Original Research Article

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Development of Pedal Operated Groundnut Decorticator

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ABSTRACT

Groundnut is the sixth major important oilseed crop in the whole world and it is cultivated by farmers in Chhattisgarh. Groundnut decortication is a time-consuming and tedious process. This process gives less output and requires high efforts by the user and eventually higher energy input. Today, many of the commercially available decorticator which are operated by hand, fall in this category. Therefore it was conceived to develop such a machine which will require less effort with less energy consumption. Overall dimension of main frame are 1760 mm x 803 mm x 1100 mm. The performance evaluation of pedal operated groundnut decorticator was evaluated by different treatment combination of clearances and moisture contents. Different clearance between rotating drum and rubbing plate i.e. 8 mm, 10 mm and 12 mm and different moisture contents of ground nut pod i.e. 6.53%, 7.85% and 9.23% dry basis were observed. The Decorticating capacity, output capacity, decorticating efficiency, unshelled pod and kernel broken were 92.41 kg/h, 51.95 kg kernels/h, 86.37 %, 13.62% and 15.65% respectively at the best optimum combination of clearance and moisture content of 10 mm and 6.53 % respectively were found. The total cost charged for the development of per unit pedal operated groundnut decorticator was ₹ 14000 and the operational cost was 90.43₹/h including fixed and variable cost. The cost required to decorticate 1 kg of groundnut pod was found ₹ 0.97. The developed pedal operated groundnut decorticator is reliable and satisfactory for the selected variety of groundnut.

Keywords

Pedal operated
Groundnut,
Decorticator,
Arachis hypogaea

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Introduction

Groundnut (*Arachis hypogaea*), is a leguminous crop which is grown and consumed worldwide. It has an important place in human beings' food due to high oil content (48-50%) and higher protein (26-28%) which is quite higher than many other oilseed crops. Groundnut is not only consumed at large scale in India but it has a good export market also. It is cultivated in all

seasons and covers about 70 lakh hectare area with a production of 80 to 85 lakh metric ton (shell groundnuts). However, about 80% of cultivated area and production comes in kharif season (IOPPC, 2019). Groundnuts cultivated in 0.59 lakh ha area of Chhattisgarh and productivity of groundnut is about 1661 kg/ha yield and the production is about 0.98 lakh tonnes (D.P.D., 2018). Decortication is most important action in groundnut processing as it permits the kernels and shell

to be used with other post harvesting methods that take place after harvest, such as oil extraction or shell briquetting. It is done either by stripping, rubbing and impact action or any combined arrangement of these methods.

Materials and Methods

The fabrication was carried out in Gagendra fabrication work, Tatibandh, Raipur and performance study were carried out at Farm Machinery Workshop of Swami Vivekananda College of Agricultural Engineering and Technology & Research Station, Faculty of Agricultural Engineering, IGKV, Raipur (C.G.) (Fig. 1–6; Table 1 and 2).

Physical properties of groundnut pod

To develop the pedal operated groundnut decorticator, physical properties of 100 random samples of groundnut pod were taken.

Description of machine

The pedal operated groundnut decorticator was developed with an overall dimension of 1760 mm x 803 mm x 1100 mm. For the development of various parts of the machine the preliminary parameters and calculations leading to the machine were done. Developed pedal operated groundnut decorticator was easy to work with minimum effort.

Modelling and Fabrication of following components

The pedal operated groundnut decorticator consisted of the following components:

1.	Operator seat	2.	Cycle frame
3.	Cycle base frame	4.	Rubbing cum outlet plate
5.	Main frame	6.	Hopper
7.	Decorticating cylinder (drum)	8.	Bearing
9.	Shaft	10.	Handle
11.	Handle height adjuster	12.	Large sprocket
13.	Pedal	14.	Flap

Performance evaluation

The performance of the developed pedal operated groundnut decorticator is evaluated at different treatment combination of clearances i.e. 8 mm, 10 mm and 12 mm and different moisture content i.e. 6.53 %, 7.85% and 9.23% dry basis. Different treatment combination is tested i.e. C₁M₁, C₁M₂, C₁M₃, C₂M₁, C₂M₂, C₂M₃, C₃M₁, C₃M₂, and C₃M₃.

Performance parameters of machine

Performance of the machine was done considering the following parameters:

Independent/Operational parameters:

- I. Clearance (mm)
- II. Moisture content (db, %)

Dependent/Response parameters:

- I. Decorticating capacity (kg pods/h)
- II. Output capacity (kg kernels/h)
- III. Decorticating efficiency (%)
- IV. Percentage unshelled pods
- V. Percentage broken kernels

Cost analysis

The cost of operation for developed machine

was determined by calculating fixed and variable cost. The fixed cost includes depreciation, interest, insurance, housing and taxes while variable cost includes repair and maintenance, lubrication and labour charges.

Results and Discussion

Physical properties of groundnut pod

Effect of clearance and moisture content on decortivating capacity

The decortivating capacity of developed decorticator is evaluated at different treatment combinations i.e. C₁M₁, C₁M₂, C₁M₃, C₂M₁, C₂M₂, C₂M₃, C₃M₁, C₃M₂, and C₃M₃ and

found that decortivating capacity ranges between 65.85–112.61 kg/h. The highest decortivating capacity 112.61 kg/h is obtain in treatment combination C₃M₁ shown in fig.7.

Effect of clearance and moisture content on output capacity

The output capacity of developed decorticator is evaluated at different treatment combinations i.e. C₁M₁, C₁M₂, C₁M₃, C₂M₁, C₂M₂, C₂M₃, C₃M₁, C₃M₂, and C₃M₃ and found that output capacity ranges between 39.05–51.95 kg kernels/h. The highest output capacity 51.95 kg kernels/h is obtained in treatment combination C₂M₁ shown in fig.8.

Table.1 Operational parameter configurations treatments and replications details

S. No	Parameters		Details
1	Clearances (C)	3 level	C ₁ = 8 mm
			C ₂ = 10 mm
			C ₃ = 12 mm
2	Moisture content (M)	3 level	M ₁ = 6.53%
			M ₂ = 7.85%
			M ₃ = 9.23%
3	Replications (R)	R ₁ , R ₂ , R ₃ , R ₄	Total = 36

Table.2 Physical properties of groundnut pod

S.No.	Particulars	Mean value
1.	Length of pod (L), mm	19.96
2.	Width of pod (W), mm	12.32
3.	Thickness of pod (T), mm	11.65
4.	Hundred pods weight, g	118.20
5.	Thousand pods weight, g	1296.12
6.	Kernel pod ratio	2.33

Table.3 Evaluated cost of developed decorticator

S.No	Parameters	Values
1.	Total fixed cost of developed decorticator, Rs/h	11.93
2.	Total variable cost of developed decorticator, Rs/h	78.50
3.	Total cost of operation, Rs/h	90.43
4.	Total fabrication cost of developed decorticator, Rs	14000

Fig.1 Physical properties of groundnut pod

L: Length of groundnut pod, W: Width of groundnut pod, T: Thickness of groundnut pod

Fig.2 Sampling of groundnut pod **Fig.3** Determination of size of groundnut pod

Fig.4 Modeling of decorticator machine in solid works software

Fig.5 Fabrication of pedal operated groundnut decorticator machine

Fig.6 Evaluating the performance of decorticator

Fig.7 Effect of clearance and moisture content on decortivating capacity

Fig.8 Effect of clearance and moisture content on output capacity

Fig.9 Effect of clearance and moisture content on decortivating efficiency

Fig.10 Effect of clearance and moisture content on unshelled pods

Fig.11 Effect of clearance and moisture content on percentage broken kernels

Effect of clearance and moisture content on decorticating efficiency

The decorticating efficiency of developed decorticator is evaluated at different treatment combinations i.e. C₁M₁, C₁M₂, C₁M₃, C₂M₁, C₂M₂, C₂M₃, C₃M₁, C₃M₂, and C₃M₃ and found that decorticating efficiency ranges between 58.82–95.12%. The highest decorticating efficiency 95.12% is obtained in treatment combination C₁M₁ shown in fig. 9.

Effect of clearance and moisture content on percentage unshelled pods

The percentage unshelled pods of developed decorticator is evaluated at different treatment combinations i.e. C₁M₁, C₁M₂, C₁M₃, C₂M₁, C₂M₂, C₂M₃, C₃M₁, C₃M₂, and C₃M₃ and found that unshelled pods range between 4.87–41.16%. The highest percentage unshelled pods 41.16% is obtain in treatment combination C₃M₃ shown in fig. 10.

Effect of clearance and moisture content on percentage broken kernels

The percentage broken kernels of developed decorticator is evaluated at different treatment combinations i.e. C₁M₁, C₁M₂, C₁M₃, C₂M₁, C₂M₂, C₂M₃, C₃M₁, C₃M₂, and C₃M₃ and found that percentage broken kernels range between 4.37–34.33%. The highest percentage unshelled pods 34.33% is obtain in treatment combination C₁M₁ shown in fig. 11.

Cost analysis

Fabrication cost of the developed unit was Rs 14000 and operational cost was 90.43 Rs/h (Table 3).

In conclusion the developed pedal operated groundnut decorticator is reliable and satisfactory for the selected variety of groundnut with overall decorticating capacity, output capacity, decorticating efficiency,

unshelled pod and kernel broken were 92.41 kg/h, 51.95 kg kernels/h, 86.37%, 13.62% and 15.65% respectively at the best optimum combination of clearance and moisture content of 10 mm and 6.53 % respectively and average capacity of developed decorticator is 92.95 kg/h with decorticating cost 0.97 ₹ /kg.

References

- Anonymous, 2018. Survey of groundnut crop, Kharif-2018. Directorate of Pulses Development. <http://dpd.gov.in/CG/Kharif/2018>.
- Anonymous, 2019. Survey of groundnut crop, Kharif-2019. Indian Oilseeds and Produce Export Promotion Council.
- Aydin, C. 2007. Some engineering properties of peanut and kernel. *J. Food Engg.*,79(7):810-816.
- CIAE Bhopal, (2007). CIAE Product Catalogue. Manually operated groundnut decorticator, equipment code: SDP-02, SDP-03.
- Fraser, B.M., Verma, S.S. and Muir, W. E. 1978. Some physical Properties of fababeans, *J. Agric. Engg. Research*, 23: 53-57.
- Indian standard: 11473-2003. Test code for groundnut decorticator.
- Khurmi, R.S. and Gupta, J.K. 2005. A textbook of machine design. 14th edition, S Chand and Co. Ltd. New Delhi, p.375-376.
- Mohesenin, N. N. 1978. Physical properties of plant and animal materials. Gordon and breach science publisher, New York.
- Sharma, D. N. and Mukesh, S. 2013. Farm machinery design principles and problems. 3rd Edition, Jain brothers New Delhi- 110005: 56-57.
- Thirupathi, V., Viswanathan, R. and Thangavel. 2004. Intensive evaluation of power operated groundnut decorticator. *Madras Agric. J.* 91 (1-3): 140-141.
- Thorat, D.S., Sahoo, P.K., De, D., and Iquebal, M. A. 2014. Design and Development of Ridge Profile Power Weeder. *Journal of Agricultural Engineering*, 51(4): 7-13.
- Ugwoke, I.C., Okegbile, O.J., and Ikechukwu, I.B. (2014). Design and Fabrication of Groundnut Shelling and Separating Machine. *International Journal of Engineering Science Invention*. Volume 3 Issue 4, Pp. 60-66.

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