Understanding the Adoption of Multiple Packages of System of Rice Intensification and Its Gender Implications

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The case of System of Rice Intensification

- The SRI is widely considered as a promising systemic approach to increase rice production at affordable costs for small-scale producers without harming the environment.
- SRI was originated in Madagascar

SRI Components/Practices

- Young seedling
- Shallow planting
- Single seedling at wider space
- Weeding by mechanical weeder
- Use of organic
- Alternate wetting and drying
- 3 principles: Plant management, Soil Management, Water management

Adoption of SRI-Existing studies

- Although several studies have highlighted the high yield and low costs benefits of SRI the rate of adoption remains to be as low .
- Various constraints especially in developing countries.
- In reality, even farmers with positive demand for adoption may not be able to adopt a new technology when there are multiple constraints (Shiferaw et al., 2015).
- Farmers do not function in a perfect information setting.
- Even in a perfect information setting, farmers with positive desired demand for adoption may fail to realise this potential demand owing to various constraints (Croppenstedt et al., 2003; Shiferaw et al., 2008; Shiferaw et al, 2015).
- Certain components of SRI such as intermittent irrigation, although perceived to be water saving, require proper crop management and irrigation availability (Dobermann, 2004)

Adoption of SRI-Existing studies

- Studies on what drives a farmer to adopt different SRI components remains limited.
- Adoption decisions are interdependent and combination of practices may influence each other (Teklewold et al., 2013).
- Analysis based on univariate modelling would exclude important economic information about interdependent and simultaneity in adoption decisions (Dorfman, 1996).
- Therefore might lead to inconsistent parameter estimates (Teklewold et al., 2013).
- There have been attempts to model the interrelationship in the adoption of multiple agricultural technologies with one of the pioneering attempts made by Feder (1982). In recent years, more studies have looked at the joint estimation of multiple agricultural technologies (e.g.Teklewold et al, 2013; Manda et al., 2015).

Study area and data

- Household data collected in 2015 from six districts that belong to three major rice producing Indian States. The States are Karnataka, Orissa and Madhya Pradesh.
- 2 districts from each state that belong to same agro-climatic zones were identified. The districts in each State belong to same agro-climatic zones but one with SRI practice and the other with SRI incorporated under NFSM are selected.
- The farmers were selected through multi stage sampling technique. First, all rice farming households in the selected taluks/blocks of the selected districts were listed and stratified into SRI participants and non-participants.
- The total number of households interviewed was 386.

Conceptual and Econometric Framework

- The utility of a farm household from adoption is specified as a linear function of the household and farm specific characteristics, institutional factors, attributes of technology as well as other factors (Marenya and Barrett, 2007). Farmers will adopt a practice or a combination of a practice that can provide maximum utility to them.
- An ith farmer will choose a practice j, over any alternative practice, k, if $U_{ij} > U_{ik}$, $k \neq j$.

Conceptual and Econometric Framework

- In our present study, farmers' choice of different interrelated SRI practices is modelled using a multivariate probit model (MVP).
- The farmer decides to adopt a k_{th} SRI practice with as a function of a set of observable household, farm, institutional and other relevant factors and multivariate normally distributed error terms ($\boldsymbol{\epsilon}_i$) (Teklewold et al., 2013; Kassiet et al., 2015). The same can be expressed as;
- $Y_{ik} = X_{ik}\beta_k + \boldsymbol{\epsilon}_{ik}$, (k=1..K) (1)
- Where Y_{ik} denotes the dependent variables which can be represented by the level of expected benefit and/or utility derived from adoption. $\mathbf{X}$ represents a set of household, farm and institutional factors and $\boldsymbol{\beta}$ is the parameter that needs to be estimated.

Conceptual and Econometric Framework

- The second system of equations describing the observable binary outcome equation variables for each of the SRI practices choice of households is given as:
- $$Y_{ik} = \begin{cases} 1 \; if \; Y_{ik} > 0 \\ 0 \; otherwise \end{cases} \qquad (2)$$

Results

A. Young Seedling	Coefficient	Z-Statistic	Marginal Effects
Age of the HOH	-.002(.008)	-0.24	-.001
Gender_HOH	-.335(.260)	-1.29	-.107
No of family members	.029(.050)	0.57	.009
Active family labour	.071(.069)	1.03	.023
No of years in agriculture	-.017(.007)	**-2.38****	-.005
Farm size	-.131(.108)	-1.21	-.042
Contact extension service	.274(.187)	1.47	.088
Member of input supply cooperatives	.440(.194)	**2.27****	.141
Distance to main market	.007(.007)	0.98	.002
Seed exchange experience	.150(.149)	1.01	.048
Wage rate for male	.005(.003)	**1.73***	.001
Wage rate for female	-.008(.003)	**-2.36****	-.003
Fear of poor yield	-.331(.155)	-2.13**	-.106
Education more than 10th	.035(.074)	0.47	.011
Irrigation facility	.269(.158)	**1.70***	.086
Terrain type	-.076(.205)	-0.37	-.024
Assets owned	.107(.033)	**3.24*****	.034
Assets rented	.320(.101)	**3.17*****	.102
NFSM	-.038(.161)	-0.23	-.012
Constant	-.124(.527)	-0.24	

Results

B.Shallow planting			
Age of the HOH	.003(.008)	0.51	.001
Gender_HOH	-.243(.241)	-1.01	-.080
No of family members	.032(.050)	0.64	.010
Active family labour	.119(.068)	**1.75***	.039
No of years in agriculture	-.022(.007)	**-3.13*****	-.007
Farm size	.018(.099)	0.18	.006
Contact extension service	.338(.173)	**1.95****	.111
Member of input supply cooperatives	.296(.177)	**1.67***	.097
Distance to main market	.008(.006)	1.20	.002
Seed exchange experience	.145(.140)	1.04	.048
Wage rate for male	-.0002(.003)	-0.10	-.000
Wage rate for female	-.007(.003)	**-2.05****	-.002
Fear of poor yield	-.083(.160)	-0.52	-.027
Education more than 10th	.012(.073)	0.16	.004
Irrigation facility	.245(.153)	1.59	.080
Terrain type	-.040(212)	-0.19	-.013
Assets owned	.132(.032)	**4.15*****	.043
Assets rented	.168(.117)	1.44	.055
NFSM	-.037(.151)	-0.25	-.012
Constant	.007(.513)	0.01	

Results

C.Seedling			
Age of the HOH	.001(.008)	0.18	.004
Gender_HOH	-.297(.236)	-1.26	-.090
No of family members	.043(.048)	0.90	.013
Active family labour	.050(.062)	0.81	.015
No of years in agriculture	-.005(.007)	-0.77	-.002
Farm size	.086(.096)	0.89	.026
Contact extension service	-.038(.168)	-0.22	-.011
Member of input supply cooperatives	.428(.172)	**2.49****	.130
Distance to main market	.012(.006)	**2.07****	.004
Seed exchange experience	.093(.136)	0.68	.028
Wage rate for male	.000(.002)	0.05	.000
Wage rate for female	-.007(.003)	**-2.23****	-.002
Fear of poor yield	-.028(.153)	-0.18	-.008
Education more than 10th	.019(.075)	0.25	.006
Irrigation facility	.386(.143)	**2.70***	.118
Terrain type	-.209(.188)	-1.11	-.064
Assets owned	.122(.30)	**4.10*****	.037
Assets rented	.010(.092)	0.11	.003
NFSM	-.043(.143)	-0.30	-.064
Constant	-.352(.492)	-0.72	

Results

D.Wider spacing			
Age of the HOH	-.009(.008)	-1.16	-.003
Gender_HOH	-.321(.238)	-1.35	-.103
No of family members	.20(.045)	**2.65****	.038
Active family labour	-.042(.060)	-0.70	-.013
No of years in agriculture	-.010(.007)	-1.36	-.003
Farm size	.069(.096)	0.72	.022
Contact extension service	.388(.174)	**2.23****	.125
Member of input supply cooperatives	.116(.172)	0.67	.037
Distance to main market	.018(.006)	**2.79****	.006
Seed exchange experience	.196(.137)	1.43	.063
Wage rate for male	.006(.003)	**2.17****	.002
Wage rate for female	-.007(.003)	**-2.32****	-.002
Fear of poor yield	.089(.146)	0.61	.029
Education more than 10th	.043(.071)	0.61	.014
Irrigation facility	.217(.141)	1.54	.069
Terrain type	.239(.192)	1.24	.077
Assets owned	.091(.029)	3.15***	.029
Assets rented	.063(.094)	1.24	.020
NFSM	-.034(.149)	-0.23	-.011
Constant	-.915(.507)	-1.81*	

Results

E.Use of Organics			
Age of the HOH	-.007(.009)	-0.71	-.001
Gender_HOH	.032(.297)	0.11	.006
No of family members	.037(.60)	0.63	.007
Active family labour	.121(.077)	1.58	.021
No of years in agriculture	-.025(.10)	**-2.58****	-.004
Farm size	.372(.124)	**3.00*****	.066
Contact extension service	.559(.232)	**2.41****	.099
Member of input supply cooperatives	.178(.232)	0.77	.031
Distance to main market	.026(.008)	3.36***	.005
Seed exchange experience	-.165(.176)	-0.94	-.029
Wage rate for male	.002(.003)	0.07	.000
Wage rate for female	.007(.003)	1.92*	.001
Fear of poor yield	-.190(.186)	-1.02	-.034
Education more than 10th	-.179(.095)	-1.89*	-.032
Irrigation facility	-.314(.179)	-1.75*	-.055
Terrain type	-.078(.233)	-0.34	-.014
Assets owned	.184(.044)	4.23***	.033
Assets rented	.169(.102)	1.65*	.30
NFSM	-1.12(.198)	-5.64***	-.198
Constant	-1.99(.564)	-3.55***	

Results

F. Use of Cono Weeder			
Age of the HOH	-.006(.008)	-0.75	-.002
Gender_HOH	-.597(.263)	**-2.27****	-.155
No of family members	.049(.050)	0.98	.013
Active family labour	.034(.069)	0.50	.009
No of years in agriculture	-.011(.007)	-1.45	-.003
Farm size	.017(.106)	0.16	.004
Contact extension service	.638(.185)	**3.45*****	.166
Member of input supply cooperatives	.329(.190)	**1.74***	.086
Distance to main market	.016(.007)	2.22**	.004
Seed exchange experience	.185(.154)	1.20	.048
Wage rate for male	.010(.003)	**3.63*****	.003
Wage rate for female	-.009(.003)	**-2.72****	-.002
Fear of poor yield	-.148(.159)	-0.93	-.038
Education more than 10th	.037(.076)	0.49	.010
Irrigation facility	.355(.159)	2.23**	.092
Terrain type	-.027(.200)	-0.14	-.007
Assets owned	.114(.031)	3.64***	.030
Assets rented	.071(.094)	0.75	.018
NFSM	.176(.162)	1.08	.046
Constant	-1.52(.534)	-2.84**	

Results

G.Wetting and drying			
Age of the HOH	-.010(.008)	-1.29	-.003
Gender_HOH	-.335(.252)	-1.33	-.089
No of family members	.044(.051)	0.87	.012
Active family labour	.045(.070)	0.64	.012
No of years in agriculture	-.004(.007)	-0.55	-.001
Farm size	.110(.105)	1.05	.029
Contact extension service	.367(.187)	**1.96****	.097
Member of input supply cooperatives	.395(.183)	**2.15****	.105
Distance to main market	-.004(.007)	-0.64	-.001
Seed exchange experience	-.068(.152)	-0.45	-.018
Wage rate for male	.002(.003)	0.92	.001
Wage rate for female	-.006(.003)	**-1.78***	-.002
Fear of poor yield	.020(.164)	0.12	.005
Education more than 10th	.016(.077)	0.21	.004
Irrigation facility	.797(.161)	**4.93*****	.212
Terrain type	-.168(.208)	-0.81	-.045
Assets owned	.098(.031)	**3.11*****	.026
Assets rented	.108(.091)	1.19	.029
NFSM	-.018(.154)	-0.12	-.005
Constant	-.657(.499)	-1.32	
No of observations	386	LR chi2(133)	444.53
Log likelihood	-830.9743	Prob>chi2	0.000

Conclusion

- Social bias and gender disparities are affecting the adoption.
- Despite considerable disparities in wage rates between male and female labourers, the present study showed that female wage rates reduced the likelihood of adoption of almost all packages.
- Interestingly, the male wage rate generally increased the likelihood of adoption.
- The weeding operations under conventional rice cultivation have been traditionally done by women. However as a result of SRI adoption, rice farmers hire more and more of male labourers for mechanical weeding .
- The results also indicate the skill intensive nature of SRI adoption and the gender implications of SRI adoption.

THANK YOU