



Research Paper

Adoption pattern of a ruling wheat variety in eastern Uttar Pradesh: With special reference to Malviya 234 (HUW 234)

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ABSTRACT : Technology plays an important role in growth and development of agricultural sector. Crop varieties are the crucial factor influencing the crop productivity. This paper examines the adoption pattern, determinants and pros and cons of an old wheat variety Malviya 234 (HUW 234) cultivated in eastern Uttar Pradesh. For the analysis, the study used various descriptive statistics and logit model to achieve the objectives. Based on the survey data, the study reveals that the variety is popular among the farmers. The finding reveals that though HUW 234 is more than 30 years old wheat variety; but still it covers a significant cropped area. It is popular mainly due to its taste, less water requirement and better performance in late sown condition. Age of the farmers is an important determinant in adoption of the variety. Intensive crop improvement programmes in old and popular variety should be promoted and policy regarding premium price to better taste should be formulated.

KEY WORDS: Technology, Adoption, Wheat variety, HUW 234, Logit model

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INTRODUCTION :

Improved technology is the primary tool for accelerating agricultural productivity in any economy (Huang and Rozelle, 1996). Here, the technology means scientific knowledge used for practical purpose which improves the production process. The scientific knowledge, techniques, methods or skills used in agriculture refers to agricultural technology. To increase the farmers' income, emphasis should be given to invest more on research and development of low cost and region specific new agricultural technologies. The crop varieties are one of the major kinds of agricultural technology.

The credit for green revolution era in India can be given to improved varieties of wheat and paddy.

The development of improved varieties plays an important role in increasing production. But development programme alone could not impart significant impact on country's production until it is transferred to the farmers and in turn adopted by the farmers. The All India Co-ordinated Wheat and Barley Improvement project has released 373 wheat varieties for different environmental and production conditions (Waddington *et al.*, 2012) but only a few varieties cover a significant area (Nagarajan, 2005). In India, breeder produce more than 60 varieties of wheat per year, yet a maximum of 15 varieties account

for 80 per cent of cropped area and of these one or two cultivars cover 30 per cent of total wheat area (Nagarajan, 2009).

In order to attract more investment in agricultural research, there is a need for researchers to produce evidence that research and technology dissemination investments have been competitive compared to other alternatives (Anandajayasekeram *et al.*, 1996). The adoption studies help in documenting the extent of adoption of the technology in question and the perception of the farmers towards the technology. These studies link the researchers with the users of the technology. They provide evidences for the breeders and researchers to improve their technology as per the need of the farmers.

HUW 234, a wheat variety (popularly known as Malviya 234 among the farmers) was released in 1986. Many literatures are available which confirm its dominance (Joshi *et al.*, 2007a; Arun *et al.*, 2003 and Joshi *et al.*, 2010). Despite the release of a multitude of varieties over the last 20 years, HUW 234 is still the dominant variety in eastern Gangetic plains (Joshi *et al.*, 2007a). According to Joshi *et al.* (2010), HUW 234 is the most popular cultivar of eastern gangetic plains under late sown conditions and in mid 1990s occupied around 4-5 million ha. They also reported that it is still grown in about 2 million ha area. But these past studies lack the adoption pattern and farmers’ perception towards HUW 234.

The present study was undertaken with four specific objectives:

- To identify the popular wheat varieties in eastern Uttar Pradesh,
- To study the adoption pattern of HUW 234 over the years,
- To enlist the pros and cons related to HUW 234,
- To determine the factors affecting adoption of

HUW 234 in eastern Uttar Pradesh.

Sample data :

The whole study was based on primary data collected from farmers by personal interview with the help of pre-structured survey schedule. Two districts from eastern Uttar Pradesh were selected purposively for the study namely, Azamgarh (highest proportion of area under wheat) and Bhadohi (lowest proportion of area under wheat). From each district, two blocks were selected randomly and from each block, two villages were selected. Forty farmers were selected from each block *i.e.* total of 160 farmer were selected randomly (Table A).

MATERIALS AND METHODS :

The descriptive statistics (frequency and percentage) were used to identify and assess the distribution pattern of wheat varieties, to assess the extent of coverage of HUW 234 in individual farm and farmers’ perception regarding pros and cons of HUW 234.

Further, the factors influencing the adoption decision of farmers were determined with the help of logistic regression model. The goal of the logistic regression model is to find the best fitting model to describe the relationship between the dichotomous dependent variable (adoption of HUW 234) and a set of independent variables (Farid *et al.*, 2010). The model used is as follows:

$$\text{Ln} \left[\frac{p_i}{1-p_i} \right] = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \dots + \beta_n X_{ni}$$

where, p_i is the probability of adoption of HUW 234, $i = 1, 2, 3, \dots, 160$

β 's are the co-efficients,

X 's are the explanatory variables *i.e.* age, household size, education, farm size and multi-variety grower.

Table A: Sampling design of the study				
District	Block	Village	No. of farmers	Total
Azamgarh	Lalganj	Kehla Sikanderpur	20	80
		Chakia	20	
	Palhna	Jamuee	20	
		Kota Khurd	20	
Bhadohi	Bhadoi	Basawanpur	20	80
		Jogipur	20	
		Pilkhuna	20	
	Gyanpur	Jagatpur	20	

RESULTS AND DATA ANALYSIS :

Firstly, the adoption pattern was studied and divided into four parts: (a) variety wise distribution of wheat crop in eastern Uttar Pradesh, (b) extent of coverage of HUW 234 on individual farm, (c) adoption pattern of HUW 234 over the years *i.e.* from 2011 to 2016, (d) Farmers' perception regarding pros and cons of HUW 234. The results of the study are discussed as follows:

Distribution of wheat varieties in eastern Uttar Pradesh:

A total of nine major wheat varieties were identified during the survey which are popular among the farmers in the study area. Among nine varieties, PBW 343, PBW 154, PBW 502 and HUW 234 are dominant varieties in eastern Uttar Pradesh. Table 2 presents the distribution of wheat varieties on the basis of number of farmers cultivating that particular variety. It is evident from the

Table 1 : Definition of explanatory variables used in the model

Variables	Definition
Age (Age)	Age of the head in number of years
Household size (HH)	Number of members in the household
Education (EDU)	High school and higher is 1; otherwise 0
Farm size (FS)	Land holding in hectares
Multi-variety grower (MVG)	1 for farmer growing more than one variety; 0 otherwise

Table 2 : Variety-wise share of farmers cultivating wheat crop (2016-17)

Sr. No.	Varieties	Azamgarh (n=80)		Bhadohi (n=80)		Overall (n=160)	
		No. of farmers	Per cent	No. of farmers	Per cent	No. of farmers	Per cent
1.	HUW 234	26	32.50	14	17.50	40	25.00
2.	PBW 343	22	27.50	26	32.50	48	30.00
3.	Kundan	12	15.00	13	16.25	25	15.62
4.	Swarna	06	7.50	--	--	06	3.75
5.	Kedar	16	20.00	08	10.00	24	15.00
6.	PBW 502	16	20.00	21	26.25	37	23.12
7.	HUW 510	03	3.75	--	--	03	1.87
8.	PBW 154	21	26.25	20	25.00	41	25.62
9.	HD 2967	--	--	15	18.75	15	9.38

Table 3 : Variety wise distribution of wheat area under cultivation (2016-17)

Sr. No.	Varieties	Azamgarh		Bhadohi		Overall	
		Area under wheat (ha)	Per cent	Area under wheat (ha)	Per cent	Area under wheat (ha)	Per cent
1.	HUW 234	15.24	10.74	11.75	8.83	26.99	9.81
2.	PBW 343	41.38	29.14	40.00	30.08	81.38	29.59
3.	Kundan	19.88	14.00	11.00	8.27	30.88	11.23
4.	Swarna	4.00	2.82	--	--	4.00	1.45
5.	Kedar	22.12	15.57	9.50	7.14	31.62	11.50
6.	PBW 502	13.75	9.68	18.50	13.91	32.25	11.72
7.	HUW 510	1.25	0.88	--	--	1.25	0.45
8.	PBW 154	24.38	17.17	22.62	17.01	47.00	17.09
9.	HD 2967	--	--	19.63	14.67	19.63	7.14
Total area under wheat		142	100	133	100	275	100

table that 32.5 per cent and 17.50 per cent of wheat growers are cultivating HUW 234 in Azamgarh and Bhadohi district, respectively. In Azamgarh district, the other popular varieties among farmers are PBW 343 and PBW 154 which are cultivated by 27.5 per cent and 26.25 per cent farmers, respectively. The wheat varieties popular in Bhadohi district are PBW 343 (32.50 %), PBW 502 (26.25%) and PBW 154 (25 %) apart from HUW 234.

Further, the popularity of varieties was assessed on the basis of area under wheat crop. Table 3 shows the variety wise distribution of wheat acreage in the study area. Table 3 reveals that maximum wheat area under PBW 343 (29.14 %) followed by PBW 154 (17.17 %), Kedar (15.57 %) and HUW 234 (10.74%) in Azamgarh district. Whereas, the dominant varieties in Bhadohi district are PBW 343 (30.08%), PBW 154 (17.01%), HD 2967 (14.67 %), PBW 502 (13.91%) and HUW 234 (8.83%).

To sum up, Fig. 1 shows the variety-wise distribution of wheat area in eastern Uttar Pradesh. The figure shows

that dominant wheat varieties of the study area are PBW 343, PBW 154, PBW 502, HUW 234, HD 2967,

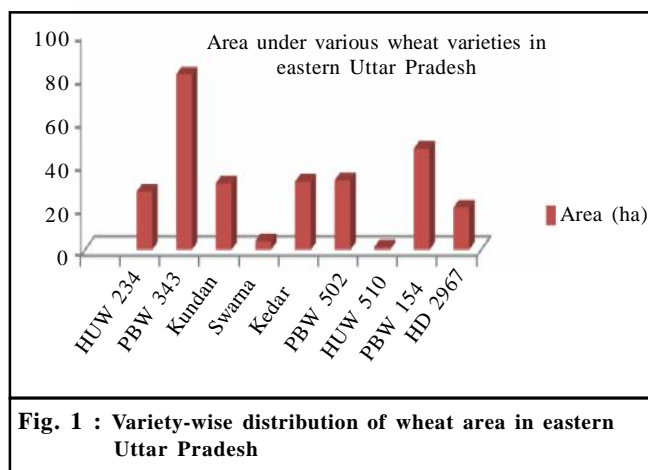


Fig. 1 : Variety-wise distribution of wheat area in eastern Uttar Pradesh

KUNDAN and Kedar.

Further, the farmers were asked about the awareness and preferences towards HUW 234. The results are presented in Table 4. The table shows that

Table 4 : Awareness and preferences of farmers towards HUW 234

Particulars	Number of farmers		
	Azamgarh	Bhadohi	Overall
Awareness about HUW 234	65 (81.25)	78 (97.50)	143 (79.44)
Preference towards HUW 234	32 (40.00)	14 (17.5)	46 (28.75)

Note: Value in () is percentage

Table 5 : Extent of coverage of HUW 234 on individual farm

Coverage range	Azamgarh		Bhadohi		Overall	
	No. of farmers	Per cent	No. of farmers	Per cent	No. of farmers	Per cent
<25 %	11	42.31	09	64.29	20	50.00
≥25 to <50 %	06	23.08	01	7.14	07	17.50
≥50 to <75%	04	15.38	03	21.43	07	17.50
≥75 to <100%	-	0.0	-	-	-	-
100 %	05	19.23	01	7.14	06	15.00
Total	26	100	14	100	40	100

Table 6: Adoption of HUW 234 over the years (2011-12 to 2016-17)

Year	Number of farmers planted HUW 234		
	Azamgarh	Bhadohi	Overall (n=160)
2011-12	44	32	76
2012-13	34	28	62
2013-14	32	19	51
2014-15	28	17	45
2015-16	25	14	39
2016-17	26	14	40

81.25 per cent and 97.50 per cent of farmers are aware about HUW 234 in Azamgarh and Bhadohi, respectively. The awareness was found to be more in Bhadohi than Azamgarh. The plausible reason behind it is the closeness of the district to Institute of Agricultural Sciences, Banaras Hindu University which makes the transfer of technology by extension workers easier.

The number of farmers (32 out of 80) showing preference towards HUW 234 was found to be higher than the number of farmers (26 out of 80) actually cultivating the variety in Azamgarh district. The reason behind this deviation is attributed to difficulty in availing seeds of HUW 234 at the agri input shops and government agency. In contrast, no such deviation was found in Bhadohi district.

Extent of coverage of HUW 234 on individual farm:

Table 5 presents the extent of coverage of HUW 234 on individual farm. The table reveals that maximum adopters (42.31 %) prefer growing multiple varieties as the extent of coverage of HUW 234 is less than 25 per cent on individual farm in Azamgarh district. 100 per cent coverage on individual farms is preferred only by 19.23 per cent adopters.

In Bhadohi, similar pattern was observed. Almost all the adopters of HUW 234 cultivate multiple varieties of wheat on their farm. Only 28.57 per cent of farmers fall under 25 to 75 per cent coverage. Maximum farmers (64.29 %) took multiple varieties and allocate less than

25 per cent of total area under wheat to HUW 234.

Adoption pattern of HUW 234 over the years:

Farmers were asked about the varieties grown by them in last six years. The results compiled here are completely memory based. Table 6 reveals the adoption pattern of HUW 234 over the years. The adoption of HUW 234 was observed to follow a declining trend in past six seasons.

It is evident from Fig. 2 that the slope of adoption curve is steep in Bhadohi district than Azamgarh district. This means that farmers of Bhadohi are quitting the older varieties at much faster rate than those of Azamgarh. Overall, the adoption curve of HUW 234 declined faster during 2011-12 to 2013-14 and then become almost

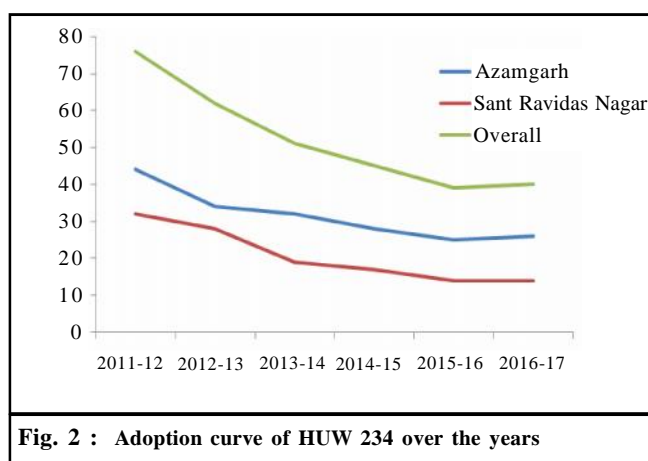


Fig. 2 : Adoption curve of HUW 234 over the years

Table 7 : Farmers' Perception regarding pros of HUW 234

Sr. No.	Pros of HUW 234	Azamgarh (n=26)		Bhadohi (n=14)	
		Number of farmers reported	Rank	Number of farmers reported	Rank
1.	Taste of grain flour	26 (100)	I	14 (100)	I
2.	Texture of dough	12 (46.15)	III	08 (57.14)	IV
3.	Performance under late sowing condition	22 (84.62)	II	12 (85.71)	II
4.	Less water requirement	11 (42.31)	IV	11 (78.57)	III
5.	Risk coverage under unfavourable condition (High adaptability)	08 (30.77)	V	05 (35.71)	V

Note: value in () is percentage

Table 8 : Farmers' perception regarding cons of HUW 234

Sr. No.	Cons of HUW 234	Azamgarh (n=65)		Bhadohi (n=78)	
		Number of farmers reported	Rank	Number of farmers reported	Rank
1.	Difficulty in availing seeds	22 (27.5)	III	10 (12.50)	III
2.	Low yield	60 (87.5)	I	76 (95.00)	I
3.	Introduction of varieties with higher yield and good taste	47(58.75)	II	38 (47.50)	II
4.	Shedding of grains	15 (18.75)	IV	08 (10.00)	IV

Note: value in () is percentage

stagnation. This means that the farmers still prefer the variety due to one or another reason that is why this problem was selected.

An important reason behind the success of HUW 234 is its broad adaptation to low resource environment prevalent in eastern India together with its ability to perform well under abiotic stresses such as heat, limited irrigation and variable fertilizer doses (Arun *et al.*, 2003). The popularity of older varieties indicates that probably the greater breeding efforts are needed to develop better varieties for the warmer areas (Joshi *et al.*, 2007b) and resource poor farmers.

Farmers' perception regarding pros and cons of HUW 234 :

The above observed decline in the adoption rate of HUW 234 raise the questions that can be answered by studying the perception of farmers regarding positive and negative qualities of the variety. The farmers' perception regarding pros and cons of HUW 234 are presented in Table 7 and 8. Table 7 reveals that as per the farmers' opinion, taste of grain flour of HUW 234 and its performance under sown condition are the major qualities due to which the variety is popular after 30 years of its release. Further, texture of its dough, less water requirement during cultivation and high adaptability are also reported by the farmers of selected districts as the factors responsible for its adoption. Here, texture of dough means the fine quality of dough which results in ease in making chapatti.

The questions related to cons were asked from the farmers who are aware about HUW 234 in both the districts. As discussed earlier, 65 farmers in Azamgarh district and 78 farmers in Bhadohi are aware about the variety. Table 8 suggests the reasons behind the decline in adoption of HUW 234 over the years. The farmers

reported four major cons of HUW 234 *viz.*, low yield, introduction of varieties with high yield, difficulty in availing seeds and shedding of grain. Among four cons, maximum farmers reported to low yield as major reason behind the decline in adoption of the variety in both the districts.

Determinants of adoption of HUW 234:

The factors influencing the adoption of HUW 234 variety in the study area were determined by the logistic regression model. The results of the model are presented in Table 9. The R square statistics in the table are greater than 0.30 which indicates the model used is good fit.

It is evident from the table that two variables *i.e.* age and multi-variety grower positively and significantly affect the adoption of HUW 234 in the study area. This indicates that older the farmer/ decision maker, more likely he will go for the cultivation of HUW 234. This may be due to the fact that the wheat variety in question is very old and older farmers still like the taste of the variety. Further, the reason behind introducing MVG (Multi-variety grower) is that it was observed during survey that the farmers are growing more than one wheat variety on their farm. The results suggest that the multi-variety growers are more likely to adopt HUW 234 than single variety grower. HUW 234 is mainly preferred due to its taste and better performance in late sown condition. Thus, the farmers who are cultivating this variety are either growing for consumption purpose or have very small holding.

Conclusion and policy implication:

The paper analyzes the adoption pattern and determinants of adoption of a popular wheat variety *i.e.* HUW 234 in eastern Uttar Pradesh. It was found that HUW 234 is still popular and covers a significant wheat

Table 9 : Parameter estimates of logistic regression model

Variables	Co-efficients/	Standard error	Wald	Exp ()	Probability
Constant	-7.201***	1.488	23.412	0.001	0.001
Age	0.062***	0.022	7.740	1.064	0.005
FS	0.022	0.032	0.459	1.022	0.498
EDU	0.229	0.475	0.232	1.257	0.630
HH	0.092	0.064	2.060	1.096	0.151
MVG	2.535***	0.583	18.913	12.616	0.000
Cox and Snell R Square	0.32				
Nagelkerke R Square	0.43				

*** Indicate significance of value at P=0.1

area; though the adoption curve is constantly decreasing in past years. The taste and cooking quality of the variety is still unbeatable by any other new and improved varieties cultivated in the area. But the prices in Indian wheat market fetch by the farmers are irrespective of quality. This shows that there is a need to create new markets where incentives in the form of premium price can be provided to the farmers for better quality and taste. The farmers also prefer this variety due to its flexibility to adapt to a range of sowing conditions and water availability. Whereas, the declining adoption curve of HUW 234 was observed due to the low yield of the variety as well as introduction of new and improved varieties. Keeping all the pros and cons of the variety in mind, it can be concluded that crop improvement programmes should be also promoted in the varieties preferred by the farmers on the basis of some characteristics like taste, cooking quality etc which are presently under estimated.

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