Indian Journal of Extension Education
Vol. 48, No. 3 & 4, 2012 (22-25)

Micro Analysis of Yield Gap and Associated Constraints in Adoption of Wheat *(Triticum aestivum L. emend. Fiori & Paol)* Production Technologies in Bihar

N. V. Kumbhare[1], Anil Kumar[2], K. Singh[3] and S. Chowdhuary[4]

ABSTRACT

The present study for on-farm assessment of wheat *(Triticum aestivum L. emend. Fiori & Paol)* production technology was carried out in two purposively selected wheat-growing districts, *i.e.* Samastipur and Muzaffarpur districts of Bihar. A stratified random sampling technique was followed to further choose the blocks, villages and respondents. A total of eight villages were drawn randomly from four blocks, *i.e.* two villages from each of two blocks of Samastipur (Kalyanpur and Samastipur) and Muzaffarpur (Sakra and Muzaffarpur) districts were selected. Thirty respondents were selected randomly from each of the sampled eight villages. Thus, a total of 240 respondents from two districts constituted the sample for the study. The findings revealed that 67.50 per cent respondents had fully adopted high-yielding varieties of wheat, which were suitable for north-eastern plains zone. The lower technology index, in 'PBW 343' (17.56 %) was observed when farmers used bio-fertilizer (*Azatobacter* + Phosphate Solubilizing Bacteria) in wheat followed by 'HD 2733' (21.81 %) under improved variety demonstration. The higher technology index of variety 'HD 2733' (35.27 %) and 'PBW 343' (34 %) under zero tillage condition was observed. The perceived constraints limiting the wheat production were non-availability of quality seeds of High-Yielding Varitey at proper time (78.75 %), followed by high cost of fertilizers (64.16 %) and late sowing of wheat (62.91 %).

Key words: Assessment, adoption, technology gap, technology index

INTRODUCTION

In the changing agricultural scenario farmers are facing a lot of problems due to extensive technological gap, yield gap and productivity constraints in wheat *(Triticum aestivum L. emend. Fiori & Paol)* based cropping system of north Bihar. Therefore, a need was felt to undertake interventions for utilization of modern production technologies and assessment of wheat production technology in north Bihar to reduce the yield gap at farmers field. North Bihar is an emerging and potential area for wheat production because of almost stagnant wheat production and productivity in Punjab and Haryana due to deteriorating soil health conditions. Considering the good soil health and increasing importance of wheat production in Bihar, a technological intervention in wheat is essential to improve the production and productivity as well as to minimize production constraints. Keeping in view, the farmers' constraints, technological and yield gap at farmers' field, an attempt was made to explore the on-farm assessment of wheat production technology in north Bihar with objectives, of characterizing the socio-economic profile of farmers of wheat-based farming system; analyzing the technology utilization pattern of farmers, ascertaining the farmers perceptions about varietal performance of rice-wheat cropping system and identifying interventions for utilization of modern production technologies.

METHODOLOGY

The study was conducted in purposively selected wheat-growing areas of Samastipur and Muzaffarpur districts of Bihar, covering four blocks, *viz.* Kalyanpur, Samastipur (Samastipur district) and Sakra and Muzaffarpur (Muzaffarpur district). A stratified random sampling technique was utilized to further choose the blocks, villages and respondents. A total of 8 villages drawn randomly from four blocks, *i.e.* two villages from each blocks, were selected. Thirty respondents were selected randomly from each of the sampled eight villages. The eight villages, namely Malinagar, Madhopur, Jagatsinghpur, Sahuri in Samastippur district; and Rajapur, Naropatti, Dihuli and Mishraulia Dih in Muzaffarpur district were selected for the study. Thus, a total of 240 respondents from two districts constituted the sample for the study. Well-structured interview schedule supported with PRA tools based survey and participants' observations were used to collect required data from the selected villages where extension interventions for reduction of yield and technological gap like on-farm trials/ demonstrations, field visit/farmers day/meeting, *kisan mela* and *goshthi* were organized for the benefit of the farming community. The micro analysis of per cent gain over local check, technology gap (yield gap-I), extension gap (yield gap-II) and technology index were computed for improved wheat varieties under different conditions.

[1] Scientist (Agricultural Extension), [3] Senior Scientist (Horticulture), Indian Agricultural Research Institute, New Delhi-12
[2] Principal Scientist (Agronomy) and [4]Ex.Head, IARI, Regional Station, Pusa, Bihar-848 125.

RESULTS AND DISCUSSION

Socio-economic profile of wheat farmers

Majority of the respondents belonged to the middle-age group (68 %), followed by old-age group (18 %) and young-age groups (14 %). The study revealed that 28 per cent farmers had schooling up to primary level, 23 per cent up to secondary level and 11 per cent up to graduate level and 38 per cent farmers were illiterate. A large majority of the farmers were marginal and small (71 %) landholders cultivating the wheat crop under rice-wheat cropping system. A significant proportion of the farm households had nuclear family with average of 5-6 members and majority of the wheat-growing farmers in the area were small and marginal landholders.

About 65 per cent farmers were found in the ₹ 50,000 to ₹ 1,00,000 annual income category and 10 per cent marginal farmers in the category of below poverty line (BPL). Social participation of majority of respondents (58 %) in formal and informal organizations was observed to be moderate.

Adoption behaviour of farmers regarding improved wheat production technology

The data in respect of adoption behavior of the wheat farmers depicted in Table 1 revealed that 67.50 per cent respondents had fully adopted the high yielding varieties of wheat, which were suitable for north eastern plains zone. Similar findings were also reported by Kher (1992), Patel *et.al*. (2003). Use of organic, inorganic fertilizers and crop residue in wheat was adopted by a majority (45.41%) of the respondents.

Table 1: Distribution of the respondents according to their adoption of improved practices of wheat cultivation.

n=240

Wheat technology demonstrated	Extent of adoption		
	Full adoption	Partial adoption	No adoption
Use of high-yielding varieties	162 (67.50)	65 (27.09)	13(5.41)
Use of zero tillage	30 (12.50)	50 (20.83)	160 (66.67)
Use of bio-fertilizer	25 (10.41)	35 (14.58)	180 (75.00)
Seed treatment	10 (4.17)	30 (12.50)	200 (83.33)
Application of recommended fertilizer	35 (14.59)	180 (75.00)	25 (10.41)
Proper and effective weed control	98 (40.83)	97 (40.41)	45 (18.76)
Use of organic, inorganic and crop residue	109 (45.41)	76 (31.67)	55(22.92)
Innovations in field day / farmers fair.	190 (79.17)	50 (20.83)	00 (0.00)

* Figures in parentheses indicate in percentage.

However, about 67 per cent of respondents had not adopted zero tillage technology in wheat and 75 per cent farmers also not adopted use of biofertilizers (Azatobacter + PSB) in wheat. It may be due to non-availability at proper time. Also a majority of the farmers (83.33 %) did not adopt the seed treatment before sowing. Hence there is a need to ensure availability of zero till seed drill machines in the area and need to motivate the farmers for use of biofertilizers and seed treatment to enhance the production and productivity in wheat. Similar findings reported by Dubey and Srivastava (2007).

Yield performance, technological gap and extension gap of wheat varieties

The potential and field performance of the improved wheat varieties under different condition were evaluated along with local check and data are presented in Table 2.

The per cent yield gain of improved wheat varieties over local check was 36.50, 20.63 and 16.82 for 'HD 2733', 'HD 2824' and 'PBW 343' respectively. Under zero-tillage condition, the per cent yield gain over local check was 15.87, 13.01 and 4.76 for 'HD 2824', 'HD 2733' and 'PBW 343', respectively. Under bio-fertilizer (*Azatobacter* +PSB) application, the per cent yield gain of 30.85, 23.80 and 19.55 for 'PBW 343', 'HD 2733' and 'HD2824', respectively was recorded.

Table 2: Yield performance, technological gap and extension gap of wheat varieties

Types of FLDs	Wheat variety	No. of FLDs	Area (ha)	Yield (kg/ha)			% gain over check	Technology (yield gap-i) (kg/ha)	Extension gap (yield gap-ii) (kg/ha)	Technology index (%)
				Potential yield	Demo. yield	Local check				
Improved Varieties	'HD 2824'	16	10	5000	3800	3150	20.63	1200	650	24.00
	'HD 2733'	10	10	5500	4300	3150	36.50	1200	1150	21.81
	'PBW 343'	20	20	5000	3680	3150	16.82	1320	530	26.40
Zero Tillage	'HD 2824'	05	05	5000	3650	3150	15.87	1350	500	27.00
	'HD 2733'	09	09	5500	3560	3150	13.01	1940	410	35.27
	'PBW 343'	07	07	5000	3300	3150	4.76	1700	150	34.00
Bio-fertilizer (*Azatobacter* +PSB)	'HD 2824'	06	06	5000	3766	3150	19.55	1234	616	24.68
	'HD 2733'	06	06	5500	3900	3150	23.80	1600	750	29.09
	'PBW 343'	06	06	5000	4122	3150	30.85	878	972	17.56

FLDs = Frontline demonstrations; PSB = Phosphate-solubilizing bacteria

The technology gap (yield gap-I) for improved wheat varieties was larger that ranges from 1,200 kg/ha for 'HD 2824' & 'HD 2733' and 1,320 kg/ha for 'PBW 343'. In zero-tillage condition the technology gap was also extensive, being 1,350 kg/ha, 1,700 kg/ha and 1,940 kg /ha for 'HD 2824', 'PBW 343' and 'HD 2733', respectively. In bio-fertilizer (*Azotobacter*+PSB) application, the technology gap was 878 kg/ha, 1,234 kg/ha and 1,600 kg/ha for 'PBW 343', 'HD 2824' and 'HD 2733',

respectively. The technology gap (yield gap-I) at farmers field may be attributed to the problems like terminal heat (high temperature at maturity), weed infestation, water stress, late sowing of wheat and lack of micronutrient management.

Higher extension gap (1,150 kg/ha) was recorded for variety 'HD 2733' followed by 650 kg/ha for 'HD 2824' and 530 kg/ha for 'PBW 343' from improved variety performance. In zero tillage condition, the large extension gap was 150 kg/ha, 410 kg/ha and 500 kg/ha for 'PBW 343', 'HD 2733' and 'HD 2824', respectively. Also wide extension gap was observed in bio-fertilizer (*Azotobacter* +PSB) applied wheat fields of the farmers, being 616 kg/ha, 750 kg/ha and 972 kg/ha for varieties 'HD 2824', 'HD 2733' and 'PBW 343', respectively. It is indicated that there is need to educate the farmers by organizing short duration training programmes before and during the crop season.

The technology index shows the feasibility of evolved technology at the farmers' field. The lower the value of technology index, more is the feasibility of the technology. The lower technology index in 'PBW 343' (17.56 %) was observed when farmers used bio-fertilizer (*Azotobacter* + PSB) in wheat followed by 'HD 2733' (21.81%) under improved variety demonstration. The higher technology index of variety 'HD 2733' (35.27 %) and 'PBW 343' (34%) under zero tillage condition indicates the existence of a considerable gap between the technology performance at research station and on the farmers' field.

Perceived constraints by farmers in adoption of wheat production technology

The perceived constraints limiting the wheat production in the study area are given in Table 3. The major constraints were non-availability of quality seeds of High-yielding variety (HYV) at proper time (78.75%), followed by poor quality of fertilizers (64.16%), high cost of fertilizers (62.91%), high cost of diesel (62.50%), lack of market facilities (60.41%), inadequate availability of electricity (57.91%), high weed infestation (56.25%), late showing of wheat (49.16%) and lack of assured irrigation (48.75%).

About 47 per cent farmers reported terminal heat problem (high temperature at maturity), and 46 per cent farmers perceived the constraints like water stress and imbalanced use of fertilizers. Other constraints perceived by the farmers were poor management practices, lack of proper institutional credit and leaf blight disease on wheat crop. Related constraints reported by Sriram and Chauhan (2005). Majority of the farmers used latest high yielding wheat varieties like HP and HD series released from IARI such as 'HD 2824', 'HD 2733', 'HP 1731', 'HP 1761', and 'HD 2643'. However, 'UP 262' being the only variety for good chapatti quality was highly popular among the farmers.

Table 3: Perceived constraints by farmers in adoption of wheat production-technology

n=240

Perceived constraints	Frequency	%	Rank
Non-availability of quality seeds	189	78.75	I
Poor quality fertilizers	154	64.16	II
High cost of fertilizers	151	62.91	III
High cost of diesel	150	62.50	IV
Lack of market facilities	145	60.41	V
Inadequate availability of electricity	139	57.91	VI
Non-availability of zero-tillage machine locally	137	57.08	VII
High weed infestation (*Phalaris minor* and *Chenopodium)*	135	56.25	VIII
Late sowing of wheat	118	49.16	IX
Lack of assured irrigation	117	48.75	X
Terminal heat (High temperature at maturity)	113	47.08	XI
Water stress	110	45.83	XII
Imbalance use of fertilizers	110	45.83	XII
Poor management practices	105	43.75	XIII
Lack of proper institutional credit	96	40.00	IVX
Infestation of Leaf blight	48	20.00	XV

CONCLUSION

The higher technology gap at farmers' field may be attributed to the problems like terminal heat, weed infestation, water stress, late sowing of wheat and lack of micronutrient management. Also, higher extension gap was recorded for 'HD 2733', 'HD 2824' and 'PBW 343' varieties under improved variety, zero tillage and bio-fertilizer application at farmers' field. The lower technology index in 'PBW 343' (17.56%) was observed when farmers used bio-fertilizer (*Azotobacter* + PSB) in wheat followed by 'HD 2733' (21.81%) under improved variety demonstration. The higher technology index of variety 'HD 2733' (35.27%) and 'PBW 343' (34%) under zero tillage condition was observed.

Hence, wheat growers should be exposed to the improved wheat production technologies. The extension agencies therefore, need to make intensive efforts for providing latest technological information to wheat growers. They should plan and execute various training programmes to provide better understanding among the

farmers so as to promote adoption of the latest wheat production technology. Research-extension-farmer-market linkages need to be strengthened and involvement of state extension functionaries in the extension programme would be an important step to strengthen transfer of technology in the region.

REFERENCES

Kher, S.K. 1992. Adoption of Improved Wheat Cultivation practices. *Indian Journal Extension Education* 08 (1&2) : 97-98.

Patel, M. M., Amit Chatterjee and Mohmood Khan 2003. Adoption of Wheat Production Technology. *Indian Journal Extension Education* Vol 39 (1&2): 58-62.

Sriram and M.S. Chauhan 2005. Constraints in the non-adoption of Improved Technology of Wheat. Development Initiatives for Farming Community, Extension Strategy. Seminar paper published by ISEE (2005):413-417.

Dubey, Akhilesh K. and Srivastava, J. P. 2007. Effect of Training Programme on Knowledge and Adoption Behaviour of Farmers on Wheat Production Technologies. *Indian Research Journal Extension Education* 7(2&3).