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Research Article

IMPACT STUDY OF FRONT LINE DEMONSTRATION ON PRODUCTIVITY OF PIGEON PEA (*Cajanus cajan*) AND CHICK PEA (*Cicer arietinum*) AT FARMERS FIELD IN CHHATTISGARH PLAIN OF MADHYA PRADESH

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Abstract- The study was Conducted during Kharif, and Rabi seasons in adopted NICRA village Koste, Balaghat, Madhya Pradesh, India during 2012-13 to 2015-16. Demonstrations on pigeon pea and chickpea crops were carried out by the active participation of farmers with the objective to harness maximum potential of crops by demonstrating the improved technologies. The improved techniques including use of new high yielding variety, seed treatment with *Rhizobium* and PSB culture, soil test based balanced fertilizer application, timely weed management and integrated pest management. Demonstration was recorded higher yield as compared to farmers practice. The improve technology recorded higher yield of 1310kg/ha, and 1370 kg/ha pigeon pea and chickpea, respectively farmers practice 970 kg/ha and 1110 kg/ha. On the basis of increase in yield of pulses, the technological gap, extension gap, technology index were exercised. The improve technology gave higher gross return and net return with higher benefit cost ratio against farmers practice.

Keywords- Chick pea, Pigeon pea, Extension gap, Technological gap, B:C ratio.

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Introduction

In India, frequency of pulse consumption is much higher than any other source of protein, which indicates the importance of pulses in their daily food habits. Keeping the above fact it is important to increase pulse production to serve balance diet among the people of the country under malnutrition programme was initiated in the district. India accounts for 33% of the world area and 22% of the world production of pulses. About 90% of global pigeon pea, 65% of chickpea and 37% of lentil area falls in India contributing 93%, 68% and 32% of global production respectively [1]. The number of chickpea growing countries has increased from 36 to 52 and importing countries from 30 to 150 during 1981 to 2011. Chickpea reached a record high global area of 13.3 million ha (mha) and production of 11.75 million tons (MT) during 2011. In 2013 the area of chickpea cultivation increased to 13.5 m ha but production remained at 13.1 MT [2]. Chickpea is currently the second most important food legume in the world after common bean. During 2013, 89.20% of the chickpea area and 84.47% of production was in Asia, 3.57% and 4.05% in Africa, 4.24% and 6.22% in Oceania, 2.44% and 4.55% in Americas and 0.55% and 0.71% in Europe [2]. The major chickpea producing countries, which contributed to about 90% of the global chickpea production during 2013, include India (67.4%), Australia (6.21%), Pakistan (5.73%), Turkey (3.86%), Myanmar (3.74%) and Iran (2.25%). India accounts for 33% of the world area and 22% of the world production of pulses. About 90% of global pigeon pea, 65% of chickpea and 37% of lentil area falls in India contributing 93%, 68% and 32% of global production respectively [1]. Although it is world largest pulse producer, 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), green gram (1.7 MT) and black gram (1.61 MT).

Pigeon pea is an important grain legume mostly being cultivated in Africa, Asia and Americas. The global chickpea area, production and yield was 6.22 mha, 4.74 MT and 762.4 kg/ha respectively [2]. During 2013, 83.09% of global pigeon pea production and 85.50% of area was in Asia, 14.34% and 12.19% in Africa, 2.57% and 2.31% in Americas respectively [2]. The major pigeon pea producing countries include India (63.74% of global production), Myanmar (18.98%), Malawi (6.07%), Tanzania (4.42%) and Uganda 1.98%). In India pigeon pea was cultivated on 4.65 mha with a total production of 3.02 MT and yield of 650.0 kg/ha during 2013. Chickpea and pigeon pea are the major pulse crops of the Madhya Pradesh. In Madhya Pradesh area under pulses is (5.39 mha) with production of (4.64 MT) and productivity (861 kg/ha). Area, production and productivity of pigeon pea and chick pea are (3.90 mha & 9.93 mha), (3.17 MT & 9.93 MT) and (813 kg/ha & 960 kg/ha) respectively in India (IIPR, 2013-14).Area, production and productivity of pigeon pea and chick pea are (0.46 mha &3.16 mha), (0.33 MT &3.29 MT) and (716 kg/ha &1044 kg/ha) respectively in Madhya Pradesh [4]. Area, production and productivity of pigeon pea and chick pea are (8.1 thousand ha & 15.6 thousand ha), (8.6 thousand T & 17.2 thousand T) and (1061 kg/ha &1097 kg/ha) respectively in Balaghat district (Deptt. of Agril, 2013-14). In the light of above, the present experiment was laid out to increase the per capita availability of pulses and popularization of new production technology amongst the farming communities of the area.

Material and Methods

The study was carried out by the Krishi Vigyan Kendra, Badgaon, Balaghat during Kharif and Rabi season in the farmer's fields at adopted NICRA village. All

demonstrations were conducted on subsides with participatory involvement of farmers. Each demonstration conducted an area of 0.4 ha. and total 10 demonstrations in 04 ha area were experimented in whole Village Koste, Distt. Balaghat, Madhya Pradesh during four years of 2012-13 to 2015-16. The treatment comprised of recommended package of practices (Improved variety Pigeonp ea-TJT 501 and Chickpea - JG 14 + Seed Treatment with Trichoderma - 10 gm/kg seed + Rhizobium culture with 10 gm/kg seed + Farm yard manure @10ton/ha + Fertilizers N:P:K:Zn:: 20:40:20:20 kg/ha + adoption of IPM techniques and PSB and Trichoderma 5 kg/ha each as soil application).

The improved technology includes high yielding varieties, seed treatment and maintenance of optimum plant population, plant protection measures etc. The sowing of pigeon pea was done during June – July in and Chickpea in Oct. - Nov. The spacing was 90 x 20 cm, 45 x 10 cm in Pigeon pea and Chickpea respectively. The seed rate of pigeon pea, chickpea 20 kg/ha, 75 kg/ha, respectively. The fertilizers were given as per soil test based recommendations as basal dose. Two hand weeding were done at 25-30 and 50-55 DAS. The crops were harvested at perfect maturity stage manually.

Soil of the area under study was sandy to sandy loam with medium to low fertility status. The average rainfall of this area was 1447 mm. In demonstration plots, critical inputs in the form of quality seed, seed treating chemicals and bio-agents were provided by KVK. Other inputs farm manure, balanced fertilizers and agro-chemicals were managed by farmers himself as per recommendation of scientists of KVK. Yield data were recorded in addition to economic analysis. Technology gap, extension gap and technology index were calculated as suggested by [11].

Technology gap : Potential yield – Demonstration yield

Extension gap : Demonstration yield – Farmers yield

$$\text{Technology index \%} = \frac{\text{Technological gap}}{\text{Potential yield}} \times 100$$

Results and Discussion

Yield Potential of pigeon pea and chickpea

During the study, the average yield of pulse crops *viz*., pigeon pea (1310 kg/ha) and chickpea (1370 kg/ha) were much higher as compared to farmers practices as of Pigeon pea (970kg/ha) and chickpea (1110kg/ha). The average percentage increased in the yield over farmers practices were 34.5 and 22.8% respectively in pigeon pea and chickpea [Table-1]. The results indicated that, the farming community of NICRA village Koste of Balaghat district as they were motivated by the new agricultural technologies applied in the demonstration plots. Under improved technologies KVK provides high yielding multiple resistant variety, Rhizobium inoculation, seed treatment with fungicide, line sowing, use of PSB, soil test based recommended dose of fertilizers, timely application of plant protection measures, timely weed control as compare to control farmers using old unidentified seed, broadcasting, no weed and fertilizer management and improper insect pest management. The results of on farm demonstrations that the yield of chickpea, pigeon pea, lentil and field pea increased by 18.3, 30.2, 25.0 and 26.2% due to only improved varieties; 14.3, 14.0, 17.1 and 16.8% due to fertilizer alone; 12.5, 14.0, 18.1 and 20.6% due to rhizobium inoculation and 26.1, 33.0, 24.5 and 24.4% due to weed management, respectively [12]. Similar findings were reported in chickpea [8]. The finding is also corroborated with the findings of [9].

Technology gap analysis

The Technology gap in the demonstration yield over potential yield were 690 kg/ha for pigeon pea and 530 kg/ha for chick pea [Table-1] and [Fig-1]. The technological gap may be attributed to the dissimilarity in the soil fertility status and weather conditions [7].

Extension gap analysis

The extension gap 340kg/ha was observed in pigeon pea and 250 kg/ha for chickpea [Table-1] and [Fig-2]. This emphasized the need to educate the farmers through various means for the adoption of improved agricultural production technologies to reverse this trend of wide extension gap. More and more use of latest production technologies with high yielding variety will subsequently change this alarming trend of galloping extension gap. The new technologies will eventually lead to the farmers to discontinue the old technology and adopt the new technology [3].

Table-1 *Yield gap analysis of Chickpea and pigeon pea on fixed price*.

Name of pulse	Area (ha)	No. of farmers	Yield (kg/ha)			Percent increase over local check	Technological gap (Kg/ha)	Extension gap (kg/ha)	Technology index
			Potential yield	Improved tech.	Farmer practice				
Chick pea	4	10.0	19	13.7	11.1	22.8	5.4	2.5	28.2
Pigeon pea	4	10.0	20	13.1	9.7	34.5	6.9	3.4	34.6

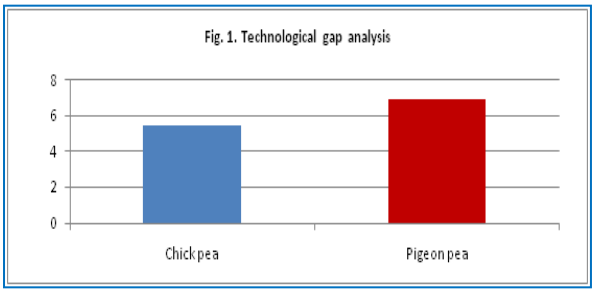

Fig-1 Technological gap analysis

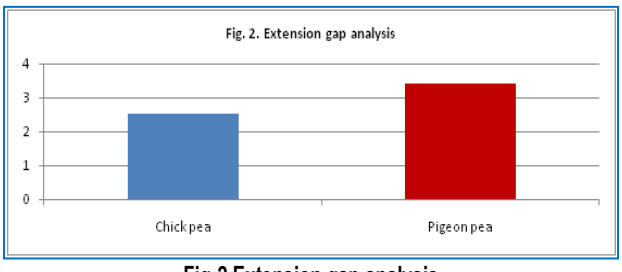

Fig-2 Extension gap analysis

Technological Index

The technology index shows the feasibility of the evolved technology at the farmer's field and the lower the value of technology index more is the feasibility of technology [5]. The technology index is calculated 34.6 percent for pigeon pea, 28.2 percent for chickpea [Table-1].

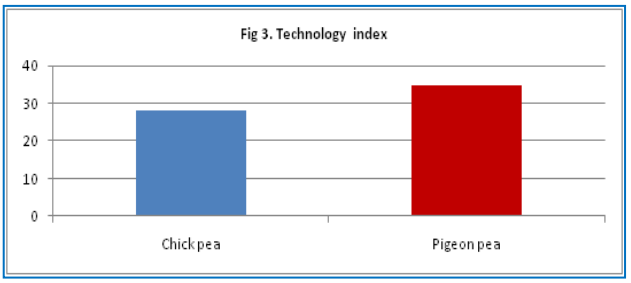

Fig-3 Technology index

Economic Analysis

The study of demonstration was taken for calculating gross return, cost of cultivation, net return and benefit: cost ratio [Table-1 and 2]. Improved

technologies gave net profit of pigeon pea during the year 2012-13, 2013-14, 2014-15 and 2015-16 of Rs. 24038, 25365, 27135 and 23595/ha respectively as maximum increase 2014-15 of Rs 27135 while lowest 2015-16 of Rs. 23595 as compared to farmers practices. The decrease in yield during 2015-16 is due to weather condition and early termination of rains and no rains during Rabi season. The benefit cost ratio of pigeon pea under improved technologies were 2012-13, 2013-14, 2014-15 and 2015-16 of 2.34,2.41,2.51 and 2.31 as compared to 2.91,3.07,3.14 and 3.05 under farmer practices. The similar finding was observed in urdbean [6] and in pigeon pea [9].

Table-2 *Analysis of economic parameter for pigeon pea cultivation during last 4 years on fixed price.*

Year	Demonstration yield	Farmers yield	Gross return (Rs.)		Cost of cultivation(Rs.)		Net Return (Rs.)		B:C ratio	
			Improved technology	Farmers practices	Improved technology	Farmers practices	Improved technology	Farmers practices	Improved technology	Farmers practices
2012-13	12.5	9.5	55313	42038	19000	18000	36313	24038	2.91	2.34
2013-14	13.2	9.8	58410	43365	19000	18000	39410	25365	3.07	2.41
2014-15	13.5	10.2	59738	45135	19000	18000	40738	27135	3.14	2.51
2015-16	13.1	9.4	57968	41595	19000	18000	38968	23595	3.05	2.31

Table-3 *Analysis of economic parameters for chick pea cultivation during last 4 years on fixed price.*

Year	Demonstration yield	Farmers yield	Gross return (Rs)		Cost of cultivation (Rs)		Net Return (Rs)		B:C ratio	
			Improved technology	Farmers practices	Improved technology	Farmers practices	Improved technology	Farmers practices	Improved technology	Farmers practices
2012-13	13.2	10.8	41580	34020	20500	19500	21080	14520	2.03	1.74
2013-14	13.5	11.7	42525	36855	20500	19500	22025	17355	2.07	1.89
2014-15	13.8	10.8	43470	34020	20500	19500	22970	14520	2.12	1.74
2015-16	14.1	11.2	44415	35280	20500	19500	23915	15780	2.17	1.81

Improved technologies gave net profit of chickpea during the year 2012-13, 2013-14, 2014-15 and 2015-16 of Rs.14520, 17355, 14520 and 15780/ha respectively as maximum increase 2015-16 of Rs. 15780, while lowest during 2012-13 of Rs. 14520 as compared to farmers practices. The benefit cost ratio of chickpea under improved technologies during the year 2012-13, 2013-14, 2014-15 and 2015-16 were of 2.03,2.07,2.12, and 2.17 as compared to 1.74,1.89,1.74 and 1.81 under farmer practices. This may be due to adoption of improved technologies under demonstration as compared to local check i.e., farmer practices [10].

Conclusion

The front line demonstration results influentially brought out that, the yield of pigeon pea and chickpea could be increased with intervention on varietal improvement, Rhizobium inoculation, seed treatment with fungicide, line sowing, use of PSB, soil test based recommended dose of fertilizers, timely application of plant protection measures and timely weed control. Technology demonstration conducted on pigeon pea and chickpea was performed better. 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.

Conflict of Interest: None declared

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