Analysis of Power Requirements for Peanut Digger (Digger - Shaker – Inverter Type)

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Abstract. An analysis of the power requirements of the peanut harvesting machine was carried out to determine the type and size of tractor power that will be used. A tractor with a self-propelled motor will distribute traction power to the peanut harvesting implement on the peanut digger unit (digger), the peanut plant shaker/shake unit and the pod reversing unit with peanut plants (inverter). Field performance results obtained by a digging machine with a 90 HP four-wheeled tractor with a working width of 120 cm, depth of 11.6 cm, working capacity of 3,27 hours/ha (0,31 ha/hours), field working efficiency of 72.05%, fuel oil usage of 6.95 liters/ h*a*, and power for harvesting peanuts of 9.2916 hp. The operational costs of a peanut harvesting machine is IDR 134,331 per ha. By using a (general) rental rate of IDR 175,000 per ha, a rental profit 0f IDR 33,951 per hais obtained with the BEP of the peanut harvesting machine having to work for 865.66 hours per year or 1,731 ha per year with a B/C ratio of 1,07966 at 10% interest and 1.06187 with 16% interest and IRR of 40,12%.

1 Introduction

Peanut digging activities on peanut plantations in Kalijati, Subang Regency, West Java are carried out fully mechanized using machine tools, such as: four-wheeled tractors for tilling, planting, maintaining plants, harvesting (digging and threshing) peanuts. To determine the size of the tractor pulling the peanut digger, this is done by calculating the traction requirements of the peanut digger, then choosing the power of the tractor that can pull the peanut digger [1].

The peanut digging tool used in Kalijati is of the type of digging, shaking and turning peanuts, so the calculation of the power requirements for pulling the peanut digger includes the power requirements for digging, shaking and turning peanuts [2].

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The method for measuring the power requirements of a peanut digging machine is based on the results of performance tests of the peanut digging machine in the field. includes measuring the power of digging, shaking and turning peanuts. The mathematical equation for the power requirements of a peanut digging machine is calculated based on the results of field measurements [3].

The measurement data is field data from performance tests of peanut digging machines at the Kalijati Plantation, Subang. Technical analysis parameters measuring the performance of peanut digging machines include: peanut harvest area, road speed, time, width, depth, capacity, efficiency and field fuel requirements. Meanwhile, financial parameter data measuring the workability of peanut digging machines is used based on the results of calculations of Benefit per Cost (B/C ratio) and IRR [4].

How to calculate the power requirements for a peanut digging machine mathematically, consisting of the power requirements to pull or move the tractor itself to overcome rolling resistance (HP1) and the power to pull or move the peanut digger which consists of a digging, shaking and turning unit. rotating (HP2) [5].

Thus, for tractor availability, it is the availability of the tractor to drive the tractor (HP1) and the power to pull the peanut digger to overcome the rolling resistance force and working speed of the tractor [6].

The amount of driving power of the tractor itself (P1) will be determined by the weight of the tractor (W1), the rolling resistance coefficient (ρ) and the working speed of the tractor (v1). Meanwhile, the amount of peanut digging power (P2) is determined by the peanut digging force (W2) and the working speed of the tractor (v2) [7].

The overall tractor power for peanut digging activities will be influenced by the reaction force of the soil to changes in soil mechanical properties such as soil moisture, soil consistency, texture, structure and colloid content of other soil binding materials, for example vegetation that grows on the soil. soil during soil demolition and design factors, size of tractor, digging plow, shaker and turning equipment and working speed peanut digging [8].

Meanwhile, to guarantee that the tractor can work in the field, including for the traction of the peanut digging equipment, it is necessary to calculate the amount of power of the tractor to pull or move the peanut digging equipment by calculating the efficiency of power transmission from the tractor to the peanut digging equipment and the efficiency of power transmission from the tractor. to the tractor drive wheels. Tractor power tolerance to overcome land slopes and other unexpected conditions (μ) when operating the tractor in the field [9].

2 Materials and methods

2.1 Materials and Equipment

Fig.1. Peanut digger implementation (Peanut DSI)

2.2 Experimental procedure

Tractor power requirement (P), the final results of calculating tractor power requirements for peanut digger activities using a peanut digger-shaker-inverter type implement will vary. This is due to the influence of soil characteristics, slope, tractor speed and others. Therefore, the calculation of tractor power requirements (P) always takes into account the power usage tolerance to overcome the slope of the land (S), the speed of digging peanuts (v1) and other unforeseen circumstances while the tractor is operating in the field [2].

Soil specific draft (dsp) measurements for peanut digging are carried out to obtain an accurate value of tractor power requirements (P) using the following equation:
Power for pulling groundnut harvesting unit with blade type digging knife (P1):

$$P1 = \frac{(dsp)x(lxd)xv1}{75x\ \eta 1} \tag{1}$$

Power to drive the tractor itself (P2):

$$P2 = \frac{Wxv2x\rho}{75x\ \eta 2} \tag{2}$$

The tractor power requirement (P) for harvesting peanuts, taking into account the power usage tolerance (μ) to overcome slopes and other unforeseen circumstances during field operations, can be written:

$$P = \frac{100}{(100-\mu)} x\ \ (P1 + P2) \tag{3}$$

Where :
P1 = power to pull/move the peanut harvester implement, (hp)
P2 = power to drive the tractor, (hp)
dsp = specific draft of peanut digging, (kg/cm^2)

l = width of peanut digging, (cm)
d = depth of digging peanuts, (cm)
v1 = speed of digging peanuts, (m/s)
v2 = speed without digging peanuts, (m/s)
S = Slope (land slope), %
η1 = power transmission efficiency of the peanut harvester implement, (%)
η2 = tractor power transmission efficiency, (%)
W = tractor weight, (kg)
ρ = rolling resistance coefficient
(ρ It really depends on the weight of the tractor, the size and shape of the wheels, the type and condition of the soil, the type of vegetation on the ground surface).
μ = tolerance for using tractor power to overcome land slopes and other conditions during field operations.

2.3 Data analysis

2.3.1. Technical Analysis

To obtain the value of field work efficiency (η), it is done from the results of calculating theoretical work capacity (Kt) by measuring actual or effective work capacity (Ka). The theoretical working capacity (Kt) is calculated based on the performance results of the peanut digging implement, where the speed of the tractor pulling the peanut digging implement reaches 100% or in other words if the peanut digging implement can work to fulfill its function for 100% of the total working time available (T), then the peanut harvesting machine works without any obstacles, so that the actual working speed becomes the theoretical working speed (Vt) and the actual working width becomes the theoretical working width (Wt), so that the field working efficiency will reach a perfect value or 100%.

The actual working capacity of the peanut digging implement (Ka) is the result of calculating the working speed of the tractor pulling the peanut digging implement which can be achieved based on the total area of peanut digging (A) which can be achieved per total time used (T) and is expressed as a function of the unit area of peanut harvesting (A) per unit of total time (T) is expressed as (ha/hour). This shows that the actual working capacity of the average peanut harvesting machine (Ka) is a function of the actual working width (Wa) and the actual working depth (d) is the peanut harvesting area (A), actual walking speed (Va) and time actual during work (Ta).

The actual working width (Wa) is determined by the occurrence of overlapping or not excavating peanuts resulting from peanut digging work in the field. This can be caused by the influence of operator skills, the peanut digging implement coupling system, actual working speed (Va) and the condition of the peanut harvesting area.

The actual working speed (Va) is determined based on field working efficiency (E) times the theoretical working capacity (Vt), while the wheel slip (Sa) is measured based on the theoretical track length whose value is obtained from the theoretical tractor wheel design system diameter (πD) times number of rotations of the tractor wheel (n) minus the lost track length of the tractor wheel (L) divided by the theoretical track length multiplied by 100%, while the amount of power (P), type and specific soil draft (dsp), operator skill (opr) and actual work speed (Va).

The actual working time during peanut digging (Ta) is calculated based on the amount of time lost which is not effectively used or time lost during peanut digging (T_l). Lost time is a time change that is difficult to assess in determining work capacity. The actual working time of the peanut digging implement minus the time lost due to the need for adjustments, overcoming traffic jams or minor damage, turning time at the end of the field, and so on.

For daily maintenance, installation or serious damage is not included in the calculation of lost time. Meanwhile, the time used for transportation to and from the field is also not taken into account in calculating work capacity and efficiency but is taken into account to determine the working costs of peanut harvesting tools and machines which are related to the mobility of tools and machines.

Field work efficiency of peanut harvesting machines (η), is the comparison between actual work capacity (Ka) and theoretical work capacity (Kt) expressed in percent (%).
Actual working capacity, calculated as follows:

$$\text{Ka} = \text{A/T} \tag{4}$$

Theoretical working capacity, calculated as follows:

$$\text{Kt} = \text{Wt x Vt x 0.36} \tag{5}$$

The field work efficiency of the peanut harvesting machine (η) is as follows:

$$\eta = \frac{Ka}{Kt} \text{ x } 100\% \tag{6}$$

The actual field work capacity calculated as a result can be written as follows:

$$\text{Ka} = (\eta \text{ x Kt})/100 \tag{7}$$

$$Vt = \frac{Va}{(1-Sa)} \tag{8}$$

The slip that occurs when digging peanuts (Sa) can be used using the following equation:

$$\text{Sa} = \frac{(\pi DN-L)}{(\pi DN)} \ 100\% \tag{9}$$

The working efficiency of the peanut harvesting machine is calculated using the equation:

$$\eta = \text{Ka/Kt x100\%} \tag{10}$$

To determine a suitable type of peanut harvesting machine to be developed at the location. So it is necessary to know how many quantities must be provided in the area so that the procurement will not crowd out job opportunities and labor that were previously available, so it must be taken into account again that providing a certain number of peanut harvesting machines is economically profitable.

To calculate the need for peanut harvesting machines, the following equation can be used:

$$N = A \, x \, K \, x \, T \, x \, \eta \tag{11}$$

(The area of peanut harvesting land above is the area of land worked using peanut harvesting machines and available human labor).

Where :

Kt = theoretical working capacity, ha/hour
Ka = actual work capacity, ha/hour
A = area of peanut digging area, ha
Wt = theoretical working width, m
Wa = actual working width, m

Vt = theoretical working speed, km/h
Va = actual working speed, km/hour
T = peanut digging time, hours
η = field work efficiency, %
π = pi (3.14159)
D = tractor wheel diameter, m
N = number of wheel revolutions along the track, non-dimensional
L = path length, m
d = depth of peanut digging, m
Sa = actual slip (slip that occurs on the wheel), %
Te = effective time for digging peanuts, hours
Tl = time lost during peanut digging, hours
N = number of peanut harvesting machines, bh
A = area of peanut harvesting land, ha/season
K = working capacity of the peanut harvesting machine, ha/hour/bh
T = available time, hours/season

2.3.2. Financial analysis

The use of a tractor to tow peanut harvesting implements in farming activities is considered profitable from an economic perspective if its use is greater than the operational costs incurred for the peanut harvesting activity or at least the use of the peanut harvesting machine must be able to pay for itself.

The economic analysis of using a peanut harvesting machine here is intended to be able to examine the cost of owning a peanut harvesting machine and the operating costs of a peanut harvesting machine, so that when using it there are no losses.

The amount of ownership costs and operational costs of peanut harvesting machines is taken into account by fixed costs and work costs (variable costs), fixed costs consisting of depreciation, capital interest, maintenance and repairs as well as taxes and insurance. Meanwhile, work costs and fuel, lubricating oil, grease, operator wages and operator assistant wages as well as costs for purchasing spare parts (rubber tires).

The operational costs of a peanut harvesting machine per year are as follows:

a. Fixed costs

- Depreciation = (P – S) / N (12)
- Capital interest = r/100x (P+S) / 2 (13)
- Maintenance and repairs = m/100 x P (14)
- Warehouse = (h/100) x P (15)

Taxes and insurance :

- Tax = (t/100) x P (16)
- Insurance = (i/100) x ((P+S)/2) (17)

Where :

P = machine purchase price (Rp)
S = final price, (Rp) (10% of purchase price, RNAM 1983)
N = economic life, (years)
r = capital interest rate, (%) (12%, RNAM 1983) iii).

m = warehouse value, (%) (0.5%, RNAM 1983) iv).
h = warehouse value, (%) (0.5%, RNAM 1983) v).
t = tax value, (%)
I = insurance value, (%) (depending on local conditions)

Total fixed costs per year = i + ii + iii + iv + v
= (A), (Rp/year)

b. Variable costs

- Fuel oil = 0.15 x Pm x Wt x Fp
- Lubricants = 0.80 x Pm x Wt x Op hp.100 hours
- Grease = 60% x of lubricating oil (Donnel Hunt, 1979)
- Operator = Wt x Wop
- Operator auxiliary power = Wt x Wl
- Tires = (n x Tp) / (Wt x Nt)

Where :
Pm = motor power, (HP)
Wt = working hours per year, (hours/year)
Fp = price of fuel oil per liter, (Rp/liter)
Op = price of lubricant per liter, (Rp/liter)
Gp = price of lubricating oil per liter, (Rp/liter)
Wop = hourly operator wages, (Rp/hour)
Wl = hourly wage for operator assistants, (Rp/hour)
n = number of tires, (pieces)
Tp = tire price per piece, (Rp/piece)
Nt = tire life, (hours)

Total work costs per year
= vi + vii + viii + ix + x + xi = B, (Rp/year)

So the total machine operating costs per year
= (A+B) ; (Rp/year)

The amount of machine operating costs per hour is
= (A + B) / Wt, (Rp/hour)

Medium operational costs per unit area
= (A+B) / Wt, (Rp/ha)

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3 Results and discussion

3.1 Description of the driving motor

Specifications of the main drive motor for the peanut digger implement can be seen in table 1 as follows:

Table 1. Motor Power Source for pulling peanut digging implements.

Parameter	Unit	Type / Size	SNI (Large Class)
Motor Power KMC 03 Series			
Drive motor type		Motor diesel	-
Brand		KMC	-
Model		2-Blade	-
Maximum power	kW (HP)	67,0 (90,0)	60 - 168,0 (80,6 – 225,6)
Average power	kW (HP)	-	-
Revolutions/minute	rpm	2400	1.200 – 2.600
Aspiration		Turbo	Turbo
Number of cylinders	number	4	4-6
Cylinder capacity	ml	4.100	< 6.000
Fuel	liter	Solar	-
	liter	90	90 - 445
Fuel tank capacity	liter	8	-
Lubricating oil capacity	liter	30	-
	liter	6	-
	liter	12	-
Transmission/hydraulic oil capacity	-	With *precleaner*	Dry/wet, with/without precleaner
Front axle oil capacity	-	Circulating water cooling	Circulating water cooling
Cooling water capacity	kg (lbs)	1043,26 - (2300)	-
Air cleaner (air cleaner)	-	*Electric*	-
Cooling system	-	*Synchromesh*	*Synchromesh*
Empty weight	-	8 forward speeds and 2 reverse speeds	-
a. Starting system	-	*Wet multi disc brakes*	Multi Disc /cooling oli

b. Transmission	-	Mechanical	Mechanical (Use your feet)
c. Main gear	-	Standard	Standard
Brake system	-	*Multi-plate wet clutch*	*Dual clutch*

3.2 Dimensions of peanut harvesting machines

The results of measuring the dimensions of the Peanut Harvesting Machine can be seen in table 2 as follows:

Table 2. Dimensions of peanut harvesting machines

Parameters	Unit	Measure	SNI (Large Class)
Overall dimensions			
Tractor unit			
a. Long*)	mm	3.905	2.500 – 6.000
b. Wide**)	mm	2.197	-
c. Tall***)	mm	2.184	> 1600
d. Weight***)	Kg (lbs)	1043.26 (2300)	2.500 – 6.000
Canopy	-	Standard	Standard/optional
Ballast			
a. Front weight		20/piece, 2 pieces	
Front wheel (starter)	kg	-	30 – 100
Additional front ballast	kg	-	(20-50)/piece, (1-15) pieces
b. Rear wheel weights	kg	-	40 – 220
c. Water ballast			
Front wheel (3/4 tire capacity)	kg	-	30-220
Rear wheels (3/4 tire capacity)	kg	-	200-550

3.3 Specific soil draft

Specific soil draft values for various types of soil, parent material and topography (physiography), show that wet soil conditions are mostly higher than moist soil. In humid conditions, the red-yellow podzolic soil type has the largest specific draft value, this soil is characterized by a high clay content.

Table 3. Specific Soil Draft on various parent soil types and topography

No.	Soil type, parent material,	Piracy Specific Draft (kg/cm2)

	topography / physiography	Moist	Wet
1.	Alluvial (alluvial material, plain)	0,342	0,467
2.	Andosols (igneous rocks, plains)	0,333	0,504
3.	Andosol (igneous rock, volcano)	0,340	0,397
4.	Latosol (igneous rock, volcano)	0,826	1,032
5.	Latosol and Litosol (sedimentary and metamorphic igneous materials, mountains)	0,826	1,090
6.	Red Yellow Podzolic (sedimentary and frozen material, folded mountains)	**1,087**	**0,936**
7.	Regosol (alluvial material, plain)	0,263	0,360
8.	Regosol & Latosol (igneous rock, volcano)	0,273	0,307

3.4 Peanut harvesting performance test

The results of modifying the peanut harvesting machine by re-activating the blade fins at the back, repairing the conveyor fins and inverter steering, the performance improvements were obtained as follows:

Table 4. Field performance tes results of peanuts harvesting machine with 2-blade knife plow implementation of peanut harvesting fields

Test date : April 10, 2023
Test location : Kalijati Village, District. Cipunegara, Kab. Subang, West Java
Harvesting Machine Name : KMC 03 Series Rigid DSI 90 - 4WD
Tooth position : 3 - 1
Initial engine speed : 2400 rpm

Number test	*Wide test plot (m2)*	*Time Work (minute)*	*Work results*		*Actual Field Capacity*			*Speed Work (km/h)*	*Slipped (%)*	*Draft sp (moist) (kg/cm2)*	*Efficiency (%)*	*Fuel consumption*		
			Wide (cm)	*In (cm)*	*(m2/hour)*	*(ha/hour)*	*(hours/ha)*					(ml/test)	(l/hour)	(l/ha)
1	633,65	11,80	117,10	11,50	3221,95	0,32	3,10	3,49	2,39	1,087	75,78	438	2,23	6,91
2	629,28	11,97	117,40	11,50	3155,16	0,32	3,17	3,50	3,41	1,087	74,20	441	2,21	7,01
3	646,76	12,87	117,40	11,60	3015,98	0,30	3,32	3,48	4,32	1,087	70,93	437	2,04	6,76
4	638,02	12,57	117,60	11,70	3046,25	0,30	3,28	3,46	3,15	1,087	71,64	448	2,14	7,02
5	620,54	12,93	117,20	11,70	2878,79	0,29	3,47	3,45	4,53	1,087	67,70	439	2,04	7,07
Rerata	**633,65**	**12,43**	**117,34**	**11,60**	**3063,63**	**0,31**	**3,27**	**3,47**	**3,56**	**1,087**	**72,05**	**440,6**	**2,13**	**6,95**
SD (%)			0,19	0,10	132,46	0,01	0,14	0,02	0,88	0,00	3,12	4,39	0,09	0,13
CV (%)			0,00	0,01	0,04	0,04	0,04	0,01	0,25	0,00	0,04	0,01	0,04	0,02

Speed without harvest = 3,54 km/hour
Theoretical working width = 120 cm = 1,20 m
Theoretical capacity = 4251,98 m^2/hour= 2,35 hour/ha

Power to tow kc tnh harvester unit (P1)

$$P1 = \frac{(dsp) \times (l \times d) \times V1}{75 \times \eta 1} = \frac{1.087 \text{ kg/cm2} \times (117.34 \text{ cm} \times 11.60 \text{ cm}) \times 3.47 \text{ km/hour}}{75 \times 85{,}98\ \%} = 1{,}087*(117{,}34*11{,}60)*(3{,}47/3{,}6)/(75*0{,}8598)$$

$$= 1{,}087*(117{,}34*11{,}60)*(3{,}47/3{,}6)/(75*0{,}8598) = 22{,}1158 \text{ kgm/s} = 0{,}29084 \text{ hp}$$

Power for peanut harvesting (P2)

$$P2 = \frac{W \times V2 \times \rho}{75 \times \eta 2} = \frac{1043{,}264 \text{ kg} \times (3{,}54 \text{ km/hour}) \times 0{,}6666}{75 \times 72{,}05\ \%} = 1043{,}264*(3{,}54/0{,}36)*(0{,}6666)/(75*0{,}7205)$$

$$= 189{,}845 \text{ kgm/s} = 2{,}49664 \text{ hp}$$

$$P = \frac{100}{(100 - \mu)} \times (P1 + P2) = \frac{100\%}{(100\ \% - 70\ \%)} \times (0{,}29084 + 2{,}49664) \text{ hp} = 3{,}33333 \times 2{,}78748 \text{ hp}$$

$$3{,}33333 \times 2{,}78748 \text{ hp} = \mathbf{9{,}2916 \text{ hp}}$$

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3.5 Operating costs for peanut harvesting machines

Operating Costs, BEP, B/C Ratio and IRR of Peanut Harvesting Machines can be seen in Tables 5 and 6 as follows:

No	Variable	Unit	Value
I	**Fixed cost**		
1	Price of KMC Peanut DSI	Rp	500000000
2	Engine Power	mobile phone	120
3	Economic Age	year	5
4	Final Score	10%	50000000
5	Bank Interest	%yr	10
6	Working hours per day	oclock	8
7	Working days per year	day	270
8	Working hours per year	oclock	2160
9	Shrinkage	Rp/yr	90000000
10	Capital Interest	Rp/yr	27500000
11	Fixed fee per year	Rp/yr	117500000
12	Total Fixed Cost	Rp/hour	54398,15
II	**Variable Cost**		
1	Fuel (Diesel)	l/hour	18
2	Fuel Price (Diesel)	Rp/l	6800
3	Fuel Cost (Diesel)	Rp/hour	122400
4	Lubricant	l/hour	0,96
5	Lubricant Prices	Rp/l	26500
6	Lubricant Cost	Rp/hour	25440
7	Grease	kg/hour	0,58
8	Grease Price	Rp/kg	38000
9	Grease Cost	Rp/hour	21888
10	Operator	Rp/day	200000
11	Operator Wages	Rp/hour	25000
12	Operator Assistant	Rp/day	150000
13	Operator Assistant Wages	Rp/hour	18750
14	Tire	kg/hour	0.0092593
15	Tire Prices	Rp/piece	8500000
16	Tire Cost	Rp/hour	787,04
17	Total Variable Cost	Rp/hour	214265,04
III	**Total Opereation Cost**	Rp/hour	268663,19

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	Total Opereation Cost	Rp/yr	580312480
IV	**Working Capacity**	hour/ha	0,50
V	**Total Operation Cost per Ha**	Rp/ha	134331,59
VI	**Fee Management**	5%	6716,58
VII	**Total Rental (Cost)**	Rp/ha	141048,17
VIII	**Total Rates (General)**	Rp/ha	175000
IX	**Rental Profits**	Rp/ha	33951,83
X	**B.E.P.**	hour/year	865,66
	B.E.P.	ha/yr	1731,32
	Working capacity per year	ha/yr	4320,00
	Income per year	Rp/yr	756000000

Meanwhile, the B/C Ratio and IRR results can be obtained as follows:

Table 6. Cash flow analysis of operating costs for dsi type peanut harvesting machines

Year to	**Investment (*1000)**	**Operating costs/year (*1000)**	**Total Cost (C)**	**Reception *Rp 1000/yr (B)**	**B-C**	**NPV i = 10 %**	**NPV i = 16 %**	**Gross B i = 10 %**	**Gross B i = 16 %**	**Gross C i = 10 %**	**Gross C i = 16 %**
1	500.000	580.312,5	1.080.312	756.000	-324.312						
2		580.312,5	580.312	756.000	175.688						
3		580.312,5	580.312	756.000	175.688						
4		580.312,5	580.312	756.000	175.688						
5		580.312,5	580.312	756.000	175.688						
	Amount		**3.401.562**	**3.780.000**	**378.438**	**211.448**	**144.218**	**2.865.835**	**2.475.366**	**2.654.386**	**2.331.148**

B/C ratio	**10%**	**1,07966**
	16%	**1,061866**
IRR	**=**	**40,12 %**

4 Conclusion

1. Field performance test results of the KMC 03 Series Type DSI groundnut harvesting machine obtained a working width of 117.34 cm, working depth of 11.60 cm, actual field capacity of 0.31 ha/hour or 3.27 hours/ha, efficiency work 72.05% with fuel oil consumption of 6.95 liters/ha and power for harvesting peanuts of 9.2916 hp.
2. The operating cost of a peanut harvesting machine is IDR 134,331 per ha. By using a (general) rental rate of IDR 175,000 per ha, a rental profit of IDR 33,951 per ha is obtained with the BEP of the peanut harvesting machine having to work for 865.66 hours per year

or 1,731 ha per year with a B/C ratio of 1.07966 at 10% interest and 1.06187 with 16% interest and an IRR of 40.12%.

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