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Adoption status of various crop production practices in different rice establishment methods in Chhattisgarh

Umesh Chandra Verma, Dr. MA Khan, Dr. PK Pandey and Twinkle Handa

Abstract
One of the most significant cereal crops in the world, rice (*Oryza sativa* L.) is grown all over the world. Three rice establishing techniques are typically used in Chhattisgarh viz, transplanting method, lehi method and broadcasting method. The present study is focused to decry the Adoption status of various crop production practices in different rice establishment methods in Chhattisgarh. The study was carried out in Raipur and Balodabazar-Bhatapara district of Chhattisgarh plains among which two blocks from each district and two villages from each block were randomly selected and a total of 15 rice growers were selected from each village (5 farmers practicing broadcast brasi, 5 farmers practicing lehi and 5 farmers practicing transplanting). Data was gathered using a pre-tested interview schedule. The present study shows that total area under transplanting, lehi and broadcasting system of rice establishment was 183.94 ha, 80.50 ha and 86.75 ha respectively. Also, total area of all the respondents under rice crop were 351.19ha among which 313.85ha was under irrigated condition and 37.34ha was under rainfed condition. Swarna, mahamaya and hybrid varieties are dominant varieties in the study area in all three methods of rice establishment due to their higher yield. Maximum (59.14 q/ha) productivity was reported under transplanting method followed by lehi (50.cha) and broadcasting (40.04 q/ha) method. In reference to knowledge and adoption of various practices of rice establishment under different methods, Maximum overall knowledge index of 77.08 percent was recorded for post harvest management practices and maximum overall adoption index of 58.75 percent was recorded for seed treatment. Also, majority of the respondents in all three establishment methods had medium level of knowledge. Moreover, the overall adoption index for transplanting method was 55.20 percent followed by 49.23 percent for lehi and 47.50 percent for broadcasting with complete adoption index for overall adoption of all practices was 50.64 percent. Moreover, majority of the respondents in all three establishment methods had medium adoption level. Relationship between independent variables and extent of adoption of rice production practices in all three establishment methods shows that economic motivation, risk bearing ability, source of information and extent of knowledge was positively and significantly correlated with extent of adoption of rice production practices at 1 percent level of significance whereas productivity and credit acquisition were positively and significantly correlated with extent of adoption of rice production practices at 5 percent level of significance. The value of coefficient of determination (R2) is 66.66% which clearly reveals that 66.66% of the variations on adoption level are due to the selected variables whereas 33.34% of variation is due to environmental factors or non- selected variables.

Keywords: Rice establishment methods, rice growers, lehi, broadcasting, transplanting, adoption, knowledge

1. Introduction
Rice (*Oryza sativa* L.) is cultivated globally, being one of the most important cereal crops worldwide. It is the most staple food for about 3 billion people of the world. In Chhattisgarh, generally three rice establishment methods are practiced. Firstly, broadcast Biasi method, seeds are broadcast in a ploughed field immediately after the onset of monsoon. After about 30 to 45 days when sufficient water is impounded in the field, the fields are ploughed in the standing crop. This is generally called as Biasi or bushening. Secondly, Lehi is a method of sowing or cultivation of paddy. It is adopted in high rainfall areas. Pre germination is necessary in case of this method of sowing. Due to high rainfall broadcasting of seed as well as transplanting becomes difficult and this method was ultimately adopted by the farmers. The last and the most important and frequently followed method is Transplanting. Under this method, seeds are sown in nursery and seedlings are prepared. After 4-5 weeks the seedlings are uprooted and planted in the field which has already been prepared for the purpose. It gives highest yields.

So, the rice crop is generally established through transplanting, broadcasting, dry seeds DSR (commonly known as khurra method) and broadcasting of wet germinated seeds in puddles field (lehi method). In Chhattisgarh, the production and productivity of Rice crop can be increased by adopting suitable rice establishment method. The low level of yield indicates the lack of adoption of proper rice establishment methods which is due to lack of proper knowledge about each and every scientific method. Therefore this investigation was designed to bring light over the adoption status of various crop production practices in different rice establishment methods in Chhattisgarh.

2. Material and Methods

The study was carried out in Raipur and Balodabazar-Bhatapara district of Chhattisgarh plains among which two blocks from each district and two villages from each block were randomly selected and a total of 15 rice growers were selected from each village (5 farmers practicing broadcast brasi, 5 farmers practicing lehi and 5 farmers practicing transplanting). Data was gathered using a pre-tested interview schedule. consisting of a set of structured questions had been prepared to act as guiding hand for the investigators in collecting information which is required during the course of investigation. During the current investigation person to person interview was conducted. Data were analyzed using frequency distribution, percentage, mean, standard deviation and SPSS software. Adoption index was calculated by using a formula-

$$\text{Adoption index} = \frac{\text{Sum ofadoption scores actually obtained by the respondents}}{\text{Maximum possible obtainable adoption score by the respondents}} * 100$$

Also, Knowledge index was calculated by using a formula-

$$\text{Knowledge index} = \frac{\text{Sum of knowledge scores actually obtained by the respondents}}{\text{Maximum possible obtainable knowledge score by the respondents}} * 100$$

3. Result and Discussion

3.1 Area and yield under different rice establishment methods growing various popular varieties

Various rice varieties grown by the respondents are presented with their area under each variety and yield of each variety in table 1 and table 2.

Table 1 shows the area under different rice establishment methods growing various popular varieties. In transplanting method, 71.72 percent of the area was under swarna variety followed by mahamaya (19.63%), hybrid varieties (3.69%), MTU 1010 (2.29%), MTU 1001 (2.01%) and other varieties (0.66%). In the same manner in lehi method, 48.33 percent of the area was under mahamaya variety followed by swarna (29.65%), hybrid varieties (10.96%), MTU 1001 (5.78%), MTU 1010 (3.98%) and other varieties (1.30%). Similarly, in broadcasting method, 46.84 percent of the area was under swarna variety followed by mahamaya (35.96%), hybrid varieties (10.63%), MTU 1001 (3.22%), MTU 1010 (2.62%) and other varieties (0.72%). This result shows that swarna, mahamaya and hybrid varieties are dominant varieties in the study area which was ranked I, II and III.

Table 1: Area under different rice establishment methods growing various popular varieties

SI. No.	Popular varieties of rice	Area (in ha)			
		Transplanting	Lehi	Broadcasting	Rank
1.	Swarna	131.92 (71.72)	23.87 (29.65)	40.63 (46.84)	I
2.	Mahamaya	36.10 (19.63)	38.90 (48.33)	31.20 (35.96)	II
3.	MTU 1010	4.22 (2.29)	3.20 (3.98)	2.28 (2.623)	IV
4.	MTU 1001	3.70 (2.01)	4.65 (5.78)	2.79 (3.22)	V
5.	Hybrid varieties (6444, dhani,etc)	6.78 (3.69)	8.83 (10.96)	9.22 (10.63)	III
6.	Other varieties (Sriram, chintu, etc)	1.22 (0.66)	1.05 (1.30)	0.63(0.72)	VI
	Total	183.94	80.50	86.75	

Table 2 shows the yield of popular varieties grown under different rice establishment methods. In transplanting method, maximum (69.23 q/ha) yield was recorded for swarna variety followed by mahamaya (63.15 q/ha), hybrid varieties (68.11 q/ha), MTU 1010 (54.25 q/ha), MTU 1001 (53.16 q/ha) and other varieties (46.99 q/ha). In the same manner in lehi method, maximum (58.33 q/ha) yield was recorded for swarna variety followed by mahamaya (56.12 q/ha), hybrid varieties (54.73 q/ha), MTU 1001 (47.18 q/ha) and MTU 1010 (44.21/ha) and other varieties (41.10 q/ha). Similarly in broadcasting method, maximum (45.12 q/ha) yield was recorded under mahamaya followed by swarna (43.90 q/ha), hybrid varieties (41.18 q/ha), MTU 1010 (40.98 q/ha), other varieties (38.90 q/ha) and MTU 1001 (30.19 q/ha). This outcome clarifies that more yield is the major factor which is considered by the respondents in choosing various varieties for rice cultivation.

Table 2: Yield of popular varieties grown under different rice establishment methods

SI. No.	Popular varieties of rice	Yield (q/ha)			
		Transplanting	Lehi	Broadcasting	Rank
1.	Swarna	69.23	58.33	43.90	I
2.	Mahamaya	63.15	56.12	45.12	II
3.	MTU 1010	54.25	44.21	40.98	IV
4.	MTU 1001	53.16	47.18	30.19	V
5.	Hybrid varieties (6444, dhani, etc)	68.11	54.73	41.18	III
6.	Other varieties (Sriram, chintu, etc)	46.99	41.10	38.90	VI
	Average yield	59.14	50.27	40.04	

3.2 Productivity

The productivity of paddy in various rice establishment methods was calculated in q/ha and presented in table 3. This shows that there was maximum (59.14 q/ha) productivity reported in transplanting method with minimum and maximum productivity as 37.05 q/ha and 70.16 q/ha respectively followed by lehi (50.27 q/ha) with minimum and maximum productivity as 34.58 q/ha and 56.81 q/ha respectively and broadcasting (40.04 q/ha) with minimum and maximum productivity as 27.17 q/ha and 44.46 q/ha respectively. This outcome reveals that transplanting system of rice establishment method dominates the other two methods in terms of productivity.

Table 3: Productivity of paddy in various rice establishment methods

SI. No.	Rice establishment method	Minimum productivity (q/ha)	Maximum productivity (q/ha)	Productivity (q/ha)
1.	Transplanting	37.05	70.16	59.14
2.	Lehi	34.58	56.81	50.27
3.	Broadcasting	27.17	44.46	40.04

3.3 Extent of Knowledge about rice establishment method

Any person's adoption level is directly related to their knowledge level. As knowledge level rises, adoption level rises as well, and the gap between technologies narrows. Table 4 shows that the maximum overall knowledge index of 77.08 percent was recorded for post harvest management practices with 79.37 percent of knowledge index for transplanting method, 73.75 percent of knowledge index for lehi method and 78.12 percent knowledge index for broadcasting method followed by land preparation with overall knowledge index of 75.00 percent under which 79.37 percent of knowledge index for transplanting method, 75.62 percent of knowledge index for lehi method and 70.00 percent knowledge index for broadcasting method, seed rate with overall knowledge index of 74.37 percent under which 76.87 percent of knowledge index for transplanting method, 81.25 percent of knowledge index for lehi method and 65.00 percent for knowledge index broadcasting method, disease management with overall knowledge index of 71.66 percent under which 72.50 percent of knowledge index for transplanting method, 71.87 percent of knowledge index for lehi method and 70.62 percent knowledge index for broadcasting method, insect management with overall knowledge index of 68.95 percent under which 85.62 percent of knowledge index for transplanting method, 62.50 percent of knowledge index for lehi method and 58.75 percent knowledge index for broadcasting method, seed sowing with overall knowledge index of 66.87 percent under which 67.50 percent of knowledge index for transplanting method, 66.87 percent of knowledge index for lehi method and 66.25 percent knowledge index for broadcasting method, weed management with overall knowledge index of 64.37 percent under which 79.37 percent of knowledge index for transplanting method, 58.12 percent of knowledge index for lehi method and 55.62 percent knowledge index for broadcasting method, irrigation management with overall knowledge index of 63.75 percent under which 76.87 percent of knowledge index for transplanting method, 58.75 percent of knowledge index for lehi method and 55.62 percent knowledge index for broadcasting method, harvesting and drying with overall knowledge index of 62.29 percent under which 67.50 percent of knowledge index for transplanting method, 54.37 percent of knowledge index for lehi method and 65.00 percent knowledge index for broadcasting method and nutrient management with overall knowledge index of 60.62 percent under which 82.50 percent of knowledge index for transplanting method, 60.00 percent of knowledge index for lehi method and 39.37 percent knowledge index for broadcasting method.

Table 4: Distribution of respondents according to their extent of knowledge

(n=120)

Sl. No.	Paddy cultivation practices	Knowledge index about different rice establishment methods (%)			
		Transplanting	Lehi	Broadcasting	Overall knowledge index
1.	Land preparation	79.37	75.62	70.00	75.00
2.	Seed rate	76.87	81.25	65.00	74.37
3.	Seed sowing	67.50	66.87	66.25	66.87
4.	Nutrient Management	82.50	60.00	39.37	60.62
5.	Weed management	79.37	58.12	55.62	64.37
6.	Insect management	85.62	62.50	58.75	68.95
7.	Disease management	72.50	71.87	70.62	71.66
8.	Irrigation management	76.87	58.75	55.62	63.75
9.	Harvesting and drying	67.50	54.37	65.00	62.29
10.	Post harvest management	79.37	73.75	78.12	77.08
	Overall Knowledge Index	74.87	66.87	63.75	68.50

Also, table 5 indicates that in transplanting method, majority (60.00%) of the respondents had medium knowledge level followed by high (30.00%) and low (10.00%) knowledge level. Similarly in lehi method, majority (67.50%) of the respondents had medium knowledge level followed by high (17.50%) and low (15.00%) knowledge level. In the same manner for broadcasting method, majority (55.00%) of the respondents had medium knowledge level followed by low (30.00%) and high (15.00%) knowledge level. This outcome makes it clear that the primary cause of the technological gap is the lack of complete knowledge transformed at the grassroots level. The results were similar with the results of Sowjanya Cheruku (2016) [8] and Khatik *et al.* (2012) [5].

Table 5: Distribution of respondents according to their overall knowledge level

(n=120)

SI. No.	Category	Transplanting (n=40) F (%)	Lehi (n=40) F (%)	Broadcasting (n=40) F (%)
1.	Low knowledge level (< 25 score)	4 (10.00)	6 (15.00)	12 (30.00)
2.	Medium knowledge level (25- 30 score)	24 (60.00)	27 (67.50)	22 (55.00)
3.	High knowledge level (> 30 score)	12 (30.00)	7 (17.50)	6 (15.00)

$\bar{X}$=27.40 $\sigma = 2.72$

3.4 Extent of adoption of rice production practices in different establishment method

The ultimate result a researcher should achieve is the adoption of any technology. Without the full use of the technologies developed through that research, that research endeavour is incomplete. Table 6 shows that the maximum overall adoption index of 58.75 percent was recorded for seed treatment with 62.50 percent of adoption index for transplanting method, 61.25 percent of adoption index for lehi method and 52.50 percent adoption index for broadcasting method followed by post harvest management practices with overall adoption index of 56.25 percent under which 61.87 percent of adoption index for transplanting method, 56.87 percent of adoption index for lehi method and 50.00 percent adoption index for broadcasting method, insect management with overall adoption index of 55.41 percent under which 63.75 percent of adoption index for transplanting method, 52.50 percent of adoption index for lehi method and 50.00 percent adoption index for broadcasting method, disease management with overall adoption index of 50.62 percent under which 54.37 percent of adoption index for transplanting method, 49.37 percent of adoption index for lehi method and 48.12 percent adoption index for broadcasting method, harvesting methods with overall adoption index of 49.58 percent under which 55.00 percent of adoption index for transplanting method, 49.37 percent of adoption index for lehi method and 44.37 percent adoption index for broadcasting method, weed management with overall adoption index of 47.70 percent under which 60.62 percent of adoption index for transplanting method, 44.37 percent of adoption index for lehi method and 38.12 percent adoption index for broadcasting method, irrigation management with overall adoption index of 47.70 percent under which 53.75 percent of adoption index for transplanting method, 44.37 percent of adoption index for lehi method and 45.00 percent adoption index for broadcasting method, land preparation with overall adoption index of 46.45 percent under which 55.00 percent of adoption index for transplanting method, 47.50 percent of adoption index for lehi method and 36.87 percent adoption index for broadcasting method and nutrient management with overall adoption index of 43.33 percent under which 52.00 percent of adoption index for transplanting method, 45.00 percent of adoption index for lehi method and 32.50 percent adoption index for broadcasting method. The overall adoption index for transplanting method was 55.20 percent followed by 49.23 percent for lehi and 47.50 percent for broadcasting with complete adoption index for overall adoption of all practices was 50.64 percent.

Table 6: Distribution of respondents according to their extent of adoption in different establishment method

Sl. No.	Paddy cultivation practices	Adoption index in different rice establishment methods (%)			
		Transplanting	Lehi	Broadcasting	Overall adoption index
1.	Land preparation	55.00	47.50	36.87	46.45
2.	Seed treatment	62.50	61.25	52.50	58.75
3.	Nutrient Management	52.50	45.00	32.50	43.33
4.	Weed management	60.62	44.37	38.12	47.70
5.	Insect management	63.75	52.50	50.00	55.41
6.	Disease management	54.37	49.37	48.12	50.62
7.	Irrigation management	53.75	44.37	45.00	47.70
8.	Harvesting	55.00	49.37	44.37	49.58
9.	Post harvest management	61.87	56.87	50.00	56.25
	Overall adoption index	55.20	49.23	47.50	50.64

Also, Data pertaining to table 7 indicates that in transplanting method, majority (55.00%) of the respondents had medium adoption level followed by low (25.00%) and high (20.00%) adoption level. Similarly in lehi method, majority (60.00%) of the respondents had medium adoption level followed by low (30.00%) and high (10.00%) adoption level. In the same manner for broadcasting method, majority (47.50%) of the respondents had medium adoption level followed by low (42.50%) and high (10.00%) adoption level. This outcome shows that the respondents had medium to low adoption level which is the major cause of technological gap at grass root level. The results were similar with the results of Rath *et al.* (2017) [6].

Table 7: Distribution of respondents according to their overall adoption level

(n=120)

SI. No.	Category	Transplanting (n=40) F (%)	Lehi (n=40) F (%)	Broadcasting (n=40) F (%)
1.	Low adoption level (< 16 score)	10 (25.00)	12 (30.00)	17 (42.50)
2.	Medium adoption level (16-20 score)	22 (55.00)	24 (60.00)	19 (47.50)
3.	High adoption level (> 20 score)	8 (20.00)	4 (10.00)	4 (10.00)

$\bar{X}$=18.21 $\sigma = 2.21$

3.5 Effect of various independent variables over extent of adoption of rice production practices

Karl Pearson's Correlation (r) analysis between independent variables and extent of adoption of rice production practices for different rice establishment methods in Table 8 shows that for transplanting method of rice establishment land holding, economic motivation, risk bearing ability, source of information and extent of knowledge was positively and significantly correlated with extent of adoption of rice production practices at 1 percent level of significance whereas productivity and credit acquisition were positively and significantly correlated with extent of adoption of rice production practices at 5 percent level of significance. Similarly, in case of lehi method of rice establishment economic motivation, risk bearing ability, source of information and extent of knowledge was positively and significantly correlated with extent of adoption of rice production practices at 1 percent level of significance whereas land holding, productivity and credit acquisition were positively and significantly correlated with extent of adoption of rice production practices at 5 percent level of significance. In the same way, in case of broadcasting method of rice establishment economic motivation, risk bearing ability, source of information and extent of knowledge was positively and significantly correlated with extent of adoption of rice production practices at 1 percent level of significance whereas land holding, productivity and credit acquisition were positively and significantly correlated with extent of adoption of rice production practices at 5 percent level of significance. Education, farming experience, material possession, irrigation availability and annual income were non- significant with extent of adoption of rice production practices.

Table 8: Correlation co-efficient between extent of adoption and independent variables of the respondents

(n=120)

SI. No.	Independent variables	Correlation coefficient (r)		
		Transplanting	Lehi	Broadcasting
1.	Education	0.043	0.032	0.039
2.	Farming experience	0.078	0.078	0.052
3.	Material possession	0.089	0.096	0.033
4.	Land holding	0.413**	0.215*	0.311*
5.	Irrigation availability	0.052	0.056	0.031
6.	Annual income	0.035	0.065	0.072
7.	Productivity	0.332*	0.421**	0.311*
8.	Credit acquitisation	0.242*	0.233*	0.212*
9.	Economic motivation	0.594**	0.321**	0.218*
10.	Risk bearing ability	0.664**	0.589**	0.489**
11.	Source of information	0.416**	0.387**	0.411**
12.	Extent of knowledge	0.587**	0.611**	0.689**

**Significance at 0.01 probability level: * Significant 0.05 probability level.

4. Conclusion

Various conclusions drawn through above findings indicates that total area under transplanting, lehi and broadcasting system of rice establishment was 183.94 ha, 80.50 ha and 86.75 ha respectively. Total area of all the respondents were 351.19 ha among which 313.85 ha was under irrigated condition and 37.34 ha was under rainfed condition. Swarna, mahamaya and hybrid varieties are dominant varieties in the study area in all three methods of rice establishment. Also, Swarna, mahamaya and hybrid varieties had more yield in all three methods of rice establishment as compared to other varieties grown by the respondents. Maximum (59.14 q/ha) productivity was reported under transplanting method followed by lehi (50.27 q/ha) and broadcasting (40.04 q/ha) method. Moreover, maximum overall knowledge index of 77.08 percent was recorded for post harvest management practices. Also, majority of the respondents in all three establishment methods had medium level of knowledge. Maximum overall adoption index of 58.75 percent was recorded for seed treatment and minimum overall index of 43.33 percent was recorded for nutrient management. Also, the overall adoption index for transplanting method was 55.20 percent followed by 49.23 percent for lehi and 47.50 percent for broadcasting with complete adoption index for overall adoption of all practices was 50.64 percent. Moreover, majority of the respondents in all three establishment methods had medium adoption level. In all three methods of rice establishment, economic motivation, risk bearing ability, source of information and extent of knowledge was positively and significantly correlated with extent of adoption of rice production practices at 1 percent level of significance whereas productivity and credit acquatisation were positively and significantly correlated with extent of adoption of rice production practices at 5 percent level of significance. The value of coefficient of determination (R2) is 66.66% which clearly reveals that 66.66% of the variations on adoption level are due to the selected variables whereas 33.34% of variation is due to environmental factors or non- selected variables.

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