Information quality, adoption of climate-smart varieties and their economic impact in flood-risk areas

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ONLINE APPENDIX

Appendix I. Rice production scenario and characteristics of sampled households

Table A1. Share of *kharif* rice area, production and flood scenario of eastern Indian states (2014-15)

State	Rice area ('000 ha)		Production ('000 tons)		Flood prone area ('000 ha)	% flood prone area to total rice area
	Kharif	Total	*Kharif*	Total		
Assam	2079	2495	3999	5223	2193	87.90
Odisha	3865	4166	7291	8298	1065	25.56
West Bengal	4086	5376	10321	14677	277	5.15
Subtotal	10030 (25.18%)	12037 (27.29%)	21611 (23.65%)	28198 (26.73%)	3535	29.37
India	39829	44110	91392	105482	-	-

Source: Rice area and production is sourced from the Ministry of Agriculture and Farmers Welfare, Government of India. Flood area calculated using remote sensing data.

Table A2. Village census and sample

State	Villages	Census households	Sample households	Household adopted SS1 (%)
Assam	155	17866	1544	1.9
Odisha	160	30719	1600	16.6
West Bengal	160	44455	1600	4.2
Total	475	93040	4744	8.9

Table A3. Household characteristics of adopters and non-adopters

Variables	SS1 adoption		Pooled (N=4698)
	Non-adopters (N=4379)	Adopters (N=319)	
Male-headed household (%)	95.5	98.1**	95.7
Married household head (%)	92.0	94.0	92.2
Average household size (number)	4.9 (2.2)	5.1* (1.9)	4.9 (2.1)
Average age of household head (years)	50.4 (12.9)	50.9 (12.5)	50.4 (12.9)
Educational status of household head (%)			
Non-literate	22.1	8.8**	14.6
Primary (up to class 8)	42.7	42.6	49.3
Secondary (class 9-12)	30.4	37.6**	30.9
Graduate & above	4.8	11.0**	5.2
Primary occupation (%)			
Agriculture	61.2	80.9***	62.5
Agricultural labor	5.7	4.1	5.6
Non-agricultural labor	11.5	5.0***	11.1
Salaried	4.5	1.6**	4.3
Self-employment	10.6	5.6***	10.2
Other	6.5	2.8**	6.3
Primary income source of the entire household (%)			
Agriculture	32.3	42.9***	33.0
Agricultural labor	8.5	7.5	8.4
Non-agricultural labor	24.3	14.4***	23.6
Salaried	9.4	7.2	9.3
Self-employment	15.7	15.0	15.6
Other	9.9	12.8	10.1
Social group: caste (%)[a]			
General caste	45.6	36.1***	45.0
Other backward caste	26.2	44.8***	27.5
Scheduled caste	20.5	18.2	20.4
Scheduled tribe	7.6	0.9***	7.1

Notes:

[a] The caste system in India is a system of closed social stratification and occupational transmission through generations wherein a person's status in society is ascribed to the caste into which he or she is born (Debnath and Jain, 2015). That is, caste is an endogamous and rigid system that ranks people right from their birth and members of a caste follow a particular occupation which is often ranked on the basis of purity. For administrative purposes, the marginalized groups have been classified into three categories: the scheduled castes (SCs), scheduled tribes (STs), and other backward classes (OBCs). SCs are individuals who are treated as untouchables and are the lowest ranked *jatis*. STs refer to marginalized tribal communities and OBCs are individuals who belong to the low to middle ranking castes, whereas the high ranking caste is called the general caste (Goel and Deshpande, 2016).

*, **, *** denote statistically significant at 10%, 5% and 1% levels of significance, respectively.

Source: Household survey conducted by authors in 2015-2016.

Table A4. Information on farm characteristics

Variables	SS1 adoption		Pooled
	Non-adopters	Adopters	
Total owned land (ha)	0.68 (0.81)	0.98*** (1.13)	0.70 (0.83)
Land cultivated in *kharif* (ha)	0.77 (0.73)	1.19*** (0.83)	0.80 (0.74)
Rice crop under *kharif* (ha)	0.70 (0.68)	1.17*** (0.78)	0.80 (0.69)
Rice varieties cultivated in *kharif* (number)	1.8 (1.1)	2.8*** (1.1)	1.9 (1.1)
Flood affected farm in *kharif* (%)	68.8	37.9***	66.7
Famine reported (%)	4.9	2.5*	4.7
Famine days (maximum)	120	30	120
Access to information on STRVs (%)	27.2	71.2***	30.2

*, *** Denotes statistically significant at 10% and 1% levels of significance, respectively.
Source: Household survey conducted by authors in 2015-2016.

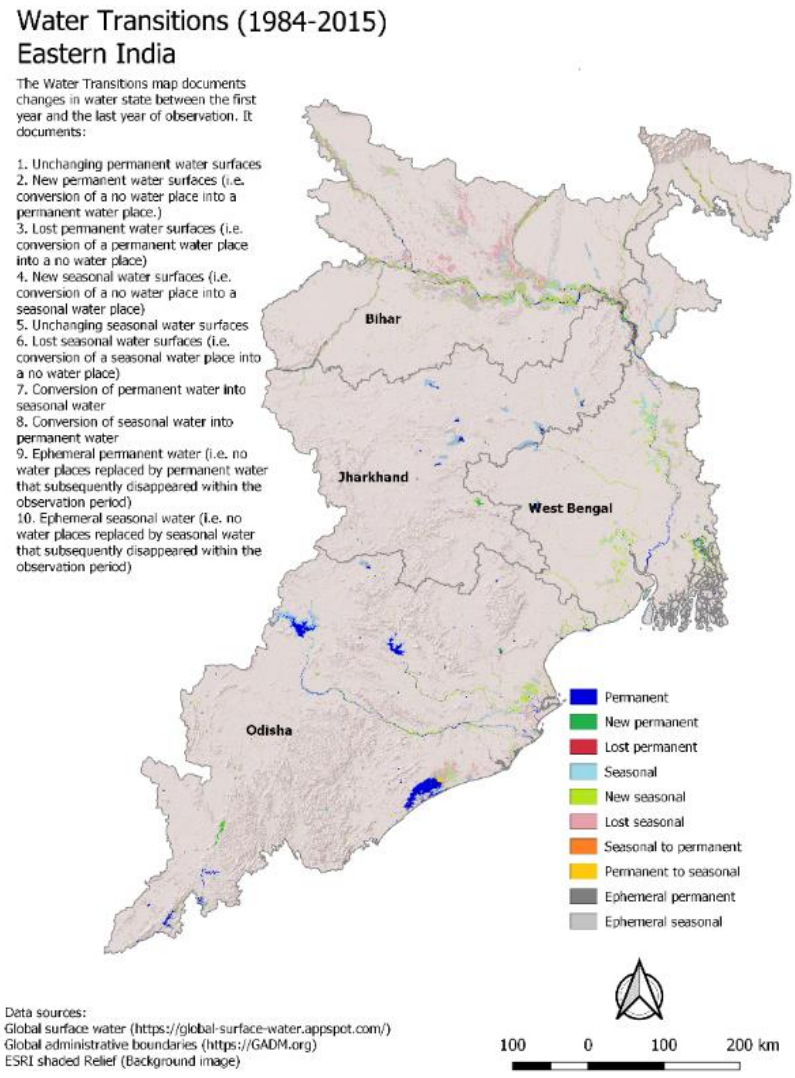

Figure A1. Water transitions in eastern India with flood risks.

Appendix II. Information and cultivation strategies for SS1

II.a. Information pertaining to SUB1: SS1 is a flood tolerant variety which can withstand medium duration (two weeks) flash floods during vegetative growth stage. It is not a genetically modified (GM) crop. The variety is not suited for stagnant or deep water, and is a high yielding variety. Given that it is not a hybrid, farmer can save the seeds for cultivation in next season and follow practices as that of other HYVs except during nursery and post-flood management.

II.b. Management of SS1: The cultivation of SS1 has two specific strategies – increasing resilience (irrespective of climatic) event and second post flood management of SS1. First, *nursery management* to increase resilience: Proper seedbed management can contribute considerably to maximize submergence tolerance and grain yield of the rice crop in the main field. Lower seeding rates (25 to 40 g m-2) and balanced N-P_2O_5-K_2O rates in the nursery, avoidance of excessive N application are recommended (Singh *et al*., 2005; Ram *et al*., 2011; Kumar *et al*., 2012). Seedling age is directly related to survival after submergence; older seedlings are more tolerant to complete submergence and hence avoid transplanting younger seedlings. Second, *post flood management of SS1*: Deposition of clay on leaves after receding of flood adversely affects the yield of Sub1 varieties. Spraying of water under pressure on such crops may help. Post flooding nutrient management has a strong bearing on regeneration growth and yield of rice crop. Application of 20 kg N/ha (45 kg urea) 5-7 days after the flood had receded, helps the crop to recover faster.

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Appendix III. Balance checking and sensitivity analysis for treatment effect estimation using PSM

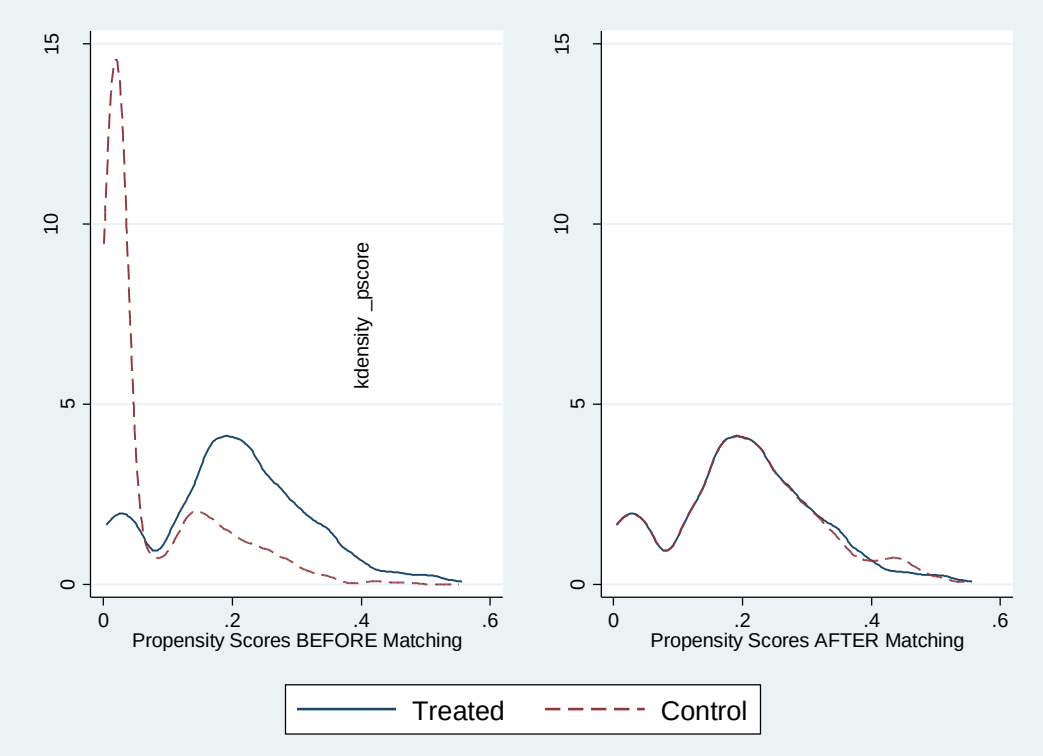

Figure A2. The balance checking before and after matching of propensity score.

We checked the sensitivity analysis of treatment effects using Mantel-Haenszen (MH) test statistic. Under the assumption of no hidden bias, the test static showed that the treatment effect is valid (p_mh+ <0.001) in all ranges from $\Gamma = 1$ to $\Gamma = 2$.

Table A5. Sensitivity analysis of treatment effects using Mantel-Haenszen (MH) test statistic

Gamma	Q_mh+	Q_mh-	p_mh+	p_mh-
1	10.533	10.533	0.000	0.000
1.1	9.806	11.282	0.000	0.000
1.2	9.156	11.980	0.000	0.000
1.3	8.569	12.637	0.000	0.000
1.4	8.035	13.259	0.000	0.000
1.5	7.545	13.850	0.000	0.000
1.6	7.093	14.415	0.000	0.000
1.7	6.673	14.956	0.000	0.000
1.8	6.282	15.475	0.000	0.000
1.9	5.915	15.976	0.000	0.000
2	5.571	16.459	0.000	0.000