Bulletin of Environment, Pharmacology and Life Sciences
Bull. Env. Pharmacol. Life Sci., Vol 6 Special issue [3] 2017: 319-322

Online ISSN 2277-1808
Journal's URL:http://www.bepls.com
CODEN: BEPLAD
Global Impact Factor 0.533
Universal Impact Factor 0.9804
NAAS Rating 4.95

FULL LENGTH ARTICLE **OPEN ACCESS**

Impact assessment of Front Line Demonstration on Pigeon pea (*Cajanus cajan* L.) under Flat and Raised bed sowing methods

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ABSTRCT
Pigeon pea is an important pulse crop of Uttar Pradesh. It is also one of the most important pulse crop of Chandauli district of Uttar Pradesh. Krishi Vigyan Kendra, Chandauli (U.P.) conducted 82 frontline demonstration of pigeon pea crop in the different locations of entire district. The results were compared with full package of practices viz., improved variety, planting methods, seed rate, proper spacing, plant population, balance fertilizers, plant protection etc. and farmers practices included local/old variety, no seed treatment with fungicides, improper spacing and imbalance use of fertilizers. The FLD in pigeon pea registered 12.5 and 15.6 per cent higher yield with flat and bed respectively over farmers practice on an average. The highest yield (13.0 ha^{-1}) was recorded with bed planting method in the year 2015-16 in FLD, which was 19.8 per cent more over the farmers practices (10.50 q ha^{-1}). The average maximum net return (Rs. 42809/-) was recorded with bed planting method over flat sowing (Rs. 37856/-) and farmer practice (Rs. 36062/-). Average extension gap was recorded 4.13 q ha^{-1} and average technology index was recorded 31.53 per cent. The technology gap ranged between 1.1 q ha^{-1} to 2.3 q ha^{-1}. On an average technology gap under 3 years of FLD program were 10.2 q ha^{-1} with flat sowing and 9.4 q ha^{-1} with bed planting method. The results indicated that the frontline demonstration has given a good impact over the farming community of Raisen district as they were motivated by the new agricultural technology applied in the FLD plots.
Key Words: *Pigeon pea, Bed planting, Extension gap, FLD, Technology gap, Technology index.*

Received 29.07.2017 Revised 09.08.2017 Accepted 27.08. 2017

INTRODUCTION

Pigeon pea, (*Cajanus cajan* L) is the second most important pulse crop in India after chickpea. It has multiple uses and occupies an important place in the prevailing farming systems in the country and vegetarian diet. It also plays an important role in sustainable agriculture by enriching the soil through biological nitrogen fixation along with deep root system of this crop which makes it more suitable for its cultivation under rain-fed conditions. Uttar Pradesh occupies 3.68 lakh hectares of land with average productivity of 889 kg ha^{-1} of pigeon pea. In order to make the nation self sufficient in pulses productivity levels of pulses need to be increased substantially from 889 kg ha^{-1} to 1,600 kg ha^{-1} by 2020 (Ali and Kumar, 2005). Faulty sowing practices, improper crop geometry, avoid use of biofertilizers, other intercultural operations and climatic variabilities are predominant reasons for limiting the potential yield of pigeon pea. The Frontline demonstrations (82) were conducted on farmer's field to demonstrate the impact of improved variety and bed planting methods other crop management technology on Pigeon pea productivity over three years during *Kharif* 2014-15 to 2016-17.

METHODOLOGY

Each frontline demonstration was laid out on 0.25 ha area with flat sowing and 0.25 bed planting, adjacent 0.25 ha was considered as control for comparison (farmer's practice). The crop management technology comprised the improved variety Narendra Arhar - 2, bed planting method with proper tillage, proper seed rate, pre emergent herbicide application and seed treatment with bio fertilizers, proper nutrient and pest management. (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. Qualitative data were converted into quantitative form and expressed in terms of per cent increase in yield calculated using following formula:

- Technological gap: Potential yield – demonstration yield
- Extension gap: Demonstration yield – yield under farmer practice
- Technology index (%): (Potential yield - demonstration yield/potential yield) X 100

TABLE 1: Improved practices and Farmers practices of Pigeon pea under FLD

Sl. No.	Technology	Improved practices under flat sowing	Improved practices under bed planting	Farmers practice	GAP (%)
1	Variety	Narendra Arhar - 2	Narendra Arhar - 2	Unnamed variety	100
2	Land preparation	Ploughing and Harrowing	Ploughing, Harrowing and Bed formation	Ploughing and Harrowing	50
3	Seed rate	12 kg (Ha)	8 kg (Ha)	20 Kg (Ha)	High seed rate
4	Seed treatment	Biofertilizers	Biofertilizers	No	100
5	Sowing method	Line sowing	Line sowing	Broadcasting	100
6	Herbicide application	Pendimethalin @ 3.3 lit. per Ha	Pendimethalin @ 3.3 lit. per Ha	No application	100
7	Fertilizer dose	25:50:25 NPK	25:50:25 NPK	Indiscriminate application	50
8	Plant protection	IPM	IPM	Indiscriminate application	100

RESULTS & DISCUSSION

The gap between the farmers practice and recommended technologies of Pigeon pea in district Chandauli is presented in table 1. Full gap was observed in case of use of improved variety, sowing method, seed treatment, plant protection and weed management and partial gap was observed in fertilizer dose, which definitely was the reason of not achieving potential yield. Farmers were not aware about recommended crop management technologies. Farmers in general used local or old-age varieties instead of the recommended high yielding resistant varieties. Unavailability of seed in time and lack of awareness were the main reasons. Farmers followed thick sowing against the recommended line sowing and because of this, they applied higher seed rate than the recommended. Yield During three years of frontline demonstrations results obtained are presented in table 2.

Grain Yield

The results revealed that due to front line demonstration on Pigeon pea an average yield was recorded 11.8 q ha^{-1} ha with flat sowing and 12.6 q ha^{-1} with bed planting method under demonstrated plots as compared farmers practice 10.4 q ha^{-1}. The highest yield in the FLD plot was 13.00 ha^{-1} in 2015-16 with bed planting method and in farmers practice 10.5 q ha^{-1} in the same year and lowest yield was recorded in 2016-17 with farmer practice (10.1 q ha^{-1}). This results clearly indicated that the higher average grain yield with bed planting method in demonstration plots over the years compare to local check due to knowledge and adoption of full package of practices *i.e.* improved variety *e.i.* Narendra Arhar - 2, sowing method *e.i.* bed planting and crop management technologies like timely sowing, seed treatment with Bio fertilizers (Rhizobium and PSB), use of balanced dose of fertilizer (25 kg N 50 kg P2O5 and 25 kg K2O ha^{-1}), timely weed management , need based plant protection etc. The average yield of pigeon pea increased 15.6 per cent over flat sowing and farmer practice. The yield of pigeon pea could be increased over the yield obtained under farmers practices (old variety, no use of the balanced dose of fertilizer, untimely sowing and no control measure adopted for pest management) of pigeon pea cultivation. The above findings are in similarity with the findings of Singh, 2002, Singh *et.al* 2013 and Singh *et.al* 2013.

Economics

Data on economics presented Table 2 revealed that demonstrated technology of pigeon pea and their associated agronomical practices produced 18.70 per cent higher net return (Rs. 42809/-) with bed planting over the existing farmer practices (Rs. 36062/-). The inputs and outputs prices of commodities prevailed during the study of demonstration were taken for calculating net return and benefit: cost ratio. The cultivation of pigeon pea under improved technologies gave higher net return of Rs. 33430, 46450 and 48548 with bed planting and Rs. 28500, 40720 and 44348 per ha with flat sowing method in the year

2014-15, 2015-16 and 2016-17 respectively as compared to farmers practices. Similar findings were reported by Singh *et al.* (2014). The average benefit cost ratio of pigeon pea cultivation under improved cultivation practices were maximum with bed planting method (3.58:1) over flat sowing (2.89:1) and farmer practice (2.75:1). This may be due to higher yield obtained under improved technologies compared to local check (farmers practice). This finding is in corroboration with the findings of Mokidue *et al.* (2011), Sharma *et al.* (2011) and Raj *et al.* (2013).

Technological gap

The technology gap is the differences between potential yield and yield of demonstrated plots were 10.2, 10.0 and 10.5 q ha^{-1} with flat sowing and 9.5, 9.0 and 9.6 q ha^{-1} with bed planting methods during 2014-15, 2015-16 and 2016-17 respectively. On an average technology gap under three years of FLD program were 10.2 q ha^{-1} with flat sowing and 9.4 q ha^{-1} with bed planting methods. The technology gap observed may be attributed to dissimilarity in the crop management practices, soil fertility status, and local climatic situation.

Extension gap

Extension gap of 1.1, 1.5 and 1.4 q ha^{-1} with flat sowing and 1.8, 2.5 and 2.3 q ha^{-1} with bed planting method were observed during 2014-15, 2015-16, and 2016-17 respectively. On an average extension gap under three years of FLD program was 1.4 q ha^{-1} with flat sowing and 2.2 q ha^{-1} with bed planting method 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 hurdle extension gap. . The above findings are in similarity with the findings of Samui, *et.al.* (2000).

Technology Index

The technology index shows the feasibility of the demonstrated technology at the farmer's field. The technology index varied from 40.9 to 47.7 per cent (Table-3). On an average technology index was observed 42.6 per cent with bed planting method and 46.5 per cent with flat sowing method during the three years of FLD program, 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 pigeon pea at farmer's field.

CONCLUSION

The front line demonstration results influentially brought out that, the yield of pigeon pea could be increased with intervention on varietal improvement, sowing methodology, *Rhizobium* inoculation, line sowing, soil test based recommended dose of fertilizers, timely application of plant protection measures and timely weed control. Technology demonstration conducted on pigeon pea was performed better. The FLD produces a significant positive result and provided the researcher an opportunity to demonstrate the productivity potential and profitability of the latest technology (Intervention) under real farming situation, 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 district Chandauli of Uttar Pradesh. The productivity gain under FLD over existing practices of pigeon pea cultivation created greater awareness and motivated the other farmers to adopt suitable production technology of pigeon pea in the district. The wide technology gap, which need to be bridged by scientific production and protection technologies in varied agro-climatic conditions. Major attention to be made on development of area specific technology module for enhancing the productivity of pulses in varied agro-Eco system. Capacity building of farmers as well as extension functionaries is must receive expected outcomes from technological intervention.

TABLE 2. Effect of Frontline Demonstrations on Yield and Economics of Pigeon pea

Year	No. of Demo. (Flat and Bed Sowing)	Area (ha) (Flat and Bed Sowing)	Yield (q ha^{-1})			% Increase		Net Return (Rs. ha^{-1})			BCR			Potential Yield (q ha^{-1})
			Demo		Farmer Practice	Flat	Bed	Demo		Farmer Practice	Demo		Farmer Practice	
			Flat	Bed				Flat	Bed		Flat	Bed		
2014-15	30	20.5	11.8	12.5	10.7	10.7	16.8	28500	33430	34595	3.04:1	3.85:1	2.96:1	22
2015-16	24	18.0	12.0	13.0	10.5	17.1	19.8	40720	46450	36076	2.75:1	3.39:1	2.61:1	22
2016-17	28	20.0	11.5	12.4	10.1	9.8	10.2	44348	48548	37515	2.90:1	3.50:1	2.68:1	22
Average	27.3	19.5	11.8	12.6	10.4	12.5	15.6	37856	42809	36062	2.89:1	3.58:1	2.75:1	22

TABLE 3. Effect of Frontline Demonstrations on Technological gap, Extension gap and Technology index of Pigeon pea

Year	Technological gap (q ha^{-1})		Extension gap (q ha^{-1})		Technology index (%)	
	Flat over Farmer Practice	Bed over Farmer Practice	Flat over Farmer Practice	Bed over Farmer Practice	Flat over Farmer Practice	Bed over Farmer Practice
2014-15	10.2	9.5	1.1	1.8	46.4	43.2
2015-16	10.0	9.0	1.5	2.5	45.5	40.9
2016-17	10.5	9.6	1.4	2.3	47.7	43.6
Average	10.2	9.4	1.3	2.2	46.5	42.6

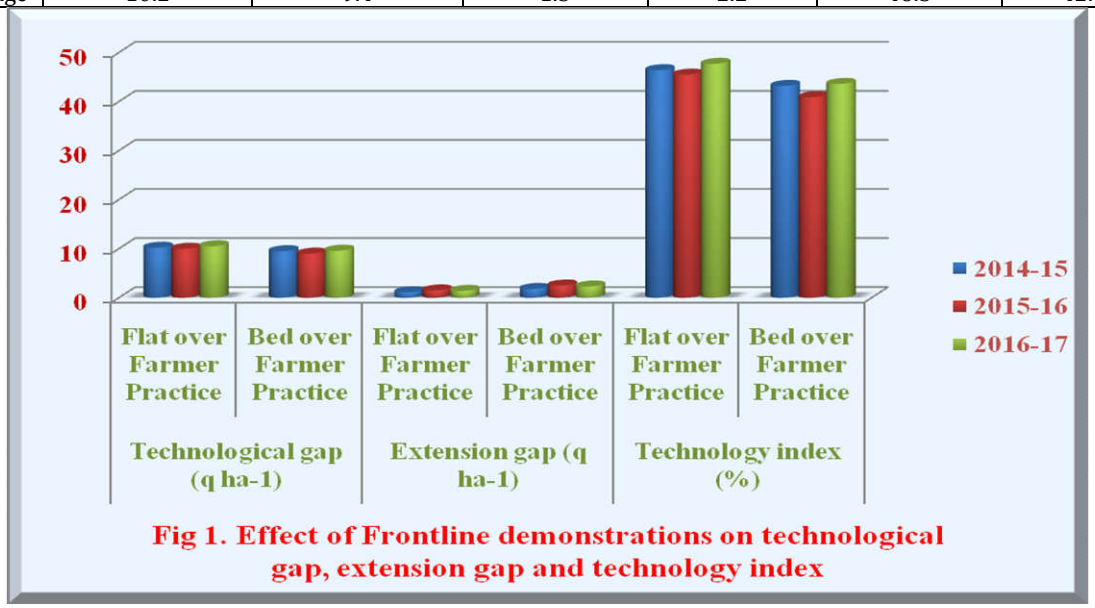

Fig 1. Effect of Frontline demonstrations on technological gap, extension gap and technology index

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CITATION OF THIS ARTICLE

Samir Kumar Pandey, Dheeraj Kumar Tiwari, Vivek Kashyap and Abhay Deep Gautam. Impact assessment of Front Line Demonstration on Pigeon pea (*Cajanus cajan* L.) under Flat and Raised bed sowing methods . Bull. Env. Pharmacol. Life Sci., Vol 6 Special issue [3] 2017: 319-322