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Performance Evaluation of Local Government Support Program Mudfish Cabinet Dryer

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ABSTRACT

This study was conducted to evaluate the performance of Local Government Support Program Mudfish (LGSP) mudfish dryer in Poblacion, Loreto, Agusan del Sur and to determine its drying efficiency and the quality of dried mudfish commonly known as "daing" or "tahay" by its quality and appearance. The LGSP mudfish dryer having an average drying efficiency of 39.39% could be ignited within 50 seconds. It's drying time varied at different temperature. The moisture reduction of the mudfish samples varied among the three layers of the dryer, but it did not vary significantly on three levels of temperature. The results revealed that at 40°C and 50°C, the color of dried mudfish turned reddish white; but, when the temperature was increased to 60°C, it turned reddish brown. Hence, the dryer performed with efficiency at a short period of time when a high temperature would be applied.

Keywords: *Agricultural engineering, mudfish cabinet dryer, descriptive-evaluative design, Caraga, Philippines*

INTRODUCTION

Drying is the oldest and the cheapest method of preservation. A lot of people in the world use the method of preserving food for storage. The presence of heat removes the moisture content that can cause spoilage in a short period of time. Since heat is core in the process, it reduces the weight and size that makes easier for packaging and transporting of food products to other places.

In the United States of America, McWilliam (2012) found that the original method of food preservation has been practiced for over 300 years now. While some consumers apply it, other food industries use dehydration rather extensively. The commercial method which is used by some food industries includes drum drying, spray drying, freeze drying, rotary drying, cabinet drying, and tunnel drying.

In the Philippines, Soriano (2010) explained that the importance of applying food preservation method is brought about by the climate condition of the province of Agusan del Sur. According to PAG-ASA, the province is categorized by an even distribution of rainfall with no marked seasonality, no pronounced dry season. A wet season with heavy precipitation occurs from the month of December to early part of March.

In Loreto, one of the municipalities of Agusan del Sur, lakes, rivers, and streams occupying a portion of the Agusan marsh are abundant of mudfish, tilapia, catfish and other inland water natural resources. Thus, most people were engaged in fishing businesses as their primary source of income. Though market demand of mudfish in the locality, ranges from 100 to 110 kilogram per week, it is sad to note that supplies could not satisfy or meet the needs because of unfavorable climatic condition in processing, and non-availability of drying facilities and equipment.

For this reason, the LGU of Loreto came up with a decision to design a mudfish dryer. With the assistance of LGSP, a cabinet dryer was constructed to address the situation and support the program of the government in promoting/ exporting good quality dried mudfish.

OBJECTIVES OF THE STUDY

The main objective of the study was to assess the drying performance of the Local Government Support Program cabinet mudfish dryer. Specifically, the study aimed to achieve the following objectives:

1. To determine the drying efficiency of the cabinet mudfish dryer;
2. To determine the quality of dried mudfish as characterized by its physical appearance; and,

3. To generate recommendations based on the findings.

METHODOLOGY

Research Design

The study used descriptive – evaluative research design. According to Cristobal and Dela Cruz-Cristobal (2013), this design involves makings judgment of worth or value. It allows the researcher to delineate, obtain, and provide information that is useful for judging decision alternatives when conducting a program or service. The evaluative design form can be formative (process) or summative (outcome).

In this study, the researcher evaluated the drying performance of LGSP cabinet mudfish dryer; hence, the design was summative as it aimed to determine the drying efficiency of the dryer based on the quality of dried mudfish produced in terms of its physical appearance.

Research Site

The study was conducted beside the public market of Barangay Poblacion, Loreto, Agusan del Sur. Loreto, officially the Municipality of Loreto, is the 1st class municipality in the province of Agusan del Sur, Philippines. According to the 2015 census, it has a population of 42,501 people (Municipality of Loreto, 2012).

In the same source, it was written that sometime in 1880, the Spaniards first came to the upper reaches of Agusan del Sur and discovered the Manobos. In convincing the Manobos to organize themselves and lived in a settlement, they named it "Loreto" in remembrance of Fr. Urios town in Spain on March 30, 1965.

On a rainy morning of January 13, 2012, Loreto became nationally notable when it became the site of a rain of fish. Seventy-two small fish were recovered and placed in an aquarium. They were about 3 inches (7.6 cm) long and had small spots, but eh species remains unknown. The Bureau of Fisheries and Aquatic Resources attributed the phenomenon to a waterspout (Fish rain down on Agusan del Sur Town, 2012).

Loreto as one of the municipalities of Agusan del Sur, Philippines comprises lakes, rivers, streams occupying a portion of the Agusan March which are abundant of mudfish, tilapia, catfish and other inland water natural resources. Thus, most people are engaged in fishing businesses as their primary source of income.

Market demand of mudfish in the locality ranges from 100 to 110 kilogram per week but sad to note that supplies could not satisfy or meet these needs because of unfavorable climatic conditions in processing, and non-availability of drying facilities and equipment.

Data Collection

The fish dryer was made of reinforced concrete with dimensions of 1.83 X 2.44 in meters, a gable roof type located beside public market of Barangay Poblacion, Loreto, Agusan del Sur. The dryer was composed of a heat exchanger made of 2 steel drums connected with an inside diameter of 60 cm. It comprised of three (3) layer – trays made of lumber and wire screen spaced apart. Lower tray was 62 cm from the heat exchanger. It had a capacity of 12 kilograms. Firewood was utilized as a fuel in this type of dryer.

The preparation before drying included weighing of mudfish, removal of scales, tails and fins, cleaning with water, and removal of fish bile. Partly, the mudfish was sliced longitudinally in two halves removing the internal organs and finally cleaning with water. The sliced mudfish was then washed in a mixture of water and sprite soft drink and marinated into a mixture of salt, vinegar with water for an hour prior to drying.

On drying of mudfish, the marinated samples were arranged into three layers of a tray having 12 kilograms each and subjected to different levels of temperatures as treatment. The weight reduction of mudfish was observed and recorded every two (2) hours until it attained a quality dried fish ready for market.

The drying efficiency of the Local Government Support Program dryer was determined using the formula:

Eff. = Output/Input X 100%

The following data were also considered for collection, drying temperature, weight of mudfish before and after drying, the fuel consumption, and color of dried fish.

The quality of dried mudfish was categorized according to its color and appearance. It was classified using the following color index: 1 – dirty white; 2 – reddish white; and 3 – reddish brown.

Statistical Techniques

All data gathered were analyzed using the Analysis of Variance (ANOVA) of Randomized Complete Block Design (RCBD).

RESULTS AND DISCUSSION

Drying Efficiency

Table 1a shows the drying efficiency of the LGSP mudfish cabinet dryer. Result reveals that the drying efficiency does not vary significantly on the three temperature trials. An operating temperature of 50^0C gives the drying efficiency

of 40.81% while 40^{0}C obtains 39.46% and 60^{0}C has the lowest drying efficiency of 37.91%.

Table 1a. Drying efficiency (%) of LGSP dryer in different layers at specified temperatures

Treatment	LAYER			TOTAL	MEAN
	I	II	III		
T1 (40^{0}C)	33.75	40.83	43.75	118.33	39.44
T2 (50^{0}C)	35.92	40.67	45.83	122.42	40.81
T3 (60^{0}C)	34.58	39.58	39.58	113.74	37.91
Total	104.25	121.08	129.16		
Grand Total				354.49	
Grand Mean					39.39

Analysis of Variance in Table 1b reveals that the result of drying efficiency is not significant as affected by different temperature.

Table 1b. Analysis of Variance of drying efficiency of the LGSP dryer at specific temperature

SV	df	SS	MS	*Comp.F*	*Tab.F*	
					5%	*1%*
Replication	2	107.67	53.835			
Treatment	2	12.57	6.285			
Ex.Error	4	11.01	2.753	*2.28 ns*	*6.44*	*18.00*
Total	8	131.25				

ns: not significant

C.V. = 4.21%

Total Weight Loss of Mudfish

Table 2a shows the total weight loss of drying mudfish. Result reveals that the weight loss of mudfish does not vary significantly on the three (3) temperature trials. An operating temperature of 50^{0}C gives the lowest weight loss of mudfish with 40.10 kg among the 40^{0}C with 7.27 kg. and 60^{0}C with 7.45 kg. The average mean of all trials is 7.273 kg.

Table 2a. Total weight loss (kg) of mudfish placed in different layers at specified temperature

Treatment	LAYER			TOTAL	MEAN
	I	II	III		
T1 (40^{0}C)	7.95	7.1	6.75	21.8	7.27
T2 (50^{0}C)	7.69	7.12	6.5	21.31	7.10
T3 (60^{0}C)	7.85	7.25	7.25	22.35	7.45
Total	23.49	21.47	20.5		
GRAND TOTAL				65.46	
GRAND MEAN					7.273

The result of Analysis of Variance in Table 2b shows that the weight loss of mudfish is not significant to the different temperatures applied.

Table 2b. Analysis of Variance of drying efficiency of the LGSP dryer at specific temperature

SV	df	SS	MS	*Comp.F*	*Tab.F*	
					5%	*1%*
Replication	2	1.55	0.775			
Treatment	2	0.18	0.09			
Ex. Error	4	0.1606	0.04015	*2.24 ns*	*6.44*	*18.00*
Total	8	1.8906				

ns: not significant
C.V. =2.75%

Dry Weight of Mudfish

As shown in Table 3a, the dry weight of mudfish does not vary significantly on three (3) different temperature. The dry weight of mudfish at 40^{0}C is 4.733 kg; at 50^{0}C is 4.897 kg; and, at 60^{0}C is 4.55 kg.

Table 3a. Average results of three trials that the dry weight of mudfish placed in different layers of LGSP dryer at specified temperature

Treatment	LAYER			TOTAL	MEAN
	I	II	III		
T1 (40^{0}C)	4.05	4.9	5.25	14.2	4.733
T2 (50^{0}C)	4.31	4.88	5.5	14.69	4.897
T3 (60^{0}C)	4.15	4.75	4.75	13.65	4.55
Total	12.51	14.53	15.5		
GRAND TOTAL				42.54	
GRAND MEAN					4.7267

The Analysis of Variance in Table 3b reveals that the dry weight of mudfish is not significantly different on the different temperature applied.

Table 3b. Analysis of Variance on the weight of mudfish (LGSP) dryer at specific temperature

SV	df	SS	MS	*Comp.F*	*Tab.F*	
					5%	*1%*
Replication	2	10.5513	0.77565			
Treatment	2	0.1805	0.045			
Ex. Error	4	0.1588	0.0265	*1.7ns*	*6.44*	*18.00*
Total	8	1.8906				

ns: not significant
C.V. = 3.44%

Number of Hours of Drying Ready for Market

Table 4a shows the number of hours of drying ready for market. Result reveals that the number of hours of drying does not vary significantly on the three (3) temperature trials. In 60^{0}C temperature, the operating time is 6 hours; at 50^{0}C is10 hours; and at 40^{0}C is 12 hours. The mean average of the trials is 9.33 hours.

Table 4a. Average results of drying hour in the LGSP dryer at specified temperature, ready for market

Treatment	LAYER			TOTAL	MEAN
	I	II	III		
T1 (40^{0}C)	12	12	12	36	12
T2 (50^{0}C)	10	10	10	30	10
T3 (60^{0}C)	6	6	6	18	6
Total	28	28	28		
GRAND TOTAL				84	
GRAND MEAN					9.33

Analysis of Variance in Table 4b reveals that the number of hours for drying ready for market is not significant as affected by different temperatures.

Table 4b. Analysis of Variance on number of hours of drying for marketable product

SV	df	SS	MS	*Comp.F*	*Tab.F*	
					5%	*1%*
Replication	2	0				
Treatment	2	56				
Ex. Error	4	0		∞	*6.44*	*18.00*
Total	8	56				

Color of Mudfish

Table 5a shows the color of dried mudfish. Result reveals that the color of dried mudfish at temperature of 40^{0}C is reddish white. The color of dried mudfish at a temperature of 50^{0}C and 60^{0}C is reddish brown. The mean average of the trials is reddish brown in color.

Table 5a. Average results of three trials of gathering the color of dried mudfish on different layers of the LGSP dryer at specified temperature

Treatment	LAYER			TOTAL	MEAN
	I	II	III		
T1 (40^{0}C)	3	2.4	1.6	7	2.33
T2 (50^{0}C)	3	2.6	2.4	8	2.67
T3 (60^{0}C)	3	3	3	9	3
Total	9	8	7		
GRAND TOTAL				24	
GRAND MEAN					2.69

Analysis of Variance in Table 5b reveals that the color of mudfish is not significant for all trials.

Table 5b. Analysis of Variance on the color of mudfish on the LGSP dryer at specific temperature

SV	df	SS	MS	*Comp.F*	*Tab.F*	
					5%	*1%*
Replication	2	0.67	0.335			
Treatment	2	0.67	0.335			
Ex. Error	4	0.50	0.125	*2.68 ns*	*6.44*	*18.00*
Total	8	1.84				

CONCLUSION

The dryer can be operated using different levels of temperatures. Its capacity increases when a high temperature is used, without any significant difference in the color of mudfish and its efficiency. Also, it is efficient to dry the mudfish at a short period of time when applying a high temperature. Therefore, 60^{0}C is the best temperature to be used for the LGSP mudfish dryer.

On these bases, the layer tray may be interchanged in every two hours so that the mudfish in the tray receives equal amount of heat during the operation. Likewise, an additional tray layer may be constructed to add the capacity of the dryer.

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