

Evaluation of the Operating Cost of an Agricultural Machine, Case of the FIAT65-66 Tractor

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Abstract: In the Republic of Guinea, generally at the level of mechanization of agricultural production, the cost of operating agricultural machinery in practice is neglected. The only places where the operating cost of machinery is taken into account in Guinea are mining companies such as Compagnie des Bauxites de Guinée (CBG), Société AngloGold Ashanti (SAG) de Guinée and Compagnie des Bauxites de Kindia. (CBK) in Guinea. To determine the operating cost, we used the depreciation methods. The tractor chosen for this study is the French type FIAT65-66 from the Center de Machinisme Agricole de Faranah. This study shows that the depreciation value of the FIAT65-66 tractor is 183766504 GNF or (18376.6504 \$) during the five (5) years planned. After years, its trade-in value is 83033496 GNF per hectare (8303.3496 \$/ha) and its hourly operating cost is 250,000 GNF per hectare or (25 \$/ha). On the basis of these results, the rental of tractors must be between 800000 GNF to 1000000 GNF per hectare or (80 to 100 \$/ha) in Guinea, in order to cover the costs of any repairs and the purchase of spare parts.

Keywords: Agricultural, Machine, Tractor, FIAT65-66, Evaluation, Cost

1. INTRODUCTION

The agriculture sector is the source of employment for the majority of African populations and generates a good part of the gross domestic product (GDP). Despite its important role, it is underdeveloped in most African countries. Yet the potential for expansion of the sector is considerable at all levels. Low levels of input use and mechanization are cited among the main constraints to the development of the sector [1, 2].

In sub-Saharan Africa, the energy necessary for agricultural production is supplied by men (65%), animals (25%), and motors (10%). Family farming, more than 75% of farms provide most of the income of rural populations. However, it has limited access to agricultural motorization [3, 4]. The most common agricultural machines are tractors, combines, threshers, manure spreaders, fertilizer spreaders, plows, cultivators, seeders and planters. In 2000, the Ivory Coast led with nearly 3 tractors per 1,000 hectares, followed by Guinea. All other countries had less than one tractor per 1000 hectares [5, 6].

Table 1. Technical characteristics of the FIAT65-66 Tractor

N°	DESIGNATION	VALUE	UNIT
1	Engine power	48	kW
2	Number of cylinder	4	-
3	Total displacement volume	3613	cm ³
4	Number of revolutions per minute	2500	Towers/min
5	Coupling point	3	-
6	Oil pump flow	35	Liter/min
7	Circuit hydraulic pressure	186	bar

The methodology adopted for the evaluation of the operating cost of the FIAT65-66 tractor, relates to the

It is in this context that we proposed to carry out an evaluation study of the operating cost of an agricultural machine, the case of the FIAT65-66 tractor of the Faranah Agricultural Machinery Center.

2. MATERIALS AND METHOD

2.1 Materials

This study was carried out at the Higher Agronomic and Veterinary Institute of Faranah. The tools used during the work are: keys (flat, closed, pipe, socket, amulets) ; a hoist, liquid soap, detergent, a grinding wheel, green papers, a metal brush, instruments of measurements (caliper, barometer, stopwatch, etc.) and tractor tracking tables. The FIAT65-66 tractor is of French brand. Theoretical data indicates that it is capable of plowing 7.5 ha per day or 0.9 ha/h. The average coefficients of availability and use of the tractor FIAT65-66 are respectively 93.16% and 81.51%. Almost 30% of breakdowns in this tractor belong to the plow. These technical characteristics are given in Table 1 [7].

8	Front wheel height	90	cm
9	Rear wheel height	140	cm
10	Fuel tank capacity	73	Liter
11	Oil pan capacity	12	Liter
12	Tractor dimensions (length)	3.47	m
13	Tractor dimensions (width)	1.94	m
14	Tractor Dimensions (Height)	2.5	m
15	Tractor mass	2.4	Tons
16	Injection pump	Rotary	-

2.2 Method

determination of the different costs of the machinery, namely: the depreciation of the machine per year; variable hourly costs

(fuel and engine oil); special replacement costs (tires, oil filter, air filter, fan,

plow and injectors) and fixed hourly costs (net depreciation, depreciation, hourly depreciation and hourly

investment). The formulas for calculating these different costs are given in Table 2 [7, 8].

Table 2 : Cost calculation formula

N°	COST	FORMULA	UNIT
1	First year depreciation	$D_1 = 35\% \times P_a$	GNF
2	Second year depreciation	$D_2 = 30\% \times V_{r1}$	GNF
3	Third year depreciation	$D_3 = 20\% \times V_{r2}$	GNF
4	Fourth year depreciation	$D_4 = 10\% \times V_{r3}$	GNF
5	Fifth year depreciation	$D_5 = 5\% \times V_{r4}$	GNF
6	Hourly fuel charge	$C_{sp} = p \times q \times f_o$	GNF/h
7	Hourly engine oil charge	$F_h = P_u \times C_{sp}$ With $C_{sp} = p \times q \times f_o + (C/t)$	GNF/h
8	Hourly Tire Replacement Cost	$C_{hrep} = C_{rep}/T_p$	GNF/h
9	Hourly cost of oil filter replacement	$C_{hrefih} = C_{refih}/T_p$	GNF/h
10	Hourly cost of air filter replacement	$C_{hrefia} = C_{refia}/T_p$	GNF/h
11	Hourly cost of fan replacement	$C_{hrv} = C_{rev}/T_p$	GNF/h
12	Hourly cost of plow replacement	$C_{hrc} = C_{rec}/T_p$	GNF/h
13	Hourly cost of injector replacement	$C_{hri} = C_{rei}/T_p$	GNF/h
14	Special charges	$F_{sp} = C_{hrp} + C_{hrefih} + C_{hrefia} + C_{hrv} + C_{hrc} + C_{hri}$	GNF/h
15	Variable hourly fee	$F_{hv} = F_{hc} + F_h + F_{sp}$	GNF/h
16	Net depreciation value	$V_{na} = D_1 + D_2 + D_3 + D_4 + D_5$	GNF/h
17	Hourly cost of depreciation	$C_{hd} = (V_a - V_r - C_{rep})/T_{ta}$	GNF/h
18	Hourly depreciation cost	$C_{ah} = V_{na}/T_{ta}$	GNF/h
19	Hourly investment cost	$C_{ih} = V_{na} \times T_i / T_a$	GNF/h
20	Operator hourly cost	$C_{ho} = S_{so}/T_m$	GNF/ha
21	Hourly operating cost	$C_{hm} = F_{hf} + F_{hv} + C_{ho}$	GNF/ha
22	Unit operating cost price	$P_{ru} = C_{hm}/P_h$	GNF/ha

With :

P_a : Purchase price (26680000GNF) ; $V_{R1} = P_a - D_1$: Trade-in value of the first year ; $V_{R2} = V_{R1} - D_2$: Trade-in value from the second year ; $V_{R3} = V_{R2} - D_3$: Trade-in value of the third year ; $V_{R4} = V_{R3} - D_4$: Trade-in value of the fourth year ; $V_{R5} = V_{R4} - D_5$: Trade-in value of the fifth year ; P_u : Unit price (9000GNF); C_{sp} : Specific consumption ; f_o : Operation factor (0.95%); q : Consumption in liters per kW/h (0.03 for oil, 0.22 for diesel) ; P : Motor power (48 kW) ; C : Oil pan capacity (12 liters) ; T : Duration in hours between oil changes (15 days) ; C_{rep} : Tire replacement cost (44000000 GNF) ; T_p : Service life of equipment (5 years) ; C_{refih} : Oil filter replacement cost (70,000 FG); T_p : Service life of equipment (30 days); C_{refia} : Cost of replacing the air filter (1500000 GNF); T_p : equipment lifetime (3 years); C_{rev} : Fan replacement cost (800000 GNF) ; T_p : Service life of the equipment); C_{rec} : Replacement cost of the plow (4000000 GNF) ; C_{rei} : Cost of replacing injectors (2500000 GNF) ; V_{na} : Net value of the machine ; T_{ta} : Amortization period ; V_{ma} : Mean value of the machine ; T_i :

Investment rate ; T_a : Number of hours of use per year (2436 hrs/year) ; S_{so} : Operator's salary ; T_m : Number of hours per month ; P_h : Hourly production and C_{hm} : Hourly cost of the machine.

3. RESULT AND DISCUSSIONS

The depreciation value of the FIAT65-66 tractor being the recovery of the sum of the depreciations, this sum amounts to the amount of 183766504 GNF or (18376.6504 \$) during the five (5) years planned. At the end of the fifth year, based on the calculations, its recovery value is FG 83033496 per hectare (8303.3496 \$/ha) and its hourly operating cost amounts to GNF 250000 per hectare, i.e. (25 \$ /ha). The Guinean government had fixed the rental of tractors from 300000 GNF to 400000 GNF per hectare, i.e. (30 to 40 \$/ha). This amount is very insignificant, given that the repair factor during the operating time of any agricultural, mining or transport machine is 0.95% of the purchase price. Thus, on the basis of the results obtained, we recommend that the authorities of the agricultural sector

increase the rental of tractors from 800000 GNF to 1000000 GNF per hectare, i.e. (80 to 100 \$/ha), in order to be able to deal with any repairs and the purchase of spare parts [9].

4. CONCLUSION

At the end of research carried out at the Higher Agronomic and Veterinary Institute of Faranah, it emerges that it is not only the purchase of an agricultural machine, of mines or of transport that generates profit, but rather the good planning of the machine's operation, its maintenance, its upkeep and the choice of a competent and trained operator for the task. Added to this is the determination of the unit cost of operating the machine, in other words the hourly cost of operating the machine, which guides us better in our decisions.

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