Factor Influencing Irrigated Rice Productivity in Region 02: The Case of Cagayan Province

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Abstract

This research was conducted due to the average low rice yield in irrigated rice growing areas in the wet and dry season. This is considerably low in Cagayan province compared to rice producing province counterparts. The experiment was based on descriptive-correlational design, covered two farming ecosystem. Nine (9) municipalities and eighteen (18) barangays were chosen considering the top three, middle three and the lowest three rice producers with a total of 395 respondents. Stratified random sampling, Slovins formula and a semi-structured survey questionnaire were used. Descriptive and inferential statistics together with the Stochastic Frontier Analysis (SFA) were tools in the analysis of data to determine the factors influencing productivity.

Factors like socio-economic profile, cultural management, climatic and environmental, support services, issues and constraints were considered to have effect on irrigated rice productivity. Multiple regression analysis results showed that few cultural management practices, climatic and environmental factors and as well as socio-economic factors were found to have positive significant effect to rice productivity. Stochastic Frontier Analysis results showed that the top 3, middle 3 and bottom 3 irrigated rice farmers are generally inefficient both in the wet season of 2013 and dry season of 2014 farm operation. Proper timing of planting, government support price to boost production and farmers should slowly convert their farms into organic system. Improve production efficiency are recommendations to address their most pressing problems.

Keywords : irrigated rice, productivity, farming ecosystem

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Introduction

Cagayan Province lies in the northeastern part of mainland Luzon occupying the lower basin of the Cagayan River. It has a total land area of 900, 270 hectares including Babuyan Island which constitutes 3 % of the total land area of the Philippines. From the total land of the province, 17.76% is classified as agricultural land. Irrigable land area is estimated at 56,783 hectares.

About 94,470 hectares of irrigated land and 30,653 hectares of rain fed land in Cagayan are planted with rice. Its average yield is 4.18 MT/hectare during dry season for irrigated land and 3.84 MT /hectare during wet season. The combined rice productivity in Cagayan Valley Region is 4.2 MT/hectare making it the second largest rice producer in the Philippines.

However, in 2014, Cagayan province only placed fourth in the top ten Rice producing provinces in the Philippines with a total rice yield of 895, 580 metric tons. With this drastic decrease in the rice yield of Cagayan province, there is a dire need to look into the contributory factors that affect the rice productivity in Cagayan Province.

Methodology

This research study made use of descriptive-correlational design. It covered the irrigated rice areas in the wet season of Calendar Year 2013 and dry season of Calendar Year 2014. Municipalities were chosen considering the top three, middle three and the lowest three rice producers in the past three years. From these nine municipalities, three barangays with the biggest rice land area per municipality were taken as actual study sites with a total of 18 sample barangays.

The stratified random sampling was used, to get the proportional number of respondents. Sample sizes were determined using Slovins formula setting the margin of error at 5%. A total of 395 respondents were chosen as actual respondents of the study.

A semi-structured survey questionnaire was designed as a primary tool in gathering data. The instrument captured: 1) socio-demographic profile, 2) factors influencing rice productivity, and 3) issues and constraints encountered and recommended solutions by rice farmers in Cagayan Valley. Data were collected through personal interview to ensure the validity and accuracy of data gathered and to minimize validation of data. Data gathering was complemented with actual observations and documentation. Secondary data needed in the study were secured from files and reports of concerned agencies

Data analysis using SPSS and Minitab statistical packages was done after data encoding using descriptive statistics like frequency counts, percentages, means and standard deviation while multiple regression is an inferential statistical tool to test the significant relationship of variables.

Stochastic Frontier Analysis (SFA) is an economic analysis tool used to evaluate production efficiency of rice in Cagayan province. The output /yield as the dependent variable correlated with factors as independent variables.

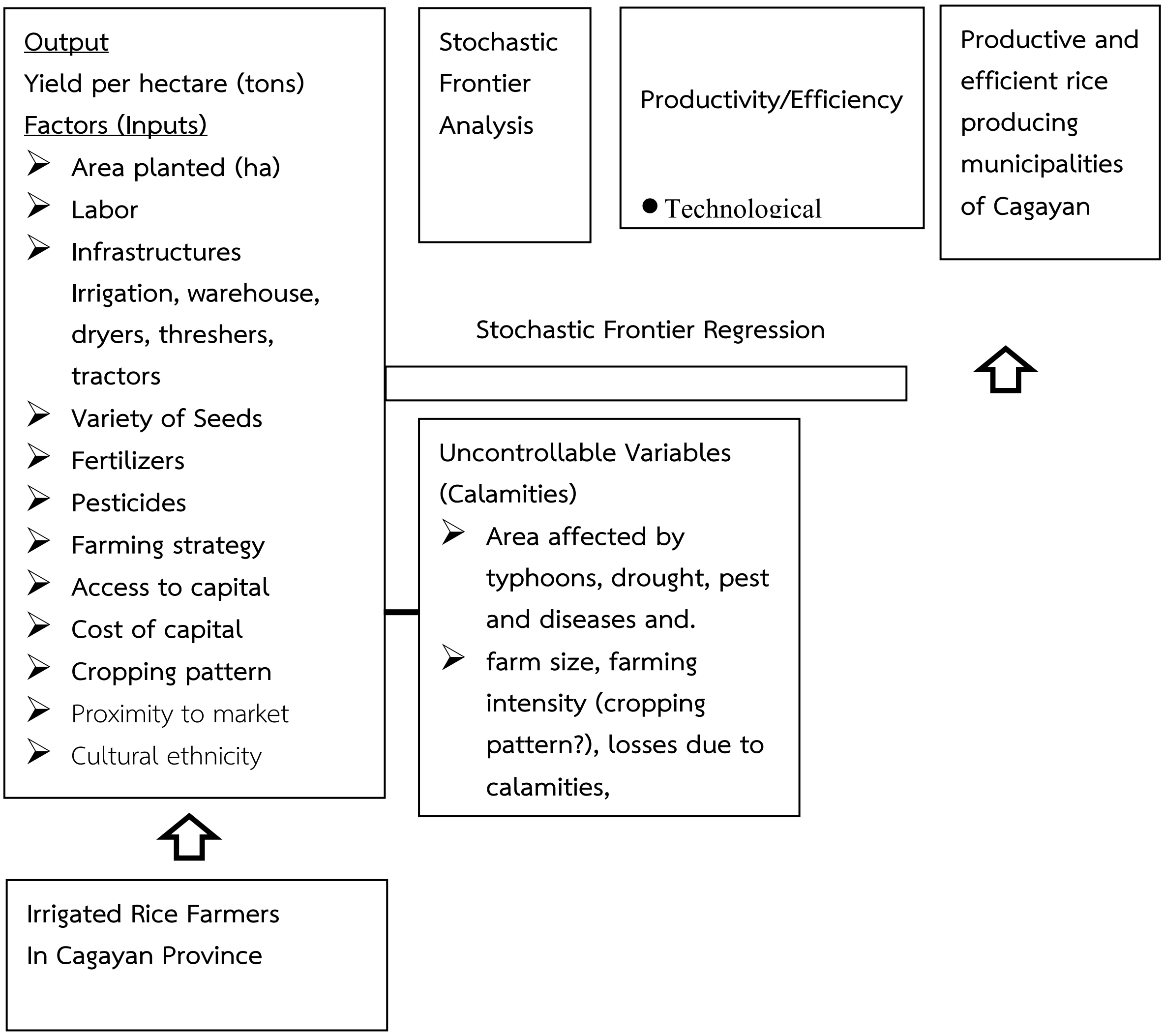

Figure 1.The SFA framework for evaluating rice production efficiency in Cagayan Valley Region.

Results and Discussion

Profile of Respondents

The top 3 respondents have a mean age of 49.8 while the middle 3 and bottom 3 irrigated rice farmer respondents have a mean age of 50.4 and 50.2 respectively. They have also a mean household size of 4.7 for the Top 3, 4.8 for the Middle 3 and 4.9 for the Bottom 3. All the farmer respondents belong to the three categories attained high school level where majority of them are males. They have been in the farming business for 22-23 years and majority of them are land owners cultivating lowland farm areas depending on the National Irrigation Authority (government agency) for their supply of irrigation water for their rice farm. The irrigated rice farmers are cultivating a mean land area of 2.64 hectares for the Top 3, 1.8 hectare for both the Middle 3 and Bottom 3 (Table 1)

Elsewhere, there are several factors influence rice yield (Rido, 2014, Livezey and Foreman, 2004). Production costs also influent yields (Devi and Ponnarasi, 2009).In this study, the differences in yield are explained by the costs of planting, fertilizer used, seedbed preparation, disease control and pest control. As cost of planting increases by 1 peso, yield in kilogram increases by 0.10. While as costs of fertilizer used increases by 1 peso, there is a corresponding increase of yield in kilogram by .013. As the seedbed preparation costs increases by 1 peso, there is an increase of 0.063 in kilogram of yield. Likewise, as the costs in disease control increases by 1 peso, an increase of yield in kilogram by .046. So with a peso increase in the costs of pest control, a corresponding increase in the yield per kilogram of .001. Result of regression analysis showed a positive high significant relationship between cost of planting, fertilizer used, seedbed preparation, disease control and pest control.

As to the Middle 3 rice farmer respondents during the wet season. As the cost in pest control increases by 1 peso, the yield increases by .004. A 2.1% differences in yield is explained by the costs in dikes repair. Any peso increase in the cost of dike repair increases the yield by .017 in kilogram. A peso increase in the cost of hybrid seed contributes a .002 increase of yield in kilogram. While a peso increase in the cost of fertilizer used, increases the yield in kilogram by .021. A 6.8% differences in yield is explained by the manual harvesting practice. As manual harvesting is employed, the yield in kilogram increases by 21.136. While as they maintain irrigation water sourced out from the National Irrigation Administration in their rice field, yield decreases in kilogram by 11.641. All the variables have a positive significant relationship to yield except for NIA irrigation which has an inverse relationship to yield.

While the Bottom 3 farmer respondents, as their cost of seed increases by 1 peso, the yield in kilogram increases by .008. While the cost of chemical pest control increases by 1 peso, yield in kilogram increases by .004. When harvesting of their rice crops are scheduled within the maturity date, their yield in kilogram increases by 32.830. The relationship of the aforementioned variables to yield are highly significant. (Table 2).

Table 3 denotes that a peso increase in the cost on chemical pest control used, increases their yield in kilogram by .005. While as the cost of random planting increases by one peso, the yield increases by .005. Moreover, a peso increase on the cost of chemical disease control increases the yield by .054. Meanwhile a peso increase in the cost of wetbed seedbed preparation causes the increase of yield in kilogram by .015. And a peso increase on the cost of hybrid seed used in planting, increases the yield in kilogram by .003. The variables have high significant relationship with yield.

Moreover, the difference in yield by 9.6% is explained by the use of hybrid seed. The use of hybrid seed causes an increase in kilogram of yield by 22.496. While as a manual harvesting practice is employed, the yield in kilogram increases by 26.041. And as they sell their products as dry, yield in kilogram is reduced by 25.982. The three above mentioned variables have high positive significant relationship to yield except the selling of rice produced in dry form.

A peso increase on the cost of chemical pest control and random planting practices increases the yield in kilogram by .005, the cost on chemical disease control explains the 2.6% differences in yield in cavan. While a peso increase in the cost of seed resulted to increase in the yield in kilogram by .003. The four aforementioned variables are highly significantly related to yield. As their irrigation water is sourced out from NIA, their yield in kilogram decreases by 16.10 as a result of insufficient supply of irrigation water.

As the cost in pest control decreases by 1 peso, yield in kilogram increases by .004. While as they practice random planting method, their yield in kilogram increases by .006. As they use hybrid seed, their yield increases by .005. The relationship of the variables to yield is highly significant. As they use mechanical threshing in their postharvest handling, their yield in kilogram increases by 17.466. The postharvest practice has significant relationship to yield.

Table 1. Socio-Demographic Profile of Farmer Respondents

Profile	Classification		
	Top 3	**Middle 3**	**Bottom 3**
Mean Age	49.8	50.4	50.2
Mean Household Size	4.7	4.8	4.9
Mean Educational Attainment	High School level	High School level	High School level
Sex (Male)	69.2%	80.3%	77.2%
Ave. No. of Years in Farming	22.0	23.6	22.4
Tenurial Status (Land owner)	79.2%	58.7%	63.2%
Type of Farm Cultivated (Lowland NIA Irrigated)	89.2%	77.4%	71.9%
Mean Area Cultivated	2.64	1.8	1.8

Table 2. Multiple Regression Analysis correlating cost and technology to yield/production during the wet season CY 2013 farm operation

	Adjusted R Square	Unstandardized Coefficients		Standardized Coefficient	t-value	Prob.
		B	Std Error	Beta		
Wet Season Top 3						
(Constant)		17.824	9.948		1.792	.076
Cost of Planting	.749	.010	.002	.378	4.812	.000
Cost Fertilizer used	.829 (.08)	.013	.003	.204	3.972	.000
Seedbed preparation	.850 (.021))	.063	.015	.196	4.279	.000
Disease control	.859 (.009)	.046	.012	.144	3.695	.000
Pest control	.865 (.006)	.001	.000	.206	2.552	.012
Nutrient management	.032	-21.084	10.295	-.178	-2.048	.043
Wet Season Middle 3						
(Constant)		14.638	8.713		1.680	.095
Pest control	.569	.004	.001	.472	6.011	.000
Dikes repair	.590 (.021)	.017	.006	.152	2.830	.005
Seed used	.600 (.01)	.004	.002	.123	2.203	.029
Fertilizer used	.607 (.007)	.021	.010	.162	2.141	.033
Harvesting practices	.068	21.136	6.593	.221	3.206	.002
Water management	.118 (.05)	-11.641	4.555	-.176	-2.556	.011
Wet Season Bottom 3						
(Constant)		9.460	10.374		.912	.366
Seed	.764	.008	.002	.516	4.739	.000
Pest control	.813 (.049)	.004	.001	.425	3.904	.000
Harvest time	.095	32.830	13.664	.308	2.403	.020

A. Dependent Variable: yield

F ratio for regression (df=15/129 = 166.053)

Table 3. Multiple Regression Analysis correlating cost and technology to yield/production during the dry season CY 2014 farm operation

	Adjusted R Square	Unstandardized Coefficients		Standardized Coefficient	t-value	Prob.
		B	Std Error	Beta		
Dry Top3						
(Constant)		10.275	6.010		1.710	.089
Chemical Pest Control	.698	.005	.000	.522	11.866	.000
Random Planting	.756 (.058)	.005	.001	.238	5.417	.000
Chemical Disease Control	.782 (.026)	.054	.012	.145	4.300	.000
WetbedSeedbed preparation	.799 (.017)	.015	.004	.120	3.743	.000
Hybrid Seed	.808 (.009)	.003	.001	.141	3.182	.002
(Constant)		77.188	3.097		24.924	.000
Seed	.096	22.496	5.749	.321	3.913	.000
Harvesting practices	.124 (.028)	26.041	12.012	.178	2.168	.032
Marketing practices	.149 (.025)	-25.982	12.012	-.177	-2.163	.032
Dry Middle 3						
(Constant)		10.275	6.010		1.710	.089
Pest control	.698	.005	.000	.522	11.866	.000
Planting practices	.756 (.058)	.005	.001	.238	5.417	.000
Disease control	.782 (.026)	.054	.012	.145	4.300	.000
Seedbed preparation	.799 (.017)	.015	.004	.120	3.743	.000
Seed	.808 (.009)	.003	.001	.141	3.182	.002
(Constant)		94.353	2.859		32.997	.000
Water management	.066	-16.100	4.256	-.256	-3.783	.000
Dry Bottom 3						
(Constant)	.860	-2.657	9.003		-.295	.769
Pest Control	.883	.004	.001	.490	3.900	.000
Planting practices	.895 (.012)	.006	.002	.223	3.791	.000
Seed	.860 (.035)	.005	.002	.310	2.633	.011
(Constant)		63.377	4.466		14.190	.000
Postharvest practices	.072	17.466	8.430	.269	2.072	.043

A: dependent variable: yield
F ratio for regression (df=17/127 = 8.427)

Figures 2, 3 and 4 shows the stochastic frontier yield line indicating the standard level of yield and the actual yield generated by the Top 3, Middle 3 and Bottom 3 irrigated rice farmers during the wet season of Calendar Year 2013. As the farmer exceeds the frontier yield line as indicated by the actual yield line, such farmers are production efficient. It is evident to note that only few Top 3, Middle 3 and Bottom 3 irrigated rice farmers during the wet season of Calendar Year 2013 farm operation are production efficient. The efficiency line indicating only few farmers hit 1.00, hence these are the only production efficient farmers.

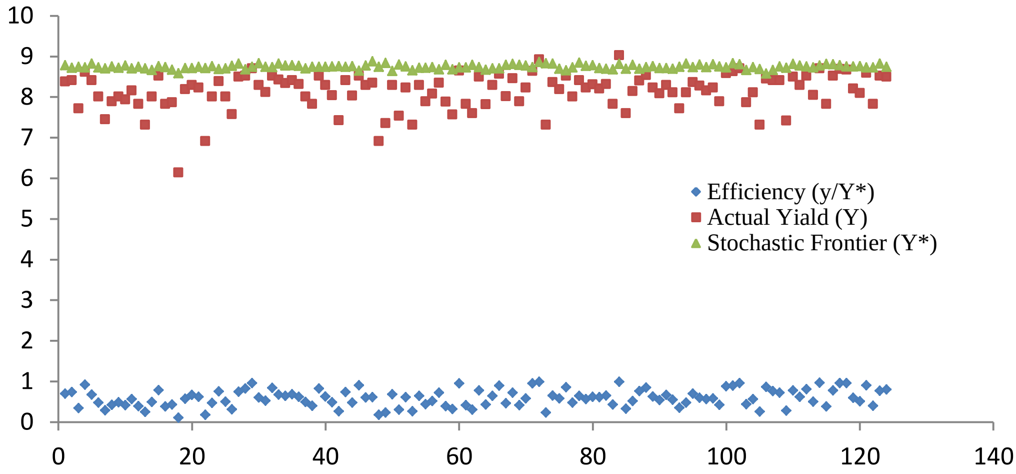

Figure 2. Stochastic Frontier Analysis graph of the Top 3 irrigated rice farmer respondents during the wet season CY 2013.

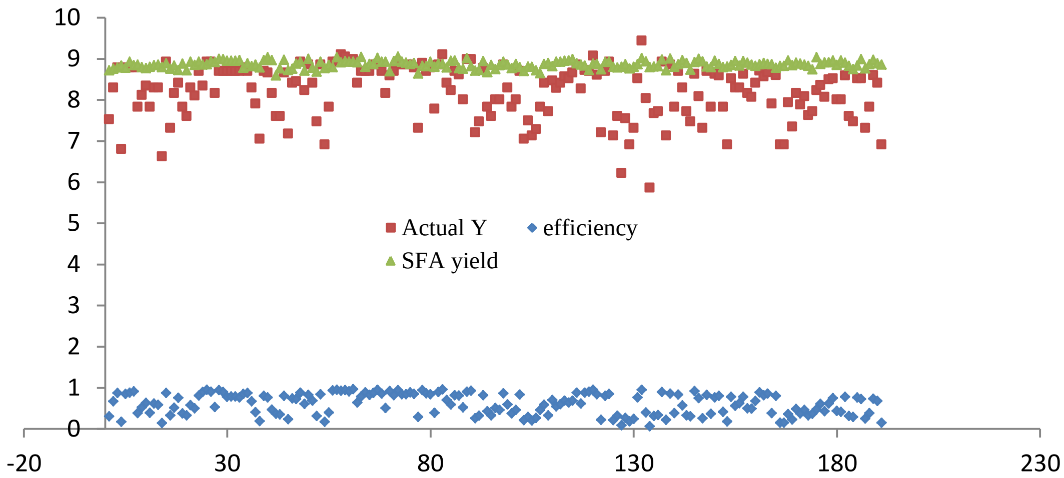

Figure 3. Stochastic Frontier Analysis graph of the Middle 3 irrigated rice farmer respondents during the wet season CY 2013

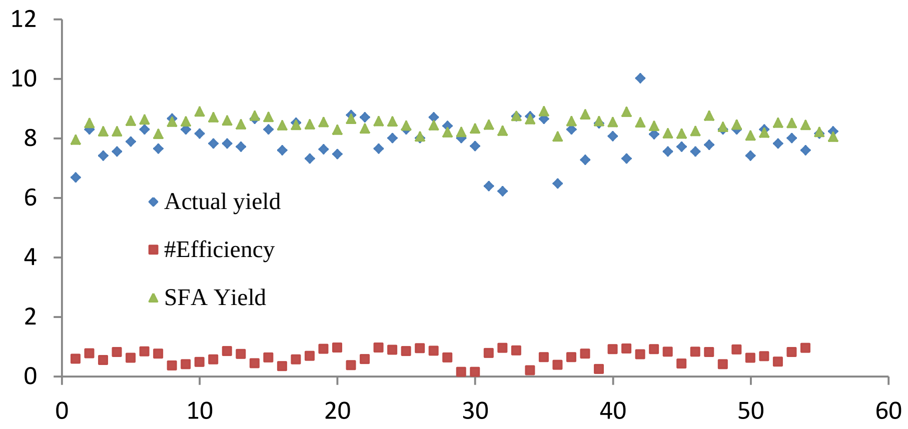

Figure 4. Stochastic Frontier Analysis graph of the Bottom 3 irrigated rice farmer respondents during the wet season of 2013

Likewise it is evident to note as illustrated in Figures 5, 6 and 7 the Stochastic Frontier Analysis graph of the Top 3, Middle 3 and Bottom 3 of the irrigated rice farmer respondents during the dry season of Calendar Year 2014. As shown in the graph, only few of the farmers exceeded the frontier yield line with their actual yield, meaning that their actual productions are lower than the standard yield. Hence, most of the Top 3 irrigated rice farmer respondents are production inefficient in their dry season CY 2014 farm operation.

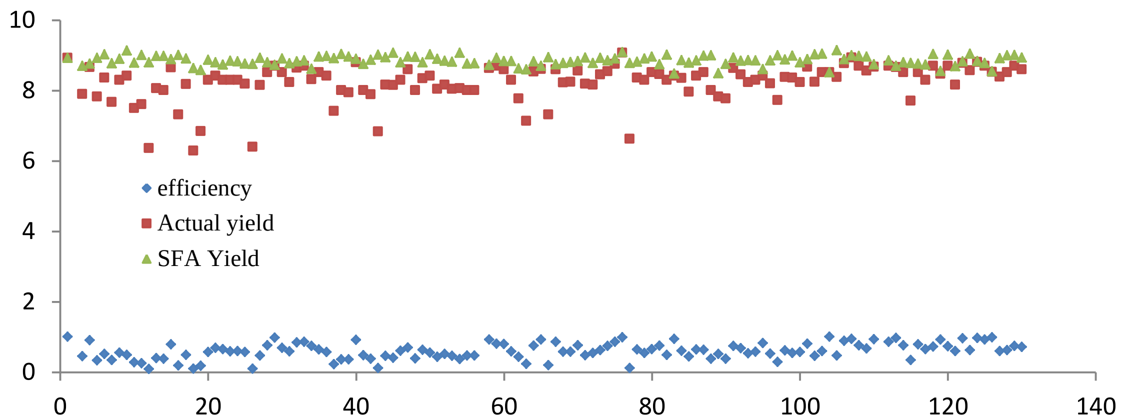

Figure 5. Stochastic Frontier Analysis graph of the Top 3 irrigated rice farmer respondents during the dry season of CY 2014

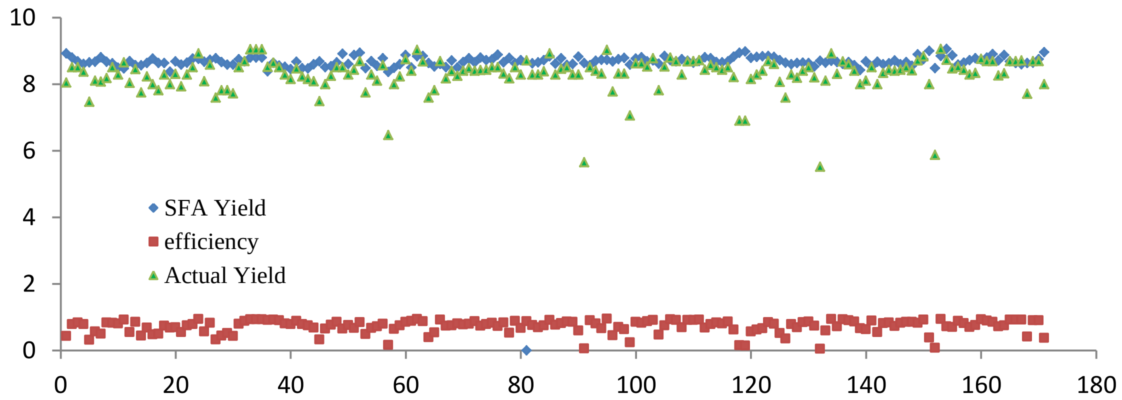

Figure 6. Stochastic Frontier Analysis graph of the Middle 3 irrigated rice farmer respondents during the dry season of 2014

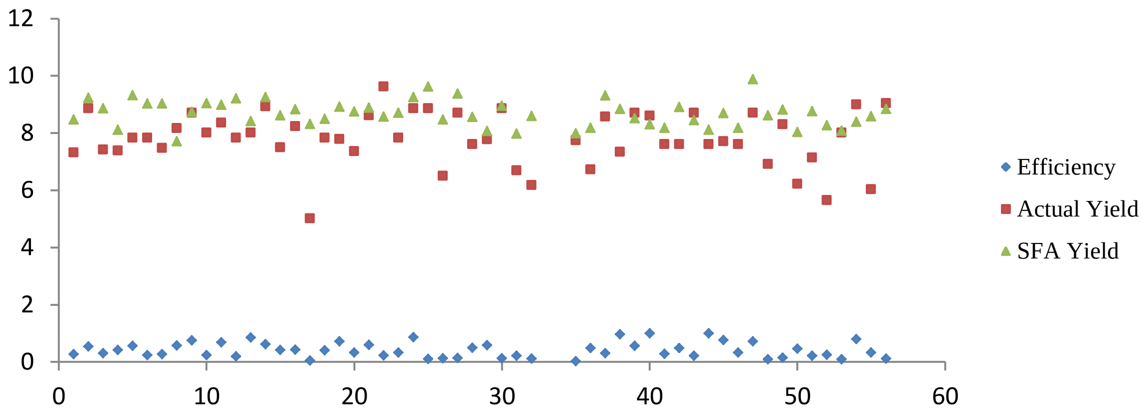

Figure 7. Stochastic Frontier Analysis graph of the Bottom 3 irrigated rice farmer respondents during the dry season of 2014

Conclusion

In light of the findings, the following conclusions are hereby drawn:

1. All the top 3, middle 3 and bottom 3 irrigated rice farmer respondents are in their middle age. All of them reached high school level and have been in farming business for an average of 22 years. They are tilling a mean area of 1.8 to 2.64 hectares and availed the services of the National Irrigation Administration as their source of irrigation water. Most of them are land owners, utilized their own money and at the same time borrow from informal money lending sources for farm operation.

2. Result of regression analysis showed a high significant relationship between cost of planting, fertilizer used, seedbed preparation, disease control and pest control to yield. Moreover, increase in yield is attributed to dikes repair, use of hybrid seeds, harvesting within the due date while irrigation water sourced out from NIA decreases yield due to inadequate supply.

3. Stochastic Frontier Analysis graphs show that all in the Top 3, Middle3 and Bottom 3 farmer respondents, only few farmers are production efficient both in the dry and wet season farm operation.

Recommendations

1. Proper timing of planting should be observed to minimize crop devastation due to floods, drought and cold spell and to have sufficient supply of irrigation water from NIA.

2. Increasing the use of inorganic fertilizer and chemical based pest and disease control causes significant decrease in yield, hence making farmers production inefficient. Farmers should slowly convert their farms into organic to improve production efficiency.

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