BIBLIOGRAPHY

TABAGO, CRYSTAL GEM T. APRIL 2012. Documentation on the Effect of Climate Change on Corn Production in Diadi, Nueva Vizcaya. Benguet State University, La Trinidad, Benguet.

Adviser: Jovita M. Sim, MSc

ABSTRACT

The study was conducted at Diadi, Nueva Vizcaya, to determine the effect of climate changes on corn; to determine the awareness, knowledge and observations of the communities on climate change and also to determine the strategies/coping mechanism employed by farmers.

Sixty corn farmers were interviewed. Finding shows that, all of the respondents were aware about climate change. Farmers observed abrupt changes in temperature, abrupt changes in weather condition, La Nina and El Nino, occurrence of super typhoon and prolong dry and wet season as perceived effect of climate change. The observed changes in agro-ecological characteristics were the following: soil easily gets dry and flooded, decreased supply of water for irrigation and changes in soil type and structure. Cropping system was changed from intercropping to mono cropping. Farmers also adopt technology for more convenient in farming. Application of fertilizers and herbicides were increasing due to the depletion of soil as perceive by the respondents.

The study recommends that farmers should reduce application of chemical inputs. These inputs contribute to the global warming through evaporation of chemicals in the air and contributing to climate change. Since climate change is due to pollution in the air and soil, the farmers and all other individual should reduce utilization of chemicals. Farmers should go back to traditional farming or utilize of organic inputs.

INTRODUCTION

Rationale

Climate is usually defined as "the average weather". It is measured by observing patterns in temperature, precipitation (such as rain or snow), wind and the days of sunlight as well as other variables that might be measured at any given site. It is the manifestation of a highly complex system consisting of five interacting components: the atmosphere (air), the hydrosphere (water), cryosphere (frozen part of the earth), the land surface and the biosphere (part of the earth where life exists (Tebtebba Foundation, 2008).

Climate change refers to any change in climate overtime, whether due to natural variability or as a result of human activity (anthropogenic causes). Climate change can result from the interaction of the atmosphere and oceans (Tebtebba Foundation, 2008).

Corn (*Zea mays*) is second in value as a staple crop and its most highly valued crop of all the cereal grains because of its invaluable and multifarious uses. About five million or more inhabitants in Cebu, Eastern Visayas, Southern and Western Mindanao and Upper Cagayan Valley use the crop as staple food crops. It is being utilized as human food, as animal feeds and as raw materials in industries (Aban, 1992). Despite the continuous advancement of technology in agriculture in the country, the average corn yield of 25-55 cavan per hectare remains to be relatively low (PCARRD, 1985). Several factors may influence the yield such as variety, fertilizer, climate change and others.

The Province of Nueva Vizcaya is located in the heart of Northern Luzon. It isgeographically located at southernmost part of Region II and is often referred to as the gateway to vast Cagayan Valley region. It is bounded on the north by Ifugao, in the north east by Isabela, east by Quirino, West by Benguet and south by Nueva Ecija.

Statement of the Problem

1. What are the weather changes in the locality for the last 20 years?
2. What are the awareness, knowledge and observations of the communities on climate change?
3. What are the observed effects of climate change to corn production?
4. What are the strategies/coping mechanism employed by farmers?

Objectives of the Study

1. To determine/document weather changes in the locality for the last 10 years.
2. To determine the awareness, local knowledge and observations of the communities on the climate change.
3. To identify observed effects of climate change on corn production.
4. To determine the strategies/coping mechanism employed by farmers.

Importance of the Study

This study would be able to unearth relevant information regarding the changes on the cultural management practices of corn farmers and yield particularly in Nueva Vizcaya as an impact of climate change. Climate change is felt all over the world and thus, the government is into development of some strategies to cope up climate change concentrating in how to reduce the effect to properties and lives.

The result of this study could be a basis in the development of plans to reduce the effect of climate change to agricultural production specifically on corn production. This could be a basis in production planning. Furthermore, the research could be a basis for other researches of the same field of interest.

Scope and Delimitation

The study focused on the effect of climate change on corn production in Diadi, Nueva Vizcaya.

REVIEW OF LITERATURE

Climate Change

Climate change may be limited to a specific region or may occur across the whole earth. Climate change results from the interaction of the atmospheric and oceanic factors. It is the ultimate effect of global warming. The United Nations Framework Convention on Climate Change (UUNFCCC) put more emphasis on anthropogenic causes of climate change particularly fossil fuel burning (Tebtebba Foundation, 2009). While the Earth's climate has always varied naturally over *millennia,* there is a scientific consensus that human activities are now changing global climate. Precipitation patterns characterizing land areas of the Northern Hemisphere have progressively changed. These changes include more rainfall in the mid to high latitudes, and on the contrary, less rainfall in the sub tropics (FAO, 2006).

Climate Change in the Philippines

Climate change is a long-term change in the statistical distribution of weatherpatterns over periodsranging from decades to millions of years. It may be a change in average weather conditions or the distribution of events around that average (e.g., more or fewer extreme weather events). The Philippines, as a developing country and biodiversity hotspot, is highly vulnerable to climate change impacts The Philippines has experienced temperature

spikes brought about by climate change. It has observed that warming is experienced most in the Northern and Southern region of the country, while Metro Manila has warm less than most parts. The sector most affected by climate change, so far, is agriculture and food security. The sharpest fall in agricultural productions are experienced during strong El Nino events and after the occurrence of severe tropical cyclones. Decreases in agricultural productivity and aquaculture will ensue due to thermal and water stress, sea- level rise, floods and droughts, and tropical cyclones would diminish food security in many countries of Asia (Jabines and Inventor, 2007 and Zhai and Zhuang, 2007). The predicted changes in temperatures and rainfall patterns, as well as their associated impacts on water availability, pests, disease, and extreme weather events are all likely to affect substantially the potential of agricultural production (Zhai and Zhuang, 2007). These factors, individually and cumulatively, lead to reductions in agricultural production. Moreover, agricultural productivity will be depressed by increased climate variability and increased intensity and frequency of extreme events such a drought and floods. During the El Nino period crops become vulnerable to pest attacks and diseases. La Nina years bring heavy rain, causing massive runoff, severe erosion of fertile soils, and inundation of agricultural areas and aquaculture farms (ADB, 2009). Farmers have always had to cope with the environment that surrounds them, gradually adapting to it. Most small-scale farmers have to deal with insufficient resources, and many are trying to grow crops in soils which the climate is changing and the resulting situations, weather temporary dry period or a hurricane, only adds to the lists of challenges and to the sense of urgency.

The Impacts of Climate Change on People and Food

Food security will depend on the inter-relationships between political and socio-economic stability, technological progress, agricultural policies and prices, growth of per capital and national incomes, poverty reduction, women's education, trade and climate variability. Climate change, however, will affect food production because of shifts in temperature and rainfall, people's access to food by lowering their income from coastal fishing because of rising sea levels or lowering a country's foreign exchange earnings by the destruction of its export crops because of the rising frequency and intensity of tropical cyclones. Overall, climate changes including global warming and increased climate variability could result in a variety of impacts on agriculture.

Some of the impacts of climate change on food production which are already visible and seem to be increasing are: Increased heat stress to crop and livestock, e.g. higher night temperatures which could adversely affect grain formation and other aspects of crop development, Increased evapo-transpiration rate caused by higher temperatures and lower soil moisture levels.

Climate Change and Agriculture

The sector most affected by climate change, so far, is agriculture and food security. The sharpest fall in agricultural productions are experienced during strong El Nino events and after the occurrence of severe tropical cyclones. Decreases in agricultural productivity and aquaculture will ensue due to thermal and water stress, sea-level rise, floods and droughts, and tropical cyclones would diminish food security in many countries of Asia (Jabines and Inventor, 2007 and Zhai and Zhuang, 2007). The predicted changes in

temperatures and rainfall patterns, as well as their associated impacts on water availability, pests, disease, and extreme weather events are all likely to affect substantially the potential of agricultural production (Zhai and Zhuang, 2007). These factors, individually and cumulatively, lead to reductions in agricultural production. Moreover, agricultural productivity will be depressed by increased climate variability and increased intensity and frequency of extreme events such a drought and floods. These factors further contribute to the difficulties in estimating the impacts of climate change on agricultural productivity (Zhai and Zhuang, 2007).

METHODOLOGY

Local and Time of the Study

The study was conducted in Diadi, Nueva Vizcaya. Three barangays was included in the study, these were San Pablo, Arwas, and Escoting. The study was conducted on October to November 2011.

Respondents of the Study

The respondents were 60corn farmers. The respondents were chosen at random.

Data Gathering Procedure

The study used primary and secondary data. Primary data gathered from survey, interview and transect walk. Survey questionnaire were distributed to the respondents. Data was validated on the collection period of questionnaire. Weather data was taken from PAGASA.

Data Gathered

The data gathered were the physical features/climatological data, production methods, yield, incidence of pest and diseases and coping mechanism of corn farmers on climate change. Secondary data were the weather data such as rainfall and temperature.

Data Analysis

The data collected were tabulated and analyzed using frequency and descriptive analysis and other appropriate statistical tool.

RESULTS AND DISCUSSION

Profile of the Respondents

Table 1 shows the profile of respondents as to their age, gender, educational attainment, civil status and religion. Thirty percent of the respondents were aged 41-50 years old, 25% were 51 to 60 years old, 20% were 31-40 years old, 12% were 21-30 years old and 10% were 61-70 years old. Sixty three percent of the respondents were male and 37% were female. This shows that corn farming is mostly done by males. Most (80%) of the respondents were Roman Catholic, Other religious affiliation of the respondents were Iglesia Ni Cristo, Pentecost, Espiritista, and Born Again Christian.

Forty two percent of the respondents had reached the elementary level, 32% had reached high school, 25% had reached college and 2% vocational course. This implies that all the respondents had attended formal education and were literate.

Most (93%) of the respondents were married. Majority (52%) of the respondents were engaged in corn production for 26 years and more, 12% were engaged in corn production for 21 to 25 years and the least is less than 5 years (3%). This shows that the respondents had enough experienced in corn production.

Average Weather Data

Weather data as to average annual rainfall, and maximum and minimum temperature was gathered from Nueva Vizcaya State University Weather Station and presented in Table 2. The data shows that the highest rainfall (201.6 mm) was experienced in 2009. It implies that there was heavy rainfall in that year. Year 2001 has the highest temperature (24.7to

28.6), this implies warm weather in that year and on 2008, had the lowest temperature at 24.5^{o}C to 26.6^{o}C.

Table 1. Profile of the respondents

PARTICULAR	BARANGAY			
	ARWAS (N=16)	ESCOTING (N=16)	SAN PABLO (N=28)	TOTAL PERCENTAGE
Age				
21-30	3	3	1	12
31-40	2	6	4	20
41-50	5	5	8	30
51-60	2	1	12	25
61-70	3	1	2	10
71-80	1	0	1	3
TOTAL	16	16	28	100
Gender				
Female	3	10	9	33
Male	13	6	19	63
Religion				
Roman Catholic	11	13	24	80
Iglesia Ni Cristo	2	1	1	7
Born Again	2	0	3	8
Espiritista	1	0	0	2
Pentecost	0	2	0	3
TOTAL	16	16	28	100

Table 1. Continued…

PARTICULAR	BARANGAY			
	ARWAS (N=16)	ESCOTING (N=16)	SAN PABLO (N=28)	TOTAL PERCENTAGE
Educational Background				
Elementary	6	8	11	42
High school	5	5	9	32
College level	4	3	8	25
Vocational	1	0	0	2
TOTAL	16	16	28	100
Marital Status				
Married	14	15	27	93
Single	1	0	0	2
Widowed	1	1	1	5
TOTAL	16	16	28	100
Years engaged in corn production				
10 years and below	2	3	0	8
11-15 years	1	1	3	8
16-20 years	0	5	7	20
21-25 years	4	1	2	12
26 and above	9	6	16	52
TOTAL	16	16	28	100

Table 2. Average Annual Rainfall and Temperature Data from 2001-2010 (PAGASA, NVSU)

YEAR	ANNUAL DATA		
	RAINFALL (mm)	TEMPERATURE (°C)	
		MINIMUM	MAXIMUM
2001	162.4	24.7	28.6
2002	110.6	24.3	27.5
2003	145.8	24.6	27.1
2004	170.0	24.6	27.1
2005	178.9	24.9	27.5
2006	213.0	24.6	27.3
2007	179.1	24.8	27.4
2008	164.9	24.5	26.6
2009	201.6	24.4	26.7
2010	161.7	25.7	28.1

Awareness on Climate Change

Table 3 shows the awareness of respondents to climate change. All of the respondents in all areas were aware about climate change. Most (97%) of the respondents observed abrupt changes in temperature, 82% mentioned abrupt changes in weather condition, 65% mentioned La Nina and El Nino, 58% mentioned occurrence of super typhoon and 53% mentioned prolong dry and wet season. This implies that the farmers in the study area were aware of climate change and have experienced some observations on changes in climate.

Table3. Awareness and perception to climate change

PARTICULAR	FREQUENCY	PERCENTAGE
Awareness		
Aware	60	100
Perception		
Abrupt changes in temperature	52	87
Occurrence of super typhoon	35	58
Abrupt changes in weather condition	49	82
Changes in season like prolong dry and wet season	32	53
La Nina	39	65
El Nino	39	65

*Multiple Responses

Area of Corn Production

The area for corn production in the study sites from 1990 -2010 were shown in Table 4. In the year 1990-2000 27% of the respondents had 3 hectares, followed by 17% having 2 hectares, 15% with one hectare, 13% had 4 hectares, 12% had 5 hectares, 10% had 1.5 hectares, five percent had 7-10 hectares and2% had 1.5 hectares. On the year 2001-2010 more of the respondents had 3 hectares (27%), 17% had two hectares, 13% of the respondents had 4 hectares, 12% had five hectares, one hectare had 9%, six percent had 1.5 hectares, 5% had 7-10 hectares and two percent had 1.75 hectares.

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Table 4 .Area of corn production

AREA (HECTARE)	1990-2000		2001-2010	
	FREQUENCY	PERCENTAGE	FREQUENCY	PERCENTAGE
1	9	15	9	15
1.5	6	10	6	10
1.75	1	2	1	2
2	10	17	10	17
3	16	26	16	26
4	8	13	8	13
5	7	12	7	12
7-10	3	5	3	5
TOTAL	60	100	60	100

Landscape of the Farm and Changes

Table 5 shows the landscape of the farm of the respondents. Most (83%) of the respondents had sloping/swidden farm landscape, 7% had flat terrain, and terraced irrigated (5%) and others had terraced unirrigated (3%) and 2% hilly.

Changes in agro-ecological profile of the farm were presented in the table based on the observation of the respondents, more than half (55%) of the respondents observed their farm and soil easily gets dry, 42% of the respondents observed their farm easily getsflooded when there is heavy rains, 33% of the respondents observed decreased supply of water for irrigation, 30% observed changed in soil type and texture, fertile soil became

unfertile, 27% observed low water holding capacity of the soil, and 13% observed sloping area became a bit flatter due to land slides and flooding.

Causes/effect of these changes were; caused by weather condition (57%), 53% caused by soil erosion (53%), caused by soil structure changes from porous to compact (35%), El Nino (35%) and La Nina (35%), caused by scarcity of water supply (15%) and caused by landslide in the farm (8%). The result implies that most of the changes and causes and effects were negative.

Table 5. Landscape of the farm

PARTICULAR	FREQUENCY	PERCENTAGE
Landscape of the Farm		
Sloping/swidden	50	83
Terraced irrigated	3	5
Terraced unirrigated	2	3
Flat terrain	4	7
Hilly	1	2
TOTAL	60	100
Changes in agro ecological profile		
Sloping area became flat	8	13
Farm area easily get flooded	25	42
Farm/soil easily get dry	33	55

Table 5. Continued…

PARTICULAR	FREQUENCY	PERCENTAGE
Decrease supply of water	20	33
Changes in soil type and texture, fertile became unfertile	18	30
Causes		
Weather conditions	34	57
Soil structure changes from porous to compact	21	35
Soil erosion	26	43
Supply of water became scarce	9	15
Landslide in the farm	5	8
El Nino	21	35
La Nina	21	35

*Multiple Responses

Crops Grown

Table 6a shows the kind of crops grown since 1990-2010. The respondents practiced intercropping in the year 1990-2000. Farmers planted corn in the first cropping (100%), and on the second cropping were the following: squash (20%), stringbeans (15%), tomato (12%), peanut (7%), eggplant (3%), mungbean, sweetpotato, bitter gourd, and hot pepper (2%). Monocropping of corn is practiced up to this period. Result shows that there was no change as to the practice in corn production.

However, in terms of variety all the respondents have changed their variety of corn from the native green corn to hybrid yellow corn intended for animal feeds, though there were

still some planting green corn but no longer the native varieties but improved varieties introduced by the Department of Agriculture (Table 6b).

The reasons of changing were provide higher yield (74%), easy to manage (64%), resistance to pests and diseases (24%), adopted to weather and climate change (18%). These reasons brought better yield (78%), provided higher income (41%), more of the respondents adopt abrupt changes in weather or temperature (31%) and better demand in the market (26%).These shows their shifting in cropping system from intercropping to monocropping.

Table 6a. Crops grown

CROPS	1990-2000			2001-2010		
	CROPPING SYSTEM	TOTAL F	TOTAL (%)	CROPPING SYSTEM	TOTAL F	TOTAL (%)
Mungbean	intercropping	1	2	-	-	-
String beans	intercropping	9	15	-	-	-
Peanut	intercropping	4	7	-	-	-
Squash	intercropping	12	20	-	-	-
Sweetpotato	intercropping	1	2	-	-	-
Tomato	intercropping	7	12	-	-	-
Bitter gourd	intercropping	1	2	-	-	-
Eggplant	intercropping	2	3	-	-	-
Hot chilli	intercropping	1	2	-	-	-
Corn	intercropping	60	100	Mono cropping	60	100

Table 6b.Changing of corn variety, reasons and effects

PARTICULAR	FREQUENCY	PERCENTAGE
Changes on corn variety		
Changed	60	100%
Reasons of changing variety		
Provide higher yield	44	74
Resistance to pests and diseases	14	24
Easy to manage	38	64
Adopted to weather changes	10	18
Adopted to climate change	10	18
These reasons lead to		
Better demand in the market	15	26
Provided higher income	24	41
More adopted to abrupt changes in weather or temperature	18	31
Better yield	46	78

*Multiple Responses

Changes in Production/Cultural Management Practices

The farmers have mentioned that their production practices had changed from manual to the use of chemical in the control of weeds, from traditional to conventional production to control pest and diseases. Table 7 shows the changes in production/cultural management practices from 1990-2010. Weeding in 1990-2000 was done twice (53%) through manual weeding with the use of sickle or bolo, while in 2001-2010, weeding was

done twice (32% of the respondents) or some (23%) were done once through the use of herbicide or weedicide. Before farm operation the farmers spray herbicide or weedicide or combine depending on the types of weeds present in the area. In 1990 – 2000, there were already some farmers who were already using herbicide but usage is minimal and farmers used knapsack sprayer. Currently, most (80%) were using power sprayer to spray herbicide.

Fertilizer application specifically in basal, it was done once (53%) through manual or by using their foot to mix fertilizer with the soil, while in 2000-2010 it was also done once (72%) through the use of *Plantilla*. Plantilla is a tool used in planting; it is elongated with a hole inside. They used this tool for faster and more convenient in planting ad also in the application of fertilizer. Farmers also apply fertilizer through sidedressing. Side dressing is done once or twice through plowing but in 2001 to 2010 is done through plantilla. This implies that the technology in farming is improving with the use of new farm implements.

Volume of Fertilizers Used

Table 8 shows the changes on the volume of fertilizers used. All the respondents were using T-14 paired with urea (1:1). More of the respondents were using 2:2 bags and 4:4 bags per hectare of fertilizer on 1990-2000 (25%), eighteen percent used 3:3 bags, 17% used 6:6 bags, 7% used 7:7 bags and two percent used 10:10 and also 1:1 bag. While on 2001-2010 more of the respondents were used 8:8 bags per hectare (32%), 13% used 2:2 bags, twelve percent used 4:4 and 10:10 bags, 8% used 6:6 bags, 3:3 bags used (7%), 5% used 5:5, and two percent used 7:7. This result implied that farmers had increased the amount of fertilizers applied. This is their way of coping climate change and increase production because soil fertility depleted.

Table 7. Changes in production/cultural management practices

ACTIVITIES	1990-2000		2001-2010	
	PERCENTAGE	PRACTICE	PERCENTAGE	PRACTICE
Weeding				
Once	13	Manual picking	23	Spraying
Twice	53		32	herbicide
Thrice	8		7	
Spraying				
Once	22	Knapsack sprayer	2	Power sprayer
Twice	2		80	
Thrice	-		5	
Fertilizer Application				
Basal				
Once	53	Manual (they	72	"Plantilla"
Twice	7	used their feet)	12	
Thrice	2		2	
Side Dressing				
Once	55	Plowing	67	"Plantilla"
Twice	8		13	
Harvesting	60	Manual	60	Packaging material
Packaging material	60	Sacks	60	Sacks

Application of Herbicide

Kind of herbicides used by corn farmers is shown in Table 9. Result shows that in 1990 to 2000, the farmers were not using herbicide in their field, however, in 2001 to 2010 or even

at present, farmers use herbicide to control weeds. All the respondents were now using herbicide. The farmer mixed 4 liters or 1 gallon with 200 L of water per one hectare in the farm. On the kind of herbicide used; 33% used Spit fire, 22% used Clear out, 17% used Pounds, 12% used Power, 10% used Round up and 7% used Demolition.

Changes in Yield of Crops

The average marketable yield is shown in Table 10a. In 1990-2000, 23% of the respondents yielded 100cavansduring their first cropping and 18% yielded 100cavans during their second cropping.

Table 8. Changes on the volume of fertilizer used

RATIO OF T14 PAIRED WITH UREA PER HECTARE	1990-2000		2001-2010	
	F	%	F	%
1:1	1	2	-	-
2:2	15	25	8	13
3:3	11	18	4	7
4:4	15	25	7	12
5:5	-	-	3	5
6:6	10	17	5	8
7:7	4	7	2	2
8:8	-	-	19	32
9:9	-	-	-	-
10:10	1	2	7	12

Table 9. Application of herbicide

	1990-2000	2001-2010

NAME OF HERBICIDE	VOLUME PER HECTARE	PERCENTAGE	VOLUME PER HECTARE	PERCENTAGE
Clear out	-	-	4L	22
Spit fire	-	-	4L	33
Round up	-	-	4L	10
Pounds	-	-	4L	17
Power	-	-	4L	12
Demolition	-	-	4L	7
TOTAL				100

Table 10b shows the average non marketable yield. In 1990-2000, 23% of the respondents had five percent non marketable during their first cropping. 14% had ten percent non marketable on their second cropping. On the year 2001-2010, 22% of the respondents had five percent non marketable yield during their first cropping and 18% of them had ten percent non marketable yield during their second cropping. The farmers who mentioned that their non-marketable yield was 50 to 75% because the farmers used seeds from previous harvest instead of purchasing a certified seeds from Municipal Agriculture Office or from certified seed growers. According to some respondents, if you plant seeds from previous harvest, the yield or no yield will be obtained. Thus, every planting season farmers buy seeds from certified seed growers.

Incidence of Pests and Diseases

Table 11 shows the incidence of pests and diseases. Leaf hopper is one of the major pests that attacked corn in 2001-2010 during wet season. Another pest are the rats, that attacked plants during dry season. Stem borer is another problem of corn farmers which is a perennial problem. Another pest is the corn borer, which is most attacked observed in 1990-2000 during wet season, birds is also another problem which attacks the corn during dry season.

On diseases, the incidence of root rotting during the wet and dry season was one of the problems encountered by farmers in corn production. Powdery mildew was also observed in 1990-2000 during wet season. The incidence of pest and diseases was observed to be moderate to high incidence. On the presence of birds that attacked the corn the incidence was during the wet season. It implies that, in every year, pests and diseases are one of the major problems of corn farmers.

Table10a. Average marketable yield

CORN PRODUCTION PER HECTARE (CAVAN)	AVERAGE MARKETABLE YIELD							
	1990-2000				2001-2010			
	FIRST CROPPING		SECOND CROPPING		FIRST CROPPING		SECOND CROPPING	
	F	%	F	(%)	F	(%)	F	(%)
30	2	3	-	-	2	3	-	-
40	-	-	1	2	-	-	1	2
50	8	13	7	12	8	13	5	8
60	5	8	3	5	5	8	4	7

Table 10a. Continued…

CORN PRODUCTION PER HECTARE (CAVAN)	AVERAGE MARKETABLE YIELD							
	1990-2000				2001-2010			
	FIRST CROPPING		SECOND CROPPING		FIRST CROPPING		SECOND CROPPING	
	F	%	F	(%)	F	(%)	F	(%)
70	2	3	2	3	2	3	2	3
80	5	8	1	2	3	5	1	2
90	4	7	4	7	5	8	3	5
100	14	23	6	10	11	18	7	12
120	6	10	17	28	3	5	13	22
130	1	2	10	17	3	5	7	12

Table10 b. Average non- marketable yield

PERCENTAGE PER HECTARE	AVERAGE NON MARKETABLE YIELD							
	1990-2000				2001-2010			
	FIRST CROPPING		SECOND CROPPING		FIRST CROPPING		SECOND CROPPING	
	F	(%)	F	(%)	F	(%)	F	(%)
5	14	23	2	3	13	22	2	3
10	8	13	14	23	5	8	11	18
15	-	-	-	-	1	2	1	2
20	4	7	-	-	5	8	5	8
25	5	8	3	5	5	8	4	7
30	2	3	3	5	2	3	2	3
50	1	2	7	12	2	3	7	12
60	-	-	4	7	-	-	5	8
75	2	3	5	8	1	2	5	8

Table11. Pests and diseases

PESTS AND DISEASES	1990-2000		2001-2010	
	MEAN		MEAN	
	WET	DRY	WET	DRY
Corn borer	3.68	3.35	2.48	2.39
Leaf hopper	3.4	3.4	3.54	3.23
Stem borer	3	3	3	3
Rat	3	3.44	3.25	3.56
Bird	2.5	3.5	1.5	2
Root rotting	4	3	3.17	4
Powdery Mildew	3.25	2.67	3	2.71

Legend:0-1.0 None 2.1-3.0 Moderate
1.1- 2.0 Low 3.1-4.0 High

Control Measures of Pests and Disease

Table 12 shows the control measures employed by the respondents on pests and diseases. Most (80%) of the respondents control pest and diseases with the use of chemicals, five percent use biological control and 3% controlled by manual picking.Respondents who practice manual picking have smaller area and incidence was low. Results show that corn farmers use chemical to control pest and diseases.

Coping Mechanism

Table 13 shows the coping mechanisms employed by the farmers. Majority (60%) changed the variety of corn, 52% changed or adjusted cropping period, some (22%) used of fertilizers and herbicides (22%), and 15% planned production program and implemented.

Table 12 . Control measures of pests and diseases

CONTROL MEASURES ON PESTS AND DISEASES	FREQUENCY	PERCENTAGE
Use of chemical	49	82
Biological control	3	5
Manual picking	2	3

Table13 . Coping mechanism

COPING MECHANISM	FREQUENCY	PERCENTAGE
Change or adjust cropping period	31	52
Plan production program and implement	9	15
Change variety of corn	36	60
More use of fertilizers and herbicide	13	22

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

The study on the effect of climate change in corn production was conducted at Diadi, Nueva Vizcaya on October 2011. Three barangays was included in the study, these were Arwas, Escoting and San Pablo. The respondents were 60 corn farmers. Primary data gathered from survey, interview and transect walk. Secondary data was taken from PAGASA at Nueva Vizcaya State University.

This study aimed to determine the weather changes in the locality for the last 20 years, awareness, knowledge and observations of the communities on the climate change, observed effects of climate change on corn production and the strategies/coping mechanisms employed by the farmers.

All the corn farmers were aware of the climate change and perceived that climate change is abrupt changes in weather and temperature, the occurrence of super typhoon, the prolonged dry and wet season (El Nino and La Nina). Farmers observed abrupt changes in temperature, abrupt changes in weather condition, La Nina and El Nino, occurrence of super typhoon and prolong dry and wet season as perceived effect of climate change. The observed changes in agro-ecological characteristics were the following: soil easily gets dry and flooded, decreased supply of water for irrigation and changes in soil type and structure. Cropping system was changed from intercropping to mono cropping. Farmers also adopt technology for more convenient in farming. Application of fertilizers and herbicides were increasing due to the depletion of soil. Using chemicals were the most control measures of pests and diseases the farmers employed. Changed the variety of corn, adjusted cropping

period, some used of fertilizers and herbicides and planned production program and implemented were the strategies/coping mechanisms of the farmers employed.

Conclusions

Based on the result of the study, the researcher concludes that climate change has an effect on corn production due to increasing application of chemicals and other inorganic farm inputs. Farmers experience reduction in yield, occurrence of pests and diseases, soil depletion, changes in soil texture and structure and it becomes compact.

Recommendations

Based on the findings, it is recommended that farmers should reduce application of chemical inputs. These inputs contribute to the global warming through evaporation of chemicals in the air and contributing to climate change. Since climate change bring experience is due to pollution in the air and soil, the farmers and all other individual should reduce utilization of chemicals. Farmers should go back to traditional farming or utilization of organic inputs. The government should inform farmers about effect of technologies or practices that contributes to global warming. Information dissemination should be done about climate change.

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