

Development and performance evaluation of pedal operated groundnut pod stripping machine

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■ **ABSTRACT** : The stripping of pod by hand is very time expensive and also by another mechanism is very expensive, time consuming and efficiency is very low. Keeping this point in view the pedal operated pod stripping machine is developed and built by using locally available materials that will be operated continuously for comparatively long time with high stripping rate without causing damage to pods. The circular drum unit is provided for stripping of pods and operated with chain and sprocket of bicycle and gear box is used. The trial was conducted in farm. The operators were given the information and practice of the machine for 10 min and machine was operated for 15 min to stripping pod. The five trial of the machine were taken on the groundnut pod. The weight of detached pods collected in the tray and from the collection unit, undetached pods, damaged pods, completely stripped pods were taken after each trial. The result showed that the machine was safe and easy to operate with an average stripping rate with 3 persons was 25 kg per hour and stripping efficiency was 98%. The average stripping rate per person of groundnut pod stripping machine was 5.84% which was higher than when operated with 3 operators and 2.48 times more than traditional hand stripping. This may be due to the reason that the free space available while working with 3 operators was comparatively less to give full output by the operators.

■ **KEY WORDS** : Stripping rate, Stripping efficiency

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Groundnut is the major oilseed crop in India accounting for 45% of oilseed area and 55% of oilseed production in the country. Groundnut (*Arachis hypogaea* L.) is believed to be the native of Brazil to Peru, Argentina and Ghana, from where it was introduced into Jamaica, Cuba and other West Indies islands. It was introduced into India during the first half of the sixteenth century from one of the Pacific islands of China, where it was introduced earlier from either Central America or South America. Now India along with china accounts for half of the world's groundnut production. Stripping is necessary process subsequent harvesting because of pods are attached to most of low acreage groundnut growers encountered several difficulties in stripping as it required relatively high expenditure of human energy. Stripping has previously been accomplished either by hammering the pods on the ground to separate the soil from pods. These methods results in serious bruising of human fingers coupled with low stripping rate. The most common practice for stripping in irrigated area is to strip within 1 or 2 days after harvesting.

Stripping is done by picking pod by pod with an average capacity of 25 kg of pod per man-day. Physical appearance of groundnut from this area is generally good *i.e.* less pods with vine attached and less impurities. For rain fed area, most of groundnut plants are dried in the fields for 4 to 5 days before stripping by pulling a handful of pods from plants. This method of stripping results in a relatively high capacity (62 kg of pod/man-day), but groundnut quality in term of physical appearance is poor. Both of the stripping methods are used in area using residual soil moisture. Most of groundnut in rain fed area is stripped by hired labour, while a significant amount of hired labour is used in irrigated area and area using residual soil moisture. This information suggest that an introduction of a paddle stripper/ winnower would help reduce turnaround time to plant subsequent crops in irrigated area, and help improve physical appearance of groundnut in area using residual soil moisture. Whereas an introduction of a modified thresher for groundnut stripping would significantly reduce turnaround time to plant subsequent crops in rain fed area.

Now a day's few motorized machines have come to market but prices of these machines are not affordable to peasant farmers. Also design of hand operated pod stripper has been constructed, but it has some limitation to use its continuously for longer time. Therefore, it is the aim of this investigation to develop and build groundnut pod stripper using locally available material that will be operated continuously for comparatively long time with high rate of stripping without causing the damage to pods.

METHODOLOGY

The details of material used for the different parts of pedal operated groundnut pod stripping machine, their dimensions, evaluation methods and experimental procedure for determination of various performance parameters selected for evaluation are explained under different sections in this paper.

Different parts of machine:

The pedal operated groundnut stripping machine consisted of frame, power transmission unit, sitting arrangement for operator, stripping unit, cover, cleaning unit, shafts and bearing etc.

Frame:

The main frame was made in square shaped MS pipes and C channel. The vertical structure was made in 40mm × 35mm size of square pipes whereas horizontal base structure was made in 680mm long square pipe (Fig. A).

The structure was made heavy to have better balance and stability during the peddling.



Fig. A : Frame

Power transmission unit:

The simple chain drive was used for transmission of power. The chain and sprockets of ordinary bicycle was

utilized for the purpose. The bigger sprocket connected with two pedals acts as driver and drives one smaller sprocket (driven) via chain.

The peddling can be easily done by operator by sitting on the seat and power gets transmitted to stripping units. The diameter and number of teeth on driver and driven sprockets were 177.8mm and 44 and 76.2mm and 18 (Fig. A).

Stripping unit:

This is the unit which actually strips out the pods from the groundnut when rotated by pedal. The wire netting sheet

Table A : Specifications of groundnut pod stripping machine

Sr. No.	Particulars	Dimensions
1	Overall Dimension (l X w X h),(mm)	1120 x 770 x 1065
2.	No. of person required	2 or 3
Stripping unit		
1.	Perimeter,(mm)	910
2.	Length,(mm)	450
3.	width of stripping unit,(mm)	35
1.	Diameter of supporting shaft,(mm)	20
7.	Distance between stripping unit and cleaning unit (mm)	540
8.	Height of stripping unit from the ground, (mm)	
	1) operator side	690
	2) opposite to operator side	740
Cleaning unit		
1.	Length,(mm)	430
2.	Width,(mm)	330
3.	Slope of cleaning unit,(degree)	20
4.	Height of cleaning unit from ground,(mm)	
	1) operator side	440
	2) opposite to operator side	350
Seat		
1.	Pan length,(mm)	300
2.	Width,(mm)	390
3.	Length of back rest,(mm)	300
4.	Width of back rest,(mm)	265
5.	Height of seat from ground,(mm)	790
6.	Height of back rest from seat surface (mm)	390
7.	Diameter of hollow pipe of seat (mm)	55
8.	Diameter of seat welded pipe (mm)	40
9.	Vertically adjusted length of seat from ground (mm)	440,450,460,470
Power transmission unit		
1.	Diameter of driven sprocket (mm)	76.2
2.	Diameter of driver sprocket (mm)	178
3.	No. of teeth on driven sprocket	18
4.	No. of teeth on driver sprocket	44
5.	Velocity ratio	1:2.5

turned into a rectangular drum was used for this purpose. The opening of the wire net was 78mm × 35mm and the diameter of wire used for net was 145 mm (Fig. B).



Fig. B : Stripping unit

Cleaning unit :

It receives the pods removed from the cleaning and reciprocates. A perforated MS foil tray (works as cleaning unit) was fixed 33mm above from ground surface. The sieve was fixed inside the tray of size 1.5×1.5cm. The cleaning unit was fixed to the bottom side of frame. Cleaning unit was given a slight the slope (%) for efficient working (Fig. C).



Fig. C : Cleaning unit

Terms used in the study:

Pod: Unbroken shell with kernel(s) inside is known as Pod.

Kernel: Edible part of groundnut is known as Kernel.

Shell: Outer hall of the pod is known as shell.

Pod stripping: Pod stripping is the process of separating the pods from veins.

Parameters selected for study:

Pod stripping rate:

It was the quantity of the groundnut pods detached from the vein in unit time. It was calculated as :

$$\text{Stripping rate} = \frac{\text{Wt. of pods}}{\text{Time}} \text{ (kg/hr)}$$

Percentage of unstripped pods:

It was the quantity of the groundnut pods not detached from the vein in unit time. It was calculated as

$$\text{Percentage of unstripped pods} = \frac{\text{Wt. of unstripped pods}}{\text{Total wt. of pods}} \times 100$$

Man-hr requirement:

$$\text{Man - hr requirement per 100 g of pods} = \frac{1000}{\text{Stripping rate}}$$

Test procedure:

The information related to construction and working of machine was given to the operators of the machine.

A practice of stripping the groundnut pods was given for 15 minutes before 30 minutes to start of actual experiment to get familiar with the machine and its operation.

A setup of machine and harvested groundnut pods was made to work the operators continuously for at least 15 minutes.

The trial of 15 minutes was started after the setup.

The observation of weight of stripped pods (collected + spread), unstripped pods, broken pods, stripped pods were recorded.

The observation recorded above were analyzed and the pod stripping rate, pod damage percentage, collection efficiency, rate of throughput were calculated and the results were discussed and conclusions were drawn from the results obtained.



Fig. D : Seating arrangement

■ RESULTS AND DISCUSSION

The test was conducted with two and three persons at a time on pedal operated groundnut pod stripping machine. The results of the tests are presented and discussed under different sections as under.

Stripping rate:

The stripping rate of pedal operated groundnut pod stripping machine when operated with 3 operators was found highest followed by when operated with 2 operators and with traditional hand stripping. The average stripping rate of pedal operated groundnut pod stripping machine with 3 operators was 41.68% which was higher than operated with 2 operators and 6 times more than traditional hand stripping. The stripping rate per person was found highest when operated with 2 operators followed by when operated with 3 operators and by traditional hand stripping method. The average stripping rate per person of groundnut pod stripping machine was 5.84% which was higher than when operated with 3 operators and 2.48 times more than traditional hand stripping. This may be due to the reason that the free space available while working with 3 operators was comparatively less to give full output by the operators.

Stripping efficiency:

The stripping efficiency of pedal operated groundnut pod stripping machine was highest when operated with 2 operators followed by when operated with 3 operators. Stripping efficiency of traditional hand stripping was almost 100%. This may be due to reason that the unmetered pods were not completely stripped by pedal operated groundnut pod stripping machine.

Pod damage:

It was recorded by observations and both by hand and pedal operated machine were able to strip the pods without damage.

Conclusion:

The average stripping rate of pedal operated groundnut pod stripping machine with 3 operators was 41.68% which was higher than operated with 2 operators and 6 times more than traditional hand stripping. Whereas, the stripping rate per person was found highest when operated with 2 operators followed by when operated with 3 operators and by traditional hand stripping method. The average stripping rate per person of groundnut pod stripping machine was 5.84% which was higher than when operated with 3 operators and 2.48 times more than traditional hand stripping. This may be due to the reason that the free space available while working with 3 operators was comparatively less to give full output by the operators.

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