Original Research Article

Assessment of Net Returns from Rice Production practiced through Conventional and SRI Methods in the light of Climate Change inBhandara District ofMaharashtra

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ABSTRACT

Indian farming witnessed surplus production of cereals along with other food commodities. The production of rice across the Indian subcontinent has a subsistent impact on achieving food security and attaining judicious socio-economic growth for the farming community. However, it also faces certain challenges and difficulties. The phenomenon of climate change has been creating a menace against the sustainable growth of food crops. Due to this, it has become necessary to assess the economic impact of farmers practicing rice crops in terms of net returns from rice. By applying *ex post facto* research design, this study aimed to estimate the inter and intra-level of interaction between sets of predicted variables, Net returns from rice (both conventional and SRI methods), and predictor variables (x_1-x_{35}) and to generate policy at the micro-level. Two hundred (200) respondents were selected from two talukas of the Bhandara district of Maharashtra using a purposive sampling method. The correlation coefficients found that farmers having a higher level of education have been showcasing higher net returns from rice produced by conventional methods. Regression results implied that 35 causal variables together have contributed 32 percent and 83.8 percent of the variance in the consequent variable, net returns from rice (y) practiced by conventional and SRI methods respectively. The results of a path analysis revealed that the variable farm size has got the highest indirect individual effect on net returns from rice practiced by both the conventional and SRI methods.

Keywords: Climate Change; conventional method;net returns from rice;rice Production; SRI Method.

1. INTRODUCTION

Climate change has grasped the whole world in its drastic clutches and posed a serious threat to the farm ecosystem across the horizons.
The continual change in various abiotic factors influences the farm ecology in adverse ways. There is an increased demand to evolve newer strategies to effectively manage the distortions in clamatorial conditions.

Climate change may affect the environment, food production, the well-being of humans, livestock, hydropower generation and tourism, and the economy as a whole. The agricultural effects of climate change have received considerable attention. [1,2,3,4,5,6,7]. The integrated responses of various eco-physiological processes to a variety of environmental conditions, such as temperature, CO2, nutrients, water, and agronomic management, are what allows plants to grow and develop in an agricultural system. [8] Furthermore, crop production patterns may change as climatic conditions change because different crops respond differently to climatic changes. [1] The four main extreme climatic events that have negatively impacted agricultural production as cyclones, floods, soil salinity, and droughts. [9] Extreme rainfall can affect rice yields, and both inadequate and excessive rainfall can increase variability. [10] Due to the sensitivity of agriculture-based livelihoods to climate change, it has been affecting the equilibrium between agriculture and livelihoods. [11].
Rice yields can be negatively impacted by higher temperatures in two ways: (i) high maximum temperatures that, when combined with high humidity, result in spikelet sterility and negatively impact grain quality; and (ii) higher nighttime temperatures that could reduce assimilate accumulation. [12] It has also been noted that a 1°C increase in temperature can result in a 3% decrease in rice production, and a 1°C decrease in rainfall can result in a 0.01% decrease in production. [13] Many nations are experimenting

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with the System of Rice Intensification (SRI) making various adjustments based on their priorities, to increase productivity while also lowering the water requirement for rice cultivation. [14] With this background, the study aimed to estimate the inter and intra-level of interaction between sets of predicted variables Net returns from rice, and predictor variables (x_1-x_{35}).

2. MATERIALS AND METHODS

2.1 SamplingDesign

Keeping in view agriculturally, areas that were socio-economically backward and areas facing major climate change impact on rice production both through SRI (System of rice intensification) and conventional method of cultivation Bhandara district in Maharashtra was selected for the study. Purposive sampling was carried out in two talukas of Bhandara i.e., Bhandara and Sakoli. From each taluka, 4 villages were purposively selected i.e., 8 villages in total were selected from these two talukas.Purposive as well as simple random sampling techniques were adopted for the study. For the selection of State, District, Blocks, and Villages purposive sampling techniques was adopted because the area was ideal concerning the problem, convenient for the researcher, and had the infrastructural facilities in case of selection of farmers or respondents simple random sampling technique was taken up.A total number of 200 respondents were selected for the interaction and collection of data. Among 200 farmers (Conventional method/SRI method), 100 farmers have been randomly selected from the selected villages of Sakoli block where the SRI method is predominantly used and another 100 farmers have been randomly selected from the selected villages of Bhandara block where only conventional method is used.

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2.2 Pilot Study

Before commencing this study, a thorough list of responses was compiled with the help of the research supervisor. An informal interview was held with a number of farmers, local officials and extension workers. A structured interview schedule and a pilot survey were used to gather the data.

2.3 Selection of Variables and Statistical Tools

The selected variables for this study had been operationalized and measured in the following manner:

I) Independent variables II) Dependent variables. Independent variables selected for the study were age (x_1), education (x_2), family education status (x_3), primary occupation (x_{41}),secondary occupation (x_{42}), caste (x_5), family type (x_6), family size (x_7), family income primary (x_{81}),family income secondary (x_{82}), farm size (x_9), social participation (x_{10}), risk orientation (x_{11}), index of farm mechanization (x_{12}), cropping intensity (x_{13}), selling % (x_{14}), debt (x_{15}), migration (x_{16}), mass media exposure (x_{17}), utilization of personal cosmopolite sources of information (x_{18}), Utilization of personal localite sources of information (x_{19}), Contact with extension personnel (x_{20}), Seed rate% (x_{21}), Fertilizer% (x_{22}) pesticide %(x_{23}), Weed management% (x_{24}), Water management% (x_{25}), Irrigation index% (x_{26}), Sowing time(x_{27}), Varietal change (x_{28}), Farm power (x_{29}), Change in rainfall pattern over last 20 years(x_{30}), Change pattern in temperature(day/night) over last 20 years (x_{31}), Change pattern in weather disaster over last 20 years (x_{32}), Change in seasonal pattern over last 20 years (x_{33}), Change pattern in insect/ pests & diseases over last 20 years (x_{34}) and Change pattern in weed problem over last 20 years(x_{35}).
Dependent variable selected for the study was Net returns from rice (y).
Using IBM SPSS v26.0, the following statistical tools have been used to carry out the study viz, Correlation coefficient, Multiple regression analysis, Step wise regression analysis and Path analysis.

2.4 Pre-testingofInterviewSchedule

The interview schedule was pre-tested in order to correct or eliminate any irregularities. Pre-testing is also performed to determine whether the prepared questionnaire is capable of eliciting honest and accurate responses from respondents. The respondents who are questioned after the pre-test are not included in the final sample.

2.5 MethodofDataCollection

The respondents were interviewed personally. The medium of communication was Marathi, which facilitated data collection in the state of Maharashtra. Secondary data relating to the demographic features of the state has been collected from published materials so far

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Comment [H4]: This can be presented in a table form available from the State Agricultural Department, KVK, Census reports, and the Directorate of Economics and Statistics of Maharashtra state. Data related to the climate were collected from available on the internet and some important data were collected from literature and books.

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3. RESULTS AND DISCUSSION

3.1 Coefficient of Correlation (r): Net returns from rice (y) practiced by conventional method Vs. 35 Independent Variables (x_1-x_{35})

Table 1 presents the correlation between net returns from rice (Y) practiced by the conventional method and 35 independent variables. It has been found that the variables farm size, water management%, and irrigation index% have recorded a significant and positive correlation with the dependent variable with 1% level of significance, while the variable secondary occupation has recorded a significant and negative correlation with the dependent variable net returns from rice with 1% level of significance. The variable education, social participation, and weed management % have recorded a significant and positive correlation with the dependent variable net returns from rice with 5% level of significance, while the variable migration, varietal change has recorded a significant and negative correlation with the dependent variable net returns from rice with 5% level of significance.

3.2 Coefficient of Correlation (r): Net returns from rice (y) practiced by SRI method Vs. 35 Independent Variables (x_1-x_{35})

Table 2presents the correlation between net returns from rice(Y) practiced by SRI method and 35 independent variables. It has been found that the variables, primary occupation, family income primary and farm size, have recorded a significant and positive correlation with the dependent variablenet returns from rice with 1% level of significance, while the variable secondary occupation, cropping intensity and migration have recorded a significant and negative correlation with the dependent variablenet returns from rice with 1% level of significance.The variable weed management% has recorded a significant and positive correlation with the dependent variable with 5% level of significance**,** while the variable age has recorded a significant and negative correlation with the dependent variablenet returns from rice (Y) with 5% level of significance.

Similar studies have found that there is need for rice farmers to adopt artificial irrigation [15] and level of education [16] in order to mitigate the effect of climate change for optimum rice productivity.

Table1. Coefficient of Correlation (r): Net returns from rice (y) practiced by conventional method Vs. 35 Independent Variables (x_1-x_{35})

Sl. No.	Independent Variables	'r' Value	Remarks
1	Age(X_1)	-0.1005	
2	Education (X_2)	**0.2067**	*
3	Family education status (X_3)	-0.1113	
4	Primary occupation (X_{41})	0.1442	
5	Secondary occupation (X_{42})	**-0.3941**	**
6	Caste (X_5)	0.1450	
7	Family type(X_6)	0.1131	
8	Family size (X_7)	0.1508	
9	Family income primary (X_{81})	0.1132	
10	Family income secondary (X_{82})	0.0010	
11	Farm size(X_9)	**0.3499**	**
12	Social participation (X_{10})	**0.2223**	*
13	Risk orientation (X_{11})	0.1937	
14	Index of farm mechanization (X_{12})	0.0069	
15	Cropping intensity (X_{13})	-0.0296	
16	Selling% (X_{14})	0.1717	
17	Debt (X_{15})	-0.1431	
18	Migration (X_{16})	**-0.2450**	*

19	Mass media exposure (X_{17})	0.0004	
20	Utilization of personal cosmopolite sources of information (X_{18})	0.0676	
21	Utilization of personal localite sources of information (X_{19})	0.1146	
22	Contact with extension personal (X_{20})	0.1693	
23	Seed rate% (X_{21})	-0.0998	
24	Fertilizer% (X_{22})	0.0579	
25	Pesticide% (X_{23})	0.0394	
26	Weed management%(X_{24})	**0.2122**	*
27	Water management% (X_{25})	**0.3430**	**
28	Irrigation index% (X_{26})	**0.3819**	**
29	Sowing time (X_{27})	0.0269	
30	Varietal change (X_{28})	**-0.2043**	*
31	Farm power (X_{29})	-0.0041	
32	Change in rainfall pattern over last 20 years (X_{30})	0.0346	
33	Change pattern in temperature (day/night) over last 20 years (X_{31})	0.1056	
34	Change pattern in weather disaster over last 20 years (X_{32})	-0.1088	
35	Change in seasonal pattern over last 20 years (X_{33})	-0.0554	
36	Change pattern in insect/ pests & diseases over last 20 years (X_{34})	-0.0745	
37	Change pattern in weed problem over last 20 years (X_{35})	0.0495	

***Correlation is significant at the 0.01 level*
**Correlation is significant at the 0.05 level*

Table 2. Coefficient of Correlation (r): Net returns from rice (y) practiced by SRI Method Vs. 35 Independent Variables (x_1-x_{35})

Sl. No.	Independent Variables	'r' Value	Remarks
1	Age (X_1)	**-0.2768**	*
2	Education (X_2)	0.1731	
3	Family education status (X_3)	0.0858	
4	Primary occupation (X_{41})	**0.3312**	**
5	Secondary occupation (X_{42})	**-0.2665**	**
6	Caste (X_5)	0.1262	
7	Family type(X_6)	-0.0523	
8	Family size (X_7)	-0.0320	
9	Family income primary (X_{81})	**0.4172**	**
10	Family income secondary (X_{82})	0.0740	
11	Farm size (X_9)	**0.8902**	**
12	Social participation (X_{10})	0.0336	
13	Risk orientation (X_{11})	0.1481	
14	Index of farm mechanization (X_{12})	-0.0198	
15	Cropping intensity (X_{13})	**-0.2767**	**
16	Selling% (X_{14})	-0.1215	
17	Debt (X_{15})	-0.1764	
18	Migration (X_{16})	**-0.3646**	**
19	Mass media exposure (X_{17})	0.1880	
20	Utilization of personal cosmopolite sources of information (X_{18})	0.0033	
21	Utilization of personal localite sources of information (X_{19})	-0.1826	
22	Contact with extension personal (X_{20})	0.1014	
23	Seed rate% (X_{21})	0.0547	
24	Fertilizer% (X_{22})	-0.0298	
25	Pesticide% (X_{23})	-0.0974	
26	Weed management% (X_{24})	**0.2064**	*
27	Water management% (X_{25})	-0.1018	
28	Irrigation index% (X_{26})	0.0169	
29	Sowing time (X_{27})	0.0873	
30	Varietal change (X_{28})	-0.1596	
31	Farm power (X_{29})	-0.1147	

32	Change in rainfall pattern over last 20 years (X_{30})	-0.1821
33	Change pattern in temperature (day/night) over last 20 years (X_{31})	0.0692
34	Change pattern in weather disaster over last 20 years (X_{32})	0.1240
35	Change in seasonal pattern over last 20 years (X_{33})	-0.1564
36	Change pattern in insect/ pests & diseases over last 20 years (X_{34})	-0.0372
37	Change pattern in weed problem over last 20 years (X_{35})	-0.0525

***Correlation is significant at the 0.01 level*
**Correlation is significant at the 0.05 level*

Table 3: Best fitted regression equation following stepwise model of multiple regression equation for selecting most significant variables having prominent regression impact on consequent variable Net returns from rice (Y).

Dependent variable(Y)	Regression equation (Stepwise)	Variable	R^2	Adj.R^2	SE(est.)	Ranking of important dependent regressors
Net returns from rice in conventional method of rice	**Y**=-8213.66-2234.59X_{42}+186.38 X_{26} + 2604.81 X_{10} + 99.45 X_{24}	(X_{42})- Secondary occupation (X_{26})- Irrigation index% (X_{10})- Social participation (X_{24})- Weed management%	0.32	0.292	12657.83	Y=X_{42}>X_{26}>X_{10}> X_{24}
Net returns from Rice in SRI method of rice	**Y**=-4593.22+ 14811.56 X_9 -15631 X_{16} + 1.14 X_{81} –3252.32 X_{19}	(X_9)- Farm size (X_{16})-Migration (X_{81})-Family income primary (X_{19})- Utilization of personal localite sources of information	0.838	0.831	11891.36	Y=X_9>X_{16}>X_{81} > X_{19}

3.3 Stepwise Regression Analysis: Net returns from rice (y) practiced by conventional method Vs. 35 Independent Variables (x_1-x_{35})

From Table 3, it has been concluded that net returns from rice (Y) is explained by the variable irrigation index% (X_{26}), social participation (X_{10}) and the variable weed management% (X_{24}) with their positive contribution towards net returns from rice (Y) in the light of climate change, while the variable secondary occupation (X_{42}) with its negative impact towards reducing the magnitude of net returns from rice (Y_1) in the light of climate change. Total variance explained by such equation is 32% and all predictors in this equation have resulted significant regression coefficient to explain net returns from Rice (Y) in the light of climate change.

3.4 Stepwise Regression Analysis: Net returns from rice (y) practiced by SRI method Vs. 35 Independent Variables (x_1-x_{35})

It has also beenfound that net returns from rice (Y) is explained by the variable farm size (X_9) and family income primary (X_{81}) with their positive contribution towards net returns from rice (Y) in the light of climate change, while the variable migration (X_{16}) and utilization of personal localite sources of information (X_{19}) with its negative impact towards reducing the magnitude of net returns from rice (Y_1) in the light of climate change. Total variance explained by such equation is 83.80% and all predictors in this equation have resulted significant regression coefficient to explain net returns from rice (Y_1) in the light of climate change.

Similar results revealed that change in temperature due to climate change causes a reduction in rice production which, in turn, has a positive impact on the propensity to migrate.[17]

Table 4. Path Analysis: Decomposition of Total Effect into Direct, Indirect and Residual Effect: Net returns from rice (y) practiced by conventional method Vs. 35 Independent Variables (x_1-x_{35})

Variables	Total Effect	Total Direct Effect	Total Indirect Effect	Substantial Indirect Effect		
				I	II	III
Age (X_1)				0.050461	0.038142	**0.024318**
	-0.101	-0.008	-0.093	X_{22}	X_{34}	**X_9**
Education (X_2)				0.093507	**0.079021**	0.049161
	0.207	0.092	0.114	X_{10}	**X_9**	X_{26}
Family education status (X_3)				0.057898	0.047439	0.029053
	-0.111	-0.034	-0.077	X_6	X_{26}	X_{82}
Primary Occupation (X_{41})				0.205419	**0.092886**	0.040631
	0.144	-0.122	0.266	X_{42}	**X_9**	X_6
Secondary occupation (X_{42})				0.085102	0.072809	0.037559
	-0.394	-0.344	-0.050	X_{13}	X_{41}	X_{82}
Caste (X_5)				0.034745	0.03067	0.025095
	0.145	-0.017	0.162	X_{10}	X_{35}	X_{13}
Family type(X_6)				0.182845	0.058651	0.049156
	0.113	-0.275	0.388	X_7	X_{31}	x_{26}
Family Size (X_7)				0.050021	0.042354	0.03618
	0.151	0.207	-0.056	X_{31}	X_{81}	X_{13}

Family income primary (X_{81})	0.113	-0.115	0.228	**0.178556** **X_9**	0.091007 X_6	0.060692 X_{82}
Family income secondary (X_{82})	0.001	0.119	-0.118	0.047749 X_{26}	0.034857 X_6	0.026017 X_{41}
Farm size (X_9)	0.350	**0.385**	-0.035	0.157644 X_{42}	0.047867 X_{10}	0.037771 x_{22}
Social participation (X_{10})	0.222	0.168	0.054	**0.109359** **X_9**	0.051297 X2	0.040892 X_{42}
Risk orientation (X_{11})	0.194	0.066	0.128	0.08647 X_{26}	0.070288 X_{42}	**0.054685** **X_9**
Index of farm mechanization (X_{12})	0.007	-0.221	0.227	**0.164071** **X_9**	0.057954 X_{42}	0.032818 X_{17}
Cropping intensity (X_{13})	-0.030	0.283	-0.313	0.058998 X_{26}	0.049849 X_{12}	0.02796 X18
Selling% (X_{14})	0.172	0.116	0.056	**0.069508** **X_9**	0.031568 X_7	0.026251 X_{26}
Debt (X_{15})	-0.143	-0.121	-0.022	0.030023 X_{31}	0.027022 X_{42}	0.019644 X_{10}
Migration (X_{16})	-0.245	0.075	-0.320	0.053516 X_{31}	0.042204 X_{81}	0.041259 X_{25}
Mass media exposure (X_{17})	0.000	-0.143	0.144	0.050577 X_{12}	**0.039217** **X_9**	0.033267 X_{31}
Utilization of personal cosmopolite sources of information (X_{18})	0.068	0.239	-0.171	0.034258 X_{41}	0.033206 X_{13}	0.023246 X_{29}
Utilization of personal localite sources of information (X_{19})	0.248	0.145	0.103	**0.089573** **X_9**	0.088865 X_{26}	0.083711 X_{42}
Contact with extension personal (X_{20})	0.169	0.187	-0.018	0.03722 X_7	0.029089 X_{31}	0.016912 X_2
Seed rate% (X_{21})	-0.100	-0.021	-0.079	0.025743 X_{17}	0.021779 X_{13}	0.016042 X_{29}
Fertilizer% (X_{22})	0.058	0.237	-0.179	**0.061276** **X_9**	0.049328 X_6	0.033698 X_{42}
Pesticide% (X_{23})	0.039	0.189	-0.150	0.042549 X_6	0.031551 X_{12}	0.021048 X_{28}

Weed management% (X_{24})	0.212	0.089	0.123	**0.093908**	0.090732	0.029376
				X_9	X_{42}	X_{22}
Water management% (X_{25})	0.343	-0.078	**0.421**	0.222624	**0.12406**	0.082328
				X_{26}	**X_9**	X_{42}
Irrigation index% (X_{26})	**0.382**	0.303	0.079	0.068888	0.055177	**0.045536**
				X_{42}	X_{13}	**X_9**
Sowing time (X_{27})	0.027	0.047	-0.020	0.042204	0.021819	0.017601
				X_{26}	X_{42}	X_6
Varietal change (X_{28})	-0.204	-0.083	-0.121	0.033278	0.026904	0.026675
				X_{18}	X_{29}	X_6
Farm power (X_{29})	-0.004	-0.107	0.103	0.047707	0.043136	**0.031968**
				X_{35}	X_{31}	**X_9**
Change in rainfall pattern over last 20 years (X_{30})	0.035	0.023	0.011	0.037481	0.034973	**0.030727**
				X_6	X_{22}	**X_9**
Change pattern in temperature(day/night) over last 20 years (X_{31})	0.106	0.282	-0.176	0.036631	**0.022797**	0.019299
				X_7	**X_9**	X_{20}
Change pattern in weather disaster over last 20 years (X_{32})	-0.109	-0.047	-0.062	0.022193	0.019371	0.018061
				X_{17}	X_{18}	X_{31}
Change in seasonal pattern over last 20 years (X_{33})	-0.055	0.052	-0.107	0.031031	0.020766	0.019708
				X_{18}	X_{15}	X_{31}
Change pattern in insect/ pests & diseases over last 20 years (X_{34})	-0.074	-0.147	0.073	0.034529	0.029342	0.019712
				X_{26}	X_{35}	X_6
Change pattern in weed problem over last 20 years (X_{35})	0.049	0.182	-0.133	**0.033175**	0.024848	0.017605
				X_9	X_7	X_{42}

Residual effect: 0.62; Highest Indirect Individual effect: x_9 (18)

Table 5. Path Analysis: Decomposition of Total Effect into Direct, Indirect and Residual Effect: Net returns from rice (y) practiced by SRI method Vs. 35 Independent Variables (x_1-x_{35})

Variables	Total Effect	Total Direct Effect	Total Indirect Effect	Substantial Indirect Effect		
				I	II	III
Age (X_1)	-0.277	-0.079	-0.198	0.013898	0.009886	0.008093
				X_7	$X1_7$	X_{82}
Education (X_2)	0.173	0.076	0.097	**0.084253**	0.033553	0.022326

Family education status (X_3)	0.086	-0.012	0.098	**X_9**	X_{81}	X_{16}	**0.034737**	0.029563	0.027042
Primary occupation (X_{41})	0.331	-0.033	**0.364**	**X_9**	X_{81}	X_7	**0.301802**	0.021971	0.01883
Secondary occupation (X_{42})	-0.267	0.000	-0.266	**X_9**	X_2	X_{81}	0.016233	0.013111	0.010767
Caste (X_5)	0.126	0.049	0.078	X_{41}	X_2	X_{31}	**0.075889**	0.017325	0.015955
Family type (X_6)	-0.052	0.003	-0.055	**X_9**	X_{15}	X_{33}	**0.065032**	0.01691	0.012435
Family size (X_7)	-0.032	-0.066	0.034	**X_9**	X_1	X_{28}	**0.073011**	0.016614	0.013109
Family income primary (X_{81})	0.417	0.146	0.271	**X_9**	X_1	X_{28}	**0.248899**	0.024498	0.017467
Family income secondary (X_{82})	0.074	-0.077	0.151	**X_9**	X_7	X_2	0.063176	**0.024709**	0.021541
Farm size (X_9)	**0.890**	**0.794**	0.096	X_{81}	**X_9**	X_2	0.045717	0.020543	0.017386
Social participation (X_{10})	0.034	-0.010	0.043	X_{81}	X_1	X_{16}	**0.033659**	0.027219	0.020563
Risk orientation (X_{11})	0.148	0.053	0.095	**X_9**	X_2	X_{81}	**0.071036**	0.013976	0.011645
Index of farm mechanization (X_{12})	-0.020	-0.037	0.017	**X_9**	X_{15}	X_{34}	0.023721	0.019755	0.013475
Cropping intensity (X_{13})	-0.277	-0.058	-0.218	X_{11}	X_{31}	X_{34}	0.019345	0.014604	0.009872
Selling% (X_{14})	-0.122	-0.053	-0.068	X_{28}	X_{82}	X_{25}	0.018768	0.010222	0.008645
Debt (X_{15})	-0.176	-0.083	-0.093	X_{81}	X_{31}	X_{28}	0.01632	0.009303	0.009301
Migration (X_{16})	-0.365	-0.071	-0.293	X_{82}	X_{23}	X_{35}	0.013274	0.010461	0.007291
Mass media exposure (X_{17})	0.188	-0.070	0.258	X_{17}	X_{19}	X_{23}	**0.157307**	0.046006	0.031006

				X_9	X_2	X_{81}
Utilization of personal cosmopolite sources of information (X_{18})	0.003	-0.033	0.036	**0.01642**	0.015092	0.013099
				X_9	X_{33}	X_{82}
Utilization of personal localite sources of information (X_{19})	-0.183	-0.089	-0.093	0.012472	0.011099	0.008334
				X_{26}	X_5	X_{16}
Contact with extension personal (X_{20})	0.101	0.008	0.093	**0.083665**	0.018205	0.018155
				X_9	X_{14}	X_1
Seed rate% (X_{21})	0.055	0.025	0.030	0.021658	**0.014893**	0.012699
				X_{15}	**X_9**	X_1
Fertilizer% (X_{22})	-0.030	0.058	-0.088	0.008726	0.007971	0.006667
				X_{24}	X_{28}	X_{29}
Pesticide% (X_{23})	-0.097	-0.077	-0.020	0.012696	0.010044	0.006715
				X_{28}	X_{15}	X_{16}
Weed management% (X_{24})	0.105	0.067	0.038	0.013777	0.011666	0.009834
				X_{16}	X_2	X_{26}
Water management% (X_{25})	-0.102	0.059	-0.161	0.018149	0.016786	0.008972
				X_{23}	X_{34}	X_{82}
Irrigation index% (X_{26})	0.017	0.074	-0.057	0.035592	0.030976	0.017052
				X_{16}	X_{81}	X_2
Sowing time (X_{27})	0.087	0.031	0.056	**0.082595**	0.017187	0.010126
				X_9	X_{81}	X_{13}
Varietal change (X_{28})	-0.160	0.065	-0.225	0.007107	0.006569	0.004503
				X_{22}	X_{11}	X_{82}
Farm power (X_{29})	-0.115	-0.030	-0.085	0.014944	0.014592	0.011066
				X_{31}	X_{26}	X_1
Change in rainfall pattern over last 20 years (X_{30})	-0.182	-0.019	-0.164	0.022238	0.016657	0.015059
				X_{28}	X_{19}	X_{34}
Change pattern in temperature(day/night) over last 20 years (X_{31})	0.069	0.113	-0.044	0.00792	0.005201	0.005188
				X_7	X_{24}	X_{41}
Change pattern in weather disaster over last 20 years (X_{32})	0.124	-0.007	0.131	**0.10931**	0.016846	0.01222
				X_9	X_{34}	X_{15}
Change in seasonal pattern over last 20 years (X_{33})	-0.156	-0.061	-0.095	0.014101	0.011894	0.008179
				X_{81}	X_{31}	X_{18}

Change pattern in insect/ pests & diseases over last 20 years (X_{34})	-0.037	-0.075	0.038	**0.02375** **X_9**	0.009911 X_5	0.008796 X_{82}
Change pattern in weed problem over last 20 years (X_{35})	-0.053	0.039	-0.091	0.0077 X_{22}	0.006664 X_1	0.005849 X_7

Residual effect: 0.32; Highest Indirect Individual effect: x_9 (17)

3.5Path Analysis: Decomposition of Total Effect into Direct, Indirect and Residual Effect: Net returns from rice(y) practiced by conventional method Vs. 35 Independent Variables (x_1-x_{35})

Table 4 presents the path analysis to explain the direct, indirect and residual effect of exogenous variables on consequent variables i.e., net returns from rice cultivation (Y) practiced by conventional method in the light of climate change.

It has been observed that the variable, farm size (X_9) exerts highest direct effect and the variable, water management % (X_{25}) exerts highest indirect effect on net returns from rice cultivation over the other 35 exogenous variables in the light of climate change. The variable, farm size (X_9) has been found to channelize the substantial indirect effect of, as many as, 18 times to define its tremendous impact over the other exogenous variables to ultimately characterize the performance of consequent variable.

Asthe residual effect is 62%, it could be concluded that with the combination of 35 variables in this investigation in the form of exogenous variables had been able to explain 38% of the variation in the consequent variable i.e., net returns from rice cultivation practiced by conventional method in the light of climate change.

3.6Path Analysis: Decomposition of Total Effect into Direct, Indirect and Residual Effect: Net returns from rice(y) practiced by conventional method Vs. 35 Independent Variables (x_1-x_{35})

Table 5 presents the path analysis to explain the direct, indirect and residual effect of exogenous variables on consequent variables i.e., net returns from rice cultivation (Y) practiced by SRI method in the light of climate change.

The above results found that the variable, farm size(X_9) exerts highest direct effect whereas the variable, primary occupation (X_{41}) exerts highest indirect effect on net returns from rice cultivation over the other 35 exogenous variables in the light of climate change.The variable, farm size (X_9) has been found to characterize the substantial indirect effect of, as many as, 17 times to extend its wider impact over the other exogenous variables to ultimately characterize the performance of consequent variable.

The residual effect being 32%, it could be concluded that the combination of 35 variables in this investigation in the form of exogenous variables had been able to explain 68% of the variation in the consequent variable i.e., net returns from rice cultivation practiced by SRI method in the light of climate change.

These results are in contrast with those of the study conducted by Bello in which farm size have been found to have a significant correlation with adaptation to climate change among rice farmers In Werstern Zone of Bauchi State, Nigeria. [18]

4. CONCLUSION

The study focused on assessing the net returns from rice production in light of climate change by comparing both the conventional and SRI methods. The results indicated that variables like family size, weed management %, social participation, and migration among others are playing a significant role in receiving net returns from producing rice in the context of climate change. It is evident that various mitigating steps have to be taken in order to provide safe and secure livelihood opportunities to farmers including alternative farming practices and crop diversification which will also take care of income perspectives. By increasing cultivar demands for higher growing degree days and improving current rice crop management practices and technologies, it is possible to lessen the negative effects of climate change. As it has become very important on a global level, this research framework has a lot of potential for conducting further studies across agro-climatic zones of Maharashtra as well as across India.

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