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RESEARCH ARTICLE

ASSESSMENT OF IMPACT OF FRONT LINE DEMONSTRATIONS (FLD) ON THE YIELD OF CHICKPEA

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ABSTRACT

Chickpea (*Cicer arietinum* L.) is most important pulse crop in Bundelkhand region of India including districts of Uttar Pradesh and Madhya Pradesh. One of the major constraints of traditional chickpea farming low productivity due to non-adoption of improved technologies. Front line demonstrations were conducted at 400-farmers' fields under 160 ha in 20-villages, to demonstrate production potential and economic benefits of improved technologies comprised *viz.*, wilt tolerant and resistant varieties (DCP 92-3, JG-130, JG-14, JG-16 and KWR108 @ 90 Kg/ha plot, line sowing (30x10 cm), integrated nutrient management (20:60:20, NPK Kg/ha+*Rhizobium*+*PSB* @ 20g/Kg of seeds)+pheromone trap @ 04/plot.+ bird percher (T-shaped pegs) @ 10/plot.+ spray of 250 LE, HaNPV after 10 days of second spray +seed treatment with *T.viride* @ 5g/Kg seed+ *Rhizobium*+*PSB* @ 2.5 Kg/ha+ spraying of Neem Seed Kernel Extract (NSKE) @ 5% at 15-days interval from pod formation stage and weed removal (at 25-days after sowing).The demonstration were carried out at Mahoba district of Uttar Pradesh under Bundelkhand agro-climatic zone during *Rabi* season of 2008-09 to 2012-13 in rainfed condition. The improved technologies gave higher yields and recorded a mean yield of 16.94q/ha which was 31.32 per cent higher than that obtained with farmer's practices yields 12.90 q/ha. The improved technologies resulted higher mean net income of Rs.36176/ha with a cost benefit cost ratio of 3.84 as compared to local check (Rs.26922/ ha, 3.63).

Key Words **:** Chickpea, Front line demonstration, improved technologies, Net return, Productivity**.**

Pulses are good sources of proteins and commonly called the poor man's meat (Reddy 2010). Pulses are grown in an area of 22-23 million hectares with an annual production of 13-18 million tons (MT). India accounts for 33% of the world area and 22% of the world production of pulses. About 90% of the global

pigeonpea, 65% of chickpea and 37% of lentil area falls in India, corresponding to 93%, 68% and 32% of the global production, respectively (FAO STAT 2011).

Chickpea (*Cicer arietinum* L.) is the largest produced food legume in South Asia and the third largest produced food legume globally, after common bean (*Phaseolus vulgaris* L.) and field pea (*Pisum sativum* L.). Chickpea is grown in more than 50 countries (89.7% area in Asia, 4.3% in Africa, 2.6% in Oceania, 2.9% in Americas and 0.4% in Europe). Chickpea is most important pulse crop of India in terms of both area and production. In the world sharing 65.25 and 65.49 per cent (FAO STAT, 2012) of the total area (11.97 m ha) and production (10.89 mt), respectively. In India, chickpea production reached to record area, production and productivity during 2011-12 is 8.32 m ha, 7.58 m tones and 912 kg/ha, respectively. Madhya Pradesh, Uttar Pradesh, Rajasthan, Maharashtra, Gujarat, Andhra Pradesh and Karnataka are the major chickpea producing states sharing over 95 % area. During last five decades, chickpea has registered significant increase in production (3.65 average annual growth rate for 1950-2009), which is primarily due to introduction of high yielding and disease (s) resistant varieties and adoption of improved production technologies. Even though pulses production increased significantly during the last decade but continuing the faster growth is a bigger challenge for researchers, extension agencies and policy makers to fulfill the domestic demand of its in India.

Among the major chickpea growing states, Uttar Pradesh, alone contributes 6.90 % in total area 5.81 (lac ha) and 7.03% (5.37 lac tonnes) production of chickpea with a productivity of 924 Kg/ha during 2011-12. In Uttar Pradesh its cultivation mainly confined to 18-major chickpea growing division. Mahoba district belongs to Bundelkhand zone of Uttar Pradesh under Chitrakootdham division contributes 14.32% in area (1.12 lac ha and 16.17% in production (80.1 thousand tonnes) of chickpea in the division. In general average productivity of chickpea continues to be lower (706 kg/ha) than expected from improved technology since last 20-years, mainly due to its cultivation on marginal lands under poor management without inputs except seed. The major constraints responsible for lower yield potential are inappropriate production technologies *viz.*, broadcast method of sowing, usage of wilt and pod borer susceptible local varieties, no use of fertilizer and untimely weed management at 45 DAS (Anon,2013).

Reddy *et al*. (2007) reported that the existing technology has the potential of doubling production without increasing area under chickpea as well as exiting yield gap among all zone is largest in the Northeast Zone (148%) can be filled by farmers adoption of the recommended package of practices. *et al* (2013) reported the yield of chickpea can be increased up to 113.25% (1480 Kg/ha) with adoption of improved technologies such as improved variety, recommended dose of fertilizer, weed management and plant production. Keeping this in view, front line demonstrations of chickpea were conducted, to demonstrate the production potential and economic benefits of latest improved technologies on farmer's fields' availability of input responsive varieties of chickpea. It is serious concern for sustainability of agro-ecosystem of northern India.

The year 2011-12 was not favorable for chickpea production due to poor rainfall during crop season and long dry spell in central and peninsular India which is main production region for chickpea. Due to this area of chickpea decreased to 9.01 million hectare which was 2.10 lakh hectares less than the area (9.21 m ha) of last crop season (2010-11) but better than the normal sown area i.e. 7.61 m ha. Similarly, chickpea production (7.58 m ha) also reduced by 6.7 lakh tonnes in comparison to previous year's (2010-11) production of 8.22 mt. Continuously for three years the productivity of chickpea was above 900 kg/ha, but in year (2011-12) it reduced to 841 kg/ha on the basis of estimated production. During last ten years, the productivity of chickpea has increased @ 1.74% but the gross chickpea production has gone up by 6.32 per cent, besides the growth in area @ 4.43%. With accelerated growth rate and steps taken by the government under National Food Security Mission, the target of 10.22 mt chickpea production by 2030 can be achieved successfully.

MATERIALS AND METHODS

The present study was carried out by the Krishi Vigyan Kendra, Belatal (Mahoba), C. S. Azad University of Agriculture & Technology, Kanpur (U.P.) in *Rabi* seasons in the farmers fields of 20-villages of Mahoba district in Bundelkhand agro-climatic zone of Uttar Pradesh during 2008-09 to 2011-12 in rainfed condition on light to medium soils with low to medium fertility status under fallow-chickpea+ mustard production system. Each demonstration was conducted in an area of 0.4 ha and 0.4 ha area adjacent to the demonstration plot as farmer's practices *i.e.* prevailing cultivation practices served as local check. All 400-front line demonstrations in 160 ha area were conducted in 20-different villages.

The improved technologies package included chickpea wilt resistant varieties, line sowing, integrated nutrient management and timely weed removal. The varieties of chickpea DCP 92-3 (lodging and wilt resistant yellowish brown and medium bold seeded suitable for high fertility and excessive moisture condition) in 2008-09, JG-130 (bold seeded resistant to wilt) in 2009-10, JG-14 (moderate resistant to wilt, dry root rot and pod borer resistant) in 2010-11, JG-16 (wilt resistant) in 2011-12 and KWR 108 (wilt resistant) in 2012-13 were included in demonstrations. The spacing was at 30x10cm on date of sowing 10 Oct – 20 Oct in 2008-09, 07-10 Oct in 2009-10, 27-30 Oct in 2010-11, 20-24 Oct 2011-12, 15-20 Oct in 2012-13 with a seed rate of 90 kg/ha. Farm manure @ 10 ton/ha and entire dose of Nirogen and Phashphorus through di-ammonium phosphate, and potash through muriate of potash @ 20:40:25 kg/ha, respectively was applied before sowing as basal. The seeds were treated with *Trichoderma viride* @ 5g/kg seed them inoculated by *Rhizobium* and *Phospho-solubilizing bacteria* bio-fertilizers each 20g/kg of seeds+pheromone trap @ 04/plot.+ bird percher (T-shaped pegs) @ 10/plot.+ spray of 250 LE, HaNPV after 10-days of second spray, spraying of Neem Seed Kernel Extract (NSKE) @ 5% at 15-days interval from pod formation stage. Hand weeding was done once at 25-days after of sowing. The crop was harvested during 25 Feb to 10 March.

Materials for the present study with respect to FLD was on following :

– Varieties-Improved and wilt resistant varieties (DCP 92-3, JG-130, JG-14, JG-16 and KWR108)

– IDM- Seed treatment with *Trichoderma viride* 5gm/ Kg seed for seed and soil born diseases,

–INM- Farm manure @ 10 ton/ha, fertilizers (N: P: K) 20:40:25 Kg/ha Seed treatment with *Rhizobium* and *PSB* culture with @20 gm/Kg seed each

–Adoption of IPM. For pod borer-The improved technologies package included- pheromone trap @ 04/plot.+ bird percher (T-shaped pegs) @ 10/plot.+ spray of 250 LE, HaNPV after 10 days of second spray, spraying of Neem Seed Kernel Extract (NSKE) @ 5% at 15-days interval from pod formation stage

In demonstration plots, critical inputs in the form of quality seed and treatment, farm manure, balanced fertilizers and agro-chemicals were provided by KVK. For the study, technology gap, extension gap and technology index were calculated as suggested by Samui, *et al* .(2000).

–Technology gap = Potential yield- Demonstration yield

–Extension gap = Demonstration yield-Farmers yield

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

RESULTS AND DISCUSSION

Yield :

The productivity of chickpea under improved production technologies ranged from 13.20 to 19.24 q/ha with highest average yield 18.61 q/ha. The cultivation of chickpea under improved technologies, the productivity ranged from 15.98 to 17.94, 13.20 to 15.35, 16.25 to 19.14, 16.32 to 17.22 and 17.33 to 19.24 q/ha with an average yield of 17.10, 14.05, 18.61, 17.10 and 17.85 q/ha during 2008-09, 2009-10, 2010-11, 2011-12 and 2012-13, respectively (Table-1) as against a yield ranged 10.10 to 13.59 with a mean of 12.90 q/ha recorded under farmer's practices

(local check). The additional yield under improved technologies over local check ranged from 3.66 to 4.49 q/ha with a mean of 4.04q/ha. In comparison to local check there was an increase of 29.05, 39.10, 31.78, 27.32 and 31.34 % in productivity of improved technologies in respective years. The increased grain yield with improved technologies was mainly because of line sowing use improved wilt resistant varieties, integrated nutrient management and timely weed management. Bunyamin and Walley (2013) reported that adoption of chickpea varieties produced 62% higher yields Nazrul Islam *et al* (2004) and 35% in blackgram compared to local varieties. Singh *et al* (1999) obtained increased (9%) gram yield of blackgram due to line sowing (30x10cm) over broadcasting method of sowing. Tomar (1998) and Tomar *et al*. (2009) reported that the application of balanced fertilizers (20:60:20 NPK kg/ha) along with PSB increased yield of blackgram by 97% over no fertilizer application. Hand weeding once at 25 days after sowing produced 57 % more yield over no weeding (Yadav and Shrivastava 1998).

1.1 Average yield (2008-09 to 2012-13) :

The average yield of chickpea (16.94 q/ha) were much higher than as compared to average yield of farmers practices (12.90 q/ha). The average percentage increased in the yield over farmer's practices was 31.33.The results indicated that the front line demonstrations have given a good impact over the farming community of Mahoba district as they were motivated by the new agricultural technologies applied in the FLD plots (Table 1). This finding is in corroboration with the findings of Poonia and Pithia (2011) and Raj *et.al*.(2013)

Net Return :

The economic viability of improved technologies over traditional farmer's practices was calculated depending on prevailing prices of inputs and outputs costs (Table-2). It was found that cost of production of chickpea varied from Rs.10500 to 15300/ha with an average of Rs.12720/ha of improved technologies as against the variation in cost of production from Rs.8340 to 13100/ha with an average of Rs.10310/ha in local check. The improved production technologies registered an additional cost of production ranging from Rs. 2160 to 2700/ha with a mean of Rs.2410/ha over local check. The additional cost incurred in the improved technologies as compared to farmer's practices was mainly due to more costs involved in balanced fertilization, improved seed and weed management practices. Cultivation of chickpea under improved technologies gave higher net return ranged from Rs.28140 to 41820/ha, with a mean value of Rs.36176/ha as compared to local check which recorded Rs.19780 to 30698/ha with a mean of Rs.26922/ha. There was an additional net return of Rs.7465 in 2008-09, 8360 in 2009-10, 10471 in 2010-11, 8540 in 2011-12 and 11432 in 2012-13/ha under demonstration plots. The improved technologies also gave higher benefit cost ratio 4.07, 3.51, 4.21, 3.71 and 3.73 compared to 3.97, 3.32, 3.99, 3.54 and

Table 1 : Seed yield of chickpea as affected by improved and local practices in farmer's fields

Year	Varieties	Area (ha)	Demons. (No.)	Potential	Yield (q/ha) Improved technology			Local Check Avg.	Extension gap (kg/ha	(%) increase in Yield over Local Check	Technology gap (kg/ha)	Technology Index (%)
					Maxi.	Mini.	Avg.					
2008-09	DCP 92-3	32	80	20.00	17.94	15.98	17.10	13.25	03.85	29.05	02.90	14.50
2009-10	JG-130	32	80	16.00	15.35	13.20	14.05	10.10	03.95	39.10	01.95	12.19
2010-11	JG-14	32	80	25.00	19.14	16.25	18.61	14.12	04.49	31.78	06.39	25.56
2011-12	JG-16	32	80	20.00	17.22	16.32	17.10	13.44	03.66	27.32	02.90	14.50
2012-13	KWR 108	32	80	23.00	19.24	17.33	17.85	13.59	04.26	31.34	05.15	22.39
Average		32	80	20.80	17.78	15.81	16.94	12.90	4.04	31.71	3.85	17.82

Table 2 : Cost Cultivation (Rs/ha), net return (Rs/ha) and Benefit: Cost-ratio of as affected by improved and local practices.

Year	Cost of Cultivation (Rs/ha)		Gross return (Rs/ha)		Net return (Rs/ha)		Additional Cost of Cultivation (Rs/ha)	Additional Net Return (Rs/ha)	Benefit cost (B:C) ratio	
	Tech.	Check	Tech.	Check	Tech.	Check			Tech.	Check
2008-09	10500	8340	42750	33125	32250	24785	2160	7465	4.07	3.97
2009-10	11200	8500	39340	28280	28140	19780	2700	8360	3.51	3.32
2010-11	12800	10250	53969	40948	41169	30698	2550	10471	4.21	3.99
2011-12	13800	11360	51300	40320	37500	28960	2440	8540	3.71	3.54
2012-13	15300	13100	57120	43488	41820	30388	2200	11432	3.73	3.31
Average	12720	10310	48896	37232	36176	26922	2410	9253	3.85	3.63

Note:-Sale rate of chickpea seed was in 2008-09(2500 Rs./qtl.),2009-10(2800 Rs./qtl.),2010-11(2900 Rs./qtl.),2011-12(3000 Rs./qtl.),2012-13(3200 Rs./qtl.),

3.31 under local check in the corresponding seasons. This may be due to higher yields obtained under improved technologies compared to local check (farmers practice). This finding is in corroboration with the findings of Mokidue *et al*, (2011).

The results from the current study clearly brought out the potential of improved production technologies in enhancing chickpea production and economic grains in rainfed condition of Uttar Pradesh.

Technology gap :

The technology gap in the demonstration chick yield over potential yield were 3.85 q/ha (Table 1).The technological gap may be attributed to the dissimilarity in the soil fertility status and weather conditions (Mukharjee, 2003)

Extension gap :

The highest extension gap of 4.49 q/ha was recorded in chickpea variety JG-14 and the lowest was observed in 3.66 q/ha in variety JG-16. 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 to adopt new technology (Table 1). This finding is in corroboration with the findings of Hiremath and Nagaraju, (2010).

Technology Index :

The technology index shows the feasibility of the evolved technology at the farmer's fields and the lower the value of technology index more is the feasibility of the technology (Jeengar, *et al*., 2006). The average technology index was 17.82 per cent, while 25.36% maximum technology index was during 2010-11 but lowest 12.19% was during 2009-10 (Table 1).

Reason of Low Yield of Pluses at Farmer's Filed :

Optimum sowing time is not followed due to non-availability of quality seed. More than 90 per cent of farmer pulses seed sowing as broadcast method and most of situation the plant population at farmer's field is very high or two-three times high of the recommended stand. Lack of popularization of seed cum fertilizer drill for sowing and use of inadequate and imbalance dose of fertilizers especially the nitrogenous and phosphate fertilizers by farmers does not make possible to fetch potential yield. Mechanical weed control is costly and chemical control is quit uncommon in this region.

Speecific Constraints with Marginal/sub Marginal Farmers

Small Holding :

The adoption of well proven technology is

constrained due to small size of holding and poor farm resources. Small and marginal farmers have less capability to take risk and do not dare to invest in the costly input due to high risk and the poor purchase capacity of small farmer.

Farm Implements and Tools :

Traditional implements and tools are still in practice due to small holding which have poor working efficiency. The lack of simple modern tools for small holding also hinders the adoption of improved technology. Thus, the cultivation of pulses with improved technologies has been found more productive and seed yield might be increase up to 23.2 per cent. Technological and extension gap extended which can be bridges by popularity package of practices with emphasis of improved variety, use of proper seed rate, balance nutrient application and proper use of plant protection measures. Replacement of local variety with the released variety of pulses would be increase in the production and net income by more than fifty six thousand rupees.

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