Impact Assessment and Upliftment of Poor and Marginal Tribal Farmers of CG State through Quality Seed Production in Chickpea (*Cicer arietinum* L.)

Abstract

The study was carried out in districts of Chhattisgarh plains and plateau by conducting front line demonstrations (FLD's) and tribal Sub Plan (TSP) of chickpea at different locations of farmer's field to promote the cultivation and adoption of improved package of practice from 2018-19 to 2022-23. The seeds of improved varieties and balanced fertilizers were the part of technological package supplied to the demonstration plot as against control. All the demonstrations were conducted by following participatory approach. Results revealed that improved varieties and balanced fertilization increased yield as compared to the farmer's practice. In demonstration plots C: B ratio was also higher as compared to control ones. It can be concluded from the findings that use of improved technologies can reduce the technology gap to a considerable extent resulting in increased productivity of rapeseed in the district. It needs the efforts of both extension and farmers to enhance adoption level of location and crop specific technologies among farmers for bridging these gaps. Therefore, the farmers' need to provide proper technical support and guidance through various improved agronomic practices for better production and productivity in the district.

Key words: Chickpea, FLD, TSP, Extension Gap, Technology Gap and Technology Index.

Introduction

Seed is the decisive input for sustained agriculture production and is paramount for realizing the potential of all other inputs without which the investment on inputs such as fertilizer, water and pesticides will not pay desired dividends to the farmers. Making the tribal farmers enable with quality seed and its wholesome production technology is imminent challenge that needs to be tackled upon.Balanced growth and economic development is the ultimate aim of every country and the strategic plans. During fifth five year plan, it was realized by policy makers that the Scheduled Tribes are still way behind the mainstream development process. Apart from this, it was also been realized that the general plan schemes and programs designed for the overall development of the economy hardly improved their socio-economic status. Similarly, the benefit of such general welfare schemes did not percolate down towards the development of STs Population of the country in any significant manner. In order to address these issues, the Tribal Sub-Plan (TSP) was initiated during Fifth Five Year Plan for socio-economic amelioration of the tribal communities. Scheduled Tribes (STs) are the disadvantaged sections of the society due to socio-economic exploitation and isolation since long time. Since long, they have been relegated to low income generating occupations, inferior trades, unhygienic environment and menial occupations.

The population of Scheduled Tribes (STs) is 104.3 million (2011 Census) constituting 8.6% of the total population of the country. Among them, 90 % of STs live in rural areas and only 10% live in urban areas. STs have their own distinctive culture and are geographically isolated with low socio-economic conditions. More than 80 per cent of the ST population is concentrated in the ten States i.e. Madhya Pradesh (14.69%), Maharashtra (10.08%), Orissa (9.2%), Rajasthan (8.86%), Gujarat (8.55%), Jharkhand (8.29%), Chhattisgarh (7.50%), Andhra Pradesh (5.68%), West Bengal (5.08%) and Karnataka (4.07%). The important development indicators *viz.* literacy (63.1%), rural poverty (47.4%), urban poverty (30.4%) and migration rate (238 migrants per 1000 persons) among tribal show large disparity with the general population. Agro-technologies generated during the past in agriculture are still out of reach of the tribal farmers (Pal *et al.*, 2014). Major cause for this is illiteracy, ignorance about the technology, poor socio-economic status and very poor connectivity of the farmers. In spite of spectacular significant strides made in agriculture, development is yet to take place in remote areas, which have not received any assistance for their upliftment and the farmers of these areas are still dependent upon the old varieties and landraces in different crops, which are available with them since ages. However, these landraces were adapted to limited resources and due to poor maintenance still remain exceedingly poor yielder and with deteriorated seed quality. Hence, these farmers are forced to earn their livelihood in the neighboring urban areas to fulfill their daily requirements. In spite of significant achievement through crop improvement research and development, the landraces are still being cultivated with minimum input due to which their potential for producing quality seed might be declining. Limited access of

farmers to improved crop varieties is one of the serious limiting factors leading to low farm level productivity. No single agency can fulfill the demand of quality seed of improved varieties. Quality and the integrity of the seed purchased from own seed markets are doubtful and often results in inferior quality of seed produced with exceedingly low productivity. Limited availability of seeds of the improved varieties in spite of the large quantity of breeder and foundation seeds being produced by the government agencies in public and private sectors seem to be major constraint in agricultural development. Looking into these facts mentioned, it is necessary to educate the tribal communities regarding their upliftment through adoption of modern agricultural technologies developed and these could also help in monetary gains. ICAR along with AICRP's has implementedFLD and TSP across the country in various tribal belts of the country. The main theme was to organize seed production in participatory mode to cater the local demands of quality seed; to impart training in quality seed production to the farmers and distribute storage structures for improvement of quality of farm saved seed and seed storability and to make supply of quality seed, storage structure or other inputs.

Agriculture in Chhattisgarh is the pivotal sector for ensuring livelihood security to almost 60 % population. Increasing production of food grains from rainfed region (80% of cultivated area is highly vulnerable to drought) is a great challenge for this state where majority of farmers are marginal. This situation is further complicated by degradation of natural resources and use of traditional methods of cultivation by farmers. In Chhattisgarh, productivity of major crops is very low compared to national average. With the objective of improving the livelihood of tribal farmers through promotion of improved agriculture interventions particularly in quality seed production, seed storage, Front Line Demonstration (FLD) and Tribal Sub Plan (TSP) was implemented.

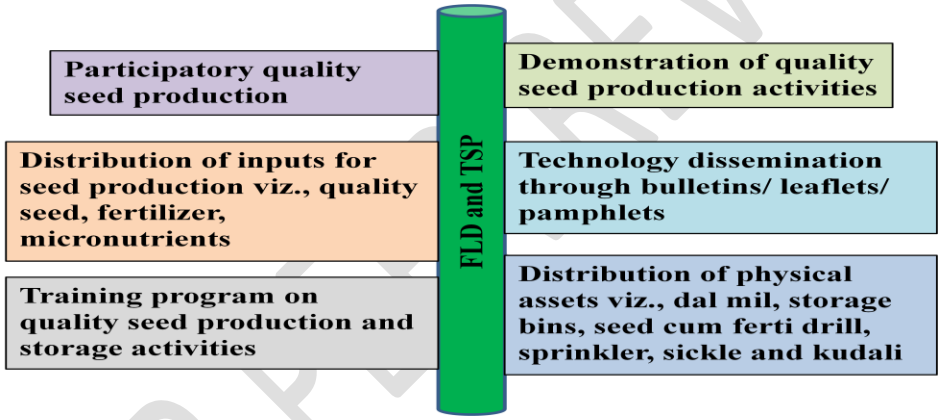


Fig1: Activities under FLD and TSP

Materials and methods:

In AICRP on chickpea, front line demonstrations (FLD) and tribal sub plan (TSP) activities/ programs were conducted during Rabi season from 2018-19 to 2022-23. These activities were held as per the guidelines provided by AICRP. The table 1 and 2 mentioned below expresses the information pertaining the year wise, district wise and villages adopted for smooth conduction of such activities *viz*., FLD and TSP, respectively.

Table 1: Front line Demonstrations of chickpea varieties at Raipur, Durg and Bemetara districts

Year	District	Villages	Varieties	No. of Demonstrations (in hectares)
2018-19	Raipur	Palond/ Aarang	JAKI 9218	10
2019-20	Durg	Kasahi/ Batang/ Santara	RVG 202	10
2020-21	Bemetara	Kongaikala/ Baharghat/ Sandi	RVG 202	15
2021-22	Bemetara	Mouhabhata	RVG 202	15
2022-23	Durg	Karga	RVG 202	15
			Total	**65**

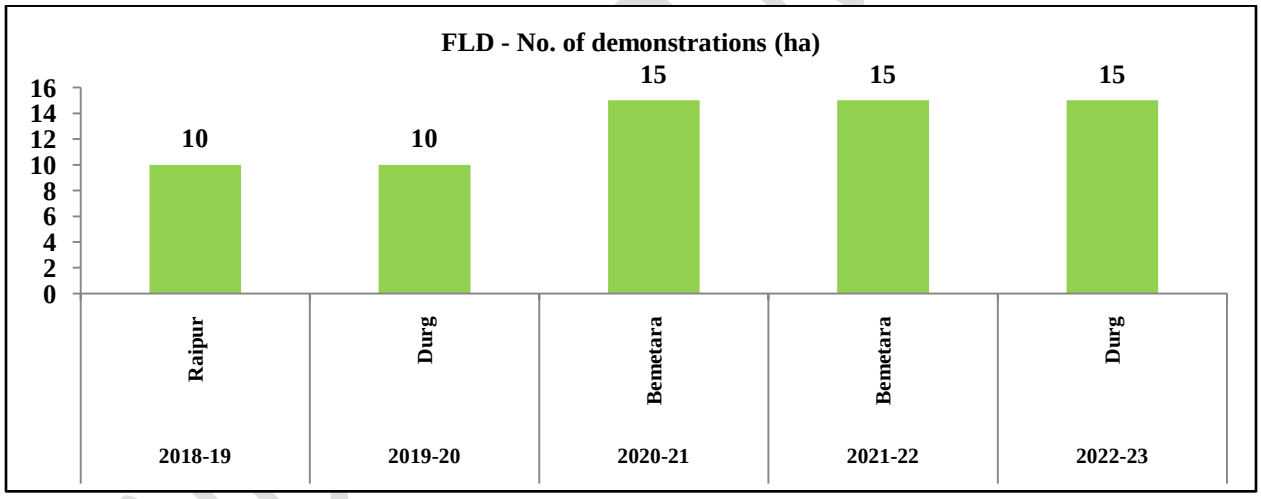
Table 2: Demonstrations in Tribal Sub plan (TSP) of chickpea varieties at Kanker and Kondagaon districts

Year	District	Villages	Varieties	No. of Demonstrations (in acres)
2018-19	Kanker	Kapasi	JAKI 9218	60
2019-20	Kanker	Kapasi/ Turakhar/ Varchegondi/ Pusawada	RVG 202	100
2020-21	Kanker	Vyaskongra/ Sureli/ Mohpur/ Kapasi/ Varchegondi	Indira Chana 1/ RVG 202	100
2021-22	Kanker	Ghotiyawahi/ Sureli/ Garpichhawadi/ Vyaskongera/ Varchegondi	Indira Chana 1/ RVG 203	100
2022-23	Kondagaon	Amadihi/ Sodhsivni	Indira Chana 1/ RVG 202	100
			Total	**460**

The CG state is a tribal dominating state formed in 2000. It has basically three agro-climatic zones namely, CG plains, Northern hills and Bastar plateau. The Raipur, Durg and Bemetara districts come under the Chhattisgarh plains and the Kanker and Kondagaon districts fall in the Bastar plateau.The extension gap, technology gap and technology index (Samui *et al*., 2000) were calculated using the standard methodology.

RESULT AND DISCUSSION:

The front line demonstration (FLD) and Tribal Sub Plan (TSP) activities were undertaken to enhance the socio-economic status and their livelihood of the farmers. These programs were held from 2018-19 to 2022-23. The figure 2 depicts the number of demonstrations conducted in FLD (in hectares) and TSP (in acres).



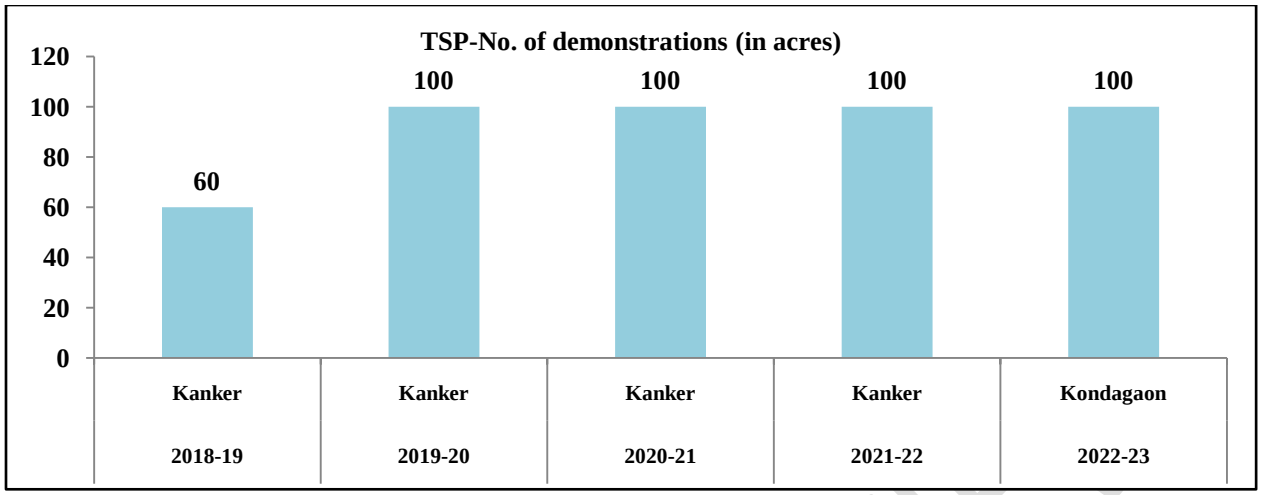


Fig 2: Demonstrations of chickpea varieties in FLD and TSP (2018-19 to 2022-23)

A total of 65 hectares area was covered with two chickpea varieties namely, JAKI 9218 and RVG 202 (Fig.2) for FLD. The graph (Fig 3) depicts that RVG 202has covered maximum area (55 ha) as compared to JAKI 9218 (10 ha). Similarly, for TSP program, RVG 202 and Indira Chana 1 shared same area i.e., 150 acres followed by JAKI 9218 (60 acres) and RVG 203 (50 acres).

Fig3: Percent area coverage under different chickpea varieties in FLD and TSP (2018-19 to 2022-23)

In FLD program, the seeds of chickpea were distributed at the rate 80 Kg/ha and in TSP activity, it was 32 Kg/ acre. Previously, to the Rabi season, the rice crop was being cultivated in the farmer's field. Thus, taking chickpea after the sowing of rice in Kharif had provided extra advantage in terms of economic returns to the farmers. There was a delay in sowing of the chickpea varieties due to late harvesting of rice.

Two approaches were taken into consideration,one being the improved package of practices and the other was the practice followed by the farmer. The idea behind this was to compare both the practices and to understand the impact of production by these two approaches and simultaneously, it enabled the farmers to understand and adopt the improved technique as compared to their conventional/ traditional method of cultivation. Before, the onset of the Rabi season, the chickpea variety seeds were procured from the reliable sources having purity and good germination percentage. The seeds were purchased from the University Farm, IGKV, Raipur and/or KVK Farms under the umbrella of IGKV. The field preparation was done by ploughing through cultivator followed by rotavator. Along with the good quality seed, vitavax (1.5 g/ Kg seed); Rhizobium, PSB and Azotobactor soil microbe culture and *Trichodermavirdi* (8-10 g/ Kg seed) were also given to the farmers and prior to sowing; training was given regarding seed treatment.After the seed treatment, the seeds were dried in shade and then the sowing was done in the field using seed drill or seed cum ferti-drill along with the fertilizer application of Nitrogen(20 KgN/ha); Phosphate (40 Kg P_2O_5/ha) and Potash(20 kg K/ha) as basal dressing. This approach demonstrated the line sowing of the chickpea seeds at 30 cm line to line distance and 10 cm seed to seed distance. After sowing, light flood irrigation

was given to the field for efficient seed germination. Two more irrigations were given after 45 days of interval through sprinkler followed by application of urea. The crop was monitored twice, at the time of flowering and at the time of seed set in the pods. The off-types were rouged out and all the recommended agricultural practices were followed in improved practice approach.

In the farmer's/ conventional/ traditional approach, the untreated seeds (seed treatment) of the local chickpea varieties were taken and the sowing was done through broadcasting method. This approach takes high seed rate. After sowing, the soil was covered and the field was irrigated through flood. No fertilizer was given.

The yield data or the production was recorded in both the approaches. The FLD (Table 3 and Fig 4) results indicate that improved practice yielded maximum as compared to farmer's practice over the years. Overall the average mean performance of IP was 1128 Kg/ha as compared to FP (818 Kg/ha) with 35.48 % yield increase. Based on varietal performance, RVG 202 showed high yield at Durg location in 2022-23 with an increase in yield advantage of 41.77 %, followed by JAKI 9218 having 39.77 % yield advantage during 2018-19.In 2019-20, the farmer's were unable to harvest the crop due heavy rainfall and hail storm at the maturity stage which led to the total loss in yield. As compared to the rest of the years, the yield in 2021-22 and 2022-23 couldn't be achieved due to natural calamities such as hike in temperature leading to less cold spell period and rainfall at the flowering stage.

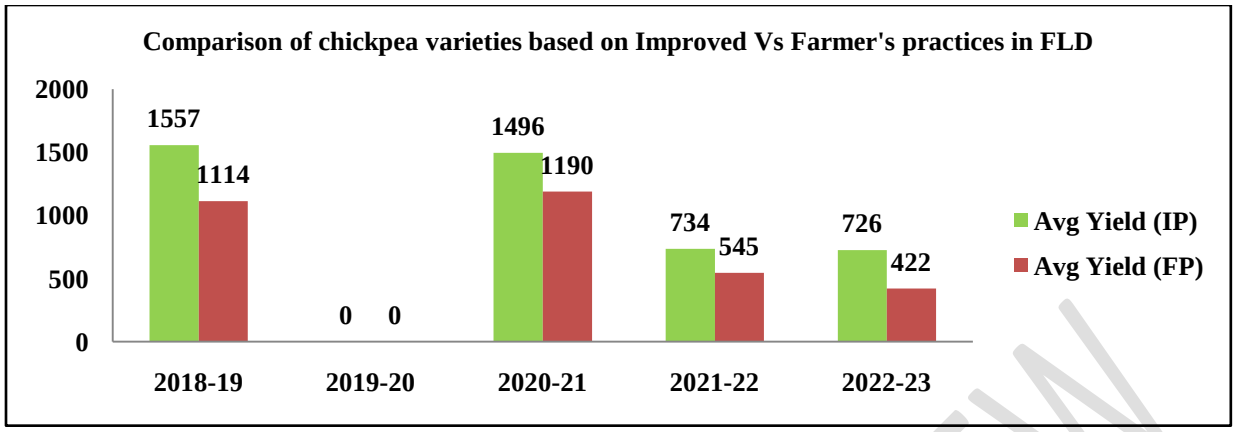
The mean TSP data in the table says that over the years and above the locations, again it was observed that there is significant yield production in improved practice (722 Kg/ha) when compared with the farmer's practice (525 Kg/ha) representing the 38.15 percent increase in yield. RVG 202 (2019-20) showed 56.47 % yield increase followed by IC-1/ RVG 202 (43.86 %). However, looking to the overall mean yield data, JAKI 9218 recorded highest yield in both (IP and FP) the practices.

Table 3: Average yield of improved practice over farmer's practice in FLD and TSP

Year	**District**	**Variety**	**No. of demonstrations (ha)**	**Avg. Yield (Kg/ha)**		**% increase**
				IP	**FP**	
FLD						
2018-19	Raipur	JAKI 9218	10	1557	1114	39.77
2019-20#	Durg	RVG 202	10	0	0	0
2020-21	Bemetara		15	1496	1190	25.71
2021-22			15	734	545	34.67
2022-23	Durg		15	726	422	41.77
		Total/ Mean	**65**	**1128**	**818**	**35.48**
TSP						
Year	**District**	**Variety**	**No. of demonstrations (acres)**	**IP**	**FP**	**% increase**
2018-19	Kanker	JAKI 9218	60	1247	968	28.82
2019-20		RVG 202	100	435	278	56.47
2020-21		IC-1/ RVG 202	100	751	522	43.86
2021-22		IC-1/ RVG 203	100	523	393	33.09
2022-23	Kondagaon	IC-1/ RVG 202	100	652	466	28.52
		Total/ Mean	**460**	**722**	**525**	**38.15**

 # FLD got vitiated

The production and productivity of chickpea was improved with the introduction of improved chickpea varieties (Kassa *et al.*, 2021). Differences in yield of different varieties across sites were possible due to variation in weather conditions, soil fertility status and location specific management practices (Dudhade*et al*., 2009 & Singh *et al*., 2017).Maximization of chickpea productivity with improved crop management was also reported by Tomar (2010).



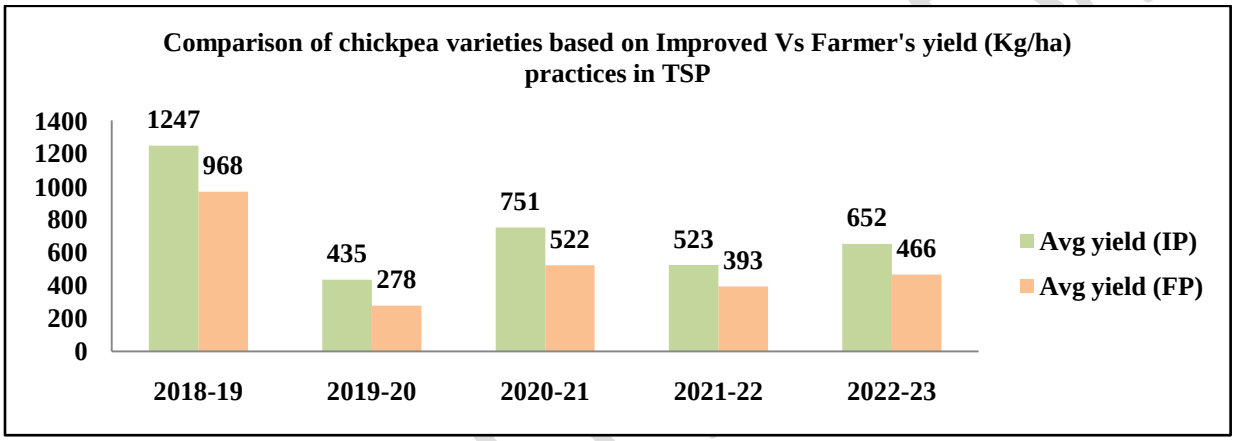


Fig 4: Performance of different chickpea varieties (IP and FP) in FLD and TSP (2015-16 to 2022-23)

The graph (Fig 4) showing above indicates that there was substantial increase in the yield of chickpea by using the improved practices followed by these marginal and tribal farmers. The reason being is that

- The farmers didn't have improved quality pure seeds
- The sowing was done using broadcasting method
- Seed treatment practice was not followed
- Recommended dose of fertilizer and irrigation was not used
- Plant protection measures were not taken seriously.
- Proper seed storage was not done by them.

It is clearly evident from such studies that no doubt the improved practices or technology plays a significant role in enhancing the yield levels. In both the approaches, a total of 544 farmers have participated to understand the dissemination of new technology for the improvement of yield at farmer's level. Out of the total figure, 84 farmers took initiative in FLD and 460 farmers participated in TSP approach (Fig 5).

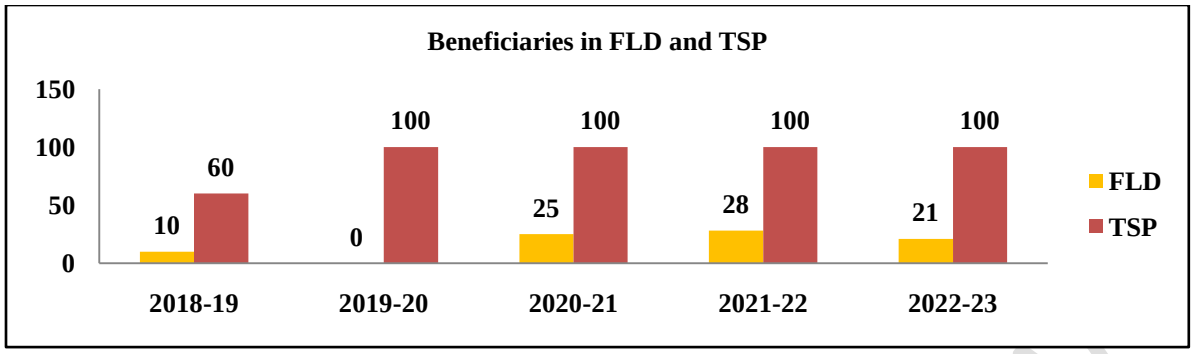


Fig 5: Beneficiaries in FLD and TSP (2015-16 to 2022-23)

After the successful conduction of these two activities, the economic gain and the benefit: cost (B: C) ratio was also worked out. The results of the same are presented in Table 4.

Table 4: Economics and B: C ratio of IP Vs FP in FLD and TSP

Year	Cost of cultivation		Gross returns		B:C ratio	
	IP	FP	IP	FP	IP	FP
FLD						
2018-19	15300.00	13400.00	68514.29	49028.57	4.48	3.66
2019-20	0	0	0	0	0	0
2020-21	21425.00	19255.00	50877.60	40446.40	2.37	2.10
2021-22	22000.00	20800.00	37466.79	27977.50	1.70	1.35
2022-23	13422.43	12672.33	36315.63	21143.33	2.71	1.67
Mean	**18036.86**	**16531.83**	**48293.57**	**34648.95**	**2.68**	**2.10**
TSP						
2018-19	16800.00	14500.00	56106.00	43545.00	3.34	3.00
2019-20	17200.00	14500.00	21756.65	13877.65	1.26	0.96
2020-21	18300.00	14850.00	38282.13	26617.87	2.09	1.79
2021-22	18300.00	14850.00	38282.13	26617.87	2.09	1.79
2022-23	19100.00	15350.00	34091.76	24378.81	1.78	1.59
Mean	**17940.00**	**14810.00**	**37703.73**	**27007.44**	**2.10**	**1.82**

 # FLD got vitiated

The mean cost of cultivation in IP was undoubtedly higher than the FP as it required quality certified seeds along with seed treatment, fertilizers and other necessary inputs as compared to the FP as it had only local and impure seeds. Likewise, the gross returns were also found greater in IP than FP. In FLD, the mean B:C ratio of IP: FP was 2.68: 2.10 and for TSP, it recorded 2.10: 1.82.The benefit-cost ratio (BCR) is an indicator showing the relationship between the relative costs and benefits, expressed in monetary or qualitative terms. A benefit-cost ratio (BCR) is a ratio used in a cost-benefit analysis to summarize the overall relationship between the relative costs and benefits. BCR is expressed in monetary or qualitative terms. Under FLD and TSP (Tribal Sub Plan) from 2018-19 to 2022-23, the results have shown that the BCR is greater than 1.0 which clearly indicates that this activity in AICRP on Chickpea project has delivered a positive net present value to the farmers indicating the socio-economic up-liftment of these farmers. Increased returns due to demonstrations in farmers' holdings were reported by Kumbhare *et al*., (2014); Nain *et al*., (2014); Singh et al., 2019; Gireesh *et al*., (2019) and Singh *et al*., (2020).

Table 5: Technology gap, Extension gap and Technological index of FLD and TSP demonstration on chickpea

Year	variety	potential yield (KG)	demo/ IP yield	farmers yield	Technology gap	Extension gap	Technology index (%)
FLD							
2018-19	JAKI 9218	1800	1557	1114	243	443	13.50
2019-20	RVG 202	2000	0	0	0	0	0
2020-21	RVG 202	2000	1496	1190	504	306	25.20
2021-22	RVG 202	2000	734	545	1266	189	63.30
2022-23	RVG 202	2000	726	422	1274	304	63.70
		Mean	**1128**	**818**	**822**	**311**	**41.42**
TSP							
2018-19	JAKI 9218	1800	1247	968	553	279	30.72
2019-20	RVG 202	2000	435	278	1565	157	78.25
2020-21	IC-1/ RVG 202	2000	751	522	1249	229	62.45
2021-22	IC-1/ RVG 203	2000	523	393	1477	130	73.85
2022-23	IC-1/ RVG 202	2000	652	466	1348	186	67.40
		Mean	**722**	**525**	**1238**	**196**	**62.53**

FLD got vitiated

An average technology gap and extension gap infive years of FLD demonstration was 822 and 311, and in TSP demonstration, it was 522 and 1238, respectively. The technology gap observed among various demonstrations may be attributed to dissimilarity in the soil fertility status, agricultural practices adopted by marginal and tribal farmers coupled with variation in local climatic situations of farm holdings. This indicates the need to educate the tribal farmers for better adoption of improved technology. Overall an average of 41.41and 62.53 per cent of technology index was observed for FLD and TSP programs. The value of technology index shows the feasibility of spreading of improved technology at the farmer's field and the lower the value of technology index indicates the feasibility of technology is more which was quite less in 2018-19 as compared to the rest of the years (Nain *et al*., 2015; Kothyari*et al*., 2018; Singh *et al*., 2018).

The inputs given to the tribal farmers were

- Improved quality seed of chickpea varieties.
- Technology dissemination regarding sowing, fertigation and plant protection measures.
- The per cent increase over farmer's practice represents the increase in the chickpea yield.
- Many farmers have become the partner in seed production as well.
- The selling of chickpea as per Minimum Support Price (MSP) from the government has improved the socio-economic status of the tribal farmers.

Thus, knowledge dissemination and time to time delivery of inputs has led to the increase in improved practice.This activity was commenced with an aim of supplying quality seeds to marginal and tribal farmers and thereby enhancing productivity in chickpea. Further, improved seed storage structures (metal bins) were supplied to beneficiaries so that, seed viability and vigour could be maintained for longer duration and losses during storage could be minimized. Training programs covering various theme areas of quality seed production and safe seed storage practices were organized in these districts. The marginal and tribal farmers are unaware about plant protection measures to be undertaken during crop production, therefore plant protection equipments*viz*., knapsack sprayers, mini dal mill, GI kothis, sickle, kudali, were supplied to the identified farmers. Demonstrations on plant protection measures, uses and safe handling of pesticides were organized at farmers' fields and 544 resource poor farmers were benefitted. Various farmers' training programs, field demonstrations and kisan ghostis were organized under capacity building program.

The pattern of livelihood in especially in Kankerand Kondagaon districts continues to be dictated by tradition. Even today, agricultural practices followed by tribal farmers are conventional and largely depend upon vagaries of monsoon. Promoting use of quality seeds in this region will give required impetus to the productivity in chickpea. More than 544 families were benefited through this program and have made positive impact on livelihood of tribal farmers.

Activities undertaken demonstrations on seed production and seed storage activities,quality seed act as catalyst in improving crop productivity. Tribal's are still using farm saved seeds of traditional varieties or landraces available in their locality. It was found that, quality attributes *viz.*, purity, germination percentage and seed health status of farm saved seed is inferior as compared to certified seeds. Therefore, with an aim to accelerate use of quality seed by tribal farmers' and to augment seed replacement rate (SRR) & varietal replacement rate (VRR), certified seed of chickpea, was supplied during the years from 2018-19 to 2022-23. Response of farmers to these demonstrations was encouraging and they were keen to know about principles of seed production in other crops also. The tribal farmers generally use traditional storage structures like kothi, dholga andgunny bags and as heap for keeping their seeds. Use of traditional methods of seed storage leads to loss in seed viability and vigour and seed stored under traditional storage structures like kothi, dholga becomes more vulnerable to attack of stored grain pests and diseases. The farmers were ignorant about precaution to be taken during seed storage, improved storage structures available for safe seed storage and seed treatments to control stored grain pests. Therefore, demonstrations of safe seed storage methods along with supply of cost effective seed storage structures was done. Improved seed storage structures like metal bins of 1.0 q capacity were given to the farmers participated in this program. Tribal farmers generally do not practice plant protection measures owing to lack of financial resources and technical knowledge of plant protectants. This has resulted into hefty yield losses and adversely affecting seed health status in different crops. Therefore, emphasis was given on distribution of Knapsack Sprayers along with field demonstrations for use of pesticides/ insecticides. Under this program farmers were trained for use of knapsack sprayers, safety measures to be taken during spraying of pesticides, preparation of formulations of different pesticides and insecticides, crop-wise safe dosage levels etc. Farmers showed keen interest in implementation of plant protection measures on their farm in order to avoid losses caused due to pest and disease in different crops. Similar findings were also reported by Nain *et al*., 2015; Kumar *et al*., 2016; Kumar & Kumawat, 2019. The implementation of various extension activities should require for better adoption of these practices to get higher production in chickpea cultivation.

Conclusion:

The proposed interventions in agriculture, particularly in seed production and storage have enhanced the knowledge and income level of the tribal families of Chhattisgarh. A desirable change was brought in socio-economic aspects of tribal farmers with adoption of improved agricultural practices. As most of the tribal farmers use farm saved seeds and depend upon informal seed supply, seed quality of such seeds cannot be assured. The FLD and Tribal Sub plan (TSP) was instrumental in supplying various farm inputs *viz.*, certified seed, fertilizers, plant protectants and seed storage structures. It assisted in linking tribal communities with formal seed supply system and augmented Seed Replacement Rate (SRR) as well as Varietal Replacement Rate (VRR) in major field crops. Such types of technological inventions benefitted for farming communities and made them self reliant.

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