The Palawan Scientist
Vol. 3, No. 1. pp. 1-9, 2007

ISSN No. 1656-4707

Development of Mechanized Peanut Sheller

Mirriam P. Banlawe
College of Engineering, Architecture and Technology
Western Philippines University
Aborlan, Palawan

ABSTRACT

The peanut sheller developed at the Agricultural Engineering section of the College of Engineering, Architecture and Technology, Western Philippines University, Aborlan, Palawan was designed to mechanize peanut shelling, reduce time, labor and cost spent in shelling and produce quality whole kernel peanut.

The Prototype recently developed met the standards set for mechanized peanut sheller. It has a shelling capacity of 65.20 kg/hr with a shelling efficiency of 99.58%; the whole kernel recovery is 99.21%; a shelling recovery of 69.48 %. The shelling recovery and head nuts recovery are affected by the dryness of the nuts. Over dried nuts have brittle kernels, which resulted to more split kernels during shelling.

The cost of fabrication of the machine is P10,092.00 (materials and labor only.). The farmer has the option to use either electric motor or engine. The cost of fabrication is considered minimal and affordable. The machine has to shell 101.62 kg/month at four hours operation and a shelling fee of P3.50/kg to break even. The return on investment is 69.25 centavos for every peso invested and the payback period is 171 days.

Keywords: peanut sheller, machine prototype development

INTRODUCTION

Peanut shelling in Palawan are usually done manually using bare hands. A kilo of unshelled peanut usually takes seven and a half (7 ½) minutes to shell by bare hands. Although this method is appropriate for Palawan condition considering that Palawan had still have plenty of labor for the operation, farmers have been reluctant to completely rely on manual labor. Shellers are often short in supply especially when shelling of peanuts coincides with the peak harvesting season of peanut, corn and rice. High labor wages also pose problems to farmers. Much of the younger labor is also going to more luxurious jobs in the cities or to other provinces and countries, while older farmers, women and children are left for such task as shelling. These force farmers and other sectors to look for alternative methods like one use of a mechanical sheller.

The first manually operated peanut sheller was developed in 1993 at the Agricultural Engineering section, Palawan National Agricultural College. The

mean output capacity of the machine per day was 380 kg at eight (8) hours of operation, which is very much higher than hand shelling that produces only 80 kg per day at ten (10) hours shelling. Though through this method there is an increase in the production of shelled nuts, still it is laborious in the sense that there should be three (3) laborers who take turns in operating the sheller, in feeding the peanuts and separating the kernels from the shells.

A continuous improvement on the design of the manually operated peanut sheller has been done. Lately, the sheller was modified and improved. Some parts were totally re-designed and necessary parts to separate the kernels and the shell were added. This improved sheller has increased both the capacity and efficiency of the machine. Whole nuts recovery was almost one hundred percent (98.88%).

This study was conducted to: develop a mechanical shelling machine; to test and evaluate the performance of the machine; and to analyze the cost and return of operating the machine.

METHODOLOGY

Major Design Considerations

1. Machine capacity of at least 40 kg per hour

   In account that the prototype has a prime mover, it is expected that the unit should have a capacity significant enough for longer operations and for custom shelling. Thus, a minimum capacity of 40 kg per hour and a maximum capacity of 60 kgs per hour were set for the unit.

2. Machine shelling efficiency

   The target machine shelling efficiency is 75% to 85%.

3. Whole nut recovery

   The quality of the shelled nut is of prime consideration in the design of the shelling drum. It is expected to yield more than ninety (90) percent whole nut and a negligible percent of broken nuts.

4. Shelling recovery

   The shelling recovery was set to 60 percent considering the bulkiness and weight of the shell. This was also based on the milling recovery of rice, which ranges from 55% to 70%.

5. The shaker and the blower

Utilize existing mechanism of the blower and shaker of paddy thresher, with modification to suit the design that is based on the characteristics of the pods and kernel of peanuts.

6. Target price of P25, 000.00

The cost of the machine must be affordable to farmers. Materials locally available and materials that can be recycled will be utilized in the design and fabrication of the machine. A target price of 25,000.00 per unit including the prime mover will be considered.

7. Mobility

For custom hiring the machine can be towed on trailer to facilitate mobility from place to place with one man operating and one man attending to bagging of shelled nuts at the side of the sheller.

DEVELOPMENT PROCESS

The development work includes the following:

1. Modification of the Shelling Drum

The existing sheller design (Prototype I) (Figure I) developed by the author was considered for the shelling components of the peanut sheller. Several modifications, however, were needed to improve the performance of the machine. One major change in the design was the use of steel bars welded to form a grilled type drum; in place of a G.I. sheet and wooden slots. The perforations between the grills were computed base on the largest size of the kernel. The shelling drum is fixed and stationary.

2. Development of the Sheller

The sheller, the part of the machine that breaks/cracks the pods into halves, was designed and developed. Instead of using a solid cylindrical wood fastened to a shaft, the principle of a "*hampasan*" was used in the development of the sheller. There were five rubber flat belts fastened to a flat bar attached to a stainless solid shafting. The rotation of the flat belts facilitates cracking of the pods.

3. Development of the Blower and Shaker

Because of the necessity of this component, design of a self-cleaning device was necessary. Thus, a blower and shaker were included in the development of the unit to separate the kernel from the shell and to remove other foreign materials during shelling. The mechanism of the thresher's shaker and blower was modified to suit the shelling operation.

4. Development of Frame Structure

The operation of the sheller caused vibrations to the whole unit thereby affecting its stability of the machine during operation was of primary concern in the design of the frame structure. The designed frame structure considered all the possible adjustments during operations, repair and replacement of parts.

RESULTS AND DISCUSSION

Description of the Prototype (Prototype II)

The Major Components of the Machine

1. The Sheller

The sheller is composed of five (5) one ply rubber plates fastened at the base to a 5/16 mm flat bar attached to a 1" Ø shafting. This sheller rotates at 375 revolutions per minute in a clockwise rotation. There is clearance between the sheller and the casing of the drum to facilitate rotation of the sheller and to create impact on the pods in order to break it.

2. The Shelling Drum

The shelling drum of the machine is instrumental in cracking the pods of peanuts. As the sheller strike the peanuts, it collides with the shelling drum and split them. The kernels and empty pods were dispensed into the shaker. The shelling drum was made to 10 mm steel and 6 mm steel bars bars.

3. The Shaker and the Blower

The thresher cleaner facilities were carefully studied to suit the peanut sheller. The size of the fan, the airflow rate, the angle of inclination of the shaker was redesigned to efficiently separate the pods from the kernels and other impurities.

4. The Prime Mover

The farmer has the option to select the prime mover to be used in operating the machine, whichever is available in the market. The power required to operate the machine was computed. For gasoline engine, the power required to operate is 3 to 5 Hp and for electric motor is 2 Hp.

5. The Feeding Hopper

The feeding hopper was designed to hold the peanuts before shelling, and to facilitate uniform feeding of pods inside the shelling drum. Over feeding causes clogging and delays operations.

The new prototype of peanut sheller machine is shown in Figure 2.

Principles of Operations

Using electric motor as the prime mover to operate the machine, shelling of peanuts was satisfactorily done. Shelling was caused by the impact as the pods come in contact with the sheller blades and shelling drum. Empty pods and kernels were dispensed to the shaker through the drum grills. As the pods falls the blower throw it out of the machine while the nuts were collected through the discharge hoppers built-in the shaker.

Performance Evaluation

The following were the major design considerations used in the evaluation of machine performance:

- Machine Capacity – is the volume/weight of peanuts shelled per unit of time.
- Machine Shelling Efficiency – the shelled nuts received at all outlets with respect to total shelled expressed as percentage by weight. [(weight of shelled nuts/ weight of shelled + weight of unshelled) x 100%]
- Shelling Recovery – is the percentage of shelled nuts during shelling operations regardless whether it is broken, split or whole. [(Shelled nut/Input) x 100%]
- Head Nuts Recovery – is the percentage of whole shelled nuts during shelling operations [(whole nuts/Output (shelled nuts) x 100%]
- Cost and return of Investment – is the analysis of the profit per peso invested

Machine Capacity

The machine capacity of the sheller of 65 kilograms per hour was eight times higher than that of manual shelling and even higher than the first prototypes developed. The degree of dryness of peanuts affects machine capacity. Peanuts to be shelled must be dried for two days or re-dried before shelling. Dried pods are brittle and will easily crack. The machine capacity of the sheller is higher than the targeted maximum capacity. Continuous testing showed that the unit has the capacity significant enough for longer operations.

Table 1. Machine Capacity (kg.)

SAMPLE	TRIAL			TOTAL	MEAN
	1	2	3		
1	72.00	59.02	64.29	195.31	65.10
2	66.06	67.92	60.00	193.98	64.60
3	65.45	75.79	56.25	197.49	65.83
Total				586.78	65.20

Machine Shelling Efficiency

The machine was very efficient in shelling peanuts, almost one hundred percent (99.58%). The reduction of the ply of the rubber blades and the adjustments of clearance between the sheller and the drum casing contributed in the efficiency of the sheller.

Shelling Recovery

The expected shelling recovery was 55% to 70%; the minimum shelling recovery computed base on the actual test was 69.48% with a maximum shelling recovery of 72.97%. The shelling recovery is greatly affected by the dryness of the pods being shelled. This was proven when a test was conducted using three samples of peanuts dried at different duration of sun drying (Table 2). Sample 1, one-day sun dried peanuts; Sample 2, one and a half day sun dried peanuts; and Sample 3, two days sun dried peanuts.

Table 2. Shelling Recovery (%)

SAMPLES	TRIALS			TOTAL	MEAN
	I	II	III		
1	67.35	69.50	66.95	203.80	67.93[a]
2	65.65	68.65	68.30	202.60	67.53[a]
3	74.00	74.20	70.70	218.90	72.97[b]
Grand Total				625.30	
Grand Mean					69.48

Head Nuts Recovery

Shelled nuts were sorted as to whole kernels, broken (large to small), and split kernels. The computed head nut recovery was 99.21% this result is higher than the targeted figure. The quality and purity of nuts is higher than that of the HQ rice. The machine produce export quality nuts.

Cost and return Analysis

The peanut sheller investment cost was P18, 092.00 without prime mover, the expected service life is five years. The expected annual gross income for a four-hour operation per day for 1`20 days with a capacity of 65 kg/hr is P109, 200.00. The computed net income was P44, 679.09 per year with a total expense of P64, 520.00. There was a return on investment of sixty-nine and 25/200 centavos (P0.6925) for every peso invested. The amount invested for the project can be generated for a period of one hundred seventy one days).

Table 2. Cost and Return Analysis

Particulars	Values
A. Fixed Cost	
1. Depreciation	P1, 106.31/year
2. Machine Cost	P 10,092.00
3. Interest on Capital	P 2,523.00
4. Taxes and Insurance	P 504.60
B. Variable Cost	
1. Labor	P 48,000.00/year
2. Power Cost	P1, 709.90/year
3. Repair and Maintenance	P504.60
Total Cost	P 64,440.41
Average Capacity of the sheller per hour of operation	65 kgs per hour
Expected Annual Gross Income	P 109,200.00 per year
Net Income	P 44,759.59

CONCLUSION

Performance of the machine was done and results showed higher performance for shelling peanuts, as to its capacity, efficiency, shelling recovery and head nuts recovery it reduced labor time spent for shelling, it is economical and can generate additional income for the farmers by customs hiring.

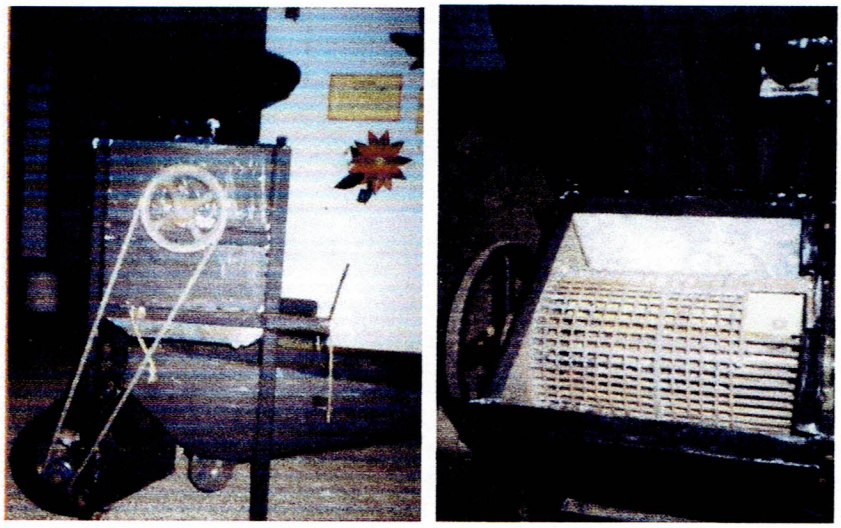

Figure 1. Prototype I of the peanut sheller machine.

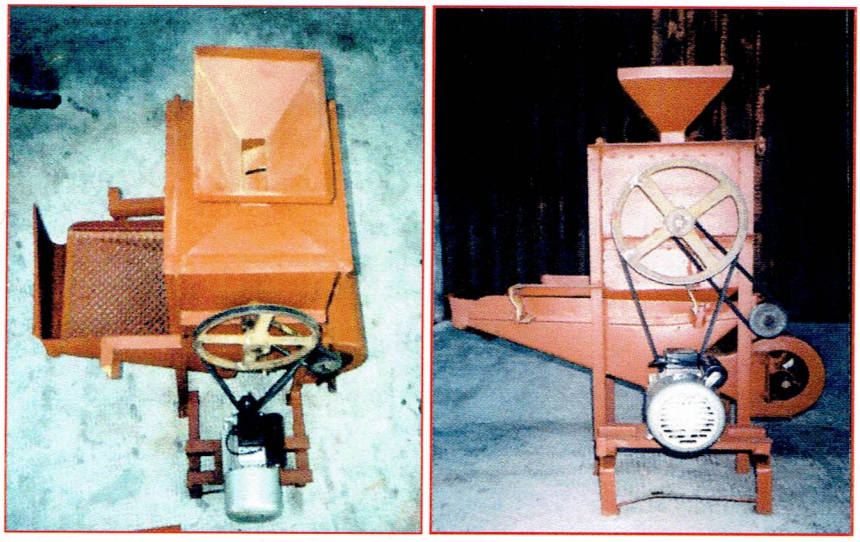

Figure 2. Prototype II, the mechanized peanut sheller machine