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S Behera
Krishi Vigyan Kendra, Kalahandi, Bhawanipatna, Odisha, India

RK Rout
College of Agriculture, OUAT, Kalahandi, Bhawanipatna, Odisha, India

AK Padhiary
Krishi Vigyan Kendra, Sambalpur, Chipilima, Odisha, India

SP Mishra
Krishi Vigyan Kendra, Jagatsinghpur, Odisha, India

M Jena
Krishi Vigyan Kendra, Kalahandi, Bhawanipatna, Odisha, India

P Nanda
Krishi Vigyan Kendra, Keonjhar, Odisha, India

Correspondence
S Behera
Krishi Vigyan Kendra, Kalahandi, Bhawanipatna, Odisha, India

Impact analysis of trainings and front line demonstrations in pigeon pea (*Cajanus cajan* (L.))

S Behera, RK Rout, AK Padhiary, SP Mishra, M Jena and P Nanda

Abstract
The impact assessment with reference to increase in knowledge levels of farmers regarding scientific package of practices, extent of adoption of selected technology and percent adoption of production technology was carried out in five adopted villages. The data about knowledge level of scientific package of practices of pigeonpea indicated that low, medium, and high level of knowledge after intervention of Krishi Vigyan Kendra, Kalahandi was found to be 14.5, 49.1 and 36.4 per cent, respectively. Highest knowledge regarding selected scientific innovations was found for Weed management (81.0 %) in pigeon pea production technology followed by Integrated Pest management (78.0 %), INM (74.0 %), irrigation management (66.0 %) and pest and disease control (65.0 respectively. The technology index indicated there was feasibility of evolving technologies at the farmer's field.

Keywords: adoption, integrated nutrient management, integrated pest management, technology index

Introduction
Pulses are important component of Indian agricultural economy next to food grains and oilseeds in terms of acreage, production and economic value (Choudhary, 2009) [1]. India is largest producer and consumer of pulses in the world, accounting for about 25 % of global production, 27 % of consumption and 34 % of food use (FAO). India is also the top importer with 11% share of global imports during 1995- 2001 (Gregory, 2003) [5]. Pulse production in India has fluctuated widely leading to steady decline in the per capita availability over last 20 years (Gregory, 2003) [5]. Thus, there is a great challenge for policy makers, farm scientists, extension functionaries and farming community to enhance pulse productivity and diversify their cropping systems to meet out the national and local pulse requirements.

Pigeon pea, *Cajanus cajan* (L) Millsp 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 rainfed conditions. District Kalahandi of western Odisha occupies 10,018 hectares of land and 6,648 metric tons production with average productivity of 664 kg ha-1 of pigeon pea. In order to make the nation self sufficient in pulses productivity levels need to be increased substantially from 598 kg ha^{-1} to 1,200 kg ha^{-1} by 2020. Faulty sowing practices, improper crop geometry, avoid use of biofertilizers, Trichoderma, other intercultural operations and climatic variabilities are predominant reasons for limiting the potential yield of pigeonpea.

The frontline demonstration programme (FLDs') in pulses is a unique programme by Ministry of Agriculture, Govt. of India, conducted under close supervision of farm scientists. Main objective of FLDs' in pulses is to demonstrate and popularize the improved agro-technology on farmers' fields under varied farming situations for effective transfer of generated technology and fill the gap between improved technology and adopted/indigenous technology to enhance pulse productivity and farm gains for sustaining the production systems especially under rainfed farming (Choudhary, 2009^b) [2].

Materials and Methods
The present study was conducted in Kalahandi district of Odisha. Fifty Five Nos. of beneficiaries from 4 villages viz., Boria, Nagupalla, chicharla of Kesinga Block and Jagannathpur of Narla Block of Kalahandi district were selected as per baseline survey. The data were collected through personnel interview, tabulated and analyzed to find out the findings and to draw the conclusion. The statistical tool like percentage was employed to analyze the data. The constraints as perceived by respondents were scored on the basis of magnitude of the problem as per Meena and Sisodiya (2004) [7].

The responses were recorded and converted in to mean percent score and ranked accordingly as per Warde *et al* (1991). The extension gap, technology gap and the technology index were work out with the help of formulas given by Samui *et al* (2000) as mentioned below:

Extension gap = Demonstration yield- farmers' yield (control)

Technology gap = Potential yield- demonstration yield

Technology index = (Technology gap/ Potential Yield) x100

Table 1: Overall knowledge of scientific package of practices of Pigeon Pea.

S. No.	Knowledge Level	Before intervention of KVK	After intervention of KVK
1	Low	25	08
2	Medium	18	27
3	High	12	20

Table 2: Knowledge regarding different technologies for Pigeon Pea cultivation.

Sl. No.	Technology	Low	Medium	High
1	Integrated nutrient Management	05	20	30
2	Pest and disease control	14	24	17
3	Integrated Pest Management	11	23	21
4	Irrigation Management	08	13	34
5	Weed Management	07	17	31

Table 3: Overall adoption of scientific package of practices of Pigeon Pea (percentage)

Sl No.	Adoption Level	Before intervention of KVK	After intervention of KVK
1	Low	30	09
2	Medium	18	25
3	High	07	21

Table 4: Adoption of technologies

Sl. No.	Technology	Adoption (%)
01	Integrated nutrient Management	74
02	Pest and disease control	65
03	Integrated Pest Management	78
04	Irrigation Management	66
05	Weed Management	81

Table 5: Exploitable productivity, extension gap, technology gap and technology index of Pigeon Pea as grown under FLDs and existing package of practices.

Year	Area (ha)	No. of demonstration	Yield q/ha		% increase in yield	B:C ratio		Extension Gap	Technology Gap	Technology Index
			T_0	T_1		T_0	T_1			
2014-15	30.0	55	15.6	23.8	52.56	2.56	4.19	8.2	3.2	11.85
2015-16	30.0	58	17.8	24.5	37.64	2.78	4.30	6.7	2.5	9.26
2016-17	30.0	60	18.9	25.2	33.33	3.10	4.68	6.3	1.8	6.67
Mean			17.4	24.5	41.18	2.81	4.39	7.07	2.5	9.26

T_0: farmers' Practice

T_1: Recommended Practice

Results and Discussion

The result of overall knowledge of Scientific Package and practices indicated that the low, medium and high level of knowledge before intervention by the KVK was 45.4, 32.7, 21.9 percent, respectively which changed to 14.5, 49.1 and 36.4 percent, after intervention of KVK through training programmes and front line demonstrations (FLDs) (Table 1). Javat *et al*. (2011) [6] and Das *et al*. (2010) [3] reported the similar results.

With respect to selected technologies and practices for pigeonpea production, 61.82 % of farmers were possessing high level of knowledge regarding irrigation management followed by weed management (56.36 %), integrated nutrient management (54.55 %), IPM (38.18 %) and pest, disease control (30.91 %) (Table 2).

Majority of the farmers had low level of knowledge (54.55%) before intervention of KVK and after intervention of KVK, 38.18 % of the farmers had high level of knowledge regarding scientific cultivation of Pigeon Pea (Table 3).

Highest knowledge regarding selected scientific innovations was found for Weed management (81.0 %) in pigeon pea production technology followed by Integrated Pest management (78.0 %), INM (74.0 %), irrigation management (66.0 %) and pest and disease control (65.0 respectively (Table 4).

Yield gap analysis of pigeon pea cultivation presented in Table no. 5, indicated that the highest yield (25.2 q ha^{-1}) was found in FLD plots and lower yield (15.6 q ha^{-1}) under farmers' plots of year 2016-17 and 2014-15 respectively. The cost benefit ratio was higher in FLD plot (1:4.68) than control (1: 2.56). The results clearly showed that due to knowledge and adoption of scientific practices, the yield of pigeon pea could be increased by 52.56 percent, 37.64 per cent and 33.3 per cent over the yield obtained under farmers' practices during the year of 2014-15,2015-16,2016-17 respectively. The above findings were in line with the findings of Dubey *et al* (2010) [8].

Yield of the front line demonstration trials and potential yield of the crop was compared to estimate the yield gaps which were further categorized into technology and extension gaps (Hiremath and Nagaraju, 2009). Average extension gap was 7.07 q/ha, which emphasized the need to educate the farmers

through various extension means like FLD. The technology gap ranged between 6.3 q/ha to 8.2 q/ha. The average technology gap from three year of FLDs programme was 2.5 q/ ha. The average technology gap observed may be attributed to dissimilarity in soil fertility status, agricultural practices and local climate conditions. The technology index indicated the feasibility of evolved technology at the farmers' field. Lower the value of technology index, more is the feasibility of technology demonstrated, (Sagar and Chandra, 2004; Arunachalam, 2011 and Kumar *et al*, 2014) [9, 10, 11].
As such reduction of technology index from 11.85 per cent (2014) to 6.67 per cent (2017) exhibited the feasibility of technology demonstrated. Similar yield enhancement in different crops in front line demonstration has amply been documented by Haque (2000) [12], Mishra *et al* (2009) [13] and Kumar *et al* (2010) [14]. The FLD obtained a significant positive results and also provided researcher an opportunity to demonstrate the productivity potential and profitability of INM under real farm situation which they have advocating for a long time. Similar finding were reported by Kirar *et al* (2005) [15] and Chauhan and Pandya (2012) [16] in gram.

Conclusion

The present study conclusively indicated that there exists a wide gap in potential yields, demonstration yields and farmers' plot yields under pulses due to technological and extension gaps. The study emphasizes upon dissemination of location specific crop management improved technologies imbedded with HYVs' to improve pulse productivity and profitability of Kalahandi district of Odisha. This study also infers that extension functionaries of Kalahandi district have to strictly focus on dissemination of proven pulse production farm technologies in pulse production systems to enhance the pulse productivity besides strengthening the irrigation facilities so that resource poor hill farmers could earn their livelihood on sustainable basis by diversifying their farming systems through pulses in Kalahandi district as well as in collateral socio-agro-economic situations in western Odisha.

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