

## Performance evaluation of groundnut thresher for freshly harvested crop

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■ **ABSTRACT** : Groundnut is cultivated as a major oilseed crop in Andhra Pradesh. As the farmers want to strip the pods immediately after harvest mainly to prevent crop damage from unexpected rains and other field losses, a fresh pod thresher for groundnut was tested for its performance in comparison with conventional method of groundnut threshing (stripping of pods by hand) at Agricultural Research Station, Anantapur. Its overall performance was satisfactory and recorded an output of 225 kg/h with threshing and cleaning efficiencies of 96 and 98 per cent, respectively. The use of groundnut thresher can save 75 per cent labour and 40 per cent of cost compared to conventional method of groundnut threshing.

■ **KEY WORDS** : Groundnut, Manual stripping, Machine threshing, Fresh pod thresher

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Groundnut is cultivated as a major oilseed crop in Andhra Pradesh. In India, Andhra Pradesh is the 3<sup>rd</sup> largest growing state with production of 1.6 million tons annually grown in an area of 1.7 million ha. Manual method of stripping of groundnut pods takes 175 to 200 women-h/ha. Since it is a labour intensive operation, scarcity of labour is often experienced during the peak harvesting season due to diversion of labour to non-agricultural and industrial activities. Singh and Verma (1972) developed and evaluated an experimental groundnut thresher and found that pod damage decrease with decrease of moisture content and the optimum cylinder speed was 5.7 m/s. Sharma *et al.* (1983) successfully developed and evaluated a multi crop thresher that can be used for groundnut threshing by simply changing concave and sieves. Its capacity was 65 kg/h with threshing and cleaning efficiencies of 92 and 95 per cent, respectively. Some of the threshers like axial and radial flow threshers developed for oil seeds and pulses were promising in India (Choude Gouda and Ranganath, 1978). These threshers are suitable for dry groundnut plants only. Even though they became popular, as the farmers want to strip the pods immediately after harvest mainly to prevent crop damage from unexpected rains and other field losses, a fresh pod thresher was developed by CIAE, Bhopal during the year 2006. The power operated throw-in type groundnut thresher for freshly harvested groundnut crop was considered to be of immense use to groundnut growers in Andhra Pradesh. Hence, a commercially available

throw-in type groundnut thresher was procured and tested in Agricultural Research Station, Anantapur for its performance in comparison with manual stripping.

### ■ METHODOLOGY

Thresher selected for study consists of frame, feed hopper, drum type threshing cylinder, concave, oscillating sieves and a blower. Total construction sits on the main frame (specifications given in Table A). The threshing cylinder has the diameter and length of 50 cm and 90 cm, respectively. The cylinder surface is provided with flat pegs arranged in 6 rows such that each row has 7 – 8 pegs (length of peg 10 cm). A concave is provided under the threshing cylinder for rough separation of pods and stripped plants. An outlet is provided at the rear portion of cylinder for stripped plants. In order to separate all the unwanted material after threshing from the pods, two sieves have been provided below the concave. The top sieve has holes of 50x17 mm size and the bottom sieve has holes of 25x9 mm size. 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 pods from the concave. Crop flow diagram for threshing freshly harvested groundnut crop is shown in Fig. A.

A popular variety of groundnut K6 freshly harvested crop was used for threshing and pod to haulm ratio was noted.

Moisture contents of both crop and pod were determined using the procedure detailed by Henderson *et al.* (1997). The samples were dried at 130 °C for 18 hours (ASAE, 2003). Weight loss of the samples was recorded and moisture in percentage determined. The blower speed was maintained to develop a velocity slightly less than terminal velocity of groundnut pods for separation of stripped plants, leaves and other foreign material from pods (Padmanathan, 2006). The cylinder and blower speeds were measured by using a digital non contact

type tachometer and the feed rate was measured by using a platform balance. A stop watch was used to note the time of operation. All tests were replicated thrice, keeping the fixed concave clearance of 40 mm (Padmanathan, 2006). Output capacity and man-h/ha for threshing by both machine and manual methods were noted. Cost of operation in terms of Rs./ tone was taken into consideration for comparison between both the methods.

**Parameters measured :**

*Threshing efficiency :*

This was taken as the ratio of weight of pods collected from all outlets per unit time and weight of input pods per unit time.

$$E_t = \frac{W_0}{W_1} \times 100$$

where,

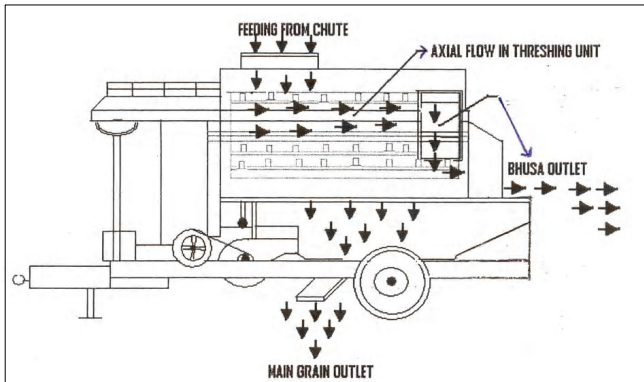
$E_t$  = Threshing efficiency, per cent

$W_0$  = Weight of pods collected from all outlets per unit time, kg

$W_1$  = Weight of input pods per unit time

**Cleaning efficiency :**

This was taken as ratio of difference between weight of



**Fig. A: Flow diagram for thresher for freshly harvested groundnut crop**

| <b>Table A: Specifications of thresher for freshly harvested groundnut crop</b> |   |
|---|---|
| Parameters  | Details                                     |
| Power source  | Tractor PTO shaft of speed 540 RPM          |
| Power transmission  | Through belt and pulley                     |
| Overall dimensions  |   |
| Length  | 3850 mm                                     |
| Width   | 1450 mm                                     |
| Height  | 2680 mm                                     |
| <b>Threshing cylinder</b>   |   |
| Type  | Drum type having pegs on its periphery      |
| Diameter  | 470 mm                                      |
| <b>Length</b>   | 900 mm                                      |
| Concave   |   |
| Inner diameter  | 250 mm                                      |
| Grate opening size  | 80 X 30 mm                                  |
| Clearance   | 40 mm                                       |
| <b>Cleaning sieves</b>  |   |
| No. of sieves   | 2   |
| Sizes of sieves   | Top sieve 50 X 17 mm bottom sieve 25 X 9 mm |
| Blower diameter   | 600 mm                                      |
| No. of paddles in blower  | 4   |
| No. of transport wheels   | 2   |
| Initial cost  | Rs.1,80,000/-                               |

Pods and weight of foreign matter collected from main outlet per unit time and weight of pods collected from main outlet per unit time.

$$E_c = \frac{W_m - W_f}{W_m} \times 100$$

where,

$E_c$  = Cleaning efficiency, per cent

$W_m$  = Weight of pods collected from main outlet per unit time, kg

$W_f$  = Weight of foreign matter collected from main outlet per unit time, kg

**Percentage of broken pods :**

This was taken as the ratio between weight of broken pods collected from main outlet per unit time and weight of input pods per unit time.

$$B_p = \frac{W_b}{W_i}$$

where,

$B_p$  = Percentage of broken pods, per cent

$W_b$  = Weight of broken pods collected from main outlet per unit time, kg

$W_i$  = Weight of input pods per unit time

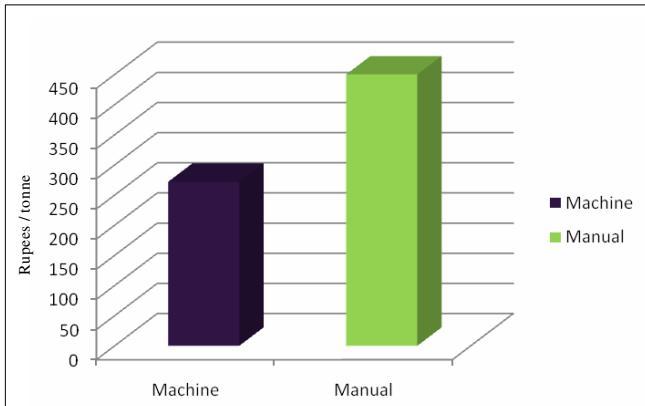
**RESULTS AND DISCUSSION**

Results obtained are shown in Table 1 and 2. It was observed that plant height was 201 mm with the average number of filled pods of 10 per plant. Average moisture contents of crop and pod were 42.4 and 40.3 per cent (wb), respectively. The pod-vine ratio was noted as 1:4.

It was observed that at the feed rate of 870 kg/h, the thresher output was 225 kg/h with the total number of labour of 6. Similarly increase of manual stripping output was only 50 kg/h with the equal number of labour. Therefore, it was found that output capacity of selected thresher was 4 times more than the manual stripping with equal number of labour requirement. The man-h/ha for machine threshing was 48 and for manual threshing was 190. High capacity of thresher permitted less man-h needed for threshing 1 ha area. Therefore it was concluded that the 75 per cent labour can be saved by using the thresher for groundnut threshing compared to manual stripping method. The threshing efficiency of machine was 96 per cent with cleaning efficiency of 98 per cent and 2 per cent of broken pods. The total grain loss of thresher was within the limit of less than 5 per cent (Mehta *et al.*, 2005). It was observed that Rs.178 can be saved for threshing of one tone of groundnut pods by using the machine in comparison to manual stripping (Fig.1).

| Table 1 : Condition of crop at the time of threshing |           |
|--|-----------|
| Parameter  | Details   |
| Name of crop   | Groundnut |
| Crop variety   | K6        |
| Crop height, mm                                      | 201       |
| No. of filled pods per plant                         | 10        |
| Crop moisture content, (wb), %                       | 42.4      |
| Pod moisture content, (wb), %                        | 40.3      |
| Pod-vine ratio                                       | 1:4       |

| Table 2 : Performance of thresher for freshly harvested groundnut crop in comparison to manual stripping |                   |                  |
|--|-------------------|------------------|
| Parameter  | Machine threshing | Manual stripping |
| Feed rate of crop, kg/h  | 870               | -                |
| Cylinder speed, RPM  | 280               | -                |
| Blower shaft speed, RPM  | 760               | -                |
| Velocity of air created by blower, m/s   | 6                 | -                |
| No. of labour required   | 6                 | 6                |
| Man-h required to thresh one ha area of groundnut crop   | 48                | 190              |
| Output capacity, kg/h  | 225               | 50               |
| Threshing efficiency, %  | 96                | 100              |
| Cleaning efficiency, %   | 98                | 100              |
| Percentage of broken pods  | 2                 | 0                |



**Fig. 1: Cost operation between machine and manual threshing**

**Conclusion :**

The throw in type groundnut thresher is suitable for freshly harvested groundnut crop. The thresher has an output of 135 kg/h with threshing efficiency of 96 per cent and cleaning efficiency of 98 per cent. The use of groundnut thresher can save 75 per cent labour and 40 per cent of cost compared to conventional method of groundnut threshing (stripping of pods by hand). The overall performance of thresher was satisfactory.

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