



WET POD GROUNDNUT THRESHER

A SUCCESS STORY



ALL INDIA COORDINATED RESEARCH PROJECT ON
FARM IMPLEMENTS AND MACHINERY
CENTRAL INSTITUTE OF AGRICULTURAL ENGINEERING
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Introduction

Groundnut is cultivated as a major oilseed crop in Tamil Nadu. The area under groundnut is around 15 lakh hectares and the annual production is 14 lakh tonnes. Manual method of stripping groundnut pods, takes 175 to 200 woman hours per hectare. Since it is a labour intensive operation, scarcity of labour is experienced during the peak harvesting season due to diversion of labour to other agricultural and industrial activities. Therefore the power operated throw-in type groundnut thresher for freshly harvested groundnut crop was considered to be of immense use to groundnut growers in our country. The available threshers suitable for dry groundnut plants, did not become popular among farmers, as the farmers want to strip the pods immediately after harvest to avoid field losses/theft. The throw-in-type groundnut thresher suitable for high moisture (green) groundnut crop, having more output and necessary safety features is a felt need.

Traditional Practices for Threshing

Mostly farm women strip the wet pods manually by holding the plants or using threshing bench but the output is very low.

Salient Features of the Machine

It is suitable for freshly harvested groundnut crop. The thresher is of axial flow type and consists of feed hopper, spike-tooth cylinder, concave, oscillating sieves and a

blower. The pegs are arranged in 10 rows on the cylinder. The cylinder is enclosed within the concave made of wire mesh with sieve opening of 80 x 25 mm. Below this cylinder and concave assembly, two oscillating sieves are fitted to separate the pods from leaves, soil and other dust materials. The blower fitted between the two sieves helps to blow out leaves. It is operated by a 3.75 kW electric motor or by the PTO of tractor.

The overall dimensions of the machine is 1850 x 1600 x 1725 mm and it weighs 350 kg. The thresher costs Rs.30,000 /- and its cost of operation is Rs.32 per quintal of pods as against Rs. 80 per quintal of pods by conventional method of manual stripping. The specifications of the groundnut thresher are given in Appendix-I.

Evolution / Design Process

During 1987 a peg tooth type radial flow groundnut thresher was developed. It consisted of feed hopper, threshing cylinder, concave, stationary fingers, oscillating sieve, blower and power transmission systems. The unit could be operated either by tractor PTO or 3.75 kW diesel engine / electric motor. The concave clearance could be adjusted according to the variety, length of crop vines, pod size and moisture content of the crop. It could thresh 100 kg of pods per hour. The threshing efficiency and cleaning efficiency were in the range of 94-99 and 84-87 per cent respectively. But consistent results could not be obtained with different varieties of groundnut.

Subsequently an axial flow type groundnut thresher with peg tooth cylinder was developed and evaluated. During trials, the crop fed into the cylinder could not be conveyed easily, causing clogging. Hence three types of cylinders were made and evaluated under laboratory and field conditions. The cylinder with curved edge pegs arranged at an angle of 15° with the cylinder axis enabled higher feed rate of 500 kg of whole crop per hour.

Subsequently, modifications were incorporated in the cylinder pegs and blower air outlet. It was found that the power available from 4 kW diesel engine was insufficient to run the cylinder at a uniform speed irrespective of load coming to the cylinder, the prime mover was replaced with a commercially available 7.5 kW Mitsubishi engine. Due to above modifications the output increased to 190 kg/h from 140 kg/h in the earlier design. Also the cleaning efficiency was improved to 94 per cent from 87 per cent.

Evaluation trials were conducted with the groundnut thresher at farmers' fields. The crop fed into the threshing cylinder moved fast to the other end due to the helical arrangement of pegs. When the vine length was shorter than 30 cm, some portion of crop was collected unthreshed. Hence a 12 mm dia rod was fixed on the concave at the outlet side. The vine thrown out from the cylinder was slightly obstructed at the angle section supporting the concave and hence the side frame was removed to ensure free movement. During operation more vibration was observed due to the 7.5 kW diesel engine. Hence the 7.5 kW Mitsubishi engine was replaced by a

3.75 kW electric motor and trials were conducted. Threshing efficiency was 98 per cent, pod breakage was 2.6 per cent and cleaning efficiency varied from 94 to 96 per cent.

A prototype groundnut thresher for threshing high moisture groundnut crop was fabricated using the optimised parameters from the experiments conducted earlier viz., cylinder peripheral speed, concave clearance, sieve slope, sieve hole size and blower air velocity. The unit consists of major components like main frame, feed hopper, threshing cylinder, concave assembly, cleaning sieves, blower and transport wheels.

a) Frame

A frame was fabricated to accommodate the cylinder concave assembly, cleaning sieves, blower and power transmission system. The frame was made of 60x60x6 mm mild steel angle sections. The overall size of the frame was 2050 mm x 1650 mm x 1570 mm.

b) Feed hopper

A feed hopper of 250 mm x 200 mm made of 1.5 mm mild steel sheet was fitted at one end of the concave with a slope of 40° to the horizontal.

c) Threshing cylinder

The drum type threshing cylinder of 400 mm diameter and 1000 mm length was made of 3 mm mild steel sheet. Based on the results of the experiments

conducted, the cylinder surface was provided with flat pegs with curved edge to eliminate clogging of feed material at high moisture content. The length of the peg was 70 mm and arranged in ten rows such that each row had 7 to 8 pegs. As the pegs had been fixed in a row on a separate flat, the pegs in a row could be raised or lowered to adjust the concave clearance.

d) Concave

A concave made of 6 mm mild steel rod with a diameter of 610 mm and sieve hole size of 80 mm x 30 mm has been provided covering the curved area of cylinder. It has an inlet opening of 230 mm x 140 mm and an outlet opening of 270 mm x 210 mm at the two ends of the concave. On inside top surface of the concave, three helical louvers were provided at a spacing of 250 mm to convey the crop material axially.

e) Cleaning sieves

In the axial-flow thresher, the entire plant is subjected to threshing action between the cylinder and concave. In the process of stripping of pod from plant, the leaves, stems and soil sticking to the root also get separated and pass through the concave to the cleaning sieves. To separate all these unwanted material from the pod, two sieves have been provided below the concave. The top sieve has holes of 50 x 17 mm size and driven by an eccentric drive of 20 mm radius. Due to the rotation of eccentric shaft, the sieve get reciprocation as well as up and down motion for

easy lifting and moving the materials on it. Similarly the bottom sieve has holes of 25x9 mm size and is driven by an eccentric shaft with 12 mm radius.

f) Blower

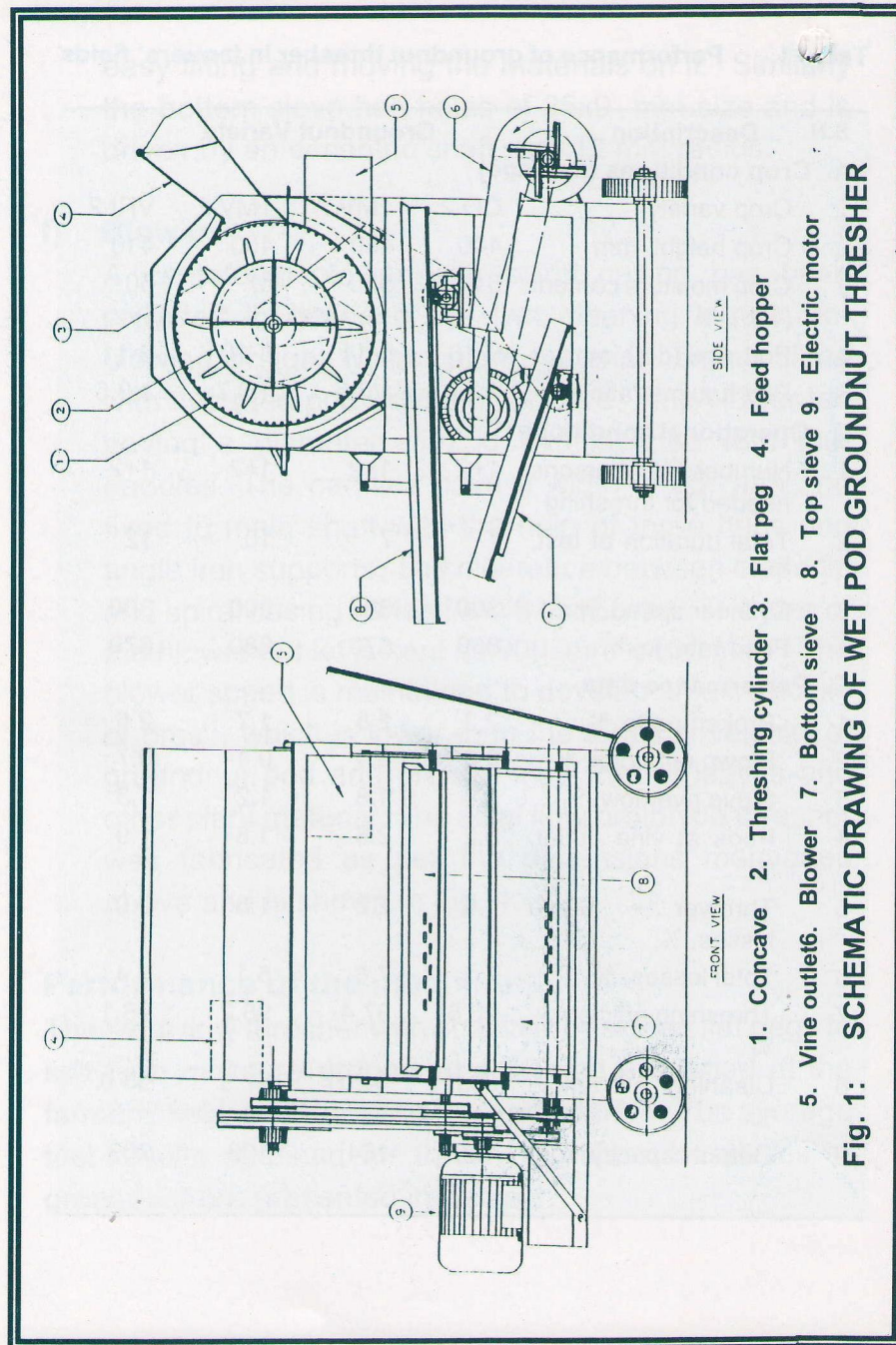
A centrifugal blower with spiral casing has been provided in between the two cleaning sieves, for blowing of light weight plant material coming along with threshed pod from the concave. The blower fan having a diameter of 250 mm is fitted with four paddles. The paddles have a width of 85 mm and fixed to main shaft with the help of three hubs and angle iron supports. The clearance between blade tip and spiral casing varies from 6 to 15 mm. The size of the blower out let is kept as 900 mm x 100 mm. The blower speed is maintained to develop an air velocity of 6ms^{-1} , which is lower than the terminal velocity of groundnut pod and greater than that of leaves and other plant material. The axial flow prototype thresher was fabricated as per the dimensions mentioned above and is shown in Fig. 1.

Performance of the machine

The axial flow thresher with specially designed flat pegs to suit high moisture groundnut crop was evaluated at the farmers' field and University research farms. The average test results obtained for threshing different varieties of groundnut are presented in Table 1.

Table 1. Performance of groundnut thresher in farmers' fields

S.N	Description	Groundnut Variety			
A. Crop conditions (average)					
1	Crop variety	CO 2	TMV 7	TMV 2	VRI 2
2	Crop height, mm	440	480	450	410
3	Crop moisture content (w.b), %	61	58	57	60
4	Pod size (dia), mm	9-10	9-11	8-10	9-11
5	Pod haulms ratio	1:3.4	1:3.5	1:3.7	1:3.5
B. Operational conditions					
1	Number of persons needed for threshing	1+2	1+2	1+2	1+2
2	Total duration of test, h	7	7	10	12
3	Cylinder speed, rpm	300	300	300	300
4	Feed rate, kg/h	660	670	680	670
C. Performance data					
1	Broken pods, %	2.3	2.8	1.7	2.5
2	Blown out pods, %	0.6	0.4	0.4	0.7
3	Sieve overflow, %	1.0	1.8	1.2	1.3
4	Pods at vine outlet, %	3.2	2.6	1.8	1.9
5	Thrower + Sieve losses, %	1.6	2.2	1.6	2.0
6	Total losses, %	7.1	7.6	5.1	6.4
7	Threshing efficiency, %	96.8	97.4	98.2	98.1
8	Cleaning efficiency, %	96.6	94.0	97.5	96.9
9	Output capacity, kg/h	192	184	198	203



1. Concave 2. Threshing cylinder 3. Flat peg 4. Feed hopper
 5. Vine outlet 6. Blower 7. Bottom sieve 8. Top sieve 9. Electric motor
Fig. 1: SCHEMATIC DRAWING OF WET POD GROUNDNUT THRESHER

The field performance studies with the developed prototype groundnut thresher was carried out for threshing freshly harvested crop of CO-1, TMV-7, TMV-2 and VRI-2 varieties. The mean values of test results in terms of threshing efficiency, pod damage, sieve and thrower loss, total loss and output are given in Table 2 and Fig. 2.

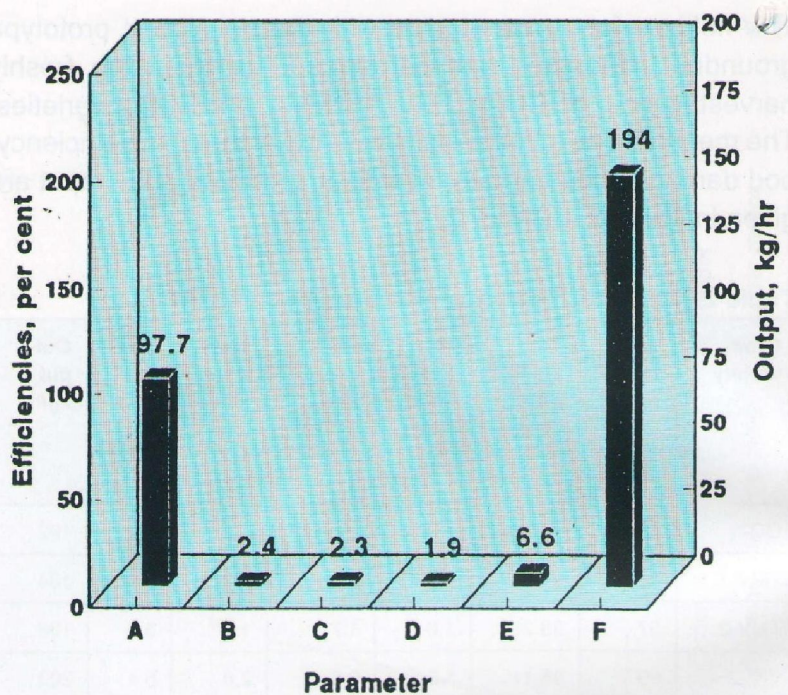
Table 2 Field performance of prototype thresher

Crop variety	Crop moisture	Threshing efficiency	Un-threshed loss	Pod breakage	Thrower+sieve loss	Total loss	Output kg/h
CO-1	61	96.8	3.2	2.3	1.6	7.1	192
TMV-7	58	97.4	2.6	2.8	2.2	7.6	184
TMV-2	57	98.2	1.8	1.7	1.6	5.1	198
VRI-2	60	98.1	1.9	2.5	2.0	6.4	203

The performance index (PI) of the thresher is of the order of 160 and 170 for the varieties tested.

Status of the Technology

The groundnut thresher was extensively tested for its feasibility at university research farms for about 50 hours and farmers fields for more than 120 hours. Also several demonstrations were conducted under Frontline Demonstration (FLD) Projects on Oilseeds and Pulses Programmes. The thresher has been released by the Tamil Nadu Agril. University and more than 45 prototypes have been sold to farmers and different agencies (Appendix-II). Linkages were developed with several manufacturers and at present eight firms have started production of the machine (Appendix. III).



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|--------------------------|--------------------------|
| A - Threshing efficiency | D - Thrower & sieve loss |
| B - Unthreshed loss | E - Total loss |
| C - Pod breakage | F - Output |

Fig. 2: Performance of Wet Pod Groundnut Thresher

Specifications of Wet Pod Groundnut Thresher

- i. Name of the machine : Wet Pod Groundnut Thresher
- ii. Suitability to crops : Fresh groundnut crop immediately after harvest
- iii. Overall dimensions, mm
 - Length : 1850
 - Width : 1600
 - Height : 1725
- iv. Weight, kg : 350
- vii. Power requirement : 5.0 kW Motor or Tractor PTO
- vi. Recommended threshing cylinder speed m/s,(rpm): 7.5 (300)
- vii. Concave clearance, mm : 35
- viii. Blower air velocity, m/s : 6
- ix. Type of threshing : Flat pegs arranged helically to provide axial flow cylinder
- x. Type of concave : 80 x 30 mm opening sieve with 6 mm ms rods to have 610 mm inner dia

- xi. Blower : Centrifugal with 4 paddles
- xii. Feed Hopper : 250 x 200 mm opening
- xiii. Cleaning sieves : Two sieves (top with 50 x 17 mm opening and bottom with 25 x 9 mm opening)
- xiv. Drive mechanism : V-belts and pulleys
- xv. Transport wheels : Circular flat rim mild steel wheels

Appendix - II

Production and Supply of Machines

1. Number of prototypes fabricated and sold by TNAU centre of AICRP on FIM:
 - (i) KVK and other centres : 4
 - (ii) R&D organisations : 5

- 2.. Number of prototypes manufactured and sold by different firms : 45

Appendix - III

LIST OF MANUFACTURERS

- i. M/s TUCAS Limited,
Tudiyalur (P.O), Coimbatore - 641 034
- ii. Universal Agro Industries
SF No. 374/5 Near Bimetal Bearings,
Maruthamalai Road, P.N.Pudur
Coimbatore - 641 041
- iii. M/s Velmurugan Industries,
Vaiyappamalai, Tiruchengodu Taluk,
Salem District, Tamil Nadu.
- iv. M/s Beracha Engineers,
436, Maruthamalai Road, P.N.Pudur (P.O),
Coimbatore - 641 034
- v. M/s Valumpuri Industries,
Maruthamalai Road, P.N.Pudur (P.O),
Coimbatore - 641 034
- vi. M/s Sree Annapoorna Farm Equipments
8-A, Iyer Hospital Road, Trichy Road, Singanallur
Coimbatore - 641 005
- vii. M/s Kovai Engineering Works
88, Iyer Hospital Road, Sowripalayam (P.O)
Coimbatore - 641 028
- viii. M/s.Vigneshawara Textile Engineers,
No.84, Extension Street No.1,
Singanallur, Coimbatore - 641 005