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AN ADOPTION STRATEGY TO MANAGE THE CLIMATE CHANGE RISK IN DIFFERENT IRRIGATION REGIMES IN CUDDALORE DISTRICT OF TAMILNADU

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Abstract:

Adaptations are adjustments or interventions, which take place in order to manage the losses or take advantage of the opportunities presented by a changing climate (IPCC 2001). Important adaptation options in the agricultural sector include: crop diversification, mixed crop-livestock farming systems, using different crop varieties, changing planting and harvesting dates, and mixing less productive, drought-resistant varieties and high-yield water sensitive crops. The diversification in agriculture is also practiced with a view to avoid risk and uncertainty due to climatic and biological vagaries. It minimizes the adverse effects of the current system of crop specialization and monoculture for better resource use, nutrient recycling, reduction of risks and uncertainty and better soil conditions. The present study was conducted to analyse by using Herfindhal & Transformed Herfindhal Index to measure the diversification in cropping area in the selected blocks of Cuddalore district (CW – Kurinjipadi and GW - Cuddalore), Tamil Nadu. The average value of Transformed Herfindhal Index was higher in CW block compared to GW block which indicated the diversified nature of crops growing in CW block than GW block. The trend in Transformed Herfindhal Index shows that the diversification was in little larger extent in CW block (0.7) compared to GW block (0.6) considering the trend there was no observable trend indicating either diversification or concentration in numbers of crops grown by the farmers either in CW or in GW block, except the mild inter year fluctuations. Hence it was understood that crop diversification was not followed as one of the adaptation strategies to overcome climate risk irrespective of the source of irrigation.

Key Words: Climate Change, Crop Diversification, Irrigation & Farmers Adaptation

Introduction:

Adaptations are adjustments or interventions, which take place in order to manage the losses or take advantage of the opportunities presented by a changing climate (IPCC 2001). Adaptation is the process of improving society's ability to cope with changes in climatic conditions across time scales, from short term (e.g. seasonal to annual) to the long term (e.g. decades to centuries). The IPCC (2001) defines adaptation capacity as the ability of a system to adjust to climate change (including climate variability and extremes), to moderate potential damages, to take advantage of opportunities, or to cope with the consequences. The goal of an adaptation measure should be to increase the capacity of a system to survive external shocks or change. The assessment of farm-level adoption of adaptation strategies is important to provide information that can be used to formulate policies that enhance adaptation as a tool for managing a variety of risks associated with climate change in agriculture. Important adaptation options in the agricultural sector include: crop diversification, mixed crop-livestock farming systems, using different crop varieties, changing planting and harvesting dates, and mixing less productive, drought-resistant varieties and high-yield water sensitive crops (Bradshaw et al. 2004).

In the third world countries like India crop diversification is a strong applied concept to eliminate the dilemma of subsistence agricultural economy and to ensure diversified nutrition status of the poor men of country. Meaning of crop diversification is rising of a variety of crops involving intensity of competition amongst field crops for arable or cultivable land. Right now there is need to move from crop specialization to crop diversification to reduce poverty and augment farm income. "The keener the competition, the higher the magnitude of the crop diversification and lesser the competition the greater will the trend toward specialization or monoculture farming where emphasis is on one or two crops" (Jasbir Singh 1976; Pal and Kar, 2012**).**

Crop diversification is a strategy to maximize the use of land, water and other resources and for the overall agricultural development in the country. It provides the farmers with viable options to grow different crops on their land. The diversification in agriculture is also practiced with a view to avoid risk and uncertainty due to climatic and biological vagaries. It minimizes the adverse effects of the current system of crop specialization and monoculture for better resource use, nutrient recycling, reduction of risks and uncertainty and better soil conditions. It also provides better economic viability with value-added products and improvement of ecology. There are quite a few methods, which explain either concentration (i.e. specialization) or diversification of crops or activities over time and space. Each method has some limitation and/or superiority over the other (Shiyani, 1998).

Design of the Study:

Adaption Strategies to Manage Climate Change Risk:

The present study was conducted to analyse by using Herfindhal & Transformed Herfindhal Index to measure the diversification in cropping area in the selected blocks of Cuddalore district (Conjunctive water use block namely CW – Kurinjipadi and Groundwater use block namely GW - Cuddalore), Tamil Nadu. The data used for the study was collected from district Statistical Office and Joint Director Office, Cuddalore. The time series data pertaining to area, production and productivity of different crops for the period from 2001 – 2015.

Diversification Index:

Diversification in agriculture is considered to have large potentialities of increasing income and employment and providing strength through reduced instabilities particularly under the situation of risk and capital constraints as revealed by several studies. Hence an attempt is made to study the crop and enterprise diversification and to compare the levels of diversification at villages representing the same levels of climate change vulnerability but is on different in irrigation regimes so as to know the farmer's coping activities in the scenario of reducing net sown area, declining agricultural production, and risks in farm income and employment. Farm level diversification is studied in terms of enterprise income and acreage under crops. Acreage diversification explains crop diversification only, whereas enterprise diversification involves all enterprises on a farm i.e., livestock along with crop enterprises. The following diversification measures are used.

Herfindhal Index (HI):

$$HI = \sum_{i=1}^{n} P_i^2$$

Where $P_i = A_i / \sum_i A_i$, (Proportion of i^{th} activity), i = 1, 2 …… n

A_i = income from i^{th} activity or acreage under i^{th} activity.

With increase in diversification, sum of squares of all crop, dairy income proportion decreases, therefore Herfindhal Index should decrease. The index (HI) takes a value one when there is complete specialization and approaches zero as diversification is perfect. Thus, HI is bound by zero (complete diversification) to one (complete specialization). The index can be calculated for the area devoted to different crops and per acre value of output of the crops / enterprises. When crop production only is considered, diversification index of area serves the purpose, but when enterprises like poultry, dairy, fishing are added to the activities of the farm, diversification index of value would be found appropriate. In order to avoid confusion, it is more preferred to use the **Transformed Herfindhal Index** defined by (THI).

$$THI = 1 - HI$$

The Transformed Herfindhal Index increase with increase in diversification and it attains the value 1 – 1/N for maximum diversification. In this study Herfindhal & Transformed Herfindhal were employed for analyzing the levels of diversification in crop enterprises alone.

Result and Discussion:

Crop Diversification Index:

Crop diversification is considered as one of the risk management strategies followed by the farmers traditionally. Hence, it was expected that crop diversification might be adopted by the farms in the study area to manage to the climate risk. The crop diversification index constructed showed that the farmers in CW Block had opted for crop diversification as one of the measures of adaptation for climatic variations. Though the prices have a strong influence in deciding the cropping pattern the availability of resource endowments particularly irrigation water had a strong bearing on farmer's decision in the selection of crop. The Transformed Herfindhal Index was calculated in CW & GW blocks as presented during the period 2001–2015. The Transformed Herfindhal Index value ranged from 0-1 and the value nearer to 0 to 1 indicate more diversification and when the value approaches 0 it indicate specialization. The average value of Transformed Herfindhal Index was higher in CW block compared to GW block which indicated the diversified nature of crops growing in CW block than GW block. The yearly Transformed Herfindhal Index was subjected to trend analysis and the results were presented in table - 1. It was understood from the figure 1, that the diversification was in little larger extent in CW block (0.7) compared to GW block (0.6) considering the trend there was no observable trend indicating either diversification or concentration in numbers of crops grown by the farmers either in CW or in GW block, except the mild inter year fluctuations. Hence it was understood that crop diversification was not followed as one of the adaptation strategies to overcome climate risk irrespective of the source of irrigation.

Conclusion:

Crop diversification is considered as one of the risk management strategies followed by the farmers traditionally. In the study area the crop diversification index show the farmers in CW block had opted for crop diversification as one of the measure of adaption for climatic variations. The average value of Transformed Herfindhal Index was higher in CW block compared to GW block which indicated the diversified nature of crops growing in CW block than GW block. The trend in Transformed Herfindhal Index shows that the diversification was in little larger extent in CW block (0.7) compared to GW block (0.6) considering the trend there was no observable trend indicating either diversification or concentration in numbers of crops grown by

the farmers either in CW or in GW block, except the mild inter year fluctuations. Hence it was understood that crop diversification was not followed as one of the adaptation strategies to overcome climate risk irrespective of the source of irrigation.

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Table 1: Crop diversification Index CW & GW Blocks (2001 - 2015)

Year	Herfindhal Index		Transformed Herfindhal Index	
	CW-Kurinjipadi	GW-Cuddalore	CW–Kurinjipadi	GW-Cuddalore
2000-2001	0.30	0.40	0.69	0.59
2001-2002	0.31	0.39	0.68	0.60
2002-2003	0.32	0.39	0.67	0.61
2003-2004	0.30	0.41	0.71	0.58
2004-2005	0.29	0.39	0.71	0.61
2005-2006	0.31	0.41	0.69	0.58
2006-2007	0.35	0.40	0.64	0.60
2007-2008	0.25	0.36	0.75	0.63
2008-2009	0.28	0.40	0.72	0.60
2009-2010	0.31	0.43	0.68	0.56
2010-2011	0.32	0.40	0.68	0.59
2011-2012	0.31	0.41	0.68	0.58
2012-2013	0.29	0.40	0.70	0.60
2013-2014	0.30	0.39	0.69	0.60
2014-2015	0.30	0.44	0.69	0.56
Average (Secondary Data)	0.30	0.40	0.69	0.59
Average (Primary Data)	0.28	0.43	0.75	0.64

Figure 1: Crop Diversification Index CW & GW Block (2001 - 2015)