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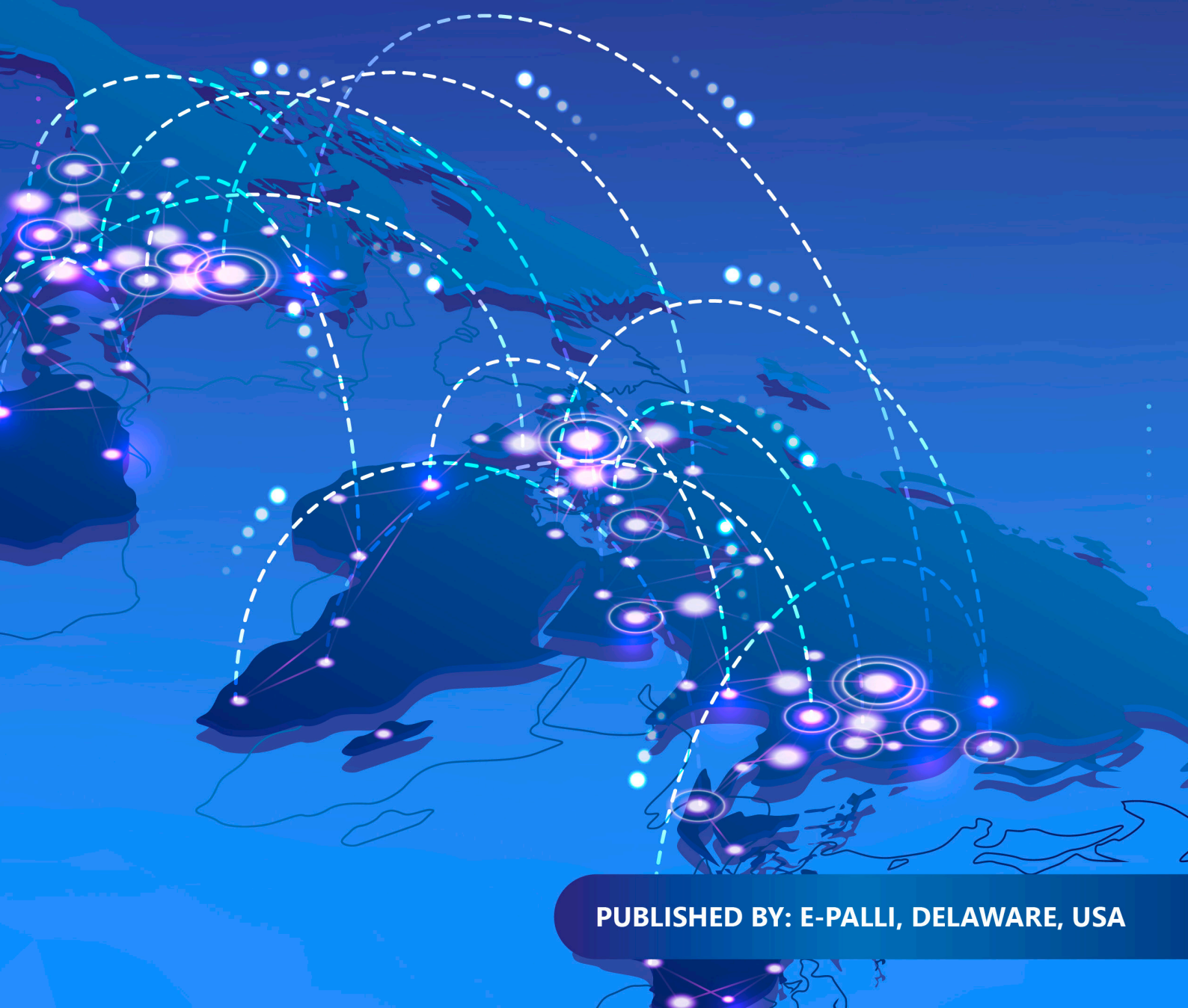

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Design, Fabricate Multi-Function Tiger Grass (Thysanolaena Maxima) Pollen Grains Remover with Soft-Broom/Samhod Wood Lathe Assembly and Convertible Rice Palay Thresher

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ABSTRACT

Commercial agricultural machines are noted for having some limitations in their functions, which motivates the proponents to develop and apply new ideas to agricultural applications. This innovative agricultural machine can clean the pollen grains by operating the cleaning cylinder at moderate speeds. A hook-on wood lathe assembly is provided in the machine for effecting attractive soft broom handles as a finished product. In addition, the machine can be utilized as a Palay-Thresher, making it multi-functional. The study utilizes the Research and Development (R&D) process since the output of the study will be useful to farmers who process tiger grass in Partido, Camarines Sur. This project study examines the technical development of designing, fabricating, testing, and evaluating a multi-function agricultural machine out of locally available materials. In its performance test, the study demonstrated a high level of acceptability regarding its functionality and efficiency. Although this study successfully established the functionality of the "Design and Fabricate Multi-Function Tiger Grass (Thysanolaena Maxima) Pollen Grains Remover with Soft-Broom /Samhod Wood Lathe Assembly and Convertible Rice Palay Thresher," more studies should be conducted to improve the design and efficiency of the device.

INTRODUCTION

"Walis Tambo" production in Camarines Sur, Philippines is seen as an alternative source of income alongside farming and fishing as the main source of livelihood. Lagonoy, Camarines Sur, and nearby coastal areas in Partido were identified as major producers of "samhod" and where production of tiger grass is extensive and commercialized because it is easy to grow and a potential source of income. The old method of shaking and brushing the stalks against the wall, trees and other hard surfaces to remove the pollen grains is actually quite a method of eliminating tiger grass pollen. Methods such as this require more manpower and are considered time-consuming.

It is common that "walis tambo" broom has a handle made from the stalks of the tiger grass, but it is time-consuming and requires tying wire to hold it in place. While some use tree branches for the handles, they have complained that the shape is irregular, and the consumers aren't attracted to the handles. Others used plastic rattan to cover the irregular shaped handle to make it look attractive but costlier. (Orley G. Fadriquel, 2017)

Using previously identified machines in the review, the study's proponents designed and developed a gender-friendly farm implement.

This machine can be operated by electricity or gas. Assembly and disassembly allow it to be transported easily from one place to another. It will also be used as a rice thresher during the rice harvest season.The project study was conducted to design, fabricate and conduct routine test on the efficacy of a multi-function Tiger Grass (Thysanolaena Maxima) Pollen Remover combined with other mechanical features for agricultural use.

LITERATURE REVIEW

During a conversation with a colleague in Partido State University (ParSU-Goa) campus, his father's method of cleaning tiger grass pollen was revealed. By striking or shaking the pollen grains of the tiger grass, the process is applied. This method consists is tedious and time-consuming as it is, some seeds are not shaken off and the stalks tend to be damaged. The old method of shaking and brushing the stalks against the wall, trees and other hard surfaces to remove the pollen grains is actually quite a method of removing tiger grass pollen. Methods such as this require more manpower and are considered time consuming. At Romblon State University, the study of Fadriquel, O.G. (2017) spent a year developing and building a Tiger grass pollen remover with a woodworking machine.

Because a pollen grain remover and handle maker were not available in his hometown, he developed one in order to help tiger grass growers. Don Mariano Marcos Memorial State University (DMMMSU) also developed a machine to remove pollen flowers from tiger grass, the material used in the production of walis tambo and to ease up the process in one of La Union's biggest industries.

Using a machine made of locally available materials, pollen grains can be removed faster and more efficiently without damaging the stalks. Nkakini et al., (2006), identified poor farmers lack incentives to use machinery in agricultural practices due to poverty, ignorance, and cheap traditional tools readily available to them. Furthermore, he emphasized that working manually in farming has resulted in the underutilization of tractors.

Taking, also, inspiration from Suzuki's (1980) paper on rice combine harvesters that were evaluated by a national

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test in Japan, Smith D.W., Sims, B.G., and O'Neill's (1994) work that examine the evaluation of machines, handling and performance characteristics, economic impact, and the greater benefits they would offer to users and manufacturers, thus this project study was conceptualized.

METHODOLOGY

The study utilizes the Research and Development (R&D) process since the output will be useful to farmers who process tiger grass in Partido. Through the descriptive method, the study was validated.

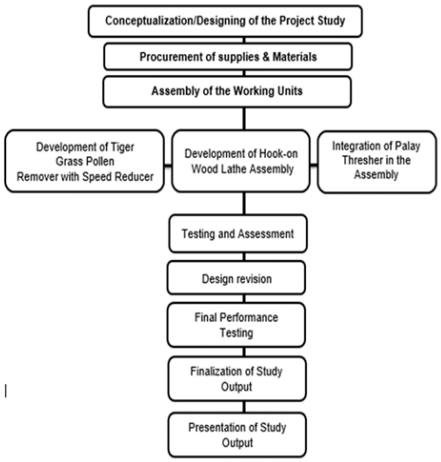

Figure 1: Activities Followed in the Conduct of the Project Study

RESULTS AND DISCUSSION

The Multi-Functional Machine

The machine shown was develop considering the Philippine Agricultural Engineering Standards PAES 205:2015, Agricultural machinery. In addition to a Palay thresher, it is also equipped with a Pollen Grains Remover and an On-hook Wood Lathe Assembly, making the machine multi-functional.

The Main Machine Parts

1. Main Frame - it is the solid frame attached to the majority of the machine parts and serve as stand of the assembly

2. Cylindrical Threshing Unit– installed in the main frame and will serve as the pollen grain remover and palay thresher.

3. Speed Reducer - integrated into the machine that operates the cylindrical threshing unit in a required and minimal speed. The elimination of too much speed will greatly reduce the risk of loss or damage of broom stalks.

4. Hook-in Wood Lathe- This piece of equipment can be used to make attractive soft broom handles and other woodworks. In this, a driving (input) gear has the same radius as a driven (output) gear.

5. Power Source- The main driving mechanism of the machine. This can be electrical or gas-fed motor whichever is available.

6. Cover- There will be two separate cover the machine will be using: a cover for Palay threshing and the other one when using the machine as Pollen Grain Remover.

Fabrication Procedures

The following fabrication procedures are shown in details below. Arc welding was utilized in joining metals.

Main Frame:

a. Secure the necessary supplies, materials, tools and equipment needed.

b. G.I. Pipe, Angle Bar, Bending Jigs, Welding Machine, Angle/Cutting Tool

c. Cut frame materials based on measurements, angles, and dimensions.

d. Main frame assembly will be performed by arc welding.

e. The adjoining parts will also be refined by grinding and filing.

Cylindrical Threshing/Cleaning Assembly

a. Prepare all supplies and materials needed.

b. Flat bar, G.I. Sheet, Axle Shaft, N.P. Bearings and Pulley, Threshing Pegs, Plastic Wire Brush, bolts and nuts

c. Prepare the Cylindrical Threshing/Cleaning Unit based on the measurements required

d. Using arc welding in conjunction with a fastener system, the "Pollen Grain Remover" as well as the "Palay Thresher" were combined into one unit.

Hook-in Wood Lathe

a. Cut and bend the needed materials according to design and measurements.

b. G.I. pipe, Pre-fabricated Tail Stock and Tool Rest Assembly, Driven Pulley

c. Weld the Wood Lathe mounting into the main frame.

d. The Wood Lathe Assembly frame should be installed and the alignment should be checked.

e. Remove jagged and irregular welds from the pipe.

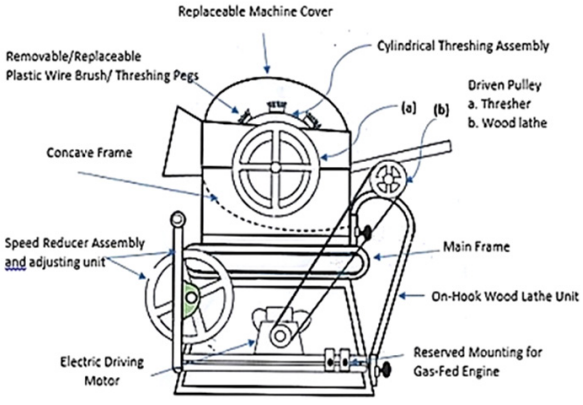

Figure 2: Multi-Function (Thysanolaena Maxima) Pollen Grains Remover with Wood Lathe and Rice Palay Thresher Convertible. Describe below are the components of the Multi-Function Agricultural device.

The diameter of the threshing drum was 110mm, and it had a length of 330mm. In addition to 85 threshing pegs for palay threshing, the cylindrical drum was equipped with 18 plastic wire brushes to clean pollen grains. It had a wrapping angle of 115 degrees. In addition to a concave, a cap was placed atop the drum. The Total Weight of the Machine is 70.5Kg and the total cost of the project is PhP 25,210.00. There is increase in weight of 19.8% if On-hook Wood Lathe assembly is added. There is increase in weight of 19.8% if Speed Reducer assembly is added.

The speed reducers are shown to provide the torque required for the machine to operate. The pollen grain remover utilizes a driver-driven pulley ratio of 18:1-two stage pulley to reduce the speed at 96.67rpm at which threshing loss decreased as well (Figure 3a); The palay thresher use a 3:1driver-driven pulley ratio at 870rpm (Figure 3b; and the wood lathe assembly uses the 1:1 drive at 1,740rpm (Figure 3c).

Table 1: Machine Specification

Materials	Measurement (cm)	Weight (kg)
Main Frame Assembly (G.I. pipe ½" dia)	51X 88 X 90	10
Thresher Cover	62 X 82	4
Feed board/table	62 X 82	4
Cylindrical Thresher/Cleaner	30 X 75	10
"Sugbo" Mounting Rest and Cover	50 X 56	2
Thresher Pegs	10	1
Plastic wire brush	16	1
Electric Motor Assembly	32 X 20	8
Driving Pulley	10	0.5
On-hook Wood Lathe Assembly	69 X 28	10
Speed Reducer Assembly	48 X 18	10
Total		70.5

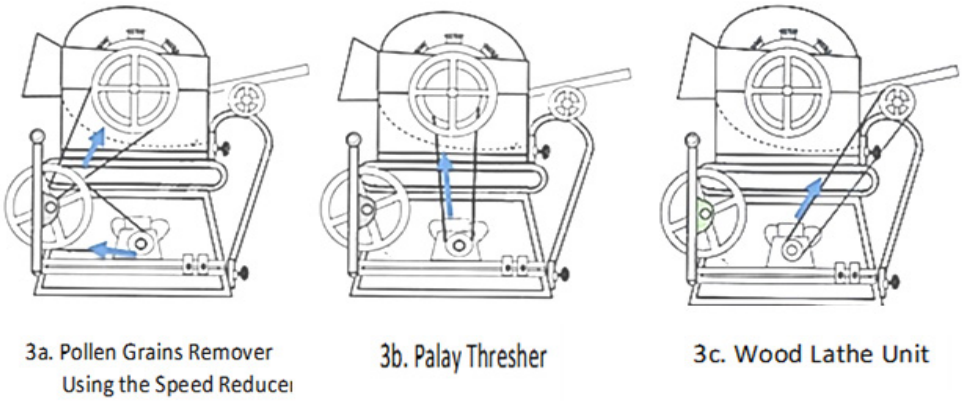

Figure 3: Application of the Driver and Driven Mechanisms. This figure shows the arrangement of the driving and driven mechanism (belt driven) depending on job performed by the machine. Arrow shows direction of the rotation.

Table 2: Power speed flow, input-output speed from driver to driven pulley

Driving Mmotor @1,740 rpm	**Driven Pulley**					
	Pollen Grain Remover		**Palay Thresher**		**Wood Lathe Assembly**	
	rpm	Pulley Ratio	rpm	Pulley ratio	rpm	Pulley ratio
	580 1st speed	3:1	870	3:1	1,740	1:1
	96.67 final speed	18:1				

Performance Test

Initial tests were carried out using "sugbo" in one cleaning speed for 25 minutes. In this, demonstrate samples with few damaged stalks after the 25-minute testing period. Time was tracked during the sampling process. No stoppages were recorded during the test, nor was there any run-down time.

Below was used as basis to test the efficiency of the machine recommended on Philippine Agricultural Engineering Standards PAES 205:2015, Agricultural machinery.

A 50kilogram Pollen Grains (Sugbo) as test piece, the

proponent come up with the testing using sheet analysis provided by Testing and Evaluation of Agricultural machinery and Equipment ISSN 1010-1365.

The above calculations were made in order to test the cleaning efficiency of the machine as recommended by Philippine Agricultural Engineering Standards PAES 205:2015, Agricultural machinery ISSN1010-1365 pp.20.

Cleaning Efficiency (Ce), % (tested for 25kg Pollen Grains at 870rpm)

The first sample at speed of 870rpm showed 68 percent

Table 3: Sheet for analysis of test samples (from Appendix 18A pp223, Testing and Evaluation of Agricultural machinery and Equipment ISSN 1010-1365

Sample No.	Feed Rate kg/h	Thresher Speed rev/min	Sample from	Total mass of sample	Mass kg			
					Clean grain	Broken grain	Un-threshed grain	Foreign material
1	25	870	Outlet	25	17	5	3	0
2	25	***99.67	Outlet	25	25	0	0	0

****with final speed reducer*

$$Ce\ \% = \frac{K}{L} \times 100$$

$$= \frac{\text{Weight of cleaned grain per unit time}}{\text{Weight of whole material per unit time}} \times 100$$

$$= \frac{17kg}{25kg} \times 100$$

$$= 68\%$$

Cleaning Efficiency (Ce), % (tested for 25kg Pollen Grains at 99.67rpm)

$$Ce\ \% = \frac{K}{L} \times 100$$

$$= \frac{\text{Weight of cleaned grain per unit time}}{\text{Weight of whole material per unit time}} \times 100$$

$$= \frac{20kg}{25kg} \times 100$$

$$= 80\%$$

Based on observations conducted, there are no factors that affect the machine's performance. The machine was left idle for one or two minutes after the testing was completed to clear residue from the outlets.

Power measurement

Means was provided to establish the power required to drive the multi-function device based on what work is performed. The electric motor was rated at 1.5horsepower equivalent to 1.122kilowatt (1hp=.7457kw), operating at 1740 revolution per minute(rpm) was found to be capable of the driving the palay thresher, pollen grain remover and carving device one at a time.

Figure 4: The Multi-function Machine for Agricultural Use.

CONCLUSION

The proponents in the conduct of the project study had drawn the following conclusions:

1. The design is a three-in-one agricultural device capable of performing the following:
   a. grass pollen remover using speed reducer;
   b. woodworking assembly; and,
   c. palay thresher convertible.
2. The study offered a way to speed up the process of making brooms, which was the major objective of the project study
3. The machine is economically workable as shown in the conduct of initial testing and analysis.
4. Using the threshing machine (for pollen and palay grains), the total grain loss was significantly reduced.
5. The working capacity is comparable to commercially available machine since the physical built meet the standard of the original one.
6. Drum speed effects on threshing loss that is why speed reducer is included to minimize damaged of grains percent when in use. The speed reducers adjust the motor speed safely and efficiently.

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