in additional return of ₹ 9,401 per hectare. Economics returns as a function of grain yield and selling price varied during all the years. The total return under demonstration plot was ranged from ₹ 44,977 per hectare to ₹ 75,810 per hectare with an average of ₹ 54,854 per hectare. Maximum return was obtained during *kharif* 2015 due to higher grain yield and higher selling price. While, in farmer's local practices plot total return ranged from ₹ 36,540 per hectare to ₹ 61,110 per hectare with an average of ₹ 45,453 per hectare (table 5). The higher effective gain of ₹ 8,132 per hectare was obtained under demonstration.

Table 5 : Economics analysis of Front Line Demonstration on greengram at farmer's field (n=147)

Year of demons-tration	Cost of Cultivation (₹/ha)		Additional cost in demons-tration (₹/ha)	Sale Price of grain (Rs/qt.)	Total return (₹/ha)		Additional return in demons-tration (₹/ha)	Effective gain (₹/ha)	Incremental B:C ratio (IBCR)
	Demons-tration	Farmers practices			Demons-tration	Farmers practices			
Kharif, 2012	12800	11300	1500	4500	46035	36540	9495	7995	6.33
Kharif, 2013	16590	15090	1500	5800	60668	49242	11426	9926	7.62
Kharif, 2014	15690	14680	1010	4900	51548	41650	9898	8888	9.80
Kharif, 2015	20600	19400	1200	7000	75810	61110	14700	13500	12.25
Kharif, 2016	20600	19400	1200	4500	50085	43875	6210	5010	5.18
Kharif, 2017	19500	18300	1200	4100	44977	40303	4674	3474	3.90
Average	**17630**	**16362**	**1268**	**5133**	**54854**	**45453**	**9401**	**8132**	**7.51**

The higher additional returns and effective gain under demonstration could be due to improved technology, non-monetary factors, timely operations of crop cultivation and scientific monitoring. The Incremental B:C ratio (IBCR) during all six years was found between 3.90 to 12.25. On the average of six year, IBCR was found 7.51. Higher IBCR could be due to higher additional return with low additional cost in demonstration. The results confirm with the finding of Front Line Demonstration on oilseeds and pulse crops by Yadav *et al.* (2004), Lathwal, (2010), Dayanand *et al.* (2014), Sharma *et al.* (2017), Rachhoya *et al.* (2018) and Rai *et al.,* (2020).

CONCLUSION

On the basis of six years of Front Line Demonstration it can be concluded that by adopting recommended package of practices under demonstration can increased 20.07 per cent yield of greengram over farmer's practices. The increase was recorded with little extra spending of Rs 1268 per hectare. This amount is not big enough that even a small and marginal farmer can afford this. The adoption of improved technology not affected by the additional cost but the ignorance and unawareness is the primary reason and it is quite appropriate to call such yield gap as extension gap. Moreover, extension gap can be also be minimized by adopting such technology under FLD. The IBCR (7.51) is much high to motivate the farmers for adoption of technology. Therefore, Front Line Demonstration of greengram was found effective for farmers in changing mind sate, attitude, skill and knowledge of improved practices of greengram cultivation including adaption. Farmers and scientist relationship also improved by this and built confidence between them. Demonstrated farmers is a good primary source of knowledge or information on improved practices of greengram cultivation and also source of good quality seed in locality and surrounding area for next season. Front Line Demonstration helps in speedy and wider dissemination of the improved proven technology to the farming community.

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