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IMPACT OF "BRINGING GREEN REVOLUTION OF EASTERN INDIA" IN CHHATTISGARH

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A B S T R A C T

To assess the impact of Bringing Green Revolution of Eastern India (BGREI) in different agro-ecological situations namely: rainfed uplands, rainfed low lands (shallow low land) and irrigated rice (hybrid, traditional), the present study has been under taken in Bilaspur, Bastar and Raipur districts of Chhattisgarh. The study was based on both secondary and primary data, collected from the officials of state, districts and blocks as well as selected rice growers. The data recorded agricultural years 2010-11 and 2011-12. Findings revealed that the BGREI programme implemented in Chhattisgarh gave positive impact on dissemination of modern technologies of farmers' field, increased cropping intensity and minimized the yield gap between potential and actual yield of paddy. There is still wide scope for further improvement in the cropping intensity and productivity of paddy in the area under study. Persisted situation calls for more efficient action for diffusion of up to date technologies to farmers' field so that the cropping intensity of farmers' field and yield of paddy can be increased in Chhattisgarh State.

Keywords: Impact, green revolution, eastern India, Chhattisgarh

INTRODUCTION

The program of Bringing Green Revolution to Eastern India (BGREI) was launched in the year 2010-11 in seven (7) States of Eastern India namely; Assam, Bihar, Chhattisgarh, Jharkhand, Eastern Uttar Pradesh, Orissa and West Bengal based on strategic action plans developed by these States (Government of India, 2010-11). The objective of the programme is to increase the productivity of rice based cropping system in the resource rich eastern region by intensive cultivation through promotion of recommended agricultural technology and package of practices by addressing the underlying constraints of different agro-climatic sub regions. Most of the activities taken up under BGREI program during 2010-11 were short-term strategies. The program for 2011-12 include a bouquet of three broad categories of interventions viz. (i) Block demonstrations of rice and wheat; (ii) Asset building activities for water conservation & utilization; such as construction of shallow tube wells, dug well/bore wells and distribution of pump sets, drum seeders, Zero till seed drills and (iii) Site Specific Activities for facilitating the petty works such as construction/renovation of field/irrigation channels/electric power supply for agriculture purposes and institution building for inputs supply (Sharma, 2012).

In 2011-12, in order to sustain the productivity gain in major cereals, focus crops namely; rice & wheat were identified and a total of 269 block demonstration of rice, each of 1000 hectares has been proposed to be implemented in the five agro-ecological sub-regions namely; rainfed uplands, rainfed low lands (shallow low land, medium deep water, deep water) and irrigated rice (traditional, hybrid). The objective of the demonstration is to improve agronomy as a whole i.e. enhancement of seed replacement rate, field sanitation, promote line sowing/planting coupled with promotion of plant nutrient and plant protection technologies. It is proposed to promote hybrid rice technologies in 40 units of 1,000 hectares each. Every farmer in these units would be encouraged to take up at least 0.40 hectare under hybrid rice (Government of India, 2010-11). The programme has completed two years of implementation in 2011-12 i.e. terminal year of Eleventh Five Year Plan. It is now peak time to conduct

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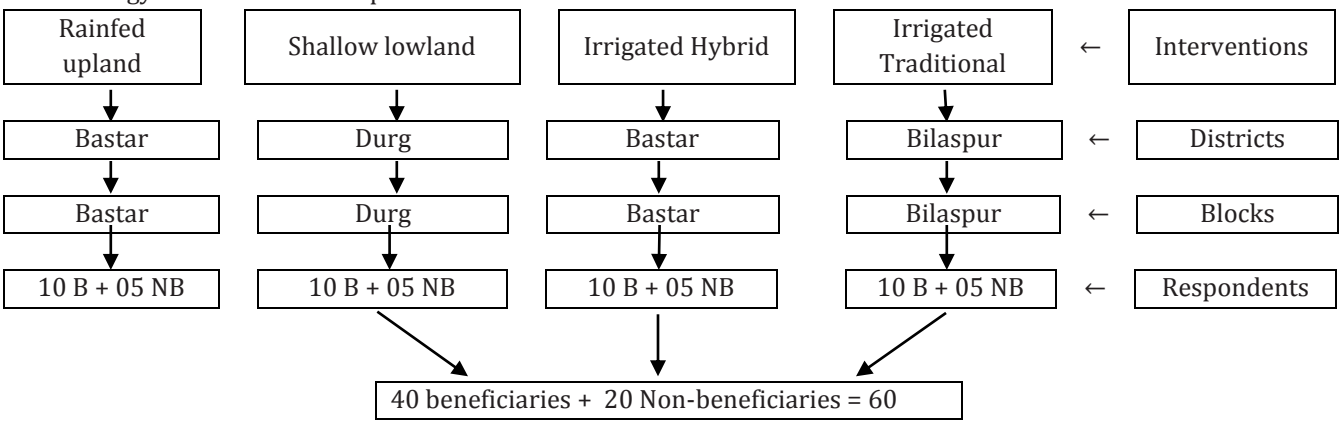
the study, to assess the actual performance of the programme during the period of its implementation both at the macro as well as micro levels. This will help the concerned states to devise the strategic action plans in conformity with the identified constraints at the grass root level. The study was undertaken keeping up the following objectives in mind.

- To assess the access of the participating farmers to technical backstopping through performance index.
- To analyse the extent of change in cropping pattern, cropping intensity and yield gap.
- To evaluate the perception status of the farmer.

MATERIALS AND METHODS

To evaluate the performance of BGREI, all the social and economic parameters have been taken into consideration by conducting intensive survey in the different locations of the State. The study was mainly based on the secondary and primary data. The secondary data were collected from the state, district and block officials from their published and unpublished records, whereas the primary data were collected from the sampled farmers'/ stake holders in order to capture grass root level impact of the programme. In order to capture grass root level response from the farmers' about the programme a three stage sampling technique was used for selection of sample units from 3 agro-ecological sub regions namely rainfed uplands, rainfed low lands (shallow low land) and irrigated rice (hybrid, traditional). At the first stage of sampling, Bastar, Durg, Bastar and Bilaspur districts were selected from rainfed upland, shallow low land, irrigated rice (hybrid) and irrigated rice (traditional) respectively, considering the concentration of demonstrations in the district. In the second stage, Bastar, Durg, Bastar and Bilaspur blocks representative of block demonstration were selected following the same procedure. In the third stage, a total of 10 beneficiaries and 5 non-beneficiaries were selected at random from each selected blocks. In sum, a total of 40 beneficiaries and 20 non-beneficiaries spread over 4 selected districts were covered in the study as depicted below:

Methodology for selection of respondents.



The primary data were collected using pre tested interview schedule from the respondents and analysed with respect to related objectives with statistical tools using MS Excel viz. yield gap, Rho value mean, percentage, whereas Rho value has been used to test of homogeneity of sample farmer (Table-1).

Test of homogeneity of the sample farmers (Beneficiary Vs. Non-beneficiary) was worked out, which indicates that Rho value for level of education was maximum (0.66) under irrigated hybrid followed by irrigated traditional (0.53) and rainfed upland (0.34). The overall Rho value for level of education in the State was 0.56. The Rho value for size of land holding was the highest under irrigated hybrid (0.50) followed by irrigated traditional (0.35) whereas this value was minimum (0.05) under rainfed upland as well as shallow low land. The Rho value of the State for size of land holding was 0.80. Hence, the sample farmer related to beneficiary and non-beneficiary of all the location were found homogeneous in nature except the respondents of Rainfed upland District Baster and shallow low land District Durg. The performance index was analysed to assess the technical backstopping of participating farmers with the help of following formula:

Performance Index (%) = (Number of Farmers reporting technical backstopping by different agencies /Total number of farmers) X 100.

Table 1. Test of homogeneity of the sample farmers (Beneficiary vs. Non-beneficiary)

S. No.	Particulars	Rho Value	Remarks
	Rainfed Upland: District: Baster		
1.	Level of education	0.34	Heterogeneous
2.	Size of land holding	0.05	Heterogeneous
	Shallow Low Land: District: Durg		
1.	Level of education	0.20	Heterogeneous
2.	Size of land holding	0.05	Heterogeneous
	Irrigated Hybrid : Baster		
1.	Level of education	0.66	Homogeneous
2.	Size of land holding	0.50	Homogeneous
	Irrigated Traditional : Bilaspur		
1.	Level of education	0.53	Homogeneous
2.	Size of land holding	0.35	Homogeneous
	State: Chhattisgarh		
1.	Level of education	0.56	Homogeneous
2.	Size of land holding	0.80	Homogeneous

Source: Field Survey

RESULTS AND DISCUSSION

The impact of Bringing Green Revolution of Eastern India Programme has been analyse in the light of technical backstopping, extent analyse in cropping pattern, cropping intensity and yield gap and perception status of the farmers.

Technical Backstopping: The farmers growing rainfed upland rice recorded maximum technical backstopping for various operations by identified extension workers except micro nutrient which was provided by progressive farmers to about 50 per cent farmers. Krishi Vigyan Kendra (KVK) did not provide any technical backstopping for seed treatment and plant protection and it was found minimum for direct seeding as well as weed management. Farmers cultivating rice under shallow lowland in Durg obtained considerably more technical backstopping supervised by identified extension workers.

It was nil for land preparation and weed management by progressive farmers and for micro nutrient by KVK. The number of farmers benefited by progressive farmers and KVK were found almost similar. The technical backstopping provided by identified extension workers for growing irrigated hybrid rice in Bastar was significantly higher than the farmers benefited by progressive farmers or KVK. The farmers coordinated by progressive farmers and monitored by KVK were found nearly same. The data recorded in Bilaspur district for the farmers growing irrigated traditional rice also indicated similar trend as noted in Bastar and Durg districts. The identified extension workers gave appreciably higher technical backstopping as compared to progressive farmers and KVK.

Table 2. Access of the participating farmers to technical backstopping.

Technical backstopping	Farmers Reporting			Performance Index (%)		
	Coordinated by progressive farmers	Supervised by identified extension worker	Monitored by KVK	Progressive farmer	Identified extension worker	KVK
	Rainfed Upland: District: Baster					
Land preparation	1	7	2	10	70	20
Sowing/planting	2	6	2	20	60	20
Direct seeding	0	9	1	00	90	10
Seed treatment	3	7	0	30	70	00
Micro nutrient	5	2	3	50	20	30
Weed management	1	8	1	10	80	10
Plant protection	3	7	0	30	70	00

Shallow Low Land: District: Durg						
Land preparation	0	8	2	00	80	20
Sowing/planting	2	7	1	20	70	10
Direct seeding	4	5	1	40	50	10
Seed treatment	3	5	2	30	50	20
Micro nutrient	1	9	0	10	90	00
Weed management	0	8	2	00	80	20
Plant protection	1	7	2	10	70	20
Irrigated Hybrid : Baster						
Land preparation	1	7	2	10	70	20
Sowing/planting	3	6	1	30	60	10
Direct seeding	0	7	3	00	70	30
Seed treatment	2	8	0	20	80	00
Micro nutrient	4	5	1	40	50	10
Weed management	0	8	2	00	80	20
Plant protection	1	6	3	10	60	30
Irrigated Traditional : Bilaspur						
Land preparation	1	7	2	10	70	20
Sowing/planting	3	7	0	30	70	00
Direct seeding	3	6	1	30	60	10
Seed treatment	2	6	2	20	60	20
Micro nutrient	0	7	3	00	70	30
Weed management	0	9	1	00	90	10
Plant protection	1	5	4	10	50	40
State: Chhattisgarh						
Land preparation	3	29	8	7.5	72.5	20
Sowing/planting	10	26	4	25.0	65.0	10
Direct seeding	7	27	6	17.5	67.5	15
Seed treatment	10	26	4	25.0	65.0	10
Micro nutrient	10	23	7	25.0	57.5	17.5
Weed management	1	33	6	2.5	82.5	15
Plant protection	6	25	9	15.0	62.5	22.5

Source: Field Survey

There was no technical backstopping for micro-nutrient and weed management by progressive farmers and for sowing/ planting by KVK. This might be due to the communication gap between the progressive farmers/ KVK and participating farmers. Hence, efforts should be made to disseminate the technology in local language.

The data recorded on access of the participating farmers to technical backstopping in Chhatisgarh State indicated that performance index of the identified extension workers varies from 62.5 to 82.5 was significantly higher than the progressive farmers (2.5% - 25%) and KVK (10 – 22%) in different technical backstopping. The coordination by progressive farmers was very low for weed management (1) and land preparation (3). The total numbers of the participating farmers coordinated by progressive farmers and monitored by KVK were found nearly similar (Table-2).Thus, it is clear that identified extension workers followed by progressive farmer and the scientists of KVKs were found to be the best sources for dissemination of information and technology in BGREI programme. The similar findings were also quoted by Dangi *et al.* (2004).

Cropping Pattern: Paddy is the major crop of Chhattisgarh growing during kharif and summer season followed by gram in rabi season (Table 3). The area under paddy crop grown by beneficiary as well as non-beneficiary farmers under rainfed upland as well as irrigated hybrid in Bastar district was considerably increased during the year 2011-12 compared to 2010-11.

Table 3. Change in cropping pattern of the sample farmers

Seasons/Crops	Area (ha) under crops				Extent of change (%) over the year 2010-11	
	Beneficiary		Non-beneficiary		Beneficiary	Non-beneficiary
	2010-11	2011-12	2010-11	2011-12	2011-12	2011-12
Rainfed Upland: District: Baster						
Kharif						
Paddy	13.0	45.6	5.7	10.2	32.5 (249.43)	4.5 (78.95)
Rabi						
Summer						
Paddy	0.0	4.0	0.0	0.0	4.0 (0.00)	0.0 (0.00)
Shallow Low Land: District: Durg						
Kharif						
Paddy	14.6	44.0	6.7	7.5	29.4 (201.37)	0.8 (11.94)
Rabi						
Gram	0.0	3.8	0.0	0.0	3.8 (0.00)	0.0 (0.00)
Tevda	0.0	0.0	0.0	2.0	0.0 (0.00)	2.0 (0.00)
Summer						
Paddy	0.0	25.5	0.0	0.0	25.5 (0.00)	0.0 (0.00)
Irrigated Hybrid : Baster						
Kharif						
Paddy	12.1	36.2	7.0	3.6	24.0 (197.45)	-3.4 (-48.57)
Rabi						
Summer						
Paddy	0.0	0.0	0.0	0.0	0.0 (0.00)	0.0 (0.00)
Irrigated Traditional : Bilaspur						
Kharif						
Paddy	23.0	35.1	12.9	15.6	12.1 (52.61)	2.7 (20.93)
Rabi						
Summer						
Paddy	15.6	26.5	8.5	12.6	10.9 (69.87)	4.1 (48.24)
State: Chhattisgarh						
Kharif						
Paddy	62.8	160.9	32.3	36.9	98.0 (156.13)	4.6 (14.24)
Rabi						
Gram	0.0	3.8	0.0	0.0	3.8 (0.00)	0 (0.00)
Tevda	0.0	0.0	2.0	0.0	0 (0.00)	-2 (-100.00)
Summer						
Paddy	15.6	56.0	8.5	12.6	40.4 (259.55)	4.1 (48.24)

Source: Field Survey Figure in parenthesis shows the percentage change over 2010-11

The extent of change in area was found to be noticed 32.5 and 4.5 ha under rainfed upland in 2011-12 over the year 2010-11 in case of beneficiary and non-beneficiary farmers respectively where as it was 24.03 and 3.4 ha under irrigated hybrid. None of the farmers found to be cultivating summer paddy under rainfed upland in the year 2010-11. Sample farmers did not grow irrigated hybrid paddy during rabi and summer season. The area of paddy cultivated under shallow low land in Durg district appreciably increased during 2011-12 as compared to 2010-11 in kharif as well as summer seasons. The extent of change was recorded to be 201.08 % (29.4 ha) & 11.94% (0.8 ha) during kharif and 25.5 ha & 0.0 ha during summer season in case of beneficiary and non-beneficiary farmers respectively. Beneficiary farmers did not grow gram crop during 2010-11 and it was increased by 3.8 hectare in 2011-12.The noticeable increase in the area of irrigated traditional paddy of Bilaspur was also recorded during the year 2011-12 in kharif and summer season. An extent of change in area during 2011-12 was noticed to be 52.61% (12.1 ha) & 20.93% (2.7 ha) in kharif and 69.87% (10.9 ha) & 48.24% (4.1 ha) in summer season in case of beneficiary and non-beneficiary farmers respectively. The data recorded on the change in cropping pattern of the sample farmers of Chhattisgarh State showed that the area under paddy crop increased considerably during 2011-12 as compared to 2010-11 in kharif as well as summer season. The extent of change recorded was 156.13% (98.0 ha) & 14.24% (4.6 ha) in kharif and 259.55% (40.4 ha) & 48.24% (4.1 ha) in summer season in case of beneficiary and non-beneficiary farmers, respectively. Area under gram crop remained constant in case of beneficiary farmers.

Thus, it is clear from the above that after the implementation of BGREI programme in the state, the area under HYVs and Hybrid paddy have been increased up to 156.13 and 14.25 per cent in case of beneficiary and non-beneficiary farmers' respectively. The Beneficiary farmers' took more advantage of the programme as compared to non-beneficiary farmers. This might be due to the fact that they were in direct contact with extension workers and took advantage of subsidized inputs.

The non-beneficiaries took more time to adopt a particular technology as compared to beneficiary farmers. The impact of this programme may be seen in long run when the advantages of technologies will be observed by seeing and believing.

Cropping Intensity: The cropping intensity of the beneficiary and non-beneficiary farmers under irrigated hybrid and non-beneficiaries under rainfed upland remained unchanged while slight increase of 9 per cent was observed in case of beneficiary under rainfed upland in the year 2011-12 over the year 2010-11 (Table 4).

Table 4. Extent of change in cropping intensity

Type of farmers	Cropping intensity		Extent of change (%)	% change over the year 2010-11
	2010-11	2011-12		
Rainfed Upland: District:Baster				
Beneficiary	100	109	9	9.00
Non-beneficiary	100	100	0	0.00
Shallow Low Land: District: Durg				
Beneficiary	100	167	67	67.00
Non-beneficiary	100	127	27	27.00
Irrigated Hybrid : Baster				
Beneficiary	100	100	0	0.00
Non-beneficiary	100	100	0	0.00
Irrigated Traditional : Bilaspur				
Beneficiary	167	175	8	4.79
Non-beneficiary	166	181	15	9.04
State: Chhattisgarh				
Beneficiary	125	137	12	9.60
Non-beneficiary	132	134	2	1.52

Source: Field Survey

The cropping intensity considerably increased under shallow low land in Durg district, which was 167 per cent (2011-12) and 127 per cent (2011-12) showing the extent of change by 67 per cent and 27 per cent in case of beneficiary and non-beneficiary farmers respectively (Table 4).

The cropping intensity of the irrigated traditional paddy in Bilaspur district was apparently higher than other district during both the years, it was 167 & 166 per cent during 2010-11 and 175 & 181 per cent during 2011-12 and extent of change was found to be 8 & 15 per cent in case of beneficiary and non-beneficiary farmers respectively. The overall increase in cropping intensity was not so remarkable with beneficiary as well as non-beneficiary farmers in the State (Table 4). At overall level the intensity of crop found to be increased by 9.60 per cent in beneficiary farmers due to excellent efforts of the extension agencies. Very meager increase of 1.52 per cent was found in non-beneficiary farmers. It shows there are possibilities to bring more and more area under cultivation of crop in the area under study. Hence, efforts should be made to explore the possibilities to bring more area in cultivation of crop in the state.

Yield Gap: The data on extent of yield gap of paddy has been recorded for the year 2011-12 in Table 5. The actual yield of paddy (3852 Kg/ha) found to be obtained by the beneficiary farmers was little lesser than the potential yield (4500 Kg /ha) in rainfed upland of Bastar but it was found low (2363 Kg /ha) than non-beneficiary farmers indicating the considerably higher yield gap of 2137 Kg /ha.

The actual yield of irrigated hybrid paddy with beneficiary farmers in Bastar district was found to be recorded as 4500 Kg/ha of its potential yield showing the yield gap only of 250 Kg/ha but it was higher (1417 Kg/ha) than non-beneficiary farmers who have obtained the actual yield of 3333 Kg/ha, which was found remarkably low than the potential yield (4750 Kg/ha). The actual yield of paddy (3891 Kg/ha) recorded in shallow low land by beneficiary farmers of Durg district was also found lesser than its potential yield (4450 Kg/ha) indicating the yield gap of 559 Kg/ha but this yield gap was noticeably high (1308 Kg/ha) than non-beneficiary farmers, who received actual yield of 3142 Kg/ha (Table 5).

Table 5. Extent of yield gap of paddy (Yield in Kg/ha).

Agro-Ecological Regions	Districts	Potential Yield	Actual Yield		Yield Gap	
			Beneficiary	Non-Beneficiary	Beneficiary	Non-Beneficiary
Rainfed Upland	Baster	4500	3852	2363	-648 (-14.40)	-2137 (-47.49)
Shallow Low land	Durg	4450	3891	3142	-559 (-12.56)	-1308 (-29.39)
Irrigated Hybrid	Baster	4750	4500	3333	-250 (-5.26)	-1417 (-29.83)
Irrigated Traditional	Bilaspur	4550	4348	4119	-202 (-4.44)	-431 (-9.47)
Chhattisgarh State		4563	4148	3239	-697 (-15.28)	-2281 (-49.99)

Source: Field Survey Figure in parenthesis shows the percentage gap to potential yield

The beneficiary farmers growing irrigated traditional paddy in Bilaspur obtained the actual yield of 4348 Kg/ha which was found to be slightly lesser than its potential yield (4550 Kg/ha) and showed the yield gap of 202 Kg/ha. The actual yield obtained by non-beneficiary farmers (4119 Kg/ha) was found to be quite satisfactory indicating the lesser yield gap (431 Kg/ha) than other districts (Table 5). The extent of yield gap of paddy in Chhattisgarh was found to be comparatively low (697 Kg/ha) of beneficiary farmers than non-beneficiary farmers (2281 Kg/ha). The actual yield of paddy in the State was found to be 4148 Kg/ha and 3239 Kg/ha, respectively of beneficiary and non-beneficiary farmers as against its potential yield of 4563 Kg/ha.

Thus, it is clear that in all the situations the implementation of the programme narrowed down yield gap between potential and actual yield of paddy. Finally at overall level the yield gap narrowed up to 50 per cent in the year only respectively at non-beneficiary and beneficiary farmers' field. Bhandari *et al.* (2003) also found similar findings for rice wheat experiment.

Perception Profiling: Perception profiling of the

beneficiary also prepared to evaluate the perception status of the farmers on various aspects and presented in table 6 which indicated that adequate supply of inputs and BGREI programme was found to be high. As regards suggestions for improvement, supply of more inputs and technical guidance available got high rating.

Table 6. Perception profiling of the beneficiary

Particulars	As perceived by the beneficiary(%)	Perception status/Remarks
1. Supply of inputs		
Adequate	95.00	Adequate supply of inputs got very high rating
Inadequate	5.00	
2. Rating BGREI		
Poor	2.50	Good rating of BGREI programme is high
Average	42.50	
Good	55.00	
3. Suggestions for improvements		
Provide modern implements	55.00	Supply of more inputs got high rating
Supply of more inputs	45.00	
4. Technical guidance available from SDA/KVK/SAU/CRRI		
Yes	100	Technical guidance available got high rating
No	00	
5. Who guided the best technical guidance		
SDA	87.50	Provision of technical guidance received from SDA got very high rating
KVK	-	
NGO	10.00	
CRRI	-	
ADO	-	
RAEO	2.50	
Progressive farmers	-	
6. Expectation of the farmers		
In-time supply of inputs	80	Expectation of the farmers regarding timely supply of input got very high rating
Technical guidance	20	
7. Problems in supply/availability of inputs		
Yes	67.50	Problem in supply/availability of inputs is high rating
No	32.50	
8. Preference for source of inputs		
Direct from input dealer	12.50	According to preference regarding source of inputs, Cooperative society got very high rating
Cooperative society	77.50	
Agril. Dept. outlets	10	
9. Faced problem in marketing of produce		
Lack of buyer	53.30	Lack of buyer got high rating regarding problem in marketing of produce
Low price	46.60	
10. Price received (Rs./q) in 2011-12		
	1180	More than the MSP
11. BGREI cultural practices will be followed next season		
Yes	100	BGREI cultural practices will be followed by the farmers in next season got very high rating
No	00	
12. If BGREI cultural practices will not be followed, the reasons		
Lack of proper guidance	50.00	Lack of proper guidance and not different from conventional practices are the two reasons got high rating for not following cultural practices as received from BGREI programme
Not different from conventional practices	50.00	

Source: Field Survey

Provision of technical guidance received from State Designated Agency (SDA) and expectations of the farmers regarding timely supply of input got very high rating. According to performance regarding source of

inputs, cooperative society got very high rating whereas problem in supply/ availability of inputs had high rating. As regarding problem in marketing of produce, lack of buyer got high rating followed by low price of produce received (Rs/q) but it was more than the Minimum Support Price (MSP). All the farmers assumed to follow cultural practices recommended by BGREI in the next season, and got very high rating. If the cultural practices recommended by BGREI will not be followed, the reasons will be lack of proper guidance and not different from conventional practices got high rating.

CONCLUSION AND RECOMMENDATIONS

The BGREI programme implemented in Chhattisgarh gave positive impact on dissemination of modern technologies of farmers' field, increased cropping intensity and narrowed down the yield gap between potential and actual yield of paddy. There is still wide scope for further improvement in the cropping intensity and productivity of paddy in the area under study. This calls for more efficient action for diffusion of up to date technologies to farmers' field in local language so that the cropping intensity of farmers' field and yield of paddy can be increased in Chhattisgarh State.

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