RESEARCH ARTICLE

TECHNOLOGY TRANSFER THROUGH FIELD TRIALS FOR INCREASING PRODUCTIVITY AND PROFITABILITY OF PIGEON PEA

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Abstract: Pigeon pea is one of the major *kharif* crop grown in district. Farm Science Centre known as KrishiVigyan Kendra laid down Front Line Demonstration in the year 2017-18 to 2018-19introducing new and high yielding variety "Rajiv Lochan" applying scientific practices in their cultivation. The FLDs were carried out in different villages of Surguja district. The productivity and economic returns of pigeon pea in improved technologies were calculated and compared with the corresponding farmer's practices (local check). Improved practices recorded higher yield as compared to farmer's practices. The improved technology recorded higher yield of 17.47 over farmers practice 9.89 q/ha. In spite of increase in yield of pigeon pea, technology gap, extension gap and technology index existed. The variation in per cent increase in the yield was found due to the lack of knowledge, and poor socio economic condition. It is concluded that the FLDs programmes were effective in changing attitude, skill and knowledge of improved package and practices of HYV of pigeon pea adoption.

Keywords: Pigeon Pea, FLDs, Economic impact, Adoption

INTRODUCTION

Pulses are of greatest importance in human diet. India is the major pulse producer, importer and consumer country of the world. In 2013, the total area and production of pulses in world was 81.0 million hectares and 73.21 million tonnes respectively. Pigeon pea (*Cajanuscajan* L. Millsp.) is a crop of vital importance in tropical countries, especially in India, where it is used as major source of protein in human diets. It is also cultivated in Australia, USA, Africa, Indonesia and some countries in South America because of its nutritional qualities and drought tolerance (Faris 1983). The total area under pigeon pea cultivation in India is 3.4 million hectare with a total production of 2.8 million tons (2003–2004). The potential yield of pigeon pea is 1.5–1.7 tons per hectare. While, only 0.58 tons per hectare is harvested at farmers field (Joshi et al. 2006). Numerous production constraints are responsible for this wide gap between potential and realized yield. Pigeon pea phenology is strongly affected by temperature (Hodges 1991; Jones et al. 1991; Ritchie and NeSmith 1991) and photoperiod (Omanga et al. 1996) emphasized that the effect of temperature on the rates of pigeon pea development can be similar in magnitude to those of photoperiod. The optimum range of temperature for proper growth and development of pigeon pea is 18–38^{o}C (Van der Maesen 1989). Whereas in the controlled environment showed that warm (>28^{o}C) and cool (<20^{o}C) temperature delay flower initiation and that the optimal temperature for flowering for early maturing type is close to 24^{o}C (Turnbull et al. 1981).
India contributed 34.77 % (28. 17 million hectares) and ranks first in the harvested area of total pulses followed by Niger (6 %) and Nigeria (4.80 %) in the world and ranks first in pulses production accounting about 25.01 percent (18.31 million tonnes) of the total production worldwide (Indiastat 2013). The world's total yield was about 9038 hectogram per hectare and India was at 176th position with 6500 hectogram per hectare (FAOSTAT 2015). Madhya Pradesh, Maharashtra, Rajasthan, Uttar Pradesh, Karnataka, Andhra Pradesh, Chhattisgarh, Tamil Nadu, Odisha and Jharkhand are the ten major pulses growing states and account for 90 percent of total pulse production and area. The total consumption of pulses in India was 21.74 million tonnes of which 4.58 million tonnes were imported and total production was 17.19 million tonnes during 2014-15 (Indiastat 2015).
Pigeon pea is second most important pulse crop of India after chickpea which is well balanced nutritionally. It is a multipurpose crop providing food, fodder, feed, fuel, functional utility, forest use and fertilizer in context of sustainable agriculture (Gowda et.al. 2015). It is an excellent source of protein (21.7g /100g), dietary fibres (15.5g /100g), soluble vitamins, minerals and essential amino acids (18, 5). Pigeon pea is also used in traditional medicines and leaves, flowers, roots, seeds are used for the cure of bronchitis, sores, respiratory ailments and also acts as an alexeritic, anthelmintic, expectorant, sedative, and vulnerary (Saxena et.al. 2010). India is one of the major pigeon pea producing countries with 63.74 percent of total global production followed by Myanmar (18.98 percent), Malawi (6.07 percent), Tanzania (4.42 percent) and Uganda (1.98 percent) (Gowda et.al. 2015). The total area under pigeon pea cultivation during 2014-15 was ~3.9 million hectares producing

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around 2.81 million tonnes of pigeon pea with an average national productivity of 729 kg/ha (Indiastat 2015). Pigeon pea is often cross pollinated crop. It is very difficult to maintain genetic purity of seed at farm level. Therefore, well organised seed production plan in each agro-climatic zone by involving farmers and other stakeholders is necessary for multiplication and supply of seeds of improved and high yielding varieties to farmers. It was observed that in recent past a number of improved varieties of pulses have been released for cultivation. But in 2010-11, the seed replacement rates (SRR) of pulses and pigeon pea were only 22.51 percent and 21.23 percent respectively Singh 2011). The farmers still use traditional/their own saved and developed varieties of seeds. High yields, resistance to pest attack, synchronous maturity time and other characteristics such as cooking quality, taste and storability are key criteria used by farmers in making a choice of any crop including pigeon pea (Manyasa et.al. 2009). Pigeon pea is mainly cultivated in Maharashtra, Karnataka, Madhya Pradesh, Andhra Pradesh, Uttar Pradesh, Gujarat, Jharkhand, Odisha and Tamil Nadu. About 98 percent of total cultivation area of pigeon pea is occupied by these ten states in India (Indiastat 2015).

MATERIALS AND METHODS

Front line demonstration (FLDs) on pigeon pea varieties were conducted by KrishiVigya Kendra, Surguja, Chhattisgarh during the period from 2017-18 to 2018-19 in different villages of district Surguja. The total 4 number of demonstration were conducted in these villages. The gap in farmer's practices and recommended practices was observed as per adoption level of scientific recommended package and practices for cultivation of crop by farmers. The component demonstration of front line technology in pigeon pea was comprised i.e. improved variety Rajeev lochan proper tillage, proper seed rate and sowing method, balance dose of fertilizer (20:60:30 kg/ha NPK), use of PSB @ of 5g/kg of seed as seed treatment, weed management and protection measure (Table-1). Total 1.5 ha of area was covered in two consecutive years. In the demonstration, one control plot was also kept where farmers practices was carried out. The FLDs were 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 analysed by using simple statistical tools. The technology gap, extension gap and technological index (Samui et al. 2000) were calculated by using following formula as given below-

$$\textbf{Percent increase yield} = \frac{\text{Demonstration yield-farmers yield}}{\text{Farmers yield}} \times 100$$

$$\textbf{Technology Index} = \frac{\text{Potential yield- Demonstrated yield}}{\text{Potential yield}} \times 100$$

Technology gap= Potential yield-Demonstrated yield
Extension gap= Demonstrated yield – Yield under existing practice

RESULTS AND DISCUSSION

In Chhattisgarh Asha, UPAS-120 and Pragativarieties of Pigeon pea adopted in Surguja district. The gap between the existing and recommended technologies of pigeon pea in district Surgujawere presented in Table-1 & 3. Full gap was observed in most of the farmer's practices except time of sowing and seed rate where partial gap was observed, which definitely resulted the reduction in potential yield. Farmers were not aware about recommended technologies. Farmers in general used degenerated seeds of local varieties instead of the recommended high yielding resistant varieties (wilt and sterility mosaic). Unavailability of seed in time and lack of awareness were the main reasons. Farmers followed broadcast method of sowing against the recommended line sowing with proper spacing and because of this, they applied higher seed rate than the recommended.

Table 1. Difference between Technological intervention and farmers' practices under FLD in Pigeon Pea.

S. No.	Particulars	Technological intervention	Existing practices	Gap
1	Farming situation	Rainfed	Rainfed	Full gap
2	Variety	Rajiv Lochan	Local variety	Full gap
3	Time of sowing	1^{st} week of July	1^{st} week of August	Partial Gap

4	Method of sowing	Line Sowing	Broadcast	Full gap
5	Seed treatment	Carbendazim&Trichoderma @ 5g /kg seed	No seed treatment	Full gap
6	Seed rate	20 kg/ha	30 kg/ha	Partial Gap
7	Fertilizer dose	N:P:K=20:60:30 kg/ha	Imbalance	Full gap
8	Plant Protection	Trizophos + Cypermethrin @ 2.0 ml/l water	No plant protection	Full gap
	Weed management	Imaazathaper@150 g/ha	No weed management	Full gap

Yield attributes

During two years of frontier technologies result obtained in Table 2. The results revealed that the FLDs on pigeon pea an average yield was recorded 17.47 q/ha under demonstrated plots as compare to farmers practice 9.89 q/ha. The highest yield in the mother trials plot was 18.30 q/ha and in farmers practice 10.25 q/ha during 2018-19. This results clearly indicated that the higher average grain yield in demonstration plots over the years compare to local check due to knowledge and adoption of full package of practices i.e. appropriate varieties such as Rajeev Lochan, timely sowing, proper spacing, seed treatment with *PSB* @ 5g/kg of seed, use of balanced dose of fertilizer, method and time of sowing, timely weed management and need based plant protection. The average yield of pigeon pea increased 76.53%. The yield of pigeon pea could be increased over the yield obtained under farmers practices (use of non-descriptive local variety, no use of the balanced dose of fertilizer, untimely sowing and no control measure adopted for pest management) of pigeon pea cultivation (Singh *et al.* 2002).

Table 2. Yield, technology gap, extension gap and technological index of pigeon pea variety Rajeev Lochan under FLDs.

Year	Trial	Area (ha.)	Average Yield (q/ha.)		% Increase	Technology Gap (q/ha.)	Extension Gap (q/ha.)	Technological Index(%)
			Trial	Farmers Practices				
2017-2018	**FLDs**	1.50	16.65	9.54	74.53	3.35	9.54	16.75
2018-2019	**Mother trial**	1.20	18.30	10.25	78.54	1.7	8.05	8.50
Total/Average		**2.70**	**17.47**	**9.89**	**76.53**	**2.52**	**8.79**	**12.62**

Technology gap

The technology gap, the differences between potential yield and yield of demonstration plots were 3.35 and 1.7 q/ha during 2017-18 and 2018-19 respectively. On an average technology gap under two year FLDs and mother trial programme was 2.52 q/ha. The technology gap observed may be attributed to dissimilarity in the soil fertility status, agricultural practices and local climatic situation.

Extension gap

Extension gap of 9.54 and 8.05 q/ha was observed during 2017-18 and 2018-19 respectively. On an average extension gap was observed 8.79 q/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 technology index shows the feasibility of the demonstrated technology at thefarmer's field. The technology index varied from 8.50 to 16.75% (Table-2). On an average technology index was observed 12.62%, 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.

CONCLUSION

The FLDs 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. The productivity gain under FLDs 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. Therefore, for enhancing the production & productivity of pigeon pea crop, strategy should be made for getting the more and more recommended technologies adopted by the farmers.

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