Dual-Powered Foliage Chopper for Organic Materials

Alfredo R. Rabena, Ph.D.
Manuel A. Bajet, Ed.D.

Abstract

The dual powered foliage chopper (DPFC) was designed and fabricated using GI pipe, angle bars, solid rotor and shafts. It is designed with a rotating shaft mounted with four (4) rotary chopping blades wrapped around the 16" long cylinder on its surface. It contains also eight (8) fixed chopping board plates mounted in the inner surface of the assembly. It is powered by foot pedal and an electric motor. The pedal is equipped with two sprockets- 4.5" and 8" diameters having an 18.5" long chain. The pedal sprocket is connected to the rotary shaft by a 16" long chain. The electric motor is connected to the rotary shaft by a 38" V belt via a 6" diameter pulley chopper assembly.

The machine chopped I kg of kakawate leaves (Gliricidia sepium) by foot and electric motor in 8 min and 5.55 min, respectively, while seaweeds (Sargassum sp.) by foot and electric motor in 10 min and 8 min, respectively. The chopped materials can pass through a .02 cm mesh.

Comparing fresh and dried materials, dried kakawate leaves were chopped more easily than fresh leaves by 0.55 min. using the electric motor. It was 2 min. easier for dried leaves when using the foot mechanism.

One unit of the newly-designed dual powered foliage chopper (DPFC) costs P 30,465.00.

Introduction

Background of the Study

The Philippines is truly an agricultural country which is dependent on the basic commodities it produces. Such commodities range from crops, vegetables, fruits, and many others. These products that are harvested can be potential inputs for economic development if given appropriate and necessary product processing standards that will be competitive with other producers. But if such products lack the minimum and safe levels required by consumers especially in bulk quantities, they cannot enter into world markets.

One way of turning these potentials into reality is the implementation of organic farming protocols. The use of botanopesticides and organic fertilizers can help arrest problems related to high pesticide residues in our farm products. One of the organic farming techniques which the University is presently piloting is the use of botanopesticides and biofertilizers. These are the utilization of earlier known plants that have high pesticidal properties.

Gliricidia sepium known as kakawate bas been in pilot farms and has manifested good effects on vegetables as well as crops including rice. Actually kakawate is already popularized in many rural areas as it had shown high efficiency in killing and driving away pests and insects in farms.

But when kakawate is needed in the area, the fanner is confronted with the problem of preparing his kakawate pesticide due to the reason that it has to be mixed with water *in* order to fully get its potent chemicals and then sprayed to the crops. How many days does it take for the farmer to prepare the said solution before he can spray the mixture including almost all the soft portions of the said tree?

That is why this gadget was conceived. The leaves, stems, and branches are to be cut into small pieces and mixed with water overnight and then sprayed the following morning. A gadget like the foliage chopper is designed to apply practically the organic farming technique without loss of time and effort and to maximize all resources, thus, economizing from the high cost of inorganic commercial pesticides and fertilizers. This environment-friendly technology will surely uplift our country from economic difficulty because aside from being safe from toxic chemicals, our products will be accepted and liked by consumers locally and internationally.

Objectives

1. To design and construct a foliage chopper for organic materials
2. To facilitate the preparation or raw materials needed in the making of organic botanopesticides, organic fertilizers, and organic manure
3. To facilitate organic farming activities in the rural areas where raw materials is readily available
4. To provide a locally available technology (equipment) which will work effectively and efficiently

Technology Description

This research on Dual Powered Foliage Chopper (DPFC) was conceptualized based on the need to efficiently chop raw materials needed in the organic farming technology specifically in the processing of botanopesticides and biofertilizers from foliages of plants and trees containing toxic chemicals like kakawate *(Gliricidia sepium)* and seaweeds *(Sargassum)*.

As the working drawings were completed, the purchase of supplies and materials were undertaken and the fabrication of the component parts came in simultaneously . Materials are locally available in the market. Such gadget can also be fabricated in the rural areas provided electricity is available for the welding of some parts of the machine.

Upon completion of the gadget , the pilot testing was undertaken in the technology adoptor areas - the end-users. Feedback from technology adaptors served as basis for the refinement of the gadget. Upon completion of the revisions, suggestions and innovations were incorporated into the gadget. Another set of trial runs was undertaken. It involved the chopping of leaves and young branches by two mechanisms using the foot-powered and motor-powered processes.

Process Flow

The designed dual powered foliage chopper could be operated using the pedal requiring no electricity and by the use of an electric motor.

When the foot powered mechanism is desired, one has to remove the belt connecting the motor.

The following figures present the working drawings and the process flow of the operation.

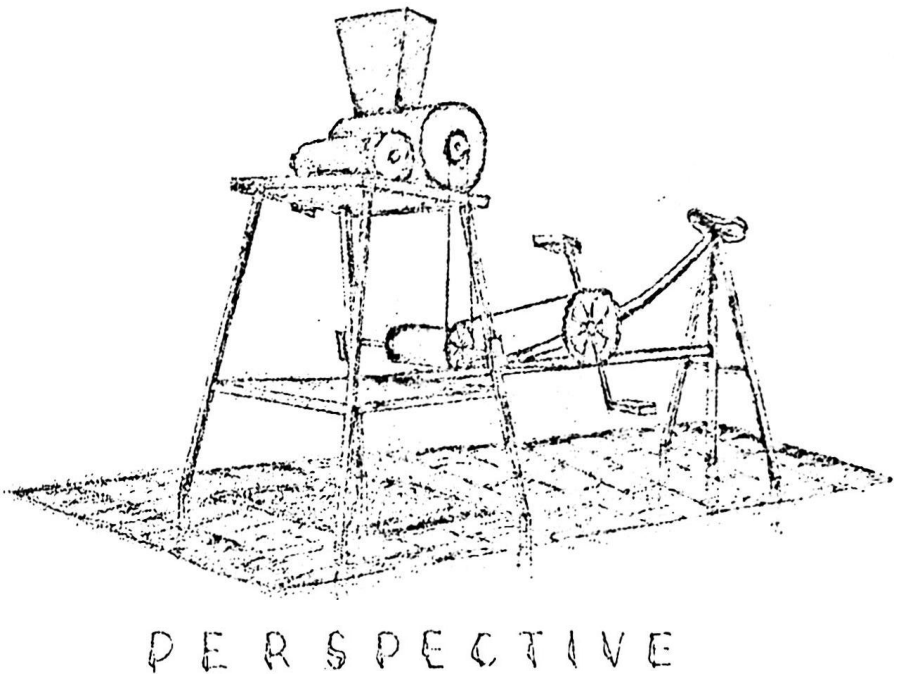


Figure 1. The Dual-Powered Foliage Chopper

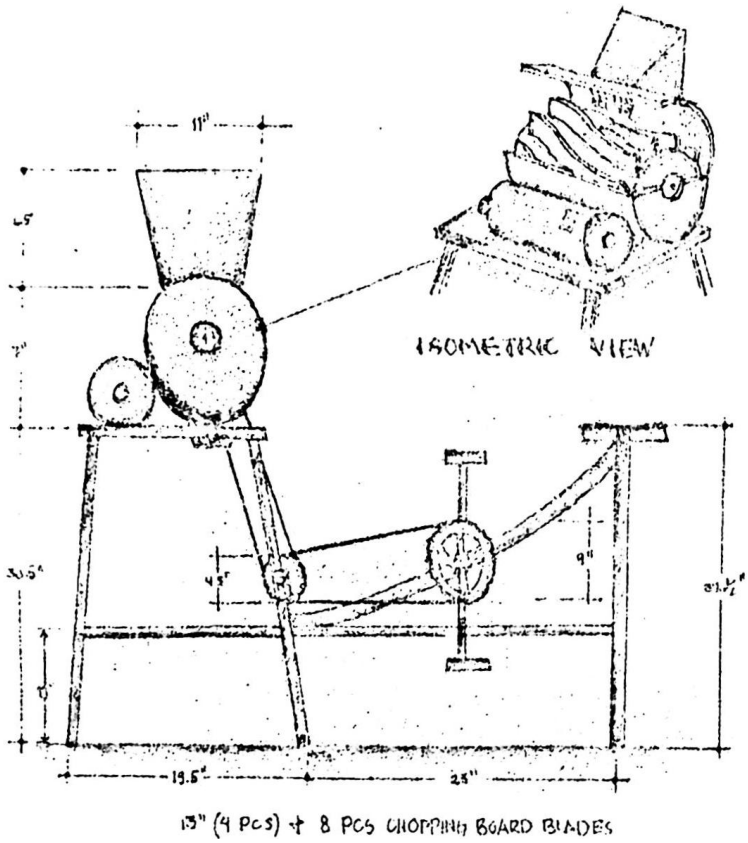


Figure 2. The Dual Powered Foliage Chopper (The Blades)

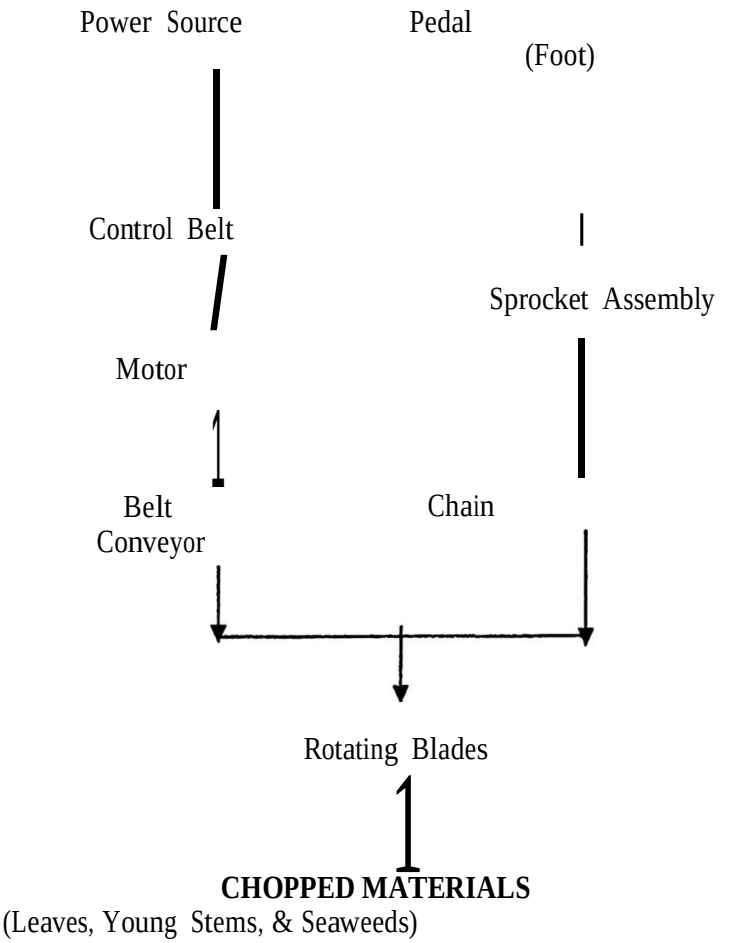


Figure 3. Process Flow of the Operation

Research Methodology

The actual fabrication was based on the working drawing of the following:

1) housing structure
2) chopping blade assembly
3) mechanical pedal
4) motor
5) downspout

The critical variables are:

1) orientation of the blade
2) size of the blade
3) number of blades
4) location of the blades

However, the size and texture of the chopped materials and the time it takes to accomplish the tasks were determined.

The efficiency of the gadget was tested based on the chopping capability operating under foot powered (pedal) and electric power mechanisms.

The gadget was tested using fresh samples and dried samples. It was tested on different kinds of samples. It was tried on kakawate *(Gliricidia sepium)* leaves and seaweeds *(Sargassum sp.)*

The sizes of the chopped leaves and seaweeds were also determined using a wire mesh.

Results and Findings

The housing structure is made of a GI pipe, angle bars, and shafts. It has a raw materials receptacle, 11" by 6.5" to accommodate a bigger volume. The pedal is attached to a 49- toothed sprocket connected to the rotating shaft via a 14-toothed sprocket to transfer a small unit of human energy exerted into an efficient gadget. These are done by a belt.

The gadget is also operated by a 1 hp. electric motor, a 220 volts 4 pole belt driver. The shaft of the motor is connected to the chopper assembly by a belt.

The four chopping blades are mounted on rotating shafts oriented at an angle running and wrapping across from end to end through a 16" distance.

The downspout for chopped materials are allowed to move out via a flapping metal cover to readily shut foreign materials.

Initial trials conducted manifested a difficulty in chopping the wet and/or fresh samples. The occurrence of clogging in the downspout made the operation inefficient while dried or slightly-dried samples

showed a much faster chopping time. Table 1 shows that out of one kilogram of fresh kakawate leaves, it took the gadget 10 minutes and 6 minutes to chop for foot-powered and motorized respectively. It is much faster to chop dried leaves using the electric motor.

Table 1. Time spent in chopping **a 1 kg** of kakawate *(Gliricidia sepium)* leaves at rotor blade-chopping blade distance at ¼ inch

Samples (Kakawate)	Ave. Time Spent (Min)		Difference (Min.)
	Foot-Powered	Electric Motor	
Fresh	10	6	4
Dried	8	5.55	2.55

Innovations

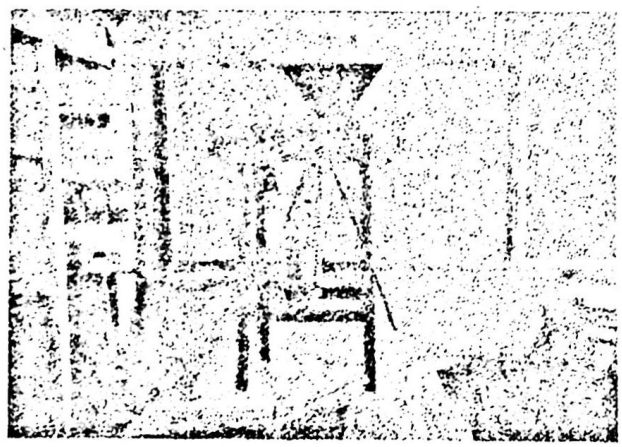
The blades were sharpened to provide efficient chopping afterwhich the blades were sharpened in chisel-type form. The wrap-around orientation of mounting the four blades allowed also the chopped materials to move readily to the other end to where the downspout is located, thus, achieving a more steady flow of materials.

The chopper was tried on different samples. A seaweed - *Sargassum sp.* was utilized. It was compared to assess its efficiency. Table 2 shows that the DPFC (motor) took 8 minutes to chop the *Sargassum sp.* while for the kakawate it took 6 minutes only. The foot powered DPFC accomplished the tasks in 10 min and 8 min chopping for *Sargassum* and kakawate, respectively.

Picture 1. A newly-fabricated dual powered foliage chopper for kakawate leaves and organic materials. (perspective)

Table 2. The efficiency of DPFC on kakawate *(Gliricidia sepium)* leaves and seaweeds *(Sargassum sp.)* having ▪ rotor-chopping blade distance

Sample Dried)	Time Spent in Chopping (min) Foot -Powered	Electric Motor	Texture/size
Kakawate leaves	8	5.5	Fine (.02 cm mesh)
Seaweed (Sargassum sp.)		8	



Picture 2. The DPFC front view showing the material feed receptacle, electric motor, rotor-blade opening, and downspout

Summary and Conclusions

1. It is possible to have a dually-powered gadget in chopping organic materials like plants and seaweeds.
2. The newly-designed and fabricated dual powered foliage chopper (DPFC) can chop materials used in organic farming like leaves of kakawate and seaweeds *(Sargassum sp.)*
3. The DPFC is capable of chopping materials both fresh and dried.

The machine chopped 1 kg leaves of kakawate *(Gliricidia sepium)* by foot and electric motor in 8 min and 5.55 min., respectively, while seaweeds *(Sargassum sp.)* by foot and electric motor in 10 min and 8 min., respectively. The chopped materials can pass through a .02 cm mesh.

Comparing the machine's performance with the fresh and dried materials, the dried kakawate leaves were chopped more easily than the fresh leaves by 0.55 min. using the electric motor; was 2 min. easier for dried leaves using the foot mechanism.

One unit of the newly-designed dual-powered foliage chopper (DPFC) costs P30,465.00.

Recommendations

1. Materials to be chopped must not be wet. When chopped, materials that are fresh or wet do not easily flow out from the gadget via the downspout.
2. One way of arresting the clogging of chopped samples is the lessening of the number of blades mounted on the rotating shaft in order to give more spaces for the chopped substances.
3. Hard materials such as matured branches are not advisable to be fed into the machine.

Potential Application and Commercialization, Replicability and Contribution to the Advancement of S & T

There are technology adoptors engaged in organic farming who were end-users of the kakawate for pesticides technology earlier developed by Rabena and Rodillas in 2004. They are:

1. Mr. Rogelio Tacla of Naglaoan, Sto. Doming, llocos Sur
2. Mr. Robert Azada of Rugsuanan, Vigan City.

There are orders from the results of the R & D Dissemination and Utilization Program of the University.

A Memorandum of Agreement is also underway which is a result of the ILARRDEC-PCARRD program on the establishment of a FITS Center in the countryside. Ayusan Norte FITS under the stewardship of Ms. Julie Esller of Ayusan Norte, Vigan made orders on the said gadget which are to be employed in their existing program.

The fabrication and utilization of the dual-powered foliage chopper may facilitate and hasten the preparation of botanopesticides thus using organic farming more practical and accessible for farmers. This may eventually pave the way for chemical and toxic- free form products and a safer environment.

References

Rabena, A. R. 1996. *The Isolation, Characterization and Identification of the Active Components of Kakawate. (Gliricidia sepium).* Ph.D. Dissertation. UPLB. College, Laguna.

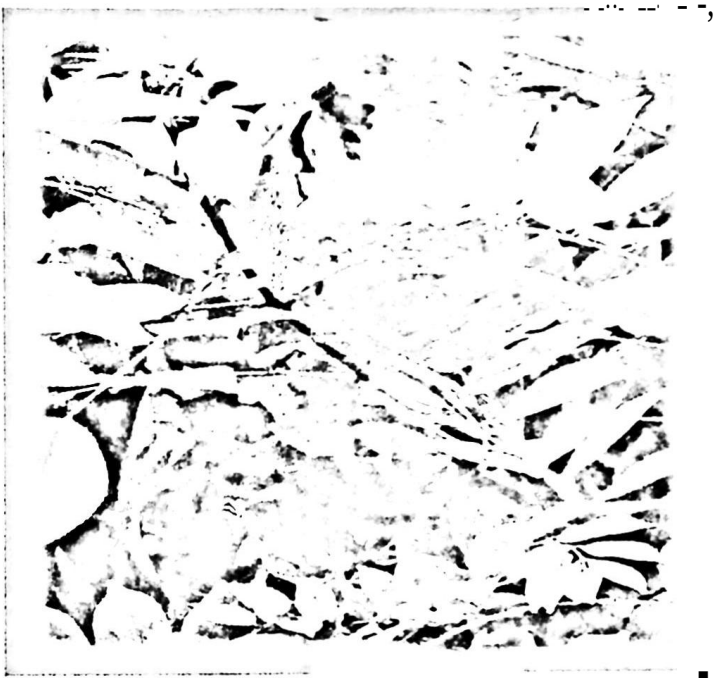
Rabena, A.R 1998. *The Isolation of Active Components of Kakawate Leaves.* Paper Presented in the 3" International Conference on Plant Molecular Biology, Suntec City, Singapore.

Rabena, A. R. and F. R. Rodillas. 2005. *The Kakawate Leaves as Botanopesticides Against Rice Pests. UNP* Research Journal 2005, UNP, Vigan City.

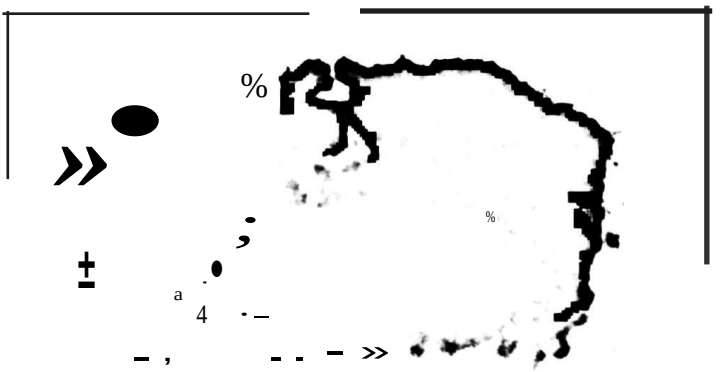
Raboy, M. R. et al. 2006. *The Utilization of Kakawate and Neem as Botanopesticides for Corn Intercropped with Eggplants and Peanuts.* UNP Research Journal 2006. UNP, Vigan City.

Rosal , E. R. Jr & R. T. Tabunan. 2005. *Production Projects of UNP. VNP* Research Journal, UNP, Vigan City.

Segismundo, A. B. 2002. *Sargassum sp. Culture in the Province of Ilocos Sur.* UNP Research Journal, UNP, Vigan City.



Picture 1. The kakawate *(Gliricidia sepium)* leaves



Picture 2. Ground kakawate *(Gliricidia sepium)* leaves and stems using the DPFC under a 0.2 cm wire mesh (fresh samples)

Picture 3. Ground kakawate *(Gliricidia sepium)* leaves and stems using the DPFC under a 0.2 cm wire mesh (dried samples)