Journal of AgriSearch **4**(4):285-289
An Open Access International Peer Reviewed Quarterly

ISSN : 2348-8808 (Print), 2348-8867 (Online)
http://dx.doi.org/10.21921/jas.v4i04.10211

Farmers perception in adoption of conservation agriculture practices in Madhubani District of Bihar, India

UJJWAL KUMAR, RAMESH CHANDRA BHARATI, RAVI KANT CHAUBEY, KK RAO, VED PRAKASH AND ABHAY KUMAR

ICAR Research Complex for Eastern Region, Patna, India

ARTICLE INFO

Received on	:	21.05.2017
Accepted on	:	20.11.2017
Published online	:	30.11.2017

ABSTRACT

The study has been conducted in Madhubani district of Bihar state to analyse gender segregated key benefits, advantages, disadvantages, issues and the key decision processes and criteria for conservation agriculture technologies adoption. Data were collected through focus group discussions involving male and female farmers. Cent per cent farmers expressed saving of labour and reduction in drudgery in Zero Tillage Direct Seeded Rice (ZTDSR). Higher yield through adoption of ZTDSR was revealed by equal percentage (75 %) of male and female farmers. Equal percentage (100 %) of male and female farmers expressed labour saving as one of the most important criteria for adoption of the ZT. Gender segregated data showed almost similar perception related to criteria adoption of ZT technology in rice-wheat system. All the female groups expressed that limited knowledge of herbicide use restricts adoption of ZTDSR. All the female groups were in the view that there is reduction of drudgery through adoption of mechanical paddy transplanter. Preparation of mat type nursery was top most disadvantages for 90 and 70 % male and female groups respectively. Eighty percent farmers groups expressed their opinion that non availability of trained tractor drivers for machine operation limits adoption of ZT machine. Preparation of mat nursery and trained operators for paddy transplanter was major criteria for adoption of mechanical paddy transplanter. There was contradiction in the perception among male and female farmers with respect to yield advantage and associated risk for poor yield due to the adoption of CA technologies.

Keywords: Conservation agriculture, Paddy transplanter, Technology adoption, Women, Zero tillage

INTRODUCTION

Rice-wheat is a prominent cropping system in eastern Indo-Gangetic Plains (IGP). Delayed planting of wheat after late harvesting of long duration conventional transplanted rice is the main bottleneck in realising higher yield of wheat(Singh *et al*., 2014). Eastern IGP, especially Bihar is experiencing an impressive phase of economic development which has dramatically reduced availability of farm labour due to rapid labour migration from agriculture to non-agriculture sectors like construction, housing and new initiatives taken by government (Singh *et al*., 2010). Acceleration of CA based technologies can reduce the labour requirement as well as reduce the drudgery of women farmers. In Bihar, efforts to adopt and promote conservation agriculture technologies have been underway for nearly a decade but it is only in the last 8-10 years that the technologies are finding rapid acceptance by farmers (Singh *et al*., 2014). Efforts to develop and spread conservation agriculture have been made through the combined efforts of several State Agricultural Universities, ICAR institutes and the Rice-Wheat Consortium for the Indo-Gangetic Plains (Joshi, 2011). The spread of technologies is taking place in India in the irrigated regions in the Indo-Gangetic plains where rice-wheat cropping systems dominate. Conservation agriculture systems have not been tried or promoted in other major agro-ecoregions like rainfed semi-arid tropics and the arid regions of the mountain agro-ecosystems (Bhan and Behera, 2014). The focus of developing and promoting conservation technologies has been on zero-till seed-cum fertilizer drill for sowing of wheat in rice-wheat system (Hobbs, 2008). Other interventions include raised-bed planting systems, laser equipment aided land levelling, residue management practices, alternatives to the rice-wheat system etc. It has been reported that the area planted with wheat adopting the zero-till drill has been increasing rapidly (Sangar *et al*., 2005), and presently 25% - 30% of wheat is zero-tilled in rice-wheat growing areas of the Indo-Gangetic plains of India.

Farmers include both male and female workers, as women are the backbone of the agriculture and play a vital role in agricultural production, management, post-harvest and value addition activities (Anonymous, 2014). Extent of female participation in agriculture varies with landowning status of farm households. Out of total female workforce, 79.22 percent are engaged in agriculture whereas only 43.48 percent male work force is engaged in agriculture (Anonymous, 2014). Wherever the new agricultural technology led to multiple cropping, the work load of women has increased. While a number of tasks performed by males have been mechanized, the tasks usually allotted to women continue to be manual

Principal Scientist and Head,[2]Principal Scientist,[3]Senior Research Fellow,[4]Scientist,[5] Scientist, [6]Principal Scientist
*Corresponding Author Email: ujkumar19@gmail.com

and suffer from drudgery. Even where improved techniques have been found suitable for the women, there is not sufficient access to training in such techniques. Encompassing the technological innovations such as weeders, multicrop drills, paddy threshers, winnowers, sprayers, harvesting tools, maize shellers, dal making machines etc. has reduced the burden of women. Transplanting of rice is highly labour intensive and majority of the transplanting is done by the female. Use of zero tillage and paddy transplanter has certainly reduced drudgery, especially of women farmers (Singh *et al*., 2014).Present study discuss about the gender segregated key benefits, advantages, disadvantages, issues and the key decision processes and criteria for conservation agriculture technology adoption in Madhubani district in North Bihar.

MATERIALS AND METHODS

This study was undertaken toexplore the key decision processes and criteria for CA technology adoption in Madhubani district of Bihar. The study focused on the problems and issues, advantages and disadvantages, criteria for adoption, and risks associated with technology adoption as experienced by male and female farmers.Madhubani district comprises of 21 blocks**.** Five villages - Korahia, Sukhet, Nanore, Mahuahi and Khairi respectively from Jainagar, Jhanjharpur, Andhrathadi, Babubarhi and Lakhnaur blocks were selected for undertaking the studies. These villages have diverse agro ecological situations. Focus Group Discussions (FGDs) technique has been adopted for getting information and perception of the farmers in a particular village. FGDs were done for exploring issues with a community or group for following purposes (1) Understanding resources of the area, existing crops, technologies and human capital, (2) Evaluate farmer perceptions of the suitability, benefits, costs and risks of the technologies being adopted by the farmers and (3) Get responses from farmer/community groups about the CA technology in the area. FGDs have been carried out by interacting thoroughly with 9 (nine) focus groups separately in each node (4 male, 4 female and 1 mix groups). Each Focus Group consists of 08-15 individuals (men/women or mix). Thus, total 45FGDs were conducted. Every care has been taken for representation from each category (landless, marginal farmers, small farmers, large farmers, small traders, farm women etc.) of household during FGDs in the selected village.

Help of village panchayat, SHGs and other institutions were also taken to get village related data. Across five nodes, a total of 428 participants were involved in the FGDs consisting of 195 male (46 %) and 233 females (54 %) (Table 1). The CA technologies assessed include zero-tillage wheat, Zero tillage direct-seeded rice (ZTDSR) and rice transplanter. This research employs a qualitative approach in analyzing the key decision processes and criteria for CA technology adoption among farmers in Madhubani.

Table 1: Participation in FGDs by gender

Nodes along with its *GPS Coordinates	Season	Period	No. Of FGDs	No. of persons		
				Male	Female	Total
Korahia, Jainagar N 26.52762;E086.15281	Pre -Rabi; Rabi and Pre - Kharif	October 2015, January, 2016, May 2016 and October, 2016	9	34	58	92
Khairi, Lakhnaur N 26.19332;E086.29973			9	48	41	89
Mahuahi, Babubarhi N 26.44334;E086.29462			9	43	46	89
Nanore, Andhrathadi N 26.33079;E086.32599			9	29	52	81
Sukhet, Jhanjharpur N 26.26615;E086.29819			9	41	36	77
Total			**45**	**195**	**233**	**428**

*Latitude and longitude

RESULTS AND DISUSSION

The CA technologies (ZTDSR), mechanical rice transplanting, ZT Wheat and others) were assessed in terms of their advantages and disadvantages, criteria for adoption, problems and risk involved in adoption of the technologies as perceived by farmers and the farmers groups.

Farmers perception about advantages and disadvantages of CA based technologies

Important advantages of CA technologies expressed by the farmers group were reduction of labour, time saving, better yield, cost saving, low tillage cost and reduction in drudgery. The advantages associated with adoption of zero tillage direct seeded rice (ZTDSR) as identified by the groups across villages include: labour saving (97.77%), increased yield/better production (75.55%), lesser tillage cost (95.55 %), reduction in drudgery (84.44 %), less irrigation/water saving (84.44%) and time saving/timely seeding (77.77%) (Table 2). Gender segregated analysis of the data revealed that all the female farmers expressed saving of labour and reduction in drudgery in ZTDSR. Lesser tillage cost was expressed by equal percentage (95%) of male and female farmers. Similarly, higher yield through adoption of ZTDSR was realised by equal percentage (75 %) of male and female farmers.

Table 2: Advantages of Zero tillage direct seeded rice

Factors	Group Response (N= 45)			
	Male (N=20)	Female (N=20)	Mix (N=5)	Total
Labour saving	19 (95)	20 (100)	05 (100)	44 (97.77)
Time saving and timely seeding	16(80)	15(75)	04(80)	35 (77.77)
Reduction in drudgery	14 (70)	20(100)	04(80)	38 (84.44)
Lesser tillage cost	19(95)	19(95)	05(100)	43 (95.55)
Water saving	12(60)	13(65)	03(60)	38 (84.44)
Higher Yield	15(75)	15(75)	04(80)	34 (75.55)

*Figures in parentheses indicates percentage

Problems associated with adoption of ZTDSR-farmer sperception

The problems associated with the use of ZTDSR technologies include: limited knowledge of herbicide use (86.66%) more weed/weed control/weed problem (77.77%), poor germination/reduced germination (48.88%), low yield (68.88%), uneven sowing/not uniform seeding (46.66%). Among those groups that identified the disadvantages, limited knowledge of herbicide use (100%) and excess weed (80 %) topped in female FGD groups followed by low (70 %), poor germination (55 %) and not uniform seeding and spacing (50 %). For male groups, an equal distribution of FGD sessions cited the same disadvantages such as excess weed (80%), lower yield (70 %), limited knowledge of herbicide use (70 %), poor seed germination (50%) and not uniform seeding and spacing (40%) (Table 3).

Table 3: Problems associated with adoption of ZTDSR

Factors	Group Response (N=45)			
	Male	Female	Mix	Total
Excess Weeds	15(75)	16 (80)	04 (80)	35 (77.77)
Poor germination	10(50)	11 (55)	01(20)	22 (48.88)
Limited knowledge of herbicide use	14 (70)	20 (100)	05(100)	39 (86.66)
Not uniform seeding and spacing (Seedling uniformity)	08 (40)	10 (50)	03(60)	21 (46.66)
Low Yield	15 (75)	14 (70)	02(40)	31 (68.88)

*Figures in parentheses indicates percentage

Farmers perception about advantages of mechanical paddy transplanter

Participants in focus group were asked about advantage and disadvantage of mechanical paddy transplanter. Major advantages includes: line sowing (100%),reduction in input cost (82.22 %), drudgery reduction (88.88%), more yield (80 %) and labour saving (77.77 %). Male and female groups expressed almost similar advantages of mechanical paddy transplanter (Table 4). The machine has some disadvantage also, that include: preparation of mat nursery (80 %), uneven sowing (no uniform transplanting) if land is not levelled (68.88 %) and gap filling in case of missed placing of rice seedlings (48.88 %).

Table 4: Advantages of mechanical paddy transplanter

Factors	Group Response			
	Male	Female	Mix	Total
Labour saving	15(75)	16(80)	04(80)	35 (77.77)
More yield	16(80)	16 (80)	04(80)	36 (80)
Reduction in input cost	17(85)	15(75)	05(100)	37 (82.22)
Line sowing makes intercultural operation easier	20(100)	20(100)	05(100)	45 (100)
Reduction in drudgery	15(75)	20(100)	05 (100)	40 (88.88)

*Figures in parentheses indicates percentage

Farmers perception regarding disadvantages of mechanical paddy transplanter

Among male groups, preparation of mat nursery (90%) was top most disadvantages, followed by seedling uniformity (75%) and gap filling (50%). Among female groups also, preparation of mat nursery (70%) was top most disadvantage, followed by seedling uniformity (60%) and gap filling (45 %). Mix groups expressed preparation of mat nursery and seedling uniformity (80%) as top most disadvantage (Table 5) for further scaling of area under mechanical transplanted rice in Madhubani district.

Table 5: Disadvantages of mechanical paddy transplanter

Factors	Group Response			
	Male	Female	Mix	Total
Preparation of Mat type nursery	18(90)	14(70)	04(80)	36 (80)
Gap filling	10(50)	09(45)	03(60)	22 (48.88)
Seedling uniformity	15(75)	12(60)	04(80)	31(68.88)

*Figures in parentheses indicates percentage

Farmer sperception regarding advantages associated with adoption of ZT wheat

Data presented in Table 6 depicts advantages of ZT wheat. All groups (100 %) revealed saving of input and tillage cost, timely sowing (93.33 %), saving of labour (91.11%), saving of water (82.22%) and higher yield (73.33%) in ZT sown wheat. This shows that ZT wheat beneficial for all groups of farmers.

Table 6: Advantages associated with adoption of ZT wheat

Factors	Group Response			
	Male	Female	Mix	Total
Timely sowing	18 (90)	19 (95)	05 (100)	42 (93.33)
Saving of labour	18 (90)	18 (90)	05(100)	41(91.11)
Saving of input and tillage cost	20 (100)	20 (100)	05(100)	45(100)
Higher yield	15 (75)	14 (70)	04(80)	33 (73.33)
Saving of Water	16 (80)	17 (85)	04(80)	37 (82.22)

*Figures in parentheses indicates percentage

Farmers perception regarding problems associated with adoption of ZT wheat

Perusal of data presented in table 7, revealed that the problems associated with the use of ZT wheat technologies include: non availability of trained tractor drivers for machine

operation (80%), appropriate moisture at the time of sowing (77.77%), poor germination in case of inappropriate depth of sowing (62.22 %), more weeds at the time of sowing (55.55%) and choking of seed and fertilizer pipe in case of excess moisture (53.33%)

Table 7: Problems associated with adoption of ZT wheat

Factors	Group Response			
	Male	Female	Mix	Total
Choking of seed and fertilizer pipe in case of excess moisture	12(60)	10(50)	02(40)	24 (53.33)
Poor germination in case of inappropriate depth of sowing	13(65)	12(60)	03(60)	28 (62.22)
Appropriate moisture required at the time of sowing	15(75)	16(80)	04(80)	35 (77.77)
More weed at the time of sowing	10(50)	12(60)	03(60)	25 (55.55)
Trained tractor driver	15(75)	16(80)	05(100)	36 (80.00)

*Figures in parentheses indicates percentage

Various issues were also encountered by the farmers across the villages during the use of the technologies. In general, issues encountered by majority of the villages include limited operators/limited skills of operators and mechanics, more weed at the time of sowing, proper levelling of the fields, appropriate moisture required at the time of sowing, availability of herbicides for weed management, timely availability of machines during the season, training for women farmers etc.

Farmer sperception regarding criteria for technology adoption

The participants of the FGD in Madhubani were particularly asked to the criteria for adopting Zero tillage technology in wheat and rice. In all nodes, the labour saving (100%) of the technology was highlighted. Majority of the nodes identified

Table 8: Criteria for adoption of ZT Technology

Factors	Group Response			
	Male	Female	Mix	Total
Saving of labour	20 (100)	20 (100)	05(100)	45 (100)
Input cost saving	18 (90)	17(85)	04(80)	39 (86.66)
Enhanced yield	15(75)	14(70)	04(80)	33 (73.33)
Time saving	16(80)	15(75)	03(60)	34 (75.55)
Saving of Water	16(80)	17(85)	04(80)	37 (82.22)
Availability of machine	18(90)	18(90)	05(100)	41(91.11)
Skilled operator availability	05(25)	06(30)	03(60)	14 (31.11)
Technical and other support	06(30)	05(25)	04(80)	15 (33.33)
Moisture content in the field	05(25)	06(30)	02(40)	13 (28.88)
No flooding / stagnant water	06(30)	06(30)	03(60)	15 (33.33)

*Figures in parentheses indicates percentage

input cost saving/advantage (86.66%), enhanced yield/crop production/productivity (73.33%), tillage time/time saving (75.55%), less irrigation/water saving (82.22%),machine availability (91.11%), availability of skilled operators of the machine (ZT machine, rice transplanter, etc) (31.11 %) and technical skills/technical support (33.33 %).Groups of some villages also expressed moisture content of the field (28.88%) and no stagnant water (33.33%) as criteria for technology adoption (Table 8). Equal percentage of male and female farmers expressed labour saving as one of the most important criteria for adoption of the ZT. Gender segregated data showed almost similar perception related to criteria adoption of ZT technology in rice-wheat system. For example, input cost saving was reported by 90 and 85 % male and female respectively.

Farmer sperception regarding criteria for adoption of mechanical paddy transplanter

The participants of the FGD were also asked to the criteria for adopting CA technology particularly mechanical paddy transplanter. Most of the men farmers (90%), women farmers (75%) and mix groups (100%) considered preparation of mat nursery as a crucial consideration. It was also important that there should not be stagnant water in the field during use of transplanter according to male (60%) and female farmers (50%). Also, availability of trained operators as expressed by 75 percent male and 70 percent female groups as well as availability of machine is also deciding criteria according to 80 percent male and 75 percent female for adoption of mechanised paddy transplanting technologies. Uniform topography of land was particularly important for both male (50 %) and female farmers (60%) (Table 9). Preparation of mat nursery is one of the most important criteria for adoption of mechanical rice transplanter and it was expressed by 90 percent male groups and 75 percent female groups.

Table 9: Criteria for adoption of mechanical paddy transplanter

Factors	Group Response			
	Male	Female	Mix	Total
Preparation of mat nursery	18(90)	15(75)	05(100)	38 (84.44)
No stagnation of the water	12(60)	10(50)	02(40)	39 (86.66)
Availability of trained operator	15(75)	14 (70)	04 (80)	33 (73.33)
Availability of Machine	16(80)	15 (75)	03(60)	34 (75.55)
Uniform topography of the land	10 (50)	12(60)	03(60)	25 (55.55)

*Figures in parentheses indicates percentage

Farmers perception regarding risk associated with CA technology adoption

Madhubani district is prone to flood as well as drought. Agricultural vulnerability is dependent upon climatic, biological, social and other infrastructural factors. Out of five studied villages in Madhubani district, agricultural vulnerability in four villages (Korahia, Sukhet, Nanore and Mauahi) was medium. Agricultural vulnerability index in these four villages varies from 0.36 to 0.48 that reveals that one should adopt technologies, crops and strategies which can

minimize risk from adverse climatic, social and biological factors (Kumar *et al.*, 2016).A number of potential risks associated with adopting CA technology were identified in Madhubani(Table 10). On the effect on yields, majority (70%)

Table 10: Risks associated with CA technology in Madhubani

Risk	Opinion/ comments	Male (%)	Female (%)
Effect on Yields	Increase	30	47
	No Change	70	53
Effect on Food security	Increase	75	53
	No change	25	47
Effect on income	Increase	80	67
	Decrease	20	33
Timely availability of Machine	Yes	77	85
	No	23	15
Early planting	Yes	78	76
	No	22	24
Other risks	No Problem	63	60
	Weed Problem	27	40

of the male farmers believed there was no change while the remaining 30percent were positive that there was an increase in yields. Female farmers (53 %) were also negative compared to those who believed there was yield enhancement (47%) with the technology introduced. On the effect on food security, majority of male farmers (75 %) was optimistic while the remaining 25percent expressed there was no change. The women farmers were also optimistic (53%) of the outcome while the remaining 47percent had no improvement in food security. In terms of income, majority of the male farmers (80%) experienced increase in income while the remaining 20percentexperienced decrease in income. Similarly, more female farmers (67%) experienced increase in income compared to those who experienced decreased in income (33%). In terms of timely availability of the machine, majority of male farmers (77%) had positive experience with machine availability compared to those who experienced delays (23%). Majority of female farmers (85%) reported timely machine availability while remaining 15percent experienced delays. Other risks identified include weed problem among men (37 %) and most especially women (40%) farmers. Lastly, in terms of early planting opportunity, majority (78 %) of male farmers were willing to use zero-tillage / direct-seeded rice in June while 22 percent were not willing. For women farmer almost equal proportion of willing farmers (76%) were observed while the remaining 24 percent were not willing to use ZT rice in June. The reasons for adopting early planting include increase of yield, saving of water, timely sowing of *rabi* crops. The farmers who were not willing to adopt early planting identified the risks of high temperature, lack of moisture during the month and the presence of summer crops (especially moong bean) in the field.

CONCLUSION

Study concluded that in CA technologies reduction of labour was primarily attributed to less labour requirement for nursery preparation, tillage, and replanting. All women groups expressed positive response related to drudgery reduction by adoption of CA technologies. There was difference in perception among men and women farmers with respect to yield enhancement by the adoption of CA technologies. Male and female group cited almost similar disadvantage of zero tillage technology. Key problems and issues affecting the performance CA technologies in Madhubani district include poor germination, weeds and limited skills of machine operators. Weed control was the primary problem faced by the participants due to zero-tillage approach and the problem was more expressed due to the non-availability of suitable herbicides on time. The limited skills of machine operators and uneven plots also contributed to the uneven sowing of the seed through ZT machine and seedlings through paddy transplanter.

ACKNOWLEDGMENTS

This study is a part of SRFSI project and authors are highly grateful to the ACIAR and CIMMYT for providing financial support to conduct the study.

REFERENCES

Anonymous. 2014. Statistical profile on women labour. Labour Bureau, Ministry of Labour and Employment, Govt. of India.

Bhan S and Behera UK. 2014. Conservation agriculture in India-Problems prospects and policy issues. *International soil and Water Conservation Research* **2**(4): 1-12

Hobbs PR, Sayre K and Gupta RK. 2008. The role of conservation agriculture in sustainable agriculture. *Philosophical Transactions Royal Soc*. **36** (3): 543-555.

Joshi PK. 2011. Conservation Agriculture: An Overview. *Indian Jr. of Economics* **66**(1): 53-63.

Kumar Ujjwal, Sarkar B, Chaubey R and Bhatt BP. 2016. Agricultural Vulnerability Assessment: A Case of Madhubani District, Bihar. *Research Journal of Agricultural Sciences***7**(2): 372-374.

Sangar S, Abrol JP and Gupta RK. 2005. Conservation Agriculture: Conserving Resources Enhancing Productivity.19 p. CASA, NASC Complex, New Delhi.

Singh SS, Singh AK and Sundaram PK.2014. Agrotechnological options for upscaling agricultural productivity in eastern IndoGangetic plains under impending climate change situations: A review. *Journal of Agrisearch***1** (2): 55-65.

Singh RG, Kumar R and Gupta RK. 2010. Conservation Agriculture based Resource Conservation Technologies for Rice- Maize System for eastern IGP. *Resource Conservation Technologies for Food Security and Rural Livelihood*.pp. 98-106.

Citation:

Kumar U, Bharati RC, ChaubeyRK, Rao KK, Prakash V and Kumar A. 2017. Farmers perception in adoption of conservation agriculture practices in Madhubani District of Bihar, India. *Journal of AgriSearch***4** (4): 285-289