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Climate Change and Paddy Production in Sri Lanka (with reference to Anuradhapura District)

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Abstract

Climate Change is defined as statistically significant variation in either mean state of the climate or in its variability, persisting for an extended period (typically decades or longer). Climate change may be due to natural internal processes or external forcing or to persistent anthropogenic changes in the composition of the atmosphere or in land use.The problem of this sudy is there any impact of climate change on paddy production in Sri Lanka. Objectives are to identify the impact of climate change on paddy production in Sri Lanka. It was used both primary and secondary data for this study. The climatic factors are changing very rapidly in Sri Lanka. To adapt farmers with the changes, government and other external agencies are providing several supports, but still there is a gap between farmers' adaptability with climate change and current level of supports. To analyze the climate change adaptability of the farmers in Sri Lanka, this study uses primary data that have been collected through questionnaire survey on paddy producing farmers in the area of Anuradhapura district, North-Central province. The data have been analyzed by using descriptive statistics, ordered regression, percentile and scale. Farmers significantly believe that buying additional fertilizer from market is not important for their current adaptation capability with climate change. As a consequence, 75.3% of the farmers never used extra fertilizer except the fully subsidized quantity. But, 41.4% farmers agree that government supports are not enough to cope properly with climate change. So, there is a gap between the current level of external supports and farmers' capability to adapt with climate change. Here, sustainability of agriculture and relevant livelihood are strongly dependent on the external supports. Therefore, farmers' adaptability to climate change needs to be focused beyond the incentive and subsidy. Farmers need some training and motivational supports for the necessary adoption. The findings of the study are important for the policy makers and relevant agencies.

Key words: Climate change, paddy production

Introduction

Climate change is a change in the statistical distribution of weather over periods of time that range from decades to millions of years. It can be a change in the average weather or a change in the distribution of weather events around an average (for example, greater or fewer extreme weather events). Climate change may be limited to a specific region, or may occur across the whole Earth. A global assessment of the potential impact of climate change on world food supply argue that doubling the atmospheric carbon dioxide concentration will be led to a small reduction of global crop production. However, developing countries are likely to bear the burden of the problem, and simulations of the impact of adaptive measures by farmers imply that these will be done less to reduce the inequality between both developed and developing countries.

Some causes of climate change are natural. These include changes in Earth's orbit and in the amount of energy coming from the sun. Ocean changes and volcanic eruptions are also natural causes of climate change.Most scientists think that recent warming can't be explained by nature alone. Most scientists say it's very likely that most of the warming since the mid-1900s is due to the burning of coal, oil and gas. Burning these fuels is how we produce most of the energy that we use every day. This burning adds heat-trapping gases, such as carbon dioxide, into the air. These gases are called greenhouse gases.

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The problem of this study is there any impact of climate change on paddy production in Sri Lanka. Objectives are to identify the impact of climate change on paddy production in Sri Lanka. It was used both primary and secondary data for this study. The climatic factors are changing very rapidly in Sri Lanka. To adapt farmers with the changes, government and other external agencies are providing several supports, but still there is a gap between farmers' adaptability with climate change and current level of supports. To analyze the climate change adaptability of the farmers in Sri Lanka, this study uses primary data that have been collected through questionnaire survey on paddy producing farmers in the area of Anuradhapura district, North-Central province. The data have been analyzed by using descriptive statistics, ordered regression, percentile and scale.

In the countries there are various adaptation methods used. Those are changes of planting date, variety and crops, an application of irrigation and fertilizer. Irrigation method assumed automatic irrigation to field capacity when plant available water dropped to 50% and 100% irrigation efficiency. These optimistic assumptions imply that water supply for irrigation would be fully available at all locations under climate change conditions. All adaptation possibilities were not used at every site and country.

Study area

Anuradhapura, is one of the ancient capitals of Sri Lanka, famous for its well-preserved ruins of ancient Lankan civilization. The city, now a UNESCO World Heritage Site, lies 205 km north of the current capital Colombo in Sri Lanka's North Central Province, on the banks of the historic MalvathuOya. It is one of the oldest continuously inhabited cities in the world.

Data Analysis

Table 1: Demographics in Anuradhapura District

Ethnicity	**Population**	**% of Total**
Sinhalese	778131	90.9
Sri Lanka Moors	3,825	8.2
Sri Lanka Tamils	5065	0.6
India Tamils	70248	0.1
Other – Burghar and Malay	1831	0.2
Total	**859100**	**100**

Source: **www.statistics.gov.lk - Census 2011**

According to the collected data from the sample it can be seen that 50% percent of the people in this area have studied only up to grade five. Out of 50% percents 28% females and 22% male have studied up to grade five. 4.3% have studied up to GCE (O/L) and GCE (A\L) and 21.8% male and 2.3 percent female have studied up to GCE (O\L). Only 4.4% have studied above GCE (O\L) and 2% male and the other 2.4% female. So this table implies that high percentage of males have been educated more than female in this area. The reason for this is that most of the female do not go to school though few have studied up to GCE (O\L). But, males go for paddy cultivation after O/Ls with their fathers and neighbors. Due to low level of education the high rate of poverty in this area has badly affected the country. They have taken loans and cultivate paddy but due climate change they lose money in some seasons.

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Table 2: Education level of the families

Category	Frequency	Percentage	Male	Female
Child population	1398	40	697	701
Pre-school	188	4	91	97
Grade 1-5	269	6	130	139
Grade 6 – 9	225	5	105	120
GCE (O\L)	198	4.3	95	103
GCE (A\L)	197	4.3	94	103
Diploma	60	1.7	28	32
Degree	95	2.7	40	45
Not educated	1112	32	551	561
Total	3472	100	1734	1738

Source: Fieldwork - 2010

Hundred and forty six farmers have taken loans from government banks and it is sixteen percent of the total farmers were observed. Three hundred and fifty five farmers have taken loans from private banks and it is twenty nine percent of the samples. Hundred and thirty five farmers are indebted to individual loan makers who give loans at high rate of interest and it is forty seven percent of the population. Sixty four farmers have taken loans from friends or relatives and it is eight percent of the sample was selected for this study. There is no motivation for the farmers to take loans from government banks and they are indebted to private sector forever. This is a cycle. Because they get loans from private sector in the out of season and pay back in the season, but when the season comes their loan also has been double due to high rate of interest is charged by private sector. Therefore they are unable to release from that circle.

Table: 3: Annual and Seasonal mean rainfall and rainy days in Anuradhapura during the period 1971-2010

Month/Season	Rainfall		Rainy Days	
	Mean	% of AR	Mean	% of AR
January	75.8	6.0	7.5	7.2
February	44.7	3.6	4.1	3.9
March	68.0	5.4	3.7	5.8
April	158.3	12.6	13.4	13.0
May	78.8	6.3	6.6	6.3
June	17.0	1.3	3.1	3.0
July	34.0	2.7	3.4	3.3
August	35.9	2.9	3.4	3.3
September	71.6	3.7	6.8	6.6
October	232.3	18.3	15.5	14.9
November	245.8	19.6	18.4	17.8
December	193.3	15.4	15.3	15.0
Annual	1255.4	100.0	103.8	100
Yala	463.6	36.9	43.6	42.1
Maha	791.9	63.1	61.0	58.9

Source: Gunarathna and Kumari - 2010

Annual, seasonal and monthly trends of rainfall data is in the table 3.The mean annual rainy days in Anuradhapura is 104 with a standard deviation of 13. Distribution of rainy days in Yala and Maha seasons are 42% and 59% respectively. As similar to the mean rainfall

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number of many days in monsoon periods recorded quite higher coefficient of variations. So this is affects for paddy production in Anuradhapura district.

There are various types of rural societies in this area. Those are Gramodaya Society, Farming Society, Cooperative Credit Society and Death Contribution Society. Three hundred and fifteen farmers are members of Gramodaya Society and it is sixty three percent of the observation. Fifty three farmers are members of Farming Society and it is eleven percent of the samples. Eighty nine are members of Cooperative Credit Society and it is eighteen percent of the observation. Forty three are members of Death Contribution Society and it is eight percent of the samples. Many people have multiple memberships in various societies. Majority are members of the Death Contribution Society, because that is the well functioning society in this area. The reason for that everybody has to face for death and when they have a funeral they have to work together and can be solved economic hardships faced by that time period.

Table 4: Descriptive statistics

Variables	Mean Values
Education of household members(years of schooling)	8.71
Age of household head (years)	46.35
Household size (number)	4.81
Total land holding	2.5
Total livestock holding	2.80
Distance to nearest market(km)	3.08
Distance to paddy land	0.25

Source: Fieldwork – 2010

The descriptive statistics shows that in education majority of the members of households have passed grade 8. Average age of household head is 46 years old. The total of the land holding is two to five acres, and most the land is granted by government. They have live stocks also. If not they are unable to survive. Distance to the nearest market is about three kilometers. Distance to paddy land is about half a kilometer. Most of the farmers live very close to the paddy land. Therefore they are able to work efficiently in their paddy land. The effects of income level on total paddy harvest and the dependence on farming. R^2 is less than five because cross sectional data are used for this study. The dependent variable is equal to the income gained by paddy farming and independent variables are the total income and total income square. Knowledge about the socio-economic determinants on farm dependency and the nature of their impacts is important in making rural resource management policies. Moreover, the effectiveness in the utilization of the rural resources appears to be linked with a number of socio-economic factors that have affected the decision-making in the paddy farming industry in Sri Lanka. Besides socio-economic factors, rules and regulations imposed by particular institutions may influence the cost of paddy harvest from the paddy land.

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Table 5: Effect of total paddy harvest on income level and dependence on farming

Variables	Dependent variable: Paddy income		Dependent variable: ratio of paddy income to non-paddy income	
	Coefficients	t- value	Coefficients	t- value
Constant	3605.375	2.605	0.276	7.875
Tot-income	5.823E-02	1.964**	-2.035E-06	-3.288***
Tot-income-sq	-2.523E-07	-1.887**	6.017E-12	2.789***

R^2 = .48, Adj R^2 = 0.47 ** and * imply significance at 5% and 1% probability levels respectively**

Gross farming income from the paddy land was regressed after socio-economic variables interacted with dummies to find out the distance and family size in order to examine the effect of climatic change paddy farming. Table 14 defines the explanatory variables incorporated in the econometric analysis. Y (for both dependent variables) was first regressed on all the explanatory variables and their interactions with the dFAMSIZE and dDISTANCE dummies to test whether these variables affected the income from farming. Only family size, landholding, distance dummy and climate change have statistical and significant effects on income gained from paddy farming. According to statistical tests it can be seen that there is some positive impact of climate change on paddy production in Sri Lanka.

Conclusion

According to data gathered it can be said that there is some impact of climate change on paddy production in Sri Lanka. So there are some solutions to mitigate this problem. Organic Agriculture has the capability to adapt and resist under climate change conditions by its principles. Its principles conduct self-regulation and are ecologically friendly, which makes this system sustainable for long term. Organic agriculture also has capability to mitigate climate change, so this system has high potential to be implemented in South Asian countries in order to face climate change impact on agriculture sector. The implementation of organic agriculture must be supported by its productivity and profitability by ensuring integration and networking from farming to consumer. Due to South Asia's natural resources and its agriculture characteristic, it has good potential to implement organic agriculture systems to overcome climate change impacts. The climatic factors are changing very rapidly in Sri Lanka. To adapt farmers with the changes, government and other external agencies are providing several supports, but still there is a gap between farmers' adaptability with climate change and current level of supports. To analyze the climate change adaptability of the farmers in Sri Lanka, this study uses primary data that have been collected through questionnaire survey on paddy producing farmers in the area of Anuradhapura district, North-Central province. The data have been analyzed by using descriptive statistics, ordered regression, percentile and scale. Farmers significantly believe that buying additional fertilizer from market is not important for their current adaptation capability with climate change. As a consequence, 75.3% of the farmers never used extra fertilizer except the fully subsidized quantity. But, 41.4% farmers agree that government supports are not enough to cope properly with climate change. So, there is a gap between the current level of external supports and farmers' capability to adapt with climate change. Here, sustainability of agriculture and relevant livelihood are strongly dependent on the external supports. Therefore, farmers' adaptability to climate change needs to be focused beyond the incentive and subsidy. Farmers need some training and motivational supports for the necessary adoption. The findings of the study are important for the policy makers and relevant agencies.

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