



## Design and Fabrication of a Tractor-Driven Groundnut Harvester

<sup>1</sup>A. A. Fagge<sup>1</sup>, <sup>2</sup>D. D. Yusuf, <sup>2</sup>U. S. Mohammed, <sup>2</sup>A. Saleh

<sup>1</sup>National Agricultural Extension and Research Liaison Services. ABU, Zaria<sup>1</sup>

<sup>2</sup>Department of Agricultural and Bio-Resources Engineering ABU, Zaria<sup>2</sup>.

### ABSTRACT

A tractor-mounted groundnut harvester was designed and fabricated specifically for small- and medium-scale farmers to reduce manual labour and minimize pod losses during harvesting. The machine comprises key components including the main frame, side flanges, picker conveyor, digger (share), conveyor, depth wheel, chain and sprockets, and a hitching system. All materials used in the construction were sourced locally, with the design intentionally kept simple to enable fabrication and maintenance by local artisans. Performance evaluation revealed an average digging efficiency of 88.80%, cleaning efficiency of 87.40%, field capacity of 0.16 ha/h, and field efficiency of 81.1%. Fuel consumption was recorded at 6.74 L/ha when the harvester was operated at a speed of 1.5 km/h, with a conveyor angle of 38° and soil moisture content of 23.1%.

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### INTRODUCTION

Groundnut (*Arachis hypogaea* L.) is a vital edible oil crop and ranks second only to soybean in terms of global production and trade (Wang et al., 2022). It plays a crucial role in meeting the world's demand for edible oil and contributes significantly to food security and the livelihoods of millions of smallholder farmers, especially in developing countries (Liu et al., 2017).

Among the various stages of groundnut cultivation, harvesting and threshing are considered the most laborious, time-consuming, and critical operations. These tasks are traditionally performed manually, requiring substantial human effort—estimated at approximately 84 man-hours per hectare (Padmanathan et al., 2006). This intensive labour demand becomes particularly problematic during the peak harvesting season when labour is often scarce or unavailable. As a result, many farmers experience delays in harvesting and threshing, which in turn leads to significant yield and economic losses (Manimaran et al., 2018).

Additionally, rural-to-urban migration has reduced the availability of agricultural labour in many areas, compounding the difficulties faced by groundnut farmers. The migration of the agricultural workforce, coupled with the rising cost of labour, has highlighted the

need for alternative solutions to enhance efficiency in groundnut production.

Given that up to 40% of the total labour input in groundnut cultivation is consumed during harvesting alone (Manimaran et al., 2018), there is a growing interest in developing and adopting mechanized solutions. Mechanization not only reduces drudgery but also improves timeliness, minimizes post-harvest losses, and enhances overall productivity.

To address these challenges, power-operated groundnut harvesters have been developed. These machines are designed to perform harvesting and threshing operations more efficiently, reliably, and cost-effectively. The adoption of such technologies is a promising step toward transforming groundnut farming practices, particularly for small- and medium-scale farmers striving to increase profitability and sustainability in the face of rising labour constraints.

### MATERIALS AND METHODS

#### Design considerations

The groundnut harvester would carry out three distinct operations, namely;

- Loosen the soil and dig out the entire groundnut plant.
- Lift the groundnut plants onto a conveyor and

Corresponding author: A. A. Fagge

✉ [aafagge@abu.edu.ng](mailto:aafagge@abu.edu.ng)

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- iii. Separate the groundnut plants from soil clods by vibration and finally drop in the windrow in one pass.

The followings are considered in the design of the machine.

The machine should be able to;

- Harvest groundnut at a higher rate than the manual method.
- Harvest groundnut planted on ridges
- Carry out digging and cleaning of the groundnut plant and drop in windrow in one pass.
- Be simple, reliable, safe to use and economical.
- Be pulled/driven and have a power requirement compatible to a tractor.
- Be simple in design so that local artisan would be able to fabricate and maintained.

## DESIGN CALCULATIONS

### A. Determination of draft and power requirement

Design of the digging blade was based on the draft acting on the groundnut harvester.

The horizontal load on the machine frame was determined from the resultant draft requirement of the cutting blade. This was obtained using equation as given by Onwaulu and Watts (1998) as the function of soil properties, blade width and the cutting depth.

$$\text{Draft } P = \gamma b d v^2 \times \frac{\sin \alpha}{\sin(\alpha + \phi)} \quad \text{-----1}$$

Where:

$\gamma$  = Bulk density of soil, kNm<sup>-3</sup> (15kgm<sup>-3</sup> ASABE, 2019)

$v$  = Tool speed, ms<sup>-1</sup> (2 ms<sup>-1</sup> maximum speed)

$d$  = Tool working depth, m (0.15m, Ahmad & Ghanny, 1987)

$b$  = Tool width, m (0.75m average width of a ridge)

$\alpha$  = Rake angle, deg (45° Ahmad & Ghanny, 1987)

$\phi$  = soil internal friction angle, deg. (35° for Sandy Loam soil. ASABE, 2019)

$$\text{Draft } P = 15\text{kgm}^{-3} \times 0.75\text{m} \times 0.15\text{m} \times (2\text{ms}^{-1})^2 \times \frac{\sin 45}{\sin(45 + 35)} \quad \text{-----2}$$

$$\text{Draft } P = 4.85\text{kgms}^{-2} = 4.85\text{N}$$

The power required to drive the implement through the soil with a draft of 4.85N at an

average speed of 2ms<sup>-1</sup>

Power = Draft x Speed

$$4.85\text{N} \times 2\text{ms}^{-1} = 9.70\text{W}.$$

### B. Determination of digger blade width

The effective zone of sweep type blade is given by the following formula

$$Z_f = W + 2d \tan \phi_s \quad \text{(Sharma and Mukesh 2013)} \quad \text{-----3}$$

Where:  $Z_f$  = Effective zone of blade, cm

$W$  = width of the blade, cm

$d$  = Depth of operation, cm

$\phi_s$  = Angle of internal friction which depend upon soil type (35° for Sandy loam) ASABE (2020)

Assuming the bottom width of the ridge is 60 and 70 cm and  $\phi_s$  is 35° and the depth of operation is 15cm.

$$65 = W + 2 \times 15 \times \tan 35^\circ$$

$$65 = W + 14.214$$

$$W = 50.79 \text{ cm} = 0.5\text{m}$$

### C. Determination of Pulley size

Pulleys are used for power transmission from one shaft to another through a flat belt, V-belt or rope. Since the velocity ratio is the inverse ratio of the diameter of driving and driven pulleys, therefore the diameter should be carefully selected in order to have a desired velocity ratio.

Since the harvester is a tractor driven and it takes power from the tractor, its necessary to make some assumptions that will help in linking the harvester to the tractor.

P.T.O shaft power = 50hp (37.3kW)

P.T.O Shaft speed = 540rpm

The centrifugal force acting on the rim of the pulley is obtained from the equation:

$$\sigma_t = \rho \cdot v^2 \quad \text{-----4}$$

Where:

$\sigma_t$  = Centrifugal force (N/m<sup>2</sup>)

$\rho$  = Density of rim material (kg/m<sup>3</sup>) [i.e cast iron = 7200kg/m<sup>3</sup>]

$$v = \text{Velocity of rim (m/s)} = \frac{\pi D N}{60} \quad \text{-----5}$$

$D$  = Diameter of pulley (m)

$N$  = speed of the pulley (r.p.m).

Assuming the driven pulley of the conveyor will move at half the average of 540rpm of the tractor pto. And also, the velocity of the rim is assumed to be 3.0m/s, the

maximum speed of the tractor for harvesting operation.

$$v = \frac{\pi DN}{60} = \pi \times D \times \frac{270}{60} = 3.0$$

$$\therefore D = \frac{3.0}{\pi \times 4.5} = 0.22m$$

or D = 220mm

The diameter for the driving pulley was determined from the equation given by (Khurmi and Gupta, 2005) as:

$$N_1 D_1 = N_2 D_2 \text{ -----6}$$

$N_1=540\text{rpm}$ ,  $D_1=?$ ,  $N_2=270\text{rpm}$  and  $D_2=22\text{cm}$

$$540 \times D_1 = 270 \times 22$$

$$D_1 = 270 \times 22 / 540$$

$$D_1 = 11\text{cm}$$

#### D. Determination of the Belt Length

The length of belt was determined using a relation given by (Khurmi and Gupta, 2005)

) Stated below:

$$L = \frac{\pi}{2} (d_1 + d_2) + 2x + \frac{(d_1 + d_2)^2}{4x} \text{ ----7}$$

Where;

L = Length of belt in cm

$d_1$  = Diameter of larger pulley in cm

$d_2$  = Diameter of smaller pulley in cm

x = Distance between the centres of the

two pulleys in cm

assuming the distance between the centres of driven and driving pulley is 70cm

$$L = \frac{\pi}{2} (22 + 11) + 2 \times 70 + \frac{(22+11)^2}{4 \times 70}$$

$$L = 195.72 \text{ cm}$$

#### E. Determination of Shaft diameter

For a solid shaft with little or no axial loading, the shaft diameter was determined from the equation (8) given by Khurmi and Gupta (2005) as:

$$d^3 = \frac{16}{\pi T_a} \sqrt{(K_m \times M_b)^2 + (K_t \times M_t)^2} \text{ ----8}$$

Where:

d = Solid shaft diameter, m

$M_b$  = Maximum bending moment, N m

$K_m$  = Combined shock and fatigue factor applied for bending moment (1.5-2.0)

$k_t$  = Combined shock and fatigue factor applied for torsional moment (1.0 to 1.5)

$M_t$  = Maximum torsional moment, N m

$T_a$  = Allowable shear stress, N/m<sup>2</sup> (120.38MN/m<sup>2</sup>) according to ASME code for mild steel carbon

The maximum torsional moment  $M_t$  was determined using an equation given Khurmi and Gupta, 2005 as follows:

$$M_t = \frac{P \times 60}{2\pi N} \text{ -----9}$$

Where:  $M_t$  = Torsional moment (Nm)

Power = Rated power transmitted by the shaft (W)

N = Rated speed of the shaft (rpm)

Assuming the rated power of the transmitted to tractor shaft  
20kW.

Assuming the rated speed of the tractor pto is 540rpm

$$M_t = \frac{20 \times 60 \times 10^3}{2\pi \times 540} = 353.68 \text{ Nm}$$

Therefore, the torsional moment ( $M_t$ ) is 353.68 Nm

The shaft diameter (d) was calculated from equation (8) as follows:

$$d^3 = \frac{16}{\pi T_a} \sqrt{(K_b \times M_b)^2 + (K_t \times M_t)^2}$$

$T_a = 120.38\text{MN/m}^2$ ,  $K_b = 1.5$ ,  $K_t = 1.0$ ,  $M_t =$

353.68Nm and  $M_b = 808.25\text{Nm}$

$$d^3 = \frac{16}{\pi \times 120.38 \times 10^6} \sqrt{(1.5 \times 808.25)^2 + (1.0 \times 353.68)^2}$$

$$d = 3.5 \times 10^{-2}\text{m} = 35\text{mm}$$

### DEVELOPMENT OF THE GROUNDNUT HARVESTER COMPONENTS

The main body frame of the harvester was constructed using a 50 x50 x 5mm square mild steel pipe, and it is the structure that hold all other components of the groundnut harvested. The side flanges are two pieces made of 3mm galvanized angle iron, to which the picker conveyor is attached to the main frame.

The picker conveyor, consist of two shafts mounted on self-aligned bearings fixed apart. Sprockets were mounted on the picker conveyor shafts. Picker pegs were welded on each cross bar. The lower end of the conveyor was made in such a way that it can be adjusted, for the pegs to be able to comb the soil for easy picking of the harvested plant. The drive for the picker conveyor is provided from the power take off (PTO) of the tractor.

The digger or share blade is a rectangular shape metal bar with sharp edges at the front. The share is made of mild steel of dimension 740 x 250mm and thickness 10mm to withstand soil resistance force as a result of

Corresponding author: A. A. Fagge

[aafagge@abu.edu.ng](mailto:aafagge@abu.edu.ng)

National Agricultural Extension and Research Liason Service, Ahmadu Bello University, Zaria.

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penetration during harvesting. The share blade is rigidly attached to the harvester frame through a metal shafts 25mm diameter.

The picker conveyor assembly consist of reel chain, spur gears, pulleys, picker bars, picker pegs and transmission shafts. The picker conveyor was mounted on two sets of gears system at 682mm long and 700mm width. 19 picker bars of dimension 460 x 22 x 8 mm mild steel bars spaced at 120mm apart were fixed on the reel chain links. 5 metal rods (picker pegs) of 5mm diameter and 80mm long were fixed vertically on each picker bar.

The depth wheel was constructed to assist in setting the depth of penetration of the digger and can be adjusted manually. To improve the traction system of the groundnut harvester, 20 pieces of 10mm diameter metal of 50mm long were welded on the outer circumference of the wheels at an offset setting adjacent to each other. All the components of Groundnut harvester after construction were assemble as shown in figure 1.

The Groundnut harvester was designed to be driven by a tractor. Therefore, proper hitching system was implored through the three-point linkage system of the tractor.

## DETERMINATION OF GROUNDNUT HARVESTER PERFORMANCE INDICES

### 1. Moisture content measurement

Soil moisture was determined by gravimetric method. The samples of soil were collected during the field trials and weighed and oven dried for 24 hours at 105°C. the following equation was used to calculate the percentage soil moisture content.

$$M_c = \frac{W_2 - W_3}{W_3 - W_1} \times 100 \quad 10$$

Where:  $M_c$  = Moisture content (%),  
 $W_1$  = Weight of container, g  
 $W_2$  = Weight of container + wet soil, g  
 $W_3$  = Weight of container + oven dried soil, g

### 2. Fuel consumption measurement

The quantity of fuel consumed by the tractor during field operations was measured by the use of measuring cylinder. The fuel consumption rate was calculated using the equation given by (Moayad et al. 2014) as:

$$FCR = \frac{C_r}{A} \times C_1 \quad 11$$

Where: FCR = fuel consumption rate, L/ha.

$C_r$  = recorded cylinder reading, ml.

$A$  = total area covered, m<sup>2</sup>

$C_1$  = conversion factor, 10.

### 3. Measurement of theoretical field capacity

Theoretical field capacity of the harvesting machine was computed using the following equation as given by Gwarzo, 1990.

$$TFC = \frac{A}{T_p} \quad 12$$

Where: TFC = theoretical field capacity, ha/h.

$A$  = area operated in hectares

$T_p$  = primary function time in hours

### 4. Measurement of effective field capacity

The effective field capacity of the machine was determined using an equation given by Gwarzo, 1990 as;

$$EFC = \frac{A}{T_p + T_s + T_d} \quad 13$$

Where: EFC = effective field capacity, ha/h.

$A$  = area operated in hectare

$T_p$  = primary function time in hours

$T_s$  = support function time in hours ie turning

$T_d$  = delay time in hours

### 5. Measurement of Field Efficiency

The field efficiency was determined using an equation given by Moayad et al. 2014 as:

$$E_f = \frac{EFC}{TFC} \times 100 \quad 14$$

Where:  $E_f$  = Field efficiency (%)

EFC = Effective field capacity (ha/h)

TFC = Theoretical field capacity (ha/h)

### 6. Determination of digging efficiency ( $\eta_h$ )

The digging efficiency was calculated using an equation given by Padmanathan et al. (2006) as:

$$\eta_h = \frac{w_p}{(w_p + w_s)} \times 100 \quad 15$$

Where:  $\eta_h$  = Digging efficiency, %

$w_p$  = weight of groundnut pods collected, (kg)  
 $w_s$  = weight of groundnut pods left out in the soil, (kg)

## 7. Determination of Cleaning Efficiency

The cleaning efficiency was determined using equation given by Padmanathan et al. (2006) as:

$$\eta_c = \frac{(w_1 - w_2)}{w_1} \times 100$$

Where:  $\eta_c$  = Cleaning efficiency, %.

$w_1$  = Total weight of plants fed at the picking end, kg.

$w_2$  = weight of plants collected at the delivery end, kg

A Randomized Complete Block Design (RCBD) was used in evaluating the performance of the groundnut harvester after the maturity of the groundnut plants.

Treatments considered are four level of speed of operation ( $S_1, S_2, S_3, S_4$ ), four levels of soil moisture ( $M_1, M_2, M_3, M_4$ ) and two levels of conveyor angles ( $C_1, C_2$ ). The treatments were randomly assigned in a 4x4x2 factorial experiment in a RCBD in three replications.

## RESULT AND DISCUSSION

The results of the ANOVA, as presented in Table 1, indicate that both the

operational speed and changes in conveyor angle had a highly significant effect on the performance of the groundnut harvester at the 1% level of significance. This suggests that these two factors—speed and conveyor angle—had a considerable impact on the digging efficiency of the harvester during performance evaluation. Tauseef et al. (2014) reported that lower operating speeds result in higher digging efficiency, a finding that is consistent with the present study. Similarly, Asghar et al. (2014) observed that digging efficiency decreases with increasing speed, confirming the significance of speed as a determining factor.

The average digging efficiency recorded for the groundnut harvester was 86.83%. Although the ANOVA results showed that soil moisture content was not statistically significant, field observations revealed a practical influence: as soil moisture content decreases and the soil becomes drier, the blade's penetration into the soil is reduced, thereby lowering the overall digging efficiency of the harvester.

Furthermore, variations in the conveyor angle from 38° to 43° also affected harvester performance. The results indicated that better operational outcomes were achieved at a conveyor angle of 38°, compared to 43°, confirming that lower conveyor angles are more effective for optimal digging efficiency.

**Table 1:** ANOVA Result of the effect of moisture content, conveyor angle and speed of harvester on the digging efficiency.

Source	DF	SS	MS	F Value	Pr > F
Rep	2	1076.543125	538.271562	34.73**	<.0001
Speed(S)	3	1026.137083	342.045694	22.07**	<.0001
Moisture Content (MS)	3	74.008750	24.669583	1.59 <sup>ns</sup>	0.2004
Conveyor Angle (CA)	1	331.526667	331.526667	21.39**	<.0001
S*MC	9	175.883750	19.542639	1.26 <sup>ns</sup>	0.2762
S*CA	3	27.449167	9.149722	0.59 <sup>ns</sup>	0.6237
MC*CA	3	9.955833	3.318611	0.21 <sup>ns</sup>	0.8863
S*MC*C	9	47.248333	5.249815	0.34 <sup>ns</sup>	0.9585
Error	62	960.963542	15.499412		
Total	95	3729.716250			

ns = Not significant \* = Significant at 5% \*\* = Significant at 1%

The cleaning efficiency of the groundnut harvester was significantly affected by the change of the conveyor angle during

evaluation at 1% level and was also significantly affected by the speed of operation at 5% level as shown in Table 2. Change in angle of

Corresponding author: A. A. Fagge

[aafagge@abu.edu.ng](mailto:aafagge@abu.edu.ng)

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operation from 38° to 43° brought about a significant change on the cleaning efficiency of the harvester. Likewise, the speed of operation

also was significant on the cleaning efficiency of the harvester. The average cleaning efficiency of the harvester was 71.98%.

**Table 2:** ANOVA Result of the effect of moisture content, conveyor angle and speed of harvester on the cleaning efficiency.

Source	DF	SS	MS	F Value	Pr > F
Rep	2	47.5289583	23.7644792	1.60 <sup>ns</sup>	0.2105
Speed(S)	3	145.1111458	48.3703819	3.25*	0.0276
Moisture Content (MS)	3	104.5453125	34.8484375	2.34 <sup>ns</sup>	0.0817
Conveyor Angle (CA)	1	243.5251042	243.5251042	16.37**	0.0001
S*MC	9	118.0551042	13.1172338	0.88 <sup>ns</sup>	0.5462
S*CA	3	32.8761458	10.9587153	0.74 <sup>ns</sup>	0.5340
MC*CA	3	15.3386458	5.1128819	0.34 <sup>ns</sup>	0.7937
S*MC*CA	9	58.9884375	6.5542708	0.44 <sup>ns</sup>	0.9076
Error	62	922.091042	14.872436		
Total	95	1688.059896			

ns = Not significant \* = Significant at 5% \*\* = Significant at 1%

Speed of operation was highly significant at 1% level of confidence on the field capacity during performance evaluation as shown in Table 3. Increase in speed of operation resulted in an increase of the field capacity of the groundnut harvester. All other independent variables were insignificant.

The speed of operation of the harvester was highly significant on the field capacity of the harvester  $P \leq 0.01$ . This indicated that increase in speed from 1.5km to 2.0km and 2.0km to 2.5km results in an increase on the

field capacity of the harvester. Asghar et.al (2014) also reported that, the higher the forward speed the more will be the productive effective time and less will be the time lost during field operation which result on greater effective field capacity.

The highest mean of field capacity of the groundnut harvester was recorded at a speed of 3.0km/hr (0.159ha/hr), while the least values were recorded at a speed of 1.5km/hr (0.085ha/hr).

**Table: 3:** ANOVA Result of the effect of moisture content, conveyor angle and speed of harvester on the field capacity of the harvester during performance evaluation.

Source	DF	SS	MS	F Value	Pr > F
Rep	2	0.00007790	0.00	0.71 <sup>ns</sup>	0.4937
Speed(S)	3	0.05151137	0.02	314.70**	<.0001
Moisture Content (MC)	3	0.00020321	0.00	1.24 <sup>ns</sup>	0.3024
Conveyor Angle (CA)	1	0.00000817	0.00	0.15 <sup>ns</sup>	0.7002
S*MC	9	0.00051471	0.00	1.05 <sup>ns</sup>	0.4132
S*CA	3	0.00008108	0.00	0.50 <sup>ns</sup>	0.6868
MC*CA	3	0.00010792	0.00	0.66 <sup>ns</sup>	0.5802
S*MC*CA	9	0.00028483	0.00	0.58 <sup>ns</sup>	0.8084
Error	62	0.00338277	0.00		
Total	95	0.05617196			

ns = Not significant( $P > 0.05$ ) \* = Significant at 5% \*\* = Significant at 1%

Table 4, shows the effect of soil moisture content, conveyor angle and speed of operation. The speed of operation and the

conveyor angle significantly affected the field efficiency of the groundnut harvester at 1% level. The interaction of speed of operation and

Corresponding author: A. A. Fagge

[aafagge@abu.edu.ng](mailto:aafagge@abu.edu.ng)

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soil moisture content affected the field efficiency of the groundnut harvester at 5% level. Asghar et.al (2014) also reported that, speed has significant effect on the field efficiency and it decreases with increase in speed. The mean

value of 78.68% was attained. It implies that an increase on the speed of operation from 1.5km/hr to 3.0km/hr resulted in an increase on the field efficiency of the harvester.

**Table 4:** ANOVA Result of the effect of moisture content, conveyor angle and speed of harvester on the field efficiency of the harvester during performance evaluation.

Source	DF	SS	MS	F Value	Pr > F
Rep	2	73.000000	36.500000	1.87 <sup>ns</sup>	0.1634
Speed(S)	3	1465.781250	488.593750	24.97**	<.0001
Moisture Content (MC)	3	109.697917	36.565972	1.87 <sup>ns</sup>	0.1441
Conveyor Angle (CA)	1	446.343750	446.343750	22.81**	<.0001
S*MC	9	362.343750	40.260417	2.06*	0.0474
S*CA	3	24.114583	8.038194	0.41 <sup>ns</sup>	0.7458
MC*CA	3	1.531250	0.510417	0.03 <sup>ns</sup>	0.9942
S*MC*CA	9	97.843750	10.871528	0.56 <sup>ns</sup>	0.8277
Error	62	1213.000000	19.564516		
Total	95	3793.656250			

ns= Not significant \* = Significant at 5% \*\* = Significant at 1%

Table 5, shows the analysis of variance result of the effect of moisture content, speed of operation and the conveyor angle on the fuel consumption of the harvester during field evaluation. The speed of operation and the conveyor angle were highly significant at 1% level, while soil moisture content was significant at 5% level. This indicated that the speed, moisture content and the conveyor angle effected the fuel consumption of the harvester during operation.

The fuel consumption increases with increase in the speed of operation. It indicated that at 2.0km/hr, 2.5km/hr and 3.0km/hr, the fuel consumptions were 7.52l/ha, 7.85l/ha, and 8.6l/ha respectively. Increase in speed of operation resulted in an increased fuel consumption as observed during evaluation. Increase in soil moisture content from 20.1% to 23.1% resulted in decreased fuel consumption from 8.05l/ha to 7.36l/ha. This shows that increased in moisture content causes a decreased in fuel consumption.

**Table 5.** ANOVA Result of the effect of moisture content, conveyor angle and speed of harvester on the fuel consumption of the harvester during performance evaluation.

Source	DF	SS	MS	F Value	Pr > F
Rep	2	0.19000000	0.09500000	0.58 <sup>ns</sup>	0.5648
Speed	3	13.17864583	4.39288194	26.66**	<.0001
Moisture Content (MC)	3	1.89031250	0.63010417	3.82*	0.0140
Conveyor Angle (CA)	1	1.37760417	1.37760417	8.36**	0.0053
S*MC	9	1.79677083	0.19964120	1.21 <sup>ns</sup>	0.3044
S*CA	3	0.28364583	0.09454861	0.57 <sup>ns</sup>	0.6344
MC*CA	3	0.41864583	0.13954861	0.85 <sup>ns</sup>	0.4735
S*MC*CA	9	1.37177083	0.15241898	0.92 <sup>ns</sup>	0.5100
Error	62	10.21666667	0.16478495		
Total	95	30.72406250			

NS = Not significant \* = Significant at 5% \*\* = Significant at 1%

## CONCLUSION

The drudgery and cost implication involved in manual harvesting of groundnut can

cause a great lost to farmers, more especially in the developing nations where the appropriate technology for mechanization is lacking. The

Corresponding author: A. A. Fagge

✉ [aafagge@abu.edu.ng](mailto:aafagge@abu.edu.ng)

National Agricultural Extension and Research Liason Service, Ahmadu Bello University, Zaria.

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development of the tractor driven groundnut harvester will go a long way to ease the drudgery and pod losses incurred in manual groundnut harvesting.

The following can be concluded from the study;

1. Maximum digging efficiency was found as 88.80 % at a speed of 1.5km/h and 38° conveyor angle. it increased with an increase in speed of operation but decreased with increase in conveyor angle. Moisture content was found to be statistically insignificant.
2. Maximum cleaning efficiency was found as 87.4% at a speed of 1.5km/h and 38° conveyor angle, and 23.1% moisture content.
3. The maximum field capacity was found as 0.16ha/h at a speed of 3.0km/h and 38° conveyor angle and at 23.1% moisture content. Field capacity increases with increase in speed. There is no statistical difference in mean of field capacity in relation to the soil moisture content.
4. The maximum field efficiency was found as 81.1% at speed of 1.5 km/h and at 38° conveyor angle. Field efficiency decreases with an increase in speed. There is no significant difference in relation between field efficiency and soil moisture change.
5. The minimum fuel consumption was found as 6.74l/ha at a speed of 1.5km/h and at 38° conveyor angle. Increase in soil moisture resulted in decrease in fuel consumption.

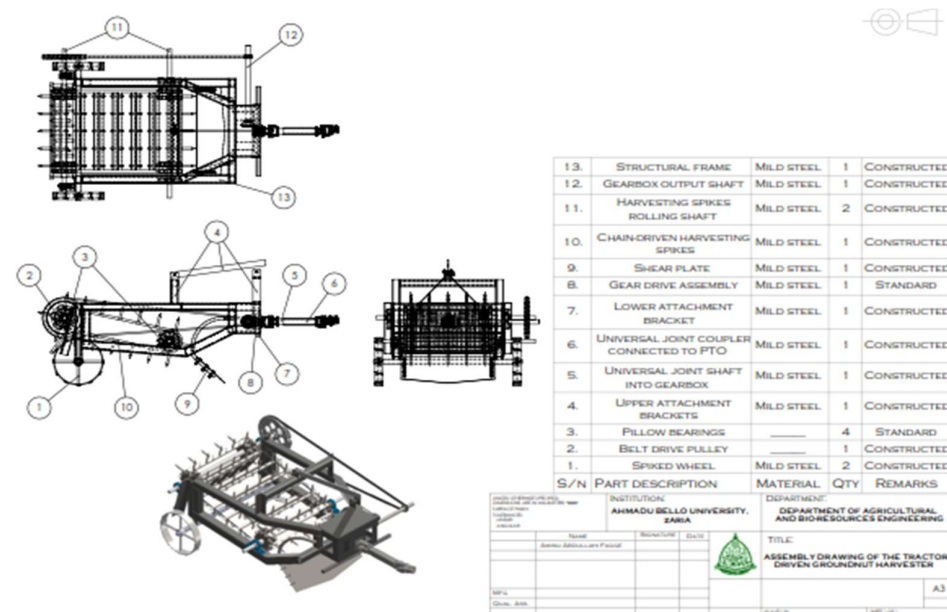


Figure 1. Assembly drawing of the Tractor Driven Groundnut Harvester

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Corresponding author: A. A. Fagge

✉ [aafagge@abu.edu.ng](mailto:aafagge@abu.edu.ng)

National Agricultural Extension and Research Liason Service, Ahmadu Bello University, Zaria.

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