



Socio-Economics and Adaptation of Farmers to Climate Change in Krishna River Basin (Nagarjuna Sagar Project) of Andhra Pradesh

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ABSTRACT

The study of socio economic conditions and adaptation of farmers to climate change in NSP right canal under Krishna river basin of Andhra Pradesh was carried out during 2008-09. The study revealed that an average age of the farmers was 36 years. The education level of farmers showed that 42.92% of farmers were educated upto high school level. The investment on health showed that 35.83% farmers invest their income on health ranging from Rs.10000-20000 year⁻¹. It also showed that 67.06% of households were more than 12 year of age and working in cultivation. The average size of farm owned in the present study area was 1.03 hectares and 0.98 hectares was leased farm. Most of the farmers lend their credit from the institutional agencies like banks and cooperative societies. The study also revealed that 59.17 % of farmers adapted strategies to climate change of which 49.29 % of farmers adapted to water saving methods followed by crop diversification 22.53 %, change to livestock by 15.49% and off farm activities by 12.67%. The farmers that obtain the technical information from department of agriculture accounts for 62.5% followed by research stations (27.08%).

Key words :Adaptation, Climate Change, Krishna river basin, Socio-economics.

Climate change is one of the major environmental concerns of today's challenge to humanity as a whole. The hydrological cycle of many climatic regions and river basins are mainly disturbed by the changes in cropping pattern, land use pattern and over exploitation of water storage.. The recurrent droughts and floods threaten the livelihood of billions of rural people who depend on the agriculture for most of their needs. Adaptation options are also widely available, but the more extensive research is lacking to reduce the vulnerability to future climate changes. It is often the poor that are most vulnerable to such climatic changes (Mendalson *et al.*, 2006). Hence the present study was taken up under NSP right canal of Krishna river basin of Andhra Pradesh.

MATERIAL AND METHODS

The study was conducted under NSP right canal command area under Krishna river basin. Multistage random sampling technique was used to select the respondents covering three mandals. two villages from each mandal were selected during 2008-09. The surveyed farmers are spread over different mandals of Guntur district covering three different locations of the Nagarjuna Sagar Project,

viz, Canal Head, Canal middle and Canal Tail. Thus the total sample of the study was 240 farmers. The main emphasis of the study was to analyze the socio economic conditions of farmers and their adaptations to climate change. A simple tabular analysis was used for the study.

RESULTS AND DISCUSSION

I. Human Capital

Human capital is an important component to understand farmer's behaviour to tide over crisis management in the context of climate change and the indicators like age, education, health and percentage of households with age >12 and working in cultivation were used for this purpose:

i. Age:

It was observed from the Table .1 that the average age of the farmers was 36 years with a minimum of 25 years and a maximum of 70 years. It can be easily seen that about 35.83% of farmer age lies between 30 and 40. The age of the head of the household represents experience in farming. The experienced farmers have a higher probability of perceiving climate change as they are exposed

to past and present climatic conditions over the longer horizon of their life span. It can be hypothesized that older and more experienced farmers have higher likelihood of perceiving climate change. In the study area, majority of the farmers were in the age group of 30-40 implying that there was a chance of adaption of new technologies to mitigate climate change impact.

ii. Education

The education level of farmers in the study area was presented in the Table.2. About 51.66% of the farmers were educated up to high school level, 22.9% upto elementary level, 17.08% have no formal education and the remaining 8.3% have education upto college level. In the head region 13.75% of the farmers were educated upto college level, 51.25% of farmers upto high school level, 23.75% upto elementary level and 11.25% has no schooling at all. In the middle region 53.75% of farmers are educated upto high school level, 7.5% upto college level, 22.75% upto elementary level and 16.25 % farmers have no schooling at all. Whereas in case of tail end 50% of the farmers were educated upto high school level, 3.75% upto college level, 22.5% upto elementary level and 23.75% farmers were without any schooling. Higher level of education was believed to be associated with access to information on improved technologies and productivity consequences. Hence, higher the education level more is the chance of adaptation to climate change.

iii. Health

An examination of farmer's investment on health from Table .3 revealed that 35.83% of the farmers invest between Rs. 10000-20000 for health and 33.75% invest less than Rs. 10000 on health and about 26.66% between Rs. 20000-30000 and 3.75% invest between Rs. 30000-40000 on health conditions. If the farmer's investment on health was more, the more was the deviation of farmers' income from investment on cultivation and hence farmers go for borrowings from private money lenders making them fall in debts and finally no chance of going for adaptation. It can be concluded that majority of the farmers investment on health was moderate in the study area.

iv. Households in Agricultural operations

Households with large family members may be forced to divert part of the labour force to off-farm activities in an attempt to earn income in order to ease the consumption pressure imposed by a large

family size. Large family size was normally associated with a higher labour endowment, which would enable a household to accomplish various agricultural tasks in terms of labour shortage. An overview of the Table .4 provided the percentage of households with more than 12 years of age and working in cultivation is an important component of human capital. Among the surveyed farmers, this percentage ranged between 63.4 and 72.7 with an average of 67.06%.

II. Physical capital

i) Farm size

Farm sizes of the study area were presented in Table 5. It can be easily seen from the table that, the total farm sizes owned by the farmers vary between 1.13 to 0.90 hectare across different regions. The average farm size owned was about 1.03 ha. The total leased in area was negligibly small in all three regions. Farm size was associated with greater wealth and it was hypothesized to increase adaptation to climate change. If the size of the farm was more the farmer may go for adaptation.

ii) Distribution of livestock:

Livestock plays a very important role by serving as a store of value, source of traction (especially oxen) and provision of manure required for soil fertility maintenance. Thus, livestock ownership was hypothesized to increase adaptation to climate change. In times of any extreme events occurs livestock rearing becomes a main source of income to the farmers. The frequency distributions of number of livestock possessed by the farmers across 3 different regions were presented in Table 6. About 18% of the farmers in the sample have no possession of livestock and 82 % of sample farmers possess livestock under Canal (head, middle and tail) regions.

Financial Capital

Farmers' income from agriculture, their investment in various assets and capacity to repay the loans borrowed for cultivation form the components of this capital. The net income was obtained by subtracting all expenses from gross income which includes revenue from yield. An overview of Table.7 provides the average income (per hectare) for paddy. The farm income per ha was found to be Rs 14452.51 .If the average farm income was high the farmer can go for adaptation of new technologies.

IV. Credit source:

Availability of credit eases the cash constraints and allows farmers to buy purchased inputs such as fertilizer, improved crop varieties and irrigation facilities. Thus, there was a positive relationship between the level of adoption and the availability of credit. The credit required by the farmers is provided by different sources like banks and cooperative societies. An examination of Table.8 revealed that cooperative society contributes to an extent of 50% and banks contribute to an extent of 39.16% followed by money lenders of 10.83%.

VII. Perception of farmers on Climate Change

Farmers were questioned to elicit their observation on changes in climate in the last 5 years. It was observed from Table 9, 51.7 % of the farmers reported that they observed many changes in climate during the last 5 years while 48.3% of the farmers opined that there was somewhat change in climate.

VIII. Adaptation measures followed

The adaptation taken up by the farmers indicate that the farmers have perceived the changes in the climate and made use of the technical guidance and finally have gone for adaptations

against changing climate. From the total adapted farmers 49.29 percent of farmers adopt water saving methods followed by crop diversification 22.53 %, change to livestock by 15.49% and off farm activities by 12.67%. In tail end region most of the farmers i.e., 63.83% of farmers adopt water saving methods followed by off farm activities with 19.15%. Whereas in head and middle region most of the farmers adopt crop diversification followed by water saving methods.

As indicated on Figure.1 above, use of water saving technologies was the most commonly used method which contributes to 29.19% of the total adaptation followed by crop diversification to extent of 13.3%, change to livestock upto 9.16% and off farm activities to an extent of 7.52%, where off-farm activities was the least adaptation practiced among the major adaptation methods identified in the Krishna river basin. Moreover, about 42 percent of the surveyed farmers reported not to have any adaptation method as indicated in the figure above due to many reasons.

IX Barriers of adaptation:

The analysis of barriers to adaptation to climate change in the study area indicates that

Table.1. Distribution of farmers age in the study area.

Region	Age			
	Less than 30	30-40 years	40-50 years	>50 years
Canal Head (n=80)	16	24	18	22
Canal Middle (n=80)	10	33	17	20
Canal Tail (n=80)	9	29	17	25
Total (n=240)	35	86	52	67
Percentage to the total	14.58	35.83	21.67	27.92

Table 2. Education levels of farmers in the study area.

Region	Education-Level			
	College Level(>10)	High School (5-10)	Elementary Level (1-5)	No Formal Schooling
Canal Head (n=80)	11 (13.75)	41 (51.25)	19 (23.75)	9 (11.25)
Canal Middle (n=80)	6 (7.50)	43 (53.75)	18 (22.75)	13 (16.25)
Canal Tail (n=80)	3 (3.75)	40 (50.00)	18 (22.50)	19 (23.75)
Total (n=240)	20 (8.33)	124(51.66)	55 (22.91)	41(17.08)

Table 3. Farmer investments on health in the study area.

Region	Investment(Rs/annum)			
	<10000	10000-20000	20000-30000	30000-40000
Canal Head (n=80)	29	32	15	4
Canal Middle (n=80)	25	28	24	3
Canal Tail (n=80)	27	26	25	2
Total (n=240)	81	86	64	9
Percentage to the total	33.75	35.83	26.66	3.75

Table 4. Distribution of households in cultivation in the study area.

Region	Percentage of Households with age greater than 12 years working in cultivation		
	Average Households		
	Average Household size	>12Years under cultivation	Percentage
Canal Head (n=80)	3.75	2.38	63.45
Canal Middle (n=80)	3.76	2.45	65.17
Canal Tail (n=80)	3.96	2.88	72.75
Total (n=240)	3.82	2.57	67.06

Table 5. Distribution of farm size (ha) in cultivation in the study area.

Region	Average owned farm	Average leased farm
Canal Head (n=80)	1.03	0.32
Canal Middle (n=80)	0.90	1.28
Canal Tail (n=80)	1.13	0.39
Total average (n=240)	1.03	0.98

Table 6. Distribution of livestock in the study area.

Particulars	Livestock possession	
	Yes	No
Canal Head (n=80)	72	8
Canal Middle (n=80)	64	16
Canal Tail (n=80)	61	19
Total (n=240)	197	43
Percentage to the total	82	18

Table 7. Average farm income of farmers in the study area.

Region	Mean income (Rs. acre ⁻¹)
Canal Head (n=80)	16696.56
Canal Middle (n=80)	11250.10
Canal Tail (n=80)	15111.21
Average	14452.51

Table 8. Credit Sources to farmers in the study area.

Region	Banks	Cooperative society	Money lenders
Canal Head (n=80)	39(41.48)	34(28.33)	7(26.92)
Canal middle (n=80)	24(25.53)	46(38.33)	10(38.46)
Canal tail (n=80)	34(36.17)	40(33.33)	9(34.61)
TOTAL	94(39.16)	120(50.00)	26(10.83)

Table 9. Frequency of Climate Change-observation by farmers in the study area.

Region	Climate Change-phenomenon-What farmers observed for the past 5 years	
	Some what	Very much
Canal Head (n=80)	35	45
Canal Middle (n=80)	54	26
Canal Tail (n=80)	27	53
Total (n=240)	116	124
Percentage to the total	48.33	51.67

Table10. Summarizes the various adaptation measures in the study area.

Region	Crop diversification	Water saving methods	Off farm activities	Change to livestock
Canal Head (n=80)	14(30.43)	16(34.78)	4(8.70)	12(26.09)
Canal Middle (n=80)	14(28.58)	24(48.98)	5(10.20)	6(12.25)
Canal Tail (n=80)	4(8.51)	30(63.83)	9(19.15)	4(8.51)
Total (n=240)	32(22.54)	70(49.30)	18(12.67)	22(15.49)

Figures in parentheses indicate percentages to total

Table11. Various barriers of adaptation of farmers in the study area.

Region	Lack of information	Lack of money	Shortage of labour	Shortage of land	Poor potential for irrigation
Canal Head (n=80)	17(50.00)	7(20.59)	10(29.41)	0(0)	0(0)
Canal Middle (n=80)	11(35.48)	5(16.13)	10(32.26)	5(16.13)	0(0)
Canal Tail (n=80)	16(42.43)	6(18.18)	4(12.12)	1(3.03)	8(24.24)
Total (n=240)	42(42.86)	18(18.37)	24(24.49)	6(6.12)	8(8.16)

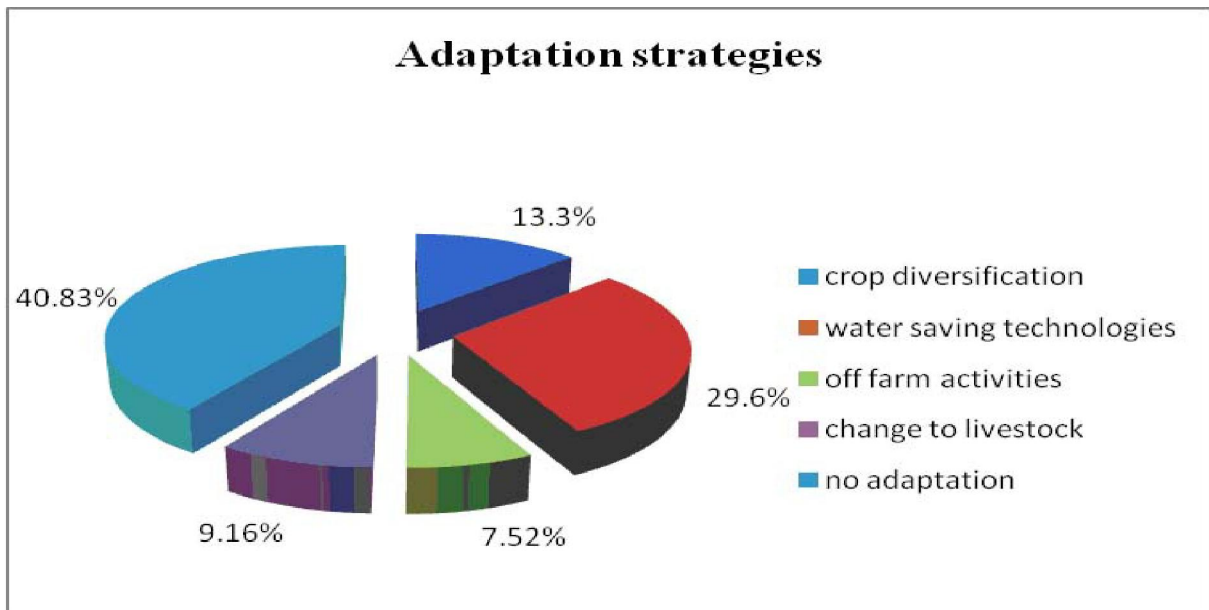
Figures in parentheses indicate percentages to total

Table 12. Extension services from various agencies.

Region	Department of agriculture	Research stations	None	Total sample
Canal Head (n=80)	48(60.00)	24(30.00)	8 (10.00)	80
Canal Middle (n=80)	51(63.75)	24(30.00)	5 (6.25)	80
Canal Tail (n=80)	51(63.75)	17(21.25)	12 (15)	80
Total (n=240)	150(62.5)	65(27.08)	25 (10.42)	240

Figures in parentheses indicate percentages to total

Fig.1. Farmers adapting to climate change (N=240).



there were five major constraints to adaptation. These were lack of information, lack of money, shortage of labour, shortage of land and poor potential for irrigation (Table 11). Lack of information to adaptation options could be attributed to the fact that research on climate change and adaptation options have not been strengthened in the country and thus, information was lacking in this area. Lack of money hinders farmers from getting the necessary resources and technologies. Adaptation to climate change was costly, and this cost could be revealed through the need for intensive labour use. Thus, if farmers do not have sufficient family labour or the financial means to higher labour, they cannot adapt. Poor irrigation potential can most probably be associated with the inability of farmers to use the already existing water due to technological incapability. It was observed from the table 4.16, the lack of information was the major constraint contributing to about 42.86%, followed by shortage of labour with 24.49%, lack of money with 18.37%, poor potential of irrigation with 8.16% and shortage of land contributing to 6.12%.

X. Agencies who helped farmers in gaining technical information

Farmers were asked to state among the different agencies that helped them in gaining technical information. Access to information on climate change through extension agents or other sources creates awareness and favourable condition for adoption of farming practices that are suitable under climate change. Thus farmers contact with extension agents or any other sources, which provide information on climate change increase the

awareness of farmers. From the table 12, it was clear that 62.5% of the farmers in the three regions obtain the extension services from the agricultural department and 27.08% of the farmers from the research stations and 10.42% farmers have reported that they haven't received any extension services.

Conclusions:

The study revealed that an average age of the farmers was 36 years. The education level of farmers showed that 42.92% of farmers were educated up to high school level. The investment on health showed that 35.83% farmers invest their income on health ranging from Rs. 10000-20000/year. It also showed that 67.06% of households were more than 12 year of age and working in cultivation. The average size of farm owned in the present study area was 1.03 hectares and 0.98 hectares was leased farm. Most of the farmers lend their credit from the institutional agencies like banks and cooperative societies. The study also revealed that 59.17% of farmers adapted strategies to climate change of which 49.29% of farmers adapted to water saving methods followed by crop diversification 22.53%, change to livestock by 15.49% and off farm activities by 12.67%. The farmers that obtain the technical information from department of agriculture accounts for 62.5% followed by research stations.

LITERATURE CITED

- Mendelsohn R, Dinar, A and Williams L 2006.** The distributional impact of climate change on rich and poor countries. *Environment and Development Economics*. 11: 159-178.

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