

Original Research Article

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## Development of Power Operated Pea Sheller

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### ABSTRACT

Power Operated Pea Sheller machine was developed by us considering the need of rural farmers. There are three types of shelling methods are available such as roller method, tumbler method and shearing method but out of this we selected roller method because it is oldest patented method and the gap between roller can be easily adjusted by screw mechanism. Developed machine is based on the principle of friction generated by the rubbing of pea pods between the two rollers. Machine fabricated by using the low cost material available in market. Test of designed machine carried at initially level and it was observed that at 50 rpm roller speed and clearance between two rollers 2-3 mm with blanched peas at temp of 98°C for time period 1.5 minute was best suited for depoding of peas from pods. The same machine was tested for unbalanced peas and it was observed that 1200 rpm roller speed and gap between two rollers was 3-4 mm best suited having average throughout capacity was 69 kg/h. Performance evaluation of machine will be done to optimize machine parameters such as peripheral speed of rollers, for blanched and unbalanced peas. Shelled bean weight for blanched peas was 72 kg/h (67.8 kg whole bean & 4.002 kg damaged pea beans). There was no any part unshelled for blanched peas and damage of pea beans was found 4.002kg/h. so for blanched peas shelling efficiency near about 95.8%. While for unblanched peas, shelled bean weight 69 kg/h (64.9 kg whole pea beans & 6.64 kg damaged), 3 kg/hr unshelled pea pods were found in power operated pea sheller. So shelling efficiency 90% for unblanched peas.

#### Keywords

Bean, Pea depoder,  
Pea Sheller,  
Blanching, Roller,  
Fabrication,  
Blanched

#### Article Info

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### Introduction

Pea is an important leguminous crop sown in rabbi season in India. The commercially grown varieties of peas are – Arkel, Bonneville, Harbhajan, Fc-1, Jawahar Peas 83, Jp 4, Jm 6, Matar Ageta 6, Mithi Phalli, Pantnagar Matar 2 and Golden. In India peas are mainly grown in Uttar Pradesh, Himachal Pradesh, Jharkhand, Madhya Pradesh, Punjab

and Uttaranchal. Maharashtra stands the fifth in pea production in India and contributes 3.8% of the total production of India peas are consumed after removing green kernels from the pods. Depoding of pea grain is based on the principle of friction generated by rubbing action of blades with the pea pods on sieves which helps in opening the pods of peas and cutting action of conveying blades Kamboj *et al.*, (2012). Manual removal of pea kernels

from pods is a laborious and time consuming job with one person depods about 3 to 3.5 kg of pea kernels from pods in one hour. It was observed that 60 rpm of blade shaft was best suited for depodding of pea from pods. By using power operated peas sheller, average throughput capacity of the machine was 30 kg/h. Chris Allen *et al.*, (2012). Today there is large size industrial use machine available but in view of low cost small size efficient domestic machines are currently necessary for small farmers. So we developed Power Operated Pea Sheller machine in Shriram College of Agril. Engg. Paniv, Tal-Malshiras, Dist: Solapur.

## Materials and Methods

### Size of pea grains

Green peas (*Pisum sativum*) Pea grain size is the geometric mean of the three dimensions i.e. length, breadth, and thickness. The dimensions of peas were measured by using Vernier caliper. Overall size of pea grain was near about 10 mm. The size was calculated using following equation. It is useful for deciding of gap between two rollers which is equals to the size of pea grain.

$$\text{Size} = (L \times B \times T)^{1/3}$$

Where,

L = length (mm)

B = breadth (mm),

T = thickness (mm)

### Size of rollers

There are various types of rollers available viz. rubber roller, tin sheet, wooden etc. but we were select hollow metal roller due to its light weight. The diameter of roller is 32 mm and length of roller is 450 mm. The gap between two rollers can be easily adjusted by simple screw mechanism. The gap between these rollers equal to thickness of the pea

shell so rollers can be easily pull the pea pods

### Size of shaft

The shaft is made up of M.S bar. in our project we required a two shaft having diameter 10 mm and length of 600 mm. Shaft used to fitting of roller in bushing & bearing.

### Bearing

The bearing used to drive the shaft along with roller. The bearing helps to guide the shaft inside it with minimum friction. The bearing size is 12 mm used in developed pea sheller.

### Sprocket



Two sprocket one is driver having size 30 mm (Dia.) and 12 teeth which is mounted on shaft of motor while another one is driven sprocket having size 60 mm (Dia.) and no. of teeth 18 mounted on the shaft of roller. These two sprockets driven by chain

### Chain

The chain of length 700 mm having center distance 180 mm is used to transmit the power from motor to the roller. The chain having minimum slippage so chain is used in the developed pea shelling machine having chain pitch was 10 mm

### Specification of chain drive

- 1) Type - Roller chain
- 2) Length – 700 mm
- 3) Chain pitch – 10 mm

### Gears

The two gears having material cast iron fitted on the shaft of two rollers which gives rotation to both rollers in anticlockwise direction.

The size of gear used is 45mm & no of tooth on each gear are 16.

### Specification of gear drive

- 1) Gear Type - Worm gear
- 2) Gear Size - 45mm
- 3) Gear Teeth – 16
- 4) Gear Tooth Thickness - 2 mm
- 5) Material – Cast Iron



### Motor

Power transmitted to the developed pea sheller by the rollers driven by the 1/12HP universal motor which fitted at bottom of frame with the help the of nut & bolt. The speed of motor 1500 rpm it can be varying by using dimmer.

### Specification of motor



### Plate No. 3 single phase A.C electric motor

Type- single phase A.C electric motor  
Speed - 1500rpm  
Power generation - 1/12 hp

### Feeding trough

A Trough which is provided inclination so which pea pods are passed towards the roller and angle of inclination  $53^{\circ}$  and capacity of trough (340× 230 ×50)mm .Feeding of pea pods in developed done by manually.

### Specification of feed trough

- 1) Length = 340 mm
- 2) Width = 230 mm
- 3) Thickness = 50 mm
- 4) Angle of Inclination =  $\tan \theta = \frac{\text{Straight side}}{\text{Adjacent side}}$



### Plate No.4 Feeding Trough

## Angle frame

The frame made up of M.S. angle. Overall size of machine frame is (450 × 300 × 300) mm. This angle joined by weld. The angle iron frame model for these purpose we cut the M.S angle in required dimension of size (450× 300 ×300) mm. This angle cut in required dimension by using cutter then this angle joined together with welding.

Length = 450mm

Width = 300mm

Thickness = 300mm

## Methods

### Development of power operated pea sheller

We fabricate the overall project in collage workshop of Shriram College of Agril. Engg. Paniv.

### General specification of machine

MAKE: Shriram College of Agricultural Engineering, Paniv

MODEL NAME: Power Operated Pea Sheller Machine.

YEAR: 2017-18

### Purchased raw material

- 1) Angle Frame
- 2) Roller
- 3) Feed Trough
- 4) Sprocket & Chain
- 5) Gears
- 6) Shaft
- 7) Bearing
- 8) Motor



## Results and Discussion

It was observed that 1500 rpm motor speed was best suited for shelling of pea from pods. The capacity of machine was approximate 69 kg/hr. The shelling efficiency of machine for blanched peas 95.8% and for unblanched peas 90% at the motor speed of 1500 rpm and M.C. of 66.6%. So we observed that m.c.& motor speed both are greatly affects on shelling efficiency of blanched and unblanched peas.

Graph 1 shows that the shelling efficiency of blanched peas at 1200 rpm is more than unblanched peas and its maximum value at m.c 66.6%. Hence we can conclude that shelling efficiency of both blanched and unblanched peas decreases with decreasing of m.c.

Graph 2 shows that the shelling efficiency of blanched peas at 1500 rpm is more than unblanched peas and its maximum value at m.c. 66.6%. Hence we can conclude that shelling efficiency of both blanched and unblanched peas decreases with decreasing of m.c.

**Table.1** Observed efficiency of pea sheller for blanched peas

M.C. (% D.B.)	Motor Speed (RPM)	Shelling eff. For blanched peas (%)	Damage For Blanched Peas (%)
<b>66.6 (Fresh)</b>	1200	92.37	7.5
	1500	95.8	5.8
<b>60 (After1 day)</b>	1200	90.98	9.02
	1500	93.75	8.8
<b>52 (After 2 days)</b>	1200	89.73	10.8
	1500	91.95	9.6

**Table.2** Observed efficiency of pea sheller for unbalanced peas

M.C. (% D.B.)	Motor Speed (RPM)	Shelling Eff. for unblanched peas (%)	Damage For Unblanched Peas (%)
<b>66.6 (Fresh)</b>	1500	90	12
	1200	88.89	14
<b>60 (After1 day)</b>	1500	89	13.8
	1200	86.81	17.6
<b>52 (After 2 days)</b>	1500	88.34	15
	1200	85.84	21.03

**Table.3** Anova table for blanched peas

Summary	Count	Sum	Average	Variance
66.6	2	188.17	94.085	5.88245
60	2	184.73	92.365	3.83645
52	2	181.68	90.84	2.4642
Lseb	3	273.08	91.02667	1.744033
Useb	3	281.5	93.83333	3.710833

**Anova Table**

Source of Variation	SS	df	MS	F	P-value	F crit
Rows	10.5427	2	5.27135	28.72409	0.033643	19
Columns	11.81606667	1	11.81607	64.38689	0.015178	18.51282
Error	0.367033333	2	0.183517			
Total	22.7258	5				

**Table.4** Anova table for unblanched peas

Summary	Count	Sum	Average	Variance
66.6	2	178.89	89.445	0.61605
60	2	175.81	87.905	2.39805
52	2	174.18	87.09	3.125
Lseb	3	261.54	87.18	2.4283
Useb	3	267.34	89.11333333	0.698533

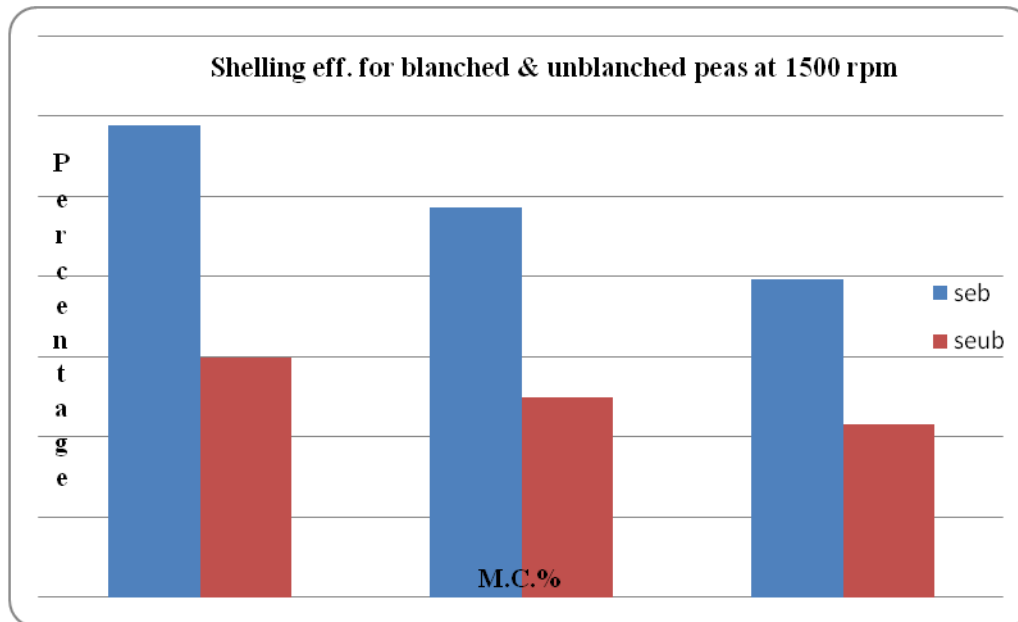
Anova Table

Source of Variation	SS	Df	MS	F	P-value	F crit
Rows	5.721233333	2	2.860616667	10.74545	0.085139	19
Columns	5.606666667	1	5.606666667	21.06054	0.044347	18.51282
Error	0.532433333	2	0.266216667			
Total	11.86033333	5				

**Graph.1** Shelling efficiency graph for blanched &Unblanched peas at 1200 rpm



**Graph.2** Shelling efficiency graph for blanched & Unblanched peas at 1500 rpm



1) From anova table the value of P varies for column as well as row means the value of P varies for m.c and motor speed. but above analysis we observed the value of P for motor speed is less than the m.c.so motor speed greatly affect the shelling efficiency than m.c. finally we conclude that the value of  $P < 0.05$  for coloumn as well as row therefore there is significant difference between m.c and motor speed on shelling efficiency of Unblanched peas.

2) From above anova we seen that variation found for m.c 66.6% is less than m.c 52%

So shelling efficiency at m.c 66.6% is more

Hence, concluded in these days, technology has converted hours of work into seconds work. Peas are very popular among people due to its nutritional value. In India and many other countries peas are widely used in dishes during some important occasions such as marriages, functions and parties etc. Manual depodding of peas is a very time consuming task. In view of the non-availability in design and development of a successful pea

depodding machine, a power operated pea sheller was undertaken by Shriram College of Agril. Engg. Paniv. Final year students during the period of 2017- 18.The machine is quite simple and is capable to extracting large amount of peas in small time. From analysis, it was observed that capacity of machine was approximate 69 kg/hr. The shelling Efficiency of machine for blanched peas 95.8% and for unblanched peas 90% at the motor speed of 1500 rpm and M.C. of 66.6%. The machine was fabricated by using the low cost material available in local market. This machine will surely help of farmers by adding the value to agricultural products.

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