International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 08 Issue: 07 | July 2021 www.irjet.net p-ISSN: 2395-0072

Design Optimization of Multi Crop Mini Thresher

Rajesh Rajkolhe[1], Hrushikesh Gangane[2], Gaurav Bhatkar[3], Kishor Dabhade[4]

[1]Professor, Department of Mechanical Engineering, S.S.G.M.C.E. Shegaon, Maharashtra, India
[2-4]B.E. Final Year Student, Department of Mechanical Engineering, S.S.G.M.C.E. Shegaon, Maharashtra, India

---

Abstract – *Current mini threshers lacks in the ability of multi cropping and threshing. Also the major problem with current mini threshers are, its operating cost and portability which is not affordable for the small scale cultivators. In this work the attempt is made to modify existing design and create a new one. The proposed new design is capable of achieving multi crop threshing and will require less operating cost. In this work CIAE data book is referred for part design calculations and CAD software is used for modelling purpose. In this research work complete part modification, part design, part modelling is discussed.*

Key Words: Thresher, multi crop, Threshing Cylinder, Sieves

1. INTRODUCTION

Threshing is an important part of postharvest activities for small grain and seed crops like Pigeon pea, Chickpeas, Soybean, Wheat and Rice. Threshing involves removal of seeds from their chaff and straw. Thresher involves following components – Threshing cylinder, Concave, Aspirator, Sieves, Rocking mechanism and transmission unit for power transmission to threshing cylinder and rocking mechanism. Beater type threshers have threshing cylinder which rotates in enclosed chamber against concave. The seeds are separated from pod due to impact forces. Afterwards chaff and straw are separated by cleaning unit i.e. Aspirator and sieves. The main objective of this study to design a multi crop threshing machine which will have less operating cost. We have modified design of Sieves, Sieve Rack, Shaking mechanism and Concave for better multi crop threshing.

2. Need for modification in design

Mini threshers in use are designed for single crop threshing. This requires special machine for different crops. This increment the overall cost of threshing operation on small scale. Modifications are made in following parts to counter these issues.

2.1 Concave

Cylinder spikes friction with this concave and due to which removal of chaff occurs. It is concave in shape and perforated to allow for the threshed seed and chaff to pass through. It covers the lower portion of the threshing cylinder. Studs are provided in concave so the gap between concave rod and spike tooth can be adjusted for suitable crop. This allows for threshing of more crops with same components with slight adjustments. Wrap Angle of concave is taken 180 degrees.

2.2 Sieves

Single Sieve is inadequate to provide proper cleaning of grains and separation of chaff and straw. There are three sieves introduced in new design. First sieve is a primary which separate large sticks from grains, then second sieve separate medium sized chaff from grains and third is for very fine stones so that we get clean seeds in our seed collector.

2.3 Sieve rack

Sieve rack is added to hold the sieves while rocking. It also makes changing sieves easier for different crops. This is made of 18x18x3 angle iron.

2.4 Rocking Mechanism

Generally mini threshers don't have a rocking mechanism due to size limitation. Rocking mechanism with gears is used in larger variants threshers. This design uses slider crank mechanism and a cam shaft for desired shaking action. It shakes sieve rack which helps separate the grains from chaff.

3. Design Calculations

3.1 Concave Calculations

Table – 1: Dimensions Selected for concave

Parameters	Specification	Selected	Reference
Concave clearance for paddy crop	15-25 mm	15 mm	CIAE Data book
Clearance between concave bars	i	9 mm	CIAE Data book
Cross section of concave bar	6×6 mm2	6×6 mm2	CIAE Data book

Radius of the concave = (Radius of the cylinder + Concave clearance) = (250+15) = 265 mm
Note clearance between threshing cylinder spike tooth's top edge to concave is 2 or 3 times the grain size. But this clearance is adjustable by studs so we can use it for multiple crops.

3.2 Sieves Calculation

1) Sizes of the sieves are 604x434 mm.
2) Centre to centre distance = 4*1.25 of holes.

Where D is hole diameter

3) In total there are three sieves for separation of grains

1st sieve = 2*grain size i.e. 2 times the size of a grain.
2nd sieve = 1:1.1 (greater the size grain)
3rd sieve = 2 to 3 mm maximum its use for separating dust soil, its size may vary according to type of soil.

Table- 2: Dimensions of sieves for different crops

Grain	Sieve1 mm	Distance between centre to centre 1 mm	Sieve 2 mm	Distance between centre to centre 2 mm
Pigeon Pea	10	12.5	5.5	6.9
Chickpeas	13.5	16.9	7.5	9.5
Soybean	16	20	8.8	11

3.3 Sieve rack calculations

Dimensions – 440x660x200 mm
Third sieve is fit at bottom.
Rocking mechanism is connected to sieve rack.

3.4 Rocking mechanism calculations

Type of Mechanism – Slider crank mechanism with Cam Shaft
Components – Holder, Cam Shaft, Connecting rod, Receiver
Dimensions –

1) Holder – height 550mm, width 365mm
2) Cam Shaft – length 75 mm, Base circle radius 30mm
3) Connecting rod – length 90 mm

4. Modeling

Parametric modeling CAD software Solidworks is used for modeling of the parts according to calculated dimensions.

4.1 Concave

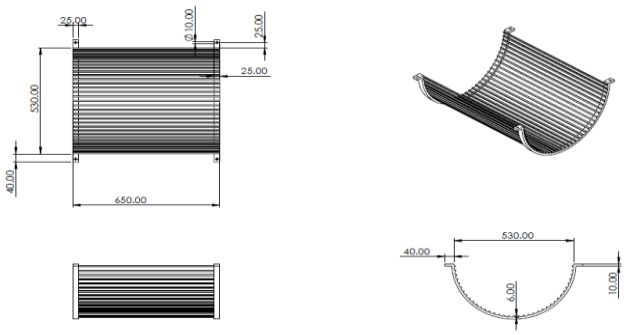

Fig – 1: Concave

Material Selected – Mild Steel

4.2 Sieves

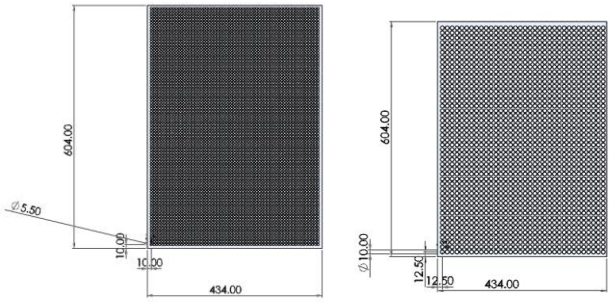

Fig- 2: Sieve 1 and Sieve 2 for pigeon pea

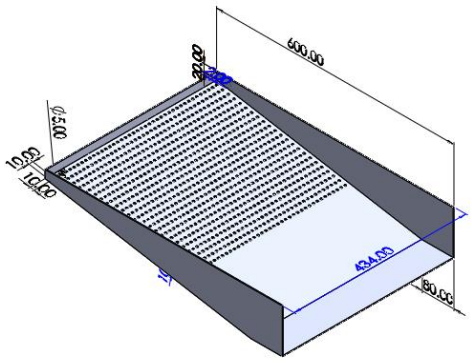

Fig- 3: Sieve 3

Material Selected – Sheet M.S. Sheet 3mm thickness

4.3 Sieve Rack

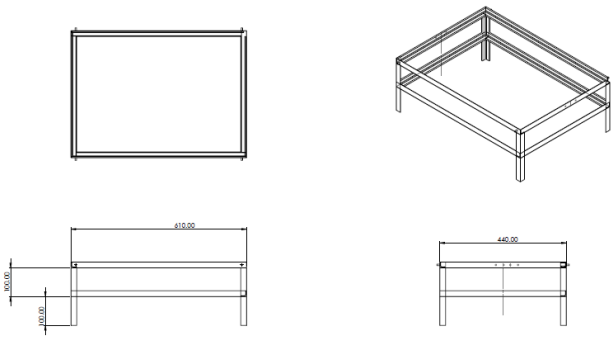

Fig- 4: Sieve Rack

4.4 Rocking Mechanism

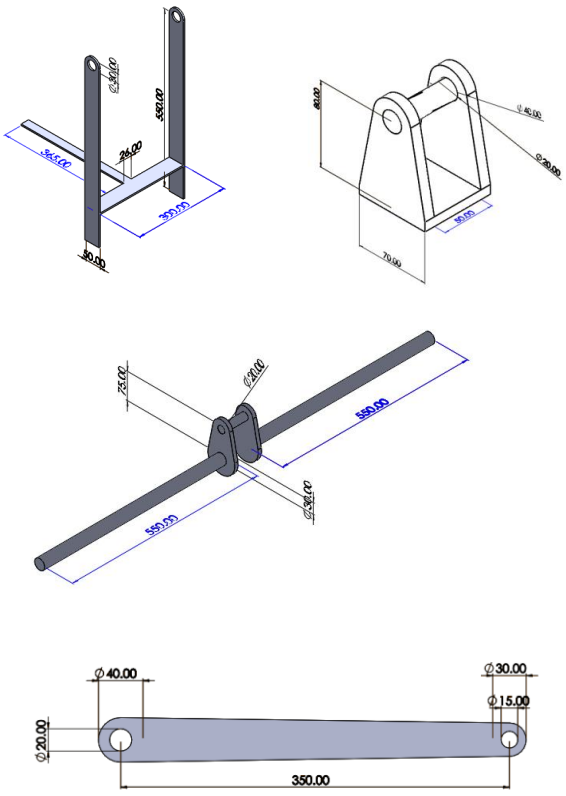

Fig- 4: Components of Rocking Mechanism
Material Selected – Mild Steel

5. Modified Assembly of mini thresher

Following parts are modified – Concave, Sieves, Sieve Rack and Rocking mechanism. Model of modified assembly is given below.

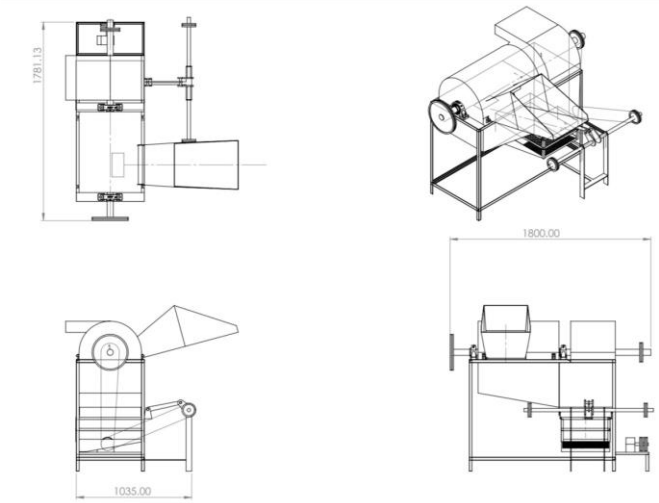

Fig- 5: Assembly of modified mini thresher

6. Comparisons

Comparison of the modified design and existing threshers.

Table-3: Comparison

Parameter	Our Thresher	Nigerian mini thresher	Hidimba Thresher
Power Source	5hp diesel engine	6hp diesel engine	Tractor pto shaft
Operating Cost	*0.87 rs per kg	--	1rs/kg
Cleaning Efficiency	*99.5%(Estimate)	77.8%	95%
Capacity	150-200 kg/hr	90kg/hr	700 to 1500 kg/hr
Crops for which product is adaptable	Pigeon pea, Chickpeas, Soybean, Wheat, Rice	Soybean	Pigeon pea, Chickpeas, Soybean
Sieves number	3	1	2
Fan Type, no	Aspirator, 1	Aspirator, 2	Aspirator, 1
Price	11000	11500	2-3 lakh

7. CONCLUSIONS

Proposed modified thresher is low in cost while possessing multi crop capabilities. It is capable of operating at relatively low operating cost.

ACKNOWLEDGEMENT

We are grateful to our guide Prof. R. V. Rajkolhe to help us and support us. We are also thankful to Dr. S. P. Trikal HOD of Department of Mechanical Engineering, SSGMCE, Shegaon for support in this project.

REFERENCES

[1] Adesoye Adekanye* , Adams Blessing Osakpamwan and Idahosa Endurance Osaivbie "Evaluation of a soybean threshing machine for small scale farmers" Timothy (Department of Agricultural and Biosystems Engineering, Landmark University, P.M.B. 1001, OmuAran, Kwara State, Nigeria)

[2] Nilda Tri Putri et al. "Redesign of Thresher Machine for Farmers Using Rapid Upper Limb Assessment (RULA) Method" 978-1-5090-3665-3/16/IEEE 1304

[3] Amadu Nomau "development and performance evaluation of an improved soybean thresher" M.SC/ENG/49390/2005-2006

[4] CIAE Data book, 2004