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Yield gap analysis of chickpea (*Cicer arietinum*) through front line demonstration on farmer's fields

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Abstract

The present study was carried out at Krishi Vigyan Kendra, Umaria to know the yield gap between improved package and practices (IP) under Front Line Demonstration (FLD) and farmer's practice (FP) of chickpea crop under limited irrigation conditions. The study found, the yield of chickpea in IP under limited irrigated conditions ranges from 11.20 to 12.53 q/ha whereas in FP it ranges between 8.20 to 9.30 q/ha. The per cent increase in yield with IP over FP was recorded in the range of 34.7 to 36.5. The extension gap and technological index were ranging between 3.0-3.23 q/ha and 30.3-37.7 per cent, respectively. The trend of technology gap reflected the farmer's cooperation in carrying out demonstrations with encouraging results in subsequent years. The cost benefit ratio was 2.25 to 2.42 under demonstration, while it was 1.88 to 1.97 under FP plots. By conducting front line demonstration of proven technologies, yield potential of chickpea crop could be enhanced to a great extent with increase in the income level of the farming community.

Key Words: Front Line Demonstration, Chickpea, JAKI-9218, Yield, BC ratio

Introduction

Chickpea is the premier food legume crop in India, covering about of 8.56 M ha area with production of 7.35 Mt and productivity of 859 kg/ha (AICRPC, 2010). India is contributing highest share in area (65.3%) and production (67.2%) in the world (FAO, 2009). Poor agronomic practice such as seed rate, date of sowing, selection of suitable varieties, fertilizer management, pest management etc. are responsible for low productivity of chickpea in India. In central part of India, chickpea is normally sown during second fortnight of October. Sometimes, its sowing is delayed depending upon the withdrawal of monsoon and late harvest of proceeding *kharif* crop like rice, which ultimately results in poor seed yield (Jettner *et al.* 1999). Within the genetic limits, time of sowing is an important agronomic factor affecting the productivity of most of the arable crops, owing to changes in environmental conditions to which phenological stages of crops are exposed. A good genotype under modified environment of different dates of sowing and maintenance of plant population may help in realizing optimum yield level. With the development of new genotypes, it becomes essential to test them at different sowing dates to exploit their full production potential. Genotypes may behave differently due to their plant architecture particularly under late sown conditions because of poor plant growth. Under such situation plant population may play an important role in improving the productivity of crop (Kumar *et al.* 2003).

As for as the chickpea cultivation in Umaria district of M.P. is concerned, it is grown on 8000 ha area (47.3% of total *rabi* pulse area i.e. 16900 ha area) but productivity far below (498 kg/ha) than the national productivity (859 kg/ha). The reasons of low productivity of chickpea in Umaria district are lack of suitable varieties (seed replacement rate of the district in *rabi* season is only 12%), lack of irrigation facilities (only 25% in *rabi* season), low fertilizer consumption (49 kg NPK/ha), poor agronomic management (broadcasting method of sowing, higher seed rate and delayed in sowing) and poor plant protection measures are responsible for the low productivity of chickpea. Singh and Bajpai (1996) reported that fertilizer and plant protection are most critical inputs for increasing seed yield of chickpea. Hence, an effort made by the KVK scientists by introducing the recommended technologies of chickpea production with HYV JAKI-9218 through front line demonstration on farmers field during *rabi* season of 2010-11 and 2011-12.

Materials and Methods

The present study was carried out by the Krishi Vigyan Kendra, Umaria during *rabi* season of 2010-11 and 2011-12 (two consecutive years) in the farmer's field in five adopted villages viz., Lorha, Chhoti pali, Dogargawan, Kohka and Chandia of Umaria district

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of Madhya Pradesh. During these two years of study, an area of 4.8 ha was covered with plot size 0.40 ha (1 acre) under front line demonstration with active participation of 12 farmers in different villages were conducted. Before conducting FLDs, a list of farmers was prepared from group meeting and specific skill training was imparted to the selected farmers regarding different aspects of cultivation etc. were followed as suggested by Choudhary, 1999 and Venkattakumar *et al.*, 2010. In case of farmer's practice plots, existing practices being used by farmers were followed. In general, soils of the area under study were sandy loam and lower in fertility status. In demonstration plots, use of quality seeds of improved variety JAKI-9218, line sowing and timely weeding, use of balanced fertilizers (using micro nutrient sulphur) and applied irrigations (2 no) on critical growth stages of irrigation as suggested by Chattopadhyay *et al.* (2003) was used as technical interventions. For the control of pod borer, Indoxacarb @ 500 ml/ha was used in demonstrated plots given in package and practices for the Umaria region were emphasized and comparison has been made with the existing practices. Visit of farmers and the extension functionaries was organized at demonstration plots to disseminate the message at large scale. The demonstration farmers were facilitated by KVK scientists in performing field operations like sowing, fertilizer application, pest management, weed management, harvesting etc. during the course of training and visits. The necessary steps for selection of site and farmers, layout of demonstration etc. were followed as suggested by Choudhary (1999). The traditional practices were maintained in case of local checks. The data output were collected from both FLD plots as well as farmer's practice plot and finally the extension gap, technology gap, technology index along with the benefit cost ratio were worked out (Samui *et al.*, 2000) as given below:

Technology gap= Potential yield-demonstration yield

Extension gap= demonstration yield-farmer's practice yield

Technology Index

$$= \frac{\text{Potential yield-demonstration yield}}{\text{Potential yield}} \times 100$$

Results and Discussion

Results of 12 front line demonstrations conducted during 2010-11 to 2011-12 in 4.8 ha area on farmer's field on five villages of Umaria district indicated that the cultivation practices comprised under FLD viz., used of improved variety recommended under semi irrigated conditions i.e. JAKI-9218, line sowing, balanced application of fertilizers (20:60:20:20 kg NPKS/ha) and management of pod bored at economic threshold level, produced on an average 35.6 % more yield of chickpea as compared to farmers practices (8.75 q/ha). The data of Table 1 revealed that the yield of chickpea fluctuated successively over the year in demonstration plots. The maximum yield was recorded (12.53 q/ha) during 2011-12 and minimum yield was recorded in year 2010-11 (11.20 q/ha) and the average yield of two years study period was recorded 11.87 q/ha over farmer's practices (8.75 q/ha). The increase in per cent of yield was ranging between 34.7 to 36.5 during two years of study. The results indicated that the front line demonstrations has given a good impact on the farming community of this district as they were motivated by the improved agricultural technologies used in the front line demonstrations. The results clearly indicates the positive effects of FLDs over the existing practices toward in enhancing the yield of chickpea in Umaria area, with its positive effect on yield attribute (Table1). The benefit cost ratio was recorded higher under demonstration against FP in both the years of study. The findings revealed that a gap exists between the actual farmer's yield and realizable yield potential of the variety. Use of improve variety carry potential to enhance the present level of chickpea productivity which is not percolating down at desired pace due to lack of confidence among the farmers. Hence, to exploit the potential of improved production and protection technologies efforts through FLDs ought to be increased awareness among the farmers. The extension gap showed an increasing trend. The extension gap ranging between 3.0-3.23 q/ha during the study period emphasizes the need to educate the farmers through various means for adoption of improved agricultural production technologies to reverse the trend. The trend of technology gap (ranging between 5.47-6.80 q/ha) reflects the farmers cooperation in carrying out such demonstrations with encouraging results in subsequent years. The technology gap observed might be attributing to the dissimilarity in soil fertility status and weather conditions. Mukharjee (2003) have also opined that depending on identification and use of farming situation, specific interventions may have greater implications in enhancing system productivity. Similar findings were also recorded by Mitra *et al.* (2010) and Katare *et al.* (2011). The technology index showed the feasibility of the evolved technology at the farmer's field. The lower the value of technology index, the more is the feasibility of technology. The wider gap in technology index (ranging between 30.3-37.7 %) during the study period in certain region, may be attributed to the difference in soil fertility status, weather conditions, non availability of irrigation water and insect-pests attack in the crop .

The benefit cost ratio of front line demonstrations have been presented in Table 2 clearly showed higher BC ratio of recommended practices was greater than

Table 1: Productivity, Yield parameters, Harvest index, Technology gap, Extension gap and Technology index of gram (JAKI-9218) as affected by recommended practices as well as farmer's practice under semi-irrigated conditions:

Year	Area (ha)	No. of farmers	No. of pods/plant		Grain yield (q/ha)			% increase over FP	Biological yield (q/ha)		Harvest Index (%)		Technology gap (q/ha)	Extension gap (q/ha)	Technology index (%)
			RP	FP	Potential	RP	FP		RP	FP	RP	FP			
2010-11	2.4	06	36.5	25.0	18	11.20	8.20	36.5	50.5	39.5	22.0	20.7	6.80	3.0	37.7
2011-12	2.4	06	40.5	28.0	18	12.53	9.30	34.7	55.0	44.0	22.7	21.0	5.47	3.23	30.3
Total/Mean	4.8	12	38.5	26.5	18	11.87	8.75	35.6	52.7	41.7	22.3	20.8	6.13	3.11	34.0

Table 2: Economics of Front Line Demonstration of gram (JAKI-9218) as affected by recommended practices as well as farmer's practices under semi-irrigated conditions:

Year	No. of demonstration	Yield (q/ha)		% increase over FP	Gross expenditure (Rs/ha)		Gross returns (Rs/ha)		Net returns (Rs/ha)		Additional net return (Rs/ha)	B:C ratio	
		RP	FP		RP	FP	RP	FP	RP	FP		RP	FP
2010-11	06	11.20	8.20	36.5	11419	9802	25760	18450	14341	8648	5693	2.25	1.88
2011-12	06	12.53	9.30	34.7	13419	11802	32578	23250	19159	11448	7711	2.42	1.97
Total/ Mean	12	11.87	8.75	35.6	12419	10802	29169	20850	16750	10048	6702	2.33	1.93

FP plots in both the year of study. The benefit cost ratio of demonstrated and FP plots were 2.25 and 1.88, 2.42 and 1.97 during 2010-11 and 2011-12, respectively. Hence favorable benefit cost ratios proved the economic viability of the interventions and convinced the farmers on the utility of interventions. Similar findings were reported by Sharma (2003) in moth bean and Gurumukhi and Mitra (2003) in sorghum.

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