Indian Journal of Extension Education
Vol. 54, No. 2, 2018 (193-200)

Impact of Technological Intervention on *Rabi* Pulses for Enhancing Income and Nutritional Security

R. P. Chaudhary[1]*, Rakesh Pandey[2], G. K. Choudhary[3], Rekha Singh[4] and R. N. Prasad[5]

ABSTRACT

Uttar Pradesh is the second largest producer of pulses in the country accounting about 16 per cent of the total production. The area, production and productivity of rabi pulses in Uttar Pradesh and the district Bhadohi of U. P. is quite low as compared to other state due to poor crop productivity, lack of awareness of suitable protection and post harvest technologies. Krishi Vigyan Kendra, Bhadohi was conducted front line demonstrations on improved technologies of Rabi pulses i.e. field pea, chickpea and lentil at farmers field during 2010-11 to 2014-15 with the objectives of, to exhibit the performance of recommended high yielding varieties of Rabi pulses and to collect feedback information for further improvement. A total of 387 demonstrations of rabi pulses were conducted in fifty villages encompassing an area of 26.81 hectares. The results of rabi pulses over a span of five years revealed that the average yield of field pea (23.3q/ha.), chickpea (21.7q/ha.) and lentil (6.13q/ha.) were obtained under demonstration plot and per cent increase in yield was 27.29, 34.73 and 34.71 per cent more against the farmer practice, respectively. Due to proven technological interventions average net profit return was recorded ₹ 31727.00, ₹43992.00 and ₹19422.00 per hectare in field pea, chickpea and lentil, respectively. The outcome of the demonstration inspired the farming communities to replace their old varieties with high yielding resistant varieties to biotic and abiotic stresses. In addition improved package of practices of cultivation are being followed by the pulse growers and achieved more return per unit area.

KEY WORDS: Economic demonstration, impact, pulses, technological intervention etc.

INTRODUCTION

Pulses are recognized as the cheapest source of proteins and the digestibility of this protein is also high. For this reason, pulses are sometimes called "vegetarian's meat". Pulses have 20 to 25% protein by weight, which is double the protein content of wheat and three times that of rice. India is the largest producer and also the largest consumer of pulses in the world. It accounts for 33 per cent of the world areas and about 25 per cent share in global production (S. K. Srivastava *et. al.,* 2010). Due to uncertain rainfall pattern during the cropping season of pulses the observed average productivity is not up to the mark. However, the optimum climatic requirement to grow the pulses will certainly boost the production. It has been estimated that India's population would reach 1.68 billion by 2030 from the present level of 1.21 billion. Accordingly, the projected pulse requirement for the year 2030 is 32 million tons with an anticipated required growth rate of 4.2% (IIPR Vision 2030). India has to produce not only enough pulses but also remain competitive to protect the

Krishi Vigyan Kendra, Bejwan, Bhadohi (U.P.), (ICAR-Indian Institute of Vegetable Research, Varanasi), SMS (Agricultural Extension) 1, Associate professor Entomology BAUT, Banda 2. SMS (Vet.Science) 3 ,SMS (Home Science) 4 ,PS (Horticulture),I IVR,Varanasi 5

indigenous pulse production. In view of this, India has to develop and adopt more efficient crop production technologies along with favourable policies to encourage farmers to bring more area under pulses. Uttar Pradesh is the second largest producer of pulses in the country accounting for about 16 per cent of the total production. The area, production and productivity of rabi pulses in Uttar Pradesh and the district Bhadohi of U. P. is quite low as compared to other state due to poor crop productivity, lack of awareness of suitable protection and post harvest technologies. Hence there is urgent needs large scale dissemination through available technology delivery mechanism of the state department of agriculture, KVKs, NGOs and other related institutions Krishi Vigyan Kendra, Bhadohi was conducted front line demonstrations on improved technologies of rabi pulses i.e. field pea ,chickpea and lentil at farmers field during 2010-11 to 2014-15 with the objectives of, to exhibit the performance of recommended high yielding varieties of rabi pulses and to collect feedback information for further improvement. A total of 387 demonstrations of rabi pulses were conducted in fifty villages encompassing an area of 26.81 hectares.

The outcome of the demonstration inspired the farming communities to replace their old varieties with high yielding resistant varieties to biotic and abiotic stresses. In addition improved package of practices of cultivation are being followed by the pulse growers and achieved more return per unit area.

METHODOLOGY

Krishi Vigyan Kendra (KVK) Bhadohi conducted 387 Front Line Demonstrations on rabi pulses at farmer's fields in 50 villages under 6 blocks of Bhadohi district (UP) during 2010-11 to 2014-15. Farmers were identified as suggested by Choudhary (1999). The required inputs were supplied and regular visits to the demonstration fields by the KVK scientists ensured proper guidance to the farmers. The recommended package of practices under FLD and farmer's practices are depicted in text box as under. The sowing was done during second fortnight of October to first week of November under assured irrigated conditions and harvested during first fortnight of March. Seeds were sown in rows 40-45 and 20-25 cm apart by drill or bullocks placed at 4-5 cm depth. However, the practices followed by farmers in general use local cultivar (small seeded), seed rate @ 160 kg/ha, no seed treatment, sowing from last week of October to last week of November, in broadcasting manner, no use of fertilizer pattern to under dose application that's to only use of DAP, no weed, water and plant protection measures followed. Field days and group meetings were also organized to provide the opportunities for other farmers to witness the benefits of demonstrated technologies. The data output were collected from both FLD plots as well as control plots and cost of cultivation, net income, and benefit cost ratio were also worked out (Samui *et al*., 2000).

RESULT AND DISCUSSION

Socio-economic profile of pulse growers

Age

Majority of the pulse growers belonged to the middle age group (38.5 %) followed by old age group (35.40%) and young age group (26.10 %) ,respectively It can be concluded that the middle age group are more engaged in pulses cultivation.

Education

Majority (85.01 per cent) of the pulse growers were literate and 14.99 per cent illiterate. 39.28 per cent where having education upto higher secondary school, followed by 28.68 per cent graduated and above, 10.34 per cent primary and 6.71 per cent middle school level of education. It can be concluded that significant number of pulse growers are illiterate. It may be suggested that some educational programmes should be launched and those having higher educational qualification should be motivated to adopt new technologies

Technological interventions against farmers practices of rabi pulses.

Package of practices	Field pea		Chick pea		Lentil	
	Technological Interventions	**Farmer's practices**	**Technological Interventions**	**Farmer's practices**	**Technological Interventions**	**Farmer's practices**
Variety	Malviya Matar-15/ Aparna	Local cultivar (Small seeded)	Pusa 291 /BGD-72/Pusa-362	Local cultivar (Small seeded)	HUL-47/ L-4076 /L-4147	Local cultivar (Small seeded)
Seed rate	80-100 kg/ha	160 kg/ha	75-100 kg/ha	160 kg/ha	45-60 kg/ha	80 kg/ha
Seed treatment	*Trichoderma* @ 8-10 gm/kg + *Rhizobium* culture @ 200 gm/10 kg	No use	*Trichoderma* @ 8-10 gm/kg + *Rhizobium* culture @ 200 gm/10 kg	No use	*Trichoderma* @ 8-10 gm/kg + *Rhizobium* culture @ 200 gm/10 kg	No use
Time of sowing	Second fortnight of October	Last week of October to first week of November	Second fortnight of October to first fortnight of November	Last week of October to last week of November	Second fortnight of October to first fortnight of November	Last week of October to last week of November
Method of sowing	20-25 cm (row to row), 8-10 cm (plant to plant) and east west direction of sowing	Broadcasting, no direction of sowing methods	40-45 cm (row to row), 20-25 cm (plant to plant) and east west direction of sowing	Broadcasting, no direction of sowing methods	20-25 cm (row to row), 8-10 cm (plant to plant) and east west direction of sowing	
Fertilizer management	20: 50: 20 (N:P:S) kg/ha	Either no use of fertilizers or use only DAP (40-50 kg/ha)	20: 50: 20 (N:P:S) kg/ha	Either no use of fertilizers or use only DAP (40-50 kg/ha)	20: 50: 20 (N:P:S) kg/ha	Either no use of fertilizers or use only DAP (40-50 kg/ha)
Weed management	Pre-emergence application of Pendimethalin 30 EC 3.3 l/ha followed by manual weeding at 30 days after sowing	No use	Pre-emergence application of Pendimethalin 30 EC 3.3 l/ha followed by manual weeding at 30 days after sowing	No use	Pre-emergence application of Pendimethalin 30 EC 3.3 l/ha followed by manual weeding at 30 days after sowing	No use
Water management	Light irrigation before flowering and after podding (at the time of no rainfall)	No use	Light irrigation before flowering and after podding (at the time of no rainfall)	No use	Light irrigation before flowering and after podding (at the time of no rainfall)	No use
Plant protection	Need based application of sulphur @ 3 gm/l of water for the management of powdery mildew	No use	Need based application of indoxacarb @ 1 ml/l of water for the management of pod borer	No use	Need based application of sulphur @ 3 gm/l of water for the management of powdery mildew	No use

Family size

It was observed that majority of the pulse growers (55.30 per cent) belonged to medium (6-10 members) size of family whereas 29.97 per cent and 14.73 per cent belonged to small(< 5 members) and large (>10 members) size of family. It can be concluded that medium size of family is more involvement in the cultivation of rabi pulses.

Land holding

It is depicted in Table that, out of total pulse growers (387) , 88.11 per cent belonged to marginal category while 6.46, 3.36 and 2.07 per cent belonged to the medium, small and big, categories of land holding, respectively. Small, medium and large categories of farmers jointly constituted only 11.89 per cent of the total population.

Farming Experiences

It was found that majority of the pulse growers (47.29 per cent) possessed to high level (>20 years) of farming experiences whereas 34.11 per cent and 18.60 per cent possessed to medium (11-20 years) and low (<10 years) level of farming experiences, respectively. It can be said that more than 50.00 per cent pulse growers had low and medium level of farming experiences in the cultivation of rabi pulses.

Occupation

A perusal of Table 1 indicates that out of total

Table 1: Distribution of pulse growers according to their socio-economic profile

(n=387)

Variables	Categories and respective scores	Frequency	Per cent
Age	Young (< 35 yrs.)	101	26.10
	Middle (35-50 yrs.)	149	38.50
	Old (> 50 yrs.)	137	35.40
Education	Illiterate	58	14.99
	Primary School	40	10.34
	Middle School	26	06.71
	Up to Higher Secondary	152	39.28
	Graduate and Above	111	28.68
Family size	Small (< 5 members)	116	29.97
	Medium (6-10 members)	214	55.30
	Large (> 10 members)	57	14.73
Land holding	Marginal (< 1 ha)	341	88.11
	Small (1 - 2 ha.)	25	6.46
	Medium (2 – 4 ha)	13	3.36
	Large (> 4 ha)	08	2.07
Farming Experience	Low (< 10 years)	72	18.60
	Medium (11-20 years)	132	34.11
	High (> 20 years)	183	47.29
Occupation	Only Agriculture	195	50.39
	Agriculture + Govt. Service	29	07.49
	Agriculture + Private Service	71	18.35
	Agriculture +Business	92	23.77
Annual income	Low (< Rs. 30000)	225	58.14
	Medium (Rs. 30001-60000)	102	26.36
	High (> Rs. 60000)	60	15.50
Social Participation	Low (< 118)	237	61.24
	Medium (119-175)	113	29.20
	High (> 175)	37	9.56

pulse growers (387), 50.39 per cent were engaged in farming whereas 23.77, 18.35 and 07.49 per cent were engaged in farming + business, farming + private service and farming + government service, respectively. Therefore, it can be inferred that maximum number of the pulse growers are associated with farming for their livelihood.

Annual Income

The study exhibited that 58.14 per cent pulse growers had low (upto Rs. 30,000) annual income followed by Rs. 30,001-60,0000 as medium (26.36 per cent) and above Rs. 60,000 as high annual income (15.60 per cent), respectively. It was observed that majority of pulse growers had low income level from their sources

Social Participation

It is clear from Table that out of a sample size of 387 pulse growers studied, the maximum of 61.24 per cent belonged to low level of social participation while 29.30 per cent and 09.56 per cent belonged to medium and high level of social participation.

It is concluded from the above discussion that high level of social participation played vital role in farming community for enhancing their decision making as compared to non-social participation in different package of practices of pulses

Technological impact on yield performance of *rabi* pulses

The yield performance of rabi pulses is depicted in Table 2, It is clearly evident that in case of chickpea, varieties pusa -296 and BGD-72 were demonstrated in 2.0 and 3.0 ha area, respectively during 2010-11 and 2011-12 and was observed 32.17 and 36.32 per cent increase over the check yield ,respectively. However ,during 2012-13 to 2014-15,3.0 ha area was demonstrated each year with variety pusa 362 and 31.11 to 41.30per cent yield increase area the check was observed.

Varieties Aparna of HUM -15 of field pea were demonstrated in 2.0 ha area during 2010-11 to 2013-14. The observed demo yield was ranged in between 18.15 to 24.64q/ha in HUM -15 and 21.70q/ha in aparna. However the check was varied in between 14.50to 19.00 q/ha during different year. The highest per cent increase over the check was observed as 36.89 per cent during 2012-13.

Table 2: Technological impact on yield performance of rabi pulses.

		2010-11	2011-12	2012-13	2013-14*	2014-15*
Chick pea	Var. Pusa-296	Var. BGD-72	Var. Pusa-362	Var. Pusa-362	Var. Pusa-362	
	No. of demonstrations	22	34	47	43	50
	Area (ha)	02.00	03.00	03.00	03.00	03.00
	Demo yield (q/ha)	22.80	26.15	24.28	19.50	13.40
	Check yield (q/ha)	17.25	19.15	18.34	13.80	10.22
	% increase over the check	32.17	36.32	32.39	41.30	31.11
Field pea	Var. Aparna	Var. HUM-15	Var. HUM-15	Var. HUM-15	NC	
	No. of demonstrations	32	28	31	33	-
	Area (ha)	02.00	02.00	02.00	02.10	-
	Demo yield (q/ha)	21.70	24.35	24.64	18.15	-
	Check yield (q/ha)	19.00	18.32	18.00	14.50	-
	% increase over the check	14.20	32.90	36.89	25.17	-
Lentil	Var. HUL-57	NC	Var. L-4076	Var. L-4076	Var. L-4076 & L-4147	
	No. of demonstrations	18	-	17	06	26
	Area (ha)	02.50	-	01.50	00.38	00.93
	Demo yield (q/ha)	16.85	-	11.52	07.10	04.05
	Check yield (q/ha)	11.52	-	08.21	06.08	03.10

Lentil varieties viz, HUL -57, L-57, L-4076 and L-4147 were demonstrated in 5.31 ha area at 67 farmers field during 2010-11 to 2014-15. The highest per cent increase over the check (46.26 per cent) was observed on HUL-57 and it was 4031 per cent in L-4076. It is also apparent from the Table 2 that all the improved varieties of chickpea, field pea and lentil considering under FLDs outperformed in comparison to local ones. In general, there was 14.20 to 46.26 per cent yield increase over the check in different varieties of rabi pulses and in particular, it has already been discussed above.

Economic impact of rabi pulses

The economic impact of rabi pulses is given in Table 3. The gross costs of cultivation of chickpea in demonstration were ₹ 33040, 37520, 38540, 39660 and 42030 per hectare during 2010-11, 2011-12, 2012-13, 2013-14 and 2014-15, respectively. However gross costs in check were ₹30100, 34500, 37600, 38860, 40120 per ha. during consecutive years from 2010-11 to 2014-15, respectively. Benefit cost ratio (B:C) was also observed as 2.21 in demostration, which was higher in comparison to check (1.85) during 2010-11. Similar pattern was followed in consecutive years and B:C ratio were 2.60,2.61,2,02 and 1.39 in demonstration and it was 2.00, 2.02 ,1.47, and 1.11 in check during respective years.

Gross costs of cultivation of field pea were ₹31340, 33430, 36125, and 37660 per hectare in demonstration during 2010-11, 2011-12, 2012-13, and 2013-14, respectively. However, gross costs were ₹29510, 31630, 35720, 36960 per ha. in check during repective years. Net return of demonstration version check were ₹15315 and 11490, ₹38402 and ₹22314, ₹46419 and ₹24580, ₹26772 and ₹15515 per hactare during 2010-11, 2011-12, 2012-13 and 2013-14 , respectively. Benefit cost ratio (B:C) was also observed as 1.50, 2.20, 2.28 and 1.70 in demostration and 1.39, 1.70, 1.69 and 1.40 in check during 2010-11, 2011-12, 2012-13 and 2013-14, respectively.

Under demonstration, the gross costs of cultivation of lentil were ₹24943, 27280, 28801 and

Table 3: Economic impact of rabi pulses.

		2010-11	2011-12	2012-13	2013-14*	2014-15*
Chickpea						
	Demonstrated Gross Cost (₹/ha)	33040	37520	38540	39960	42030
	Net Return (₹/ha)	39920	60605	62222	40965	16250
	B:C	2.21	2.60	2.61	2.02	1.39
	Check Cross Cost (₹/ha)	30100	34500	37600	38860	40120
	Net Return (₹/ha)	25545	37525	38511	18410	4337
	B:C	1.85	2.0	2.02	1.47	1.11
Field pea						
	Demonstrated Gross Cost (₹/ha)	31340	33430	36125	37660	NA
	Net Return(₹/ha)	15315	38402	46419	26772	-
	B:C	1.50	2.2	2.28	1.70	-
·	Check Gross Cost (₹/ha)	29510	31630	35720	36960	-
	Net Return (₹/ha)	11490	22314	24580	15515	-
	B:C	1.39	1.7	1.69	1.40	-
Lentil						
	Demonstrated Gross Cost (₹/ha)	24943	NA	27280	28801	29910
	Net Return(₹/ha)	36560	-	29744	7054	3200
	B:C	2.47	-	2.09	1.24	1.11
·	Check Gross Cost (₹/ha)	23943	-	26710	27750	26110
	Net Return (₹/ha)	18105	-	13929	1954	-690
	B:C	1.76	-	1.52	1.07	-

29910 per hectare during 2010-11, 2012-13, 2013-14 and 2014-15, respectively as well as net returns per hactare were 36560, 29744, 7054 and 3200, during respective years. Benefit cost ratio (B:C) was observed as 2.47, 2.09, 1.24 and 1.11 in demostration during 2010-11, 2012-13, 2013-14 and 2014-15, respectively. However, the gross costs of cultivation in check and net returns per hactare were 23943, 26710, 27750, 26110 and 18105, 13929, 1954, -690, respectively during 2010-11, 2012-13, 2013-14 and 2014-15. Front line demonstration of recommended technology revealed that yield potential and net income from rabi pulses cultivation can lead to economic improvement and empowerment of farmers.

Level of technological gaps in rabi pulse

The Table 4 reflects that the level of technological gap has been analysed for demonstrated technology and farmer's practices against recommended crop management practices of rabi pulses. The findings clearly indicate that there were no any gaps found in case of field preparation, used of improved varieties, seed treatment, seed rate and application of fertilizers whereas 15.25, 14.47, 13.44, 9.04 and 8.53 per cent obtained partial gaps like weed management, method of sowing, time of sowing, water management and pest & disease management under demonstrated plot.

While complete higher gap was visible in case of method of sowing (96.12 per cent), seed treatment (89.92 per cent), pest & disease management (78.04 per cent), used improved varieties (67.18 per cent) and weed management (51.94 per cent) whereas ,higher partial technological gaps were obtained in case of time of sowing, field preparation, application of fertilizers and water management under farmers practices. However, for almost all the practices, significant number of farmers showed no technological gaps under demonstrated technologies.

CONCLUSION

It may be inferred from the finding that majority of the pulse growers belonged to middle age, literate, medium family size, marginal land holding, high farming experience, main occupation as agriculture, low annual income and low social participation. The analysis presented that 31.11 to 41.30 per cent yield increase was observed during the course of study in chick pea. However 14.2 to 36.89 per cent gain was recorded in field pea and 16.78 to 46.26 per cent yield was observed in lentil. The data clearly indicate that B C ratio in chickpea was ranged in between 1.39 to 2.61 during the year 2010-11 to 2014-15. In field pea B C ratio was observed in between 1.50 to 2.28 and in case of lentil B C ratio was ranged in 1.11 to 2.47 in demonstrated variety during same year. The

Table 4: Level of technological gaps in rabi pulse in the district of Bhadohi

(n=387)

Improved practices	Extent of technology gap					
	Gap in Demonstrated technology			Gap in Farmer's practices		
	Complete	Partial	No	Complete	Partial	No
Field preparation	-	-	387(100.0)	-	325(83.98)	62(16.02)
Used improved varieties	-	-	387(100.0)	260(67.18)	127(32.82)	-
Seed treatment	-	-	387(100.0)	348(89.92)	39(10.08)	-
Seed rate	-	-	387(100.0)	-	271(70.03)	116(29.97)
Time of sowing	-	52(13.44)	335(86.56)	-	340(87.86)	47(12.14)
Method of sowing	-	56(14.47)	331(85.53)	372(96.12)	15(3.88)	-
Application of fertilizers	-	-	387(100.0)	72(18.60)	315(81.40)	-
Water management	-	35(09.04)	352(90.96)	-	290(75.94)	97(25.06)
Weed management	-	59(15.25)	328(84.75)	201(51.94)	120(31.01)	66(17.05)
Pest & Disease management	-	33(8.53)	354(91.47)	302(78.04)	85(21.96)	-

recipient farmers of FLD also play an important role as source of information and quality seeds for wider dissemination of the improved varieties of rabi pulses for neighbouring others farmers. It is concluded from the above discussion that after intervention through the FLD as a sources of technologies like HYVs, training and field days etc. by the KVK scientist may change the knowledge, attitude and skills of the district farmers for enhancing the production and productivity of rabi pulses.

Paper received on : April 07, 2018
Accepted on : April 22, 2018

REFERENCES

Balai, C.M.; Meena, R.P.; Meena, B.L. and Bairwa, R.K. (2012). Impact of frontline on rapeseed and mustard yield improvement. *Indian Res. J. of Extn. Edu.,* **12** (2) : 113-116.

Burman, R.R.; Singh, S.K. and Singh, A.K. (2010). Gap in adoption of improved pulse production technologies in Uttar Pradesh. *Indian Res. J. of Ext. Edu.,* **10** (1):99-104.

Choudhary, B.N. (1999). Krishi Vigyan Kendra-guide for KVK managers. Publication, Division of Agril.Extn., ICAR, pp 73-78.

IIPR Vision 2030. (2011). Printed & Published by the Director, Indian Institute of Pulses Research (ICAR), Kanpur-208024.

Jukanti AK, Gaur PM, Gowda CLL and Chibbar RN. (2012). Nutritional quality and health benefits of chickpea (*Cicer arietinum* L.): a review. British Journal of Nutrition 108, S11-S26.

Khan AA, Jilani G, Akhtar MS, Naqvi SMS, Rasheed M. (2009). Phosphorous solubilizing bacteria: Occurance, Mechanisms and their role in crop production. Journal of Agriculture and Biological Sciences 1, 48-58.

Kumar Asheesh and Elamathi, S. (2007). Effect of nitrogen levels and rhizobium application methods on yield attributes, yield and economics of black gram (*Vigna mungo* L.). *Intl. J. of Agril. Sci.,* **3** (1): 179-180.

Materne M and Reddy AA. 2007. Commercial cultivation and profitability of lentil. Pages 173-186 Oweis T, Hachum A, Pala M. (2004). Water use efficiency of wintersown chickpea under supplemental irrigation in a Mediterranean environment. Agriculture Water Management 66, 163–179.

Samui, S K, Maitra, S, Roy, DK, Mandal, AK and Saha, D. (2000). Evaluation of front line demonstration on groundnut. *J Indian Soc Coastal Agric Res*, **18**: 180-183

Saxena K B, Singh G, Gupta HS, Mahajan V, Kumar RV, Singh B, Vales MI, Sultana R. (2011). Enhancing the livelihoods of Uttarakhand farmers by introducing pigeonpea cultivation in hilly areas. Journal of Food Legumes 24, 128-132.

Sinclair T R and Vadez V. (2012). The future of grain legumes in cropping systems. Crop & Pasture Science. http://dx.doi.org/10.1071/ CP12128.