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Assessment of season-long specialists' training on climate smart agriculture in selected municipalities of Isabela, Philippines

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Key words: Climate smart agriculture, Adopter and non- adopters, Household income, Stochastic analysis, Climate change

Abstract

This study was conducted to determine the demographic profile of the farmers-adopters and non- adopters of the Season-long Specialists' Training on Climate Smart Agriculture (CSA), evaluate the farm productivity of the adopters and non- adopters, identify the effects of the program to the farming operations and socio-economic conditions of adopters, and to determine the problems and constraints confronting the farmers in dealing with the season-long training. The study was confined at different barangays of San Mateo and Cabatuan, Isabela, Philippines observations and the used of semi-structured questionnaires for the personal interviews with the respondents were applied. Microsoft Excel, SPSS, Front41 and Minitab statistical packages were used for encoding and analysis of data. Descriptive analyses were frequency counts, percentages and means. Inferential statistics were employed like stochastic frontier analysis (SFA), chi-square and Z - test. There were 150 farmers' respondents in which 113 were participants of the season-long training and 37 were non- participants from that 101 were adopters and 49 were non-adopters. The result of the study revealed that yield of rice, gross income of rice, total farm labor cost, seeds quantity of rice were the variables generally affecting the household income of the respondents. During the year 2014, there was a high significant difference at 5% and 1% degree of level on the income of adopters and non-adopters which the mean difference was ₱12, 375.38. At the same time, there was a high significant difference at 5% and 1% degree of level on the yield in cavans of adopters and non-adopters which the mean yield was 102.72 cavans.

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Introduction

Climate Smart Agriculture (CSA) was one of the Agricultural Training Institute- Regional Training Center 02's (DA- ATI- RTC 02) program which aimed to accelerate the promotion of the appropriate production technologies by showcasing feasible and viable farming enterprises within the context of integrated farming system approach in order to increase productivity and income of farmers despite experiencing climate change (Alaska, 2012).

Integrated farming system with integration of weather forecast in the farm operation of farmers is one way to increase farm productivity and household income of farmers. This study generally aimed to assess the Season-long Specialists' Training on Climate Smart Agriculture implemented by DA- ATI- RTC 02. Specifically, this study aimed to determine the demographic profile of the farmers-adopters and non- adopters of the Season-long Specialists' Training on Climate Smart Agriculture (CSA), evaluate the farm productivity of the adopters and non- adopters, identify the effects of the program to the farming operations and socio-economic conditions of adopters, and to determine the problems and constraints confronting the farmers in dealing with the season-long training. The study was undertaken in the different barangays of Cabatuan and San Mateo, Isabela specifically in Gaddanan, Malasin, Marasat Grande, Nueva Era, Tandul, Paraiso, Del Corpuz and Macalaoat. The data considered were the two cropping seasons of the year 2014. The study was conducted from November 2014 to March 2015.

This study focused on the analysis of the assessment of Season-long Specialists Training on Climate Smart Agriculture. It concentrated on collecting information to the farmers who adopted and did not adopt the practices and technologies of the season-long training. The study concentrated on collecting informations on farming operations specifically on their rice farm operation and production.

The study focused on the assessment of Season-long Specialists' Training on Climate Smart Agriculture in San Mateo and Cabatuan, Isabela which was one of the Agricultural Training Institute- Regional Training Center 02's (DA- ATI- RTC 02) program.

The study showed the relationship of the Independent Variables, Dependent Variables, Intervening Variables and Outputs. The Independent Variable showed the demographic profile of farmer (Name, age, gender, civil status, educational attainment, religion, sources of income, amount of income monthly), tenurial status, farming experience, farm location. While the Dependent Variable shows the Climate Smart Agriculture in Cabatuan and San Mateo, Isabela (trainings, seminars, FFS, leaflets, pamphlets and flyers) which were the information transmitted and adopted by the farmers. The Intervening Variable shows the time availability of farmers and the acceptance of farmers regarding the different practices and technologies on farming operations. All these factors result in an increase production and income, better farming system and technology, and improve standard of living at the same time the ability of the farmers to adopt and mitigate climate change for better farming system.

Materials and methods

The study employed quantitative and qualitative research methods. For quantitative, it employed descriptive survey while the qualitative method it employed observations and personal interviews. The researcher made an observation and used semi-structured questionnaires for the personal interviews with the respondents. Microsoft Excel, SPSS, Front 41 and Minitab statistical packages were used for encoding and analysis of data. The data were classified and analyzed through descriptive and inferential statistics. Descriptive analyses were frequency counts, percentages and means. Inferential statistics were employed like stochastic frontier analysis (SFA), chi-square and z-test.

Results and discussion

As shown in Table 1, data revealed that from the total respondents, most respondents were male, average of 49.15 years old, almost all were married with average household members of 4, all respondents can speak and can understand Ilocano dialect, most respondents were Roman Catholic, and in an average respondents were High School Graduates, averagely farmers- respondents has 25.45 experienced years in farming, almost all farmers do not only rely on farming instead they also have other sources of income like sari-sari stores, wages and salaries, honorariums as barangay officials which most of the respondents has household income of ₱9,647 – ₱283,275 and they owned the land they till.

Table 1. Frequency Distribution by Demographic Profile.

Variables	Particular	Frequency	Percentage
Sex	Male	105	70
	Female	45	30
Age	20-31	9	6
	32-43	30	20.00
	44-55	68	45.33
	56-67	38	25.33
	68-79	5	3.33
	Mean Age= 49.15		
Civil Status	Single	11	7.33
	Married	134	89.33
	Widowed	5	3.33
Dialect	Ilocano	71	47.30
	Gaddang	1	0.70
	Others	1	0,70
	Can speak 2 or more dialects	77	51.30
Household Size	2-4	86	57.33
	5-7	57	38.00
	8-10	86	4.00
	11-13	57	0.67
	Mean Household Size= 4		
Religion	Roman Catholic	62	41.33
	Methodist	25	16.67
	INC	27	18.00
	Born Again Christian	13	8.67
	Others	23	15.33
Educational Attainment	Elementary Level	5	3.33
	Elementary Graduate	13	8,67
	High School Level	20	13.13
	High School Graduate	46	30.67
	College Level	17	11.33
	College Graduate	43	28.67
	Vocational	6	4.00
Years in Farming	1-12	31	20.67
	13-24	40	26.67
	25-36	53	35.33
	37-48	23	15.33
	49-60	3	2.00
	Mean Years in arming	24.47	
Sources of Income	Farming	72	84.00
	Interest	2	14.67
	Wages	1	0.67
	Farming and Other Sources	75	0.67
Amount of Income (Philippine Pesos)	9,648-283,275	126	84.00
	283,276-556,902	22	14.67
	556,903-830,529	1	0.67
	830,530-1,104,157	1	0.67
	Mean Income 148,679.60		
Tenurial Status	Land Owner	108	72.00
	Shareholder Tenant	27	18.00
	Leaseholder Tenant	10	6.67
	Others (Farm-in-charge)	1	0.67
	No Farm	4	2.67

Table 2 shows the distribution of respondents by capital sources. It can be seen that the farmers sourced out their capital form their personal saving (116 or 77.33%), least number of farmers are sourcing out from land for tenants (17 or 11.33%), loans/ agrisupplier (13 or 8.67%), trader (2 or 1.33%), and government subsidy (2 or 1.33).

Table 2. Frequency Distribution of Respondents by Capital Sources.

Cpital Sources	Frequency	Percentage (%)
Personal Savings	116	77.33
Trader	2	1.33
Loans/Agrisupplier	13	8.67
Government Subsidy	2	1.33
Owners of Land for Tenants	17	11.33
Total	150	100.00

In Table 3, most of the respondents (39 or 55.71%) were member of Irrigators Association. This shows that the farmers are benefitting from the services of the National Irrigators Association.

Table 3. Frequency Distribution of Respondents by Membership in Organization.

Name of Organization	Number of Reporting	Percentage (%)
Cabatuan Farmers Association	1	1.43
CASADELCO	4	5.71
CAVOFA	1	1.43
CA	1	1.43
DA-Extensionists	1	1.43
Farmer Lead Extensionist	1	1.43
Good Samaritan Cooperative	1	1.43
Irrigators Association	39	55.71
Kasaka Cooperative	1	1.43
MAFC	8	11.43
Magasakang Siyentista	2	2.86
Nueva Era Multi-purpose Cooperative	1	1.43
Total	70	100

Table 4. Frequency Distribution of Respondents by Number of Trainings Attended.

Number of Traings	Numbr of Reporting	Percentage (%)
None	37	25
1	96	64
2	6	4
3	11	7
Total	150	100

As shown in Table 4, 96 or 64% farmer respondents attended one training and seminar for the last three years related to climate change mitigation and adaptation in farming system. This shows that farmers are being capacitated by the national government to have their farming practices can adapt with climate change.

Table 5. Frequency Distribution of Respondents by Group.

Group	Frequency	Percentage (%)
Participants	113	75.33
Non-Participants	37	24.67
Total	150	100.00

It can be seen in Table 5 that 113 or about 75.33% of the respondents were participants of Climate Smart Agriculture Farmers Field School while 37 or almost 24.67% of the respondents were non- participants of the CSA. The table reveals that majority of the respondents are participants of climate smart agriculture field schooling.

Table 6. Frequency Distribution of Respondents by Adopter.

Adopter/Non-Adopter	Frequency	Percentage (%)
Adopter	101	67.33
Non-Adopter	49	32.67
Total	150	100.00

Table 6 shows the classification of the respondents whether they were adopters or non-adopters of the rice practices and technologies introduced by the Season-long Specialists training on Climate Smart Agriculture. It was 10 or about 67.33% of the respondents were adopters and around 49 or 32.67% of the total respondents were non-adopters.

Productivity Analysis and Technical Efficiency Effect

Table 7 revealed the Ordinary Least Squares (OLS) that gross income rice (b2) has direct relationship to increase household income of farmers for it was statistically significant difference at 1% level. For Maximum Likelihood Estimates, it was found that farmers-adopters gained the positive coefficient variable the yield of rice (b1) and gross income of rice (b2) which were significantly different at 1% level. Thus, the said variables had contributed efficiently to improve the household income. Other variable with negative coefficient was the total farm labor costs (b9) which was statistically significant difference at 5% level indicating inefficiency to household income.

Table 7. Ordinary Least Square and Maximum Likelihood Estimates for Parameters of the Stochastic Frontier Model by Farmers- Adopters of Climate Smart Agriculture.

Parameters	Name of Variable	OLS		MLE	
		Coefficeint	t-ratio	Coefficeint	t-ratio
b0	Constant	-4.70^{**}	-0.47	-0.91^{ns}	-0.29
b1	Yield of rice (per ha (kg))	1.58^{ns}	0.79	3.74^{**}	4.70
b2	Gross Income (Rice)	3.35^{**}	1.66	4.79^{**}	6.36
b3	Seeds Quantity (kg)	0.21^{ns}	1.04	-0.09^{ns}	-0.86
b4	Fertilizer Quanityt (kg)	0.08^{ns}	0.32	0.08^{ns}	0.63
b5	Seeds Cost	0.25^{ns}	0.64	0.07^{ns}	0.37
b6	Fertilizer Cost	-0.15^{ns}	-0.20	0.08^{ns}	0.17
b7	Chemical Sprayed Cost	-0.11^{ns}	-0.46	-0.08^{ns}	-0.54
b8	Total Farm Inputs Cost	-0.23^{ns}	-0.19	-00.15^{ns}	-0.23
b9	Total Farm Labor Cost (rice)	-0.66^{ns}	-1.33	-0.84^{*}	-1.87
b10	Irrigation Fee	-0.11^{ns}	-0.26	0.00^{ns}	-0.01

Note: ** - Significant at 1% level * - Significant at 5% level ns – Not significant

Table 8. Ordinary Least Square and Maximum Likelihood Estimates for Parameters of the Stochastic Frontier Model by Farmers' Non- Adopters of Climate Smart Agriculture.

Parameters	Name of Variable	OLS		MLE	
		Coefficeint	t-ratio	Coefficeint	t-ratio
b0	Constant	15.22^{**}	3.98	15.29^{**}	14.96
b1	Yield of rice (per ha (kg))	2.99^{**}	3.25	2.98^{**}	3.27
b2	Gross Income (Rice)	-1.61^{*}	-1.88	-1.62^{*}	-1.81
b3	Seeds Quantity (kg)	-0.22^{*}	-2.20	-0.23^{ns}	-0.37
b4	Fertilizer Quanityt (kg)	0.11^{ns}	0.77	0.11^{ns}	0.11
b5	Seeds Cost	-0.08^{ns}	-0.41	-0.09^{ns}	-0.09
b6	Fertilizer Cost	-0.38^{ns}	-1.20	-0.37^{ns}	-0.52
b7	Chemical Sprayed Cost	-0.12^{ns}	0.75	0.11^{ns}	0.24
b8	Total Farm Inputs Cost	-0.11^{ns}	0.24	0.12^{ns}	0.13
b9	Total Farm Labor Cost (rice)	-0.75^{**}	-3.61	-0.73^{*}	-0.85
b10	Irrigation Fee	-0.15^{ns}	-0.69	-0.15^{ns}	-0.16

Note: ** - Significant at 1% level * - Significant at 5% level ns – Not significant

Table 8 revealed the Ordinary Least Squares (OLS), it was found that non- adopters obtained a positive coefficient variable particularly the yield of rice per hectare (b1) which was significantly different at 1% level. The said variable has direct relationship. Other variables with negative coefficients were particularly total farm labor costs of rice (b9) which was found significantly different at 1%, while the gross income (b2) and seeds quantity (b3) were found significantly different at 5% level. The said variables have an inverse relationship to household income.

Table 9 revealed from among demographic profile variables of the adopters and non- adopters of CSA. Religion (b5) was the only significant variable in adopters while in the non- adopters, none of the demographic profile of the farmers were significant. It denotes that Roman Catholic farmers have more shown efficiencies in obtaining household income compared to other religions.

The following farming technologies/practices variables of the farmers- adopters that was found significantly different at 1% level like the practice of IPM (b23) and the use of synthetic chemicals (b24) found significantly different at 5% level while in non- adopters none of the farming technologies/ practices were significant. Result implied that practicing IPM and the use of synthetic chemicals contributed to an increase of household income for farmers- adopters.

Table 9. Summary of Technical Inefficiency Model by Farmers Adopters and Non Adopters of Climate Smart Agriculture.

Parameters	Name of Variable	OLS		MLE	
		Coefficeint	t-ratio	Coefficeint	t-ratio
b0	Constant	0.24^{ns}	0.26	-0.03^{ns}	-0.02
b1	Gender (Male)	-0.11^{ns}	-0.37	0.01^{ns}	0.01
b2	Status (Married)	0.24^{ns}	0.26	-0.01^{ns}	-0.01
b3	Age	0.00^{ns}	-0.17	0.00^{ns}	-0.04
b4	Household Size	-0.04^{ns}	-0.57	0.00^{ns}	0.01
b5	Religion (Roman Catholic)	0.69^{**}	4.40	-0.02^{ns}	-0.02
b6	Elementary Level	0.01^{ns}	0.01	0.03^{ns}	0.03
b7	Elementary Graduate	0.49^{ns}	1.37	-0.04^{ns}	-0.03
b8	High School Level	0.00^{ns}	0.00	-0.01^{ns}	-0.01
b9	High School Graduate	0.09^{ns}	0.18	0.00^{ns}	0.00
b10	College Level	-0.41^{ns}	-0.84	-0.03^{ns}	-0.04
b11	College Graduate	-0.24^{ns}	-0.50	-0.02^{ns}	-0.02
b12	Vocational	0.00^{ns}	0.00	0.06^{ns}	0.05
b13	Years in farming	0.00^{ns}	-0.32	0.01^{ns}	0.13
b14	Dialect (Ilocano)	0.24^{ns}	0.26	-0.03^{ns}	-0.02
b15	Land Owner	-0.27^{ns}	-0.97	0.05^{ns}	0.04
b16	Personal Savings	0.20^{ns}	0.61	-0.02^{ns}	-0.01
b17	Type of seeds used (Hybrid)	-0.04^{ns}	-0.18	-0.01^{ns}	-0.02
b18	Seed Treatment (Bio-N/Seed Inoculant)	-0.22^{ns}	-0.71	0.00^{ns}	0.00
b19	Seedbed Preparation (Dapog)	-0.26^{ns}	-0.86	0.02^{ns}	0.02
b20	Mechanical Land Preparation	-0.27^{ns}	-0.74	-0.01^{ns}	-0.01
b21	Planting (Mechanical Transplanter)	-0.17^{ns}	-0.68	0.03^{ns}	0.02
b22	Use of Organic Fertilizer in Seed bed	0.12^{ns}	0.60	0.02^{ns}	0.02
b23	Pest management (IPM)	0.80^{**}	3.77	-0.04^{ns}	-0.05
b24	Use of Synthetic Chemicals	0.85^{*}	1.78	-0.05^{ns}	-0.03
b25	Use of Combine Harvester and Thresher	0.24^{ns}	0.26	-0.03^{ns}	-0.02

Note : Positive (+) sign coefficient variables have contributed to household income efficiency

** - Significant at 1% level * - Significant at 5% level ns – Not significant

Table 10. Variance Parameters in Farmers- Adopters and Non- Adopters of Climate Smart Agriculture's Practices and Technologies.

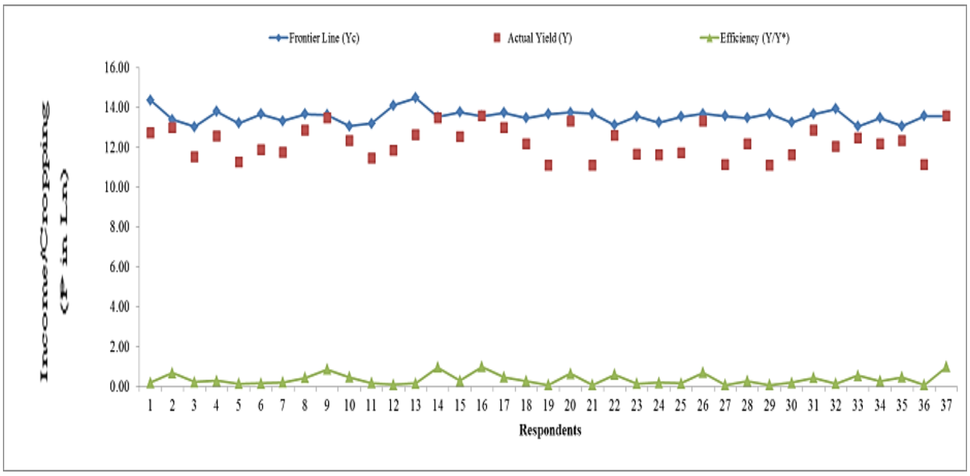
Parameter	Variables	Adopters		Non-Adopters	
		Coefficeint	t-ratio	Coefficeint	t-ratio
σ^2	Sigma Squared	0.24^{**}	4.78	0.15^{**}	4.33
γ	Gamma	1.00^{**}	10119847.00	0.02^{ns}	0.05
	Log-Likelihood Function	-41.17		-33.54	
	Return to scale	0.11		0.13	
	Mean technical Efficiency	0.37		0.92	

Table 10 shows the estimated sigma squared (σ^2) which was 0.24 and 0.15 for farmers-adopters and non- adopters, respectively were statistically significant at one (1) percent level of risk thereby confirming the model to be a good fit. The farmers-adopters has a gamma value (γ) of 1.00 which found significantly different at 1% level of probability which means that there was inefficiencies in the utilization of resource while farmers-non-adopters found out that there was no significant difference. This denotes that non-adopters showed efficiencies in utilizing their resources as shown to the mean of technical efficiency of 92%. Furthermore, there was a positive value to returns on scale with 0.11 and 0.13 on farmers- adopters and non-adopters respectively which means an increasing return to scale.

The mean technical efficiencies were 0.37 and 0.92 for farmers-adopters and non-adopters of Climate Smart Agriculture in San Mateo and Cabatuan, Isabela.

Graphical Information and Analysis for Farmers-Adopters and Non-Adopters of the Climate Smart Agriculture

A. Dry Cropping Season



B. Wet Cropping Season

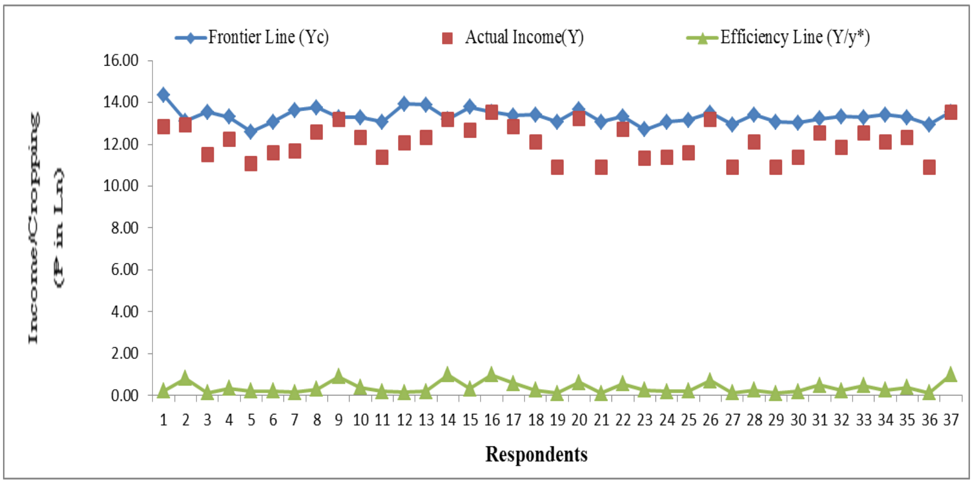


Table 11. Difference of Net Income (₱) in a Year of Farmers-Adopters and Non- Adopters of Climate Smart Agriculture.

Particular	Adopters	Non-adopters	Difference
Mean	86,783.71	74,408.33	12,375.38
Standard Deviation	20,673.87	20,941.75	
Z value:		3.1677**	
df:		146	
Probability Value:		0.0002044	

Note : ** - Significant at 1% level* - Significant at 5% levelns – Not significant

Table 11 shows the mean net income of the farmers-adopters during the year 2014 was Php 86,783.71 while the non- adopters gained a mean net income of ₱ 74,408.33, therefore the mean difference of adopters and non-adopters' net income was ₱ 12,375.38. The Z- test computed was 3.1677 with probability value of 0.00002044 and the data revealed that there was high significant difference between the net income of the adopters and non-adopters at both one 1% level and 5% level.

Table 12. Difference Between the Yield in Cavans in a Year by Farmers - Adopters and Non - Adopters of Climate Smart Agriculture.

Particular	Adopters	Non-adopters	Difference
Mean	251.74	149.01	102.73
Standard Deviation	177.06	135.46	
Z value:		3.9637**	
df:		146	
Probability Value:		0.00005755	

Effects of the Climate Smart Agriculture on the Socio- Economic Condition of Farmers and Farming Operations

Table 13. Chi-Square Result on Level of Applications of Farmers-Adopters on the CSA.

Particulars	Poor		Fair		Good		Very good		Excellent	
	O	E	O	E	O	E	O	E	O	E
Ability discuss climate elements and application to agriculture	0	0.54	4	1.71	14	15.57	36	39.86	59	55.299
Ability of articulate climate change adaptation measures and particularly on the particularly adjustments in cropping calendar based on forecasts, water-saving technologies, crop management, climate proofing of agri-infrastucture and integrated farming system	0	0.54	2	1.71	16	15.86	44	39.86	51	55.299
Ability of explain agriculture as an enterprise	0	0.54	4	1.71	12	15.57	30	39.86	67	55.299
Ability to demonstrate cultural management practices	1	0.54	0	1071	19	15.57	45	39.86	48	55.299
Ability of identify and classify pests and natural enemies	1	0.54	0	1.71	15	15.57	40	39.86	57	55.299
Ability to illustrate the disease cycle an biology of insect species	1	0.54	2	1.71	17	17	40	39.86	53	55.299
Ability to recommend appropriate management strategies	1	0.54	0	1.71	16	15.57	44	39.86	52	55.299
Total	4	4	12	12	109	109	279	279	387	387
X^2: 24.945[NS]										
d.f.: 24										
Prob: 0.407										

Table 13 shows the application of skills by the Season Long Specialists' Training Climate Smart Agriculture. The chi-square value computed was 24.945 with degrees of freedom of 24 and probability value of 0.407. Statistically, however, the value computed suggests that there is no significant variation between observed and expected frequencies at 5% and 1% level.

Table 14. Effectiveness of the Season-Long Specialists Training on Climate Smart Agriculture.

Parameters	Poor		Fair		Good		Very good		Excellent	
	O	E	O	E	O	E	O	E	O	E
CSA is an effective tool for the improvement of practices for farming.	0	0	0	0.5	4	12	33	41	76	59
The technology and practices introduced by CSA is useful for the farmers.	0	0	0	0.5	5	12	35	41	73	59
The program uplifts the quality of life of the Filipinos in the rural areas	0	0	1	0.5	18	12	51	41	43	59
The Agri-Eco Tourism sets the inclusion of community activities to show the beauty of agricultural landscape which attracts educational tours for students, local government officials, extension workers and even researchers with interest in these developments.	0	0	1	0.5	25	12	49	41	38	59
The Agri-Eco Tourism sets the inclusion of community activities to show the beauty of agricultural landscape which attracts educational tours for students, local government officials, extension workers and even researchers with interest in these developments.	0	0	1	0.5	17	12	59	41	36	59
The CSA is an effective modality to disseminate and transfer informations to the farmers regarding new technologies and practices in the field of agriculture specifically in rice production.	1	0	0	0.5	5	12	21	41	86	59
Total	1	1	3	3	74	74	248	248	352	352
X^2: 106.168**										
d.f.: 20										
Prob: 0.0006										

Table 14 shows the effectiveness of the CSA to farmers. The value of X2 obtained from the gathered data was 105.196 with DF value of 20 and a probability value of 0.0006 which was statistically significant at one (1) percent level and five (5) percent level. It proved that the Season- Long Specialists Training on Climate Smart Agriculture is a highly effective program for farmers.

Table 15. Effectiveness of the Season-Long Specialists Training on Climate Smart Agriculture.

Modalities Employed	Not Effective		Fair		Effective	
	O	E	O	E	O	E
Techno Gabay IEC Materials	0	4	22	33.42	91	75.58
Radio Agri Program	5	4	71	33.42	37	75.58
TV Agri Program	0	4	15	33.42	98	75.58
DA Field Technician	16	4	39	33.42	58	75.58
Farmer's Field Technician	10	4	56	33.42	47	75.58
Season-long Training	0	4	6	33.42	107	75.58
Seminar	3	4	41	33.42	69	75.58
Trade Fair	4	4	55	33.42	54	75.58
Symposia	5	4	54	33.42	54	75.58
Field/farm Demonstration	0	4	7	33.42	106	75.58
Farmer's Field day	2	4	18	33.42	93	75.58
Lakbay Aral	3	4	17	33.42	93	75.58
Total	48	48	401	401	907	907
X^2: 313.023**						
d.f.: 22						
Prob: 0.0006						

Note : 0.01< probability value < 0.05, there is a significant difference at 1% & 5%level

*** - Significant at 1% level * - Significant at 5% level ns – Not significant*

Problems and Constraints in Dealing with Climate Smart Agriculture

It was so hard to inculcate and let the farmers adopt new practices in farming system because farmers were still relying on traditional farming system. Cultural beliefs and practices of farmers greatly affect the profit and yield. In general, farmers were willing to adopt changes yet it takes time. Impartation of new practices and technologies regarding farming operations must be continuous to be inculcated with farmers.

Conclusion

Based on the findings of the study, the following conclusions were drawn: (1) Samples were based on the lists of farmers participated in the CSAFFS and random sampling of non- participants of the said program. In the study, most of the respondents were male aged 49.15 years with an average 24.47 years in farming and most of the respondents were high school graduates who were married having average household members of 4. Most respondents were Roman Catholic and everyone can understand and speak the Ilocano dialect. The respondents had an average farm size of 1.58 hectares and earned ₱148,679.60 per cropping season.

In the Stochastic Frontier analysis of farmers-adopters of Climate Smart Agriculture in San Mateo and Cabatuan, Isabela, the only significant variable in OLS of farmers was the gross income (b2) of rice while in MLE, the variables gross income (b2) of rice, yield of rice (b1) and total farm labor costs (b9) found significant in the household income of farmers-adopters. While in the non-adopters data (OLS), the yield of rice (b1), total farm labor costs of rice (b9), gross income (b2) and seeds quantity (b3) was found significant in the household income of farmers-non-adopters. In Cobb- Douglas production function, it was found that non- adopters with variables yield of rice per hectare (b1) and gross income (b2) were the significant on the household income.

In technical efficiencies effect model shows farming technologies/practices of adopters were found significant differences like the practice of IPM (b 23) and the use of synthetic chemicals (b24) while in non-adopters none of the farming technologies/ practices were significant in household income. (4) Based on the gathered data, there was a high significant difference at both one 1% level and 5% level between the incomes of farmers-adopters and non-adopters for the whole year 2014. The mean net income of the farmers-adopters during the year 2014 was ₱86,783.71 while the non- adopters gained a mean net income of ₱74,408.33, therefore the mean difference of adopters and non-adopters' net income was ₱12,375.38. The Z- test computed was 3.1677 with probability value of 0.00002044.

At the same time data revealed that there was a high significant difference between the yield in cavans of adopters and non- adopters at 5% and 1% level. The mean yield of the farmers-adopters during year 2014 was 251.74 cavans while, the non- adopters gained a mean yield of 149.01 cavans, thus, the mean difference of adopters and non-adopters yield in cavans was 102.73. The Z- test computed was 3.9637 with probability value of 0.00005.

In getting the level of the application of skills by the Season Long Specialists' Training on Climate Smart Agriculture, chi- square has been applied. The chi-square computed was 24.945 with the degrees of freedom of 24 and probability value of 0.407 which showed that there is no significant variation between the observed and expected frequency of parameters.

The establishment of CSA was very useful, helpful and effective for farmers. It has been proved by the value of X2 obtained from the data gathered was 105. 196 with DF value of 20 and a probability value of 0.0006 which was statistically significant to 1% level and 5% level. The value computed suggested that there were variations between observed and expected frequencies at 1% level of the parameters. The different extension methodologies employed in the banner program Climate Smart Agriculture obtained a value X2 with 313. 023, while the degree of freedom was 22; the probability value was 0.0006 which was found significantly different at 1% and 5% degree of levels which proved showed that there were significant variations on the observed and expected frequencies. Most farmers-adopters claimed that after adopting the practices of Climate Smart Agriculture, their expenses generally decreased and their income increased.

Recommendations

Based form the conclusion of the study, the following recommendations are offered:

(1) Agricultural Training Institute must continue to conduct Climate Smart Agriculture in the following ways: (a) Enhanced Farmers' Field School (EFFS); (b) Elaborate and Innovate the Integrated Farming System; (c) Engage all land-owners (not the tenants) to get common understanding of CSA that is acceptable to all. (d) Knowledge must be summarized in the form of a handbook for CSA used by farmers, extension officers and training institutions.

(2) Institutions teaching agriculture should be requested to include CSA in the teaching curricula and those engaged in research to prioritize and include CSA in their institutional research strategies.

(3) The government must allocate a fund for a friendly competition on increasing profit and yield with the practices and technologies of CSA among farmers to encourage and let farmers adopt new safe and profitable ways of farming.

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