COMPARATIVE ASSESSMENT OF FUEL CONSUMPTION RATE OF THE TRACTORS (FIAT – 666, MF – 185 AND STEYR – 8075)

BY

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MATRIC № 2003/14831EA

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November, 2008

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BEING A FINAL YEAR PROJECT SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE AWARD OF BACHELOR OF ENGINEERING (B.ENG) DEGREE IN AGRICULTURAL AND BIO-RESOURCES ENGINEERING, FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA

November, 2008.

CETIFICATION

This is to certify that this project titled, comparative assessment of fuel consumption rate of fiat – 666, mf – 185 and steyr – 8075 tractors was carried out by Mohammed Alfa with Matric.No 2003/ 1483 IEA, under the supervision of ENG. PETER IDAH of the Department of Agricultural and Bioresources Engineering, School of Engineering and Enginnering Technology, Federal University of Technology Minna.

ENGR. PETER IDAH — 15/12/08 Date

Project supervisor

Dr.Mrs Z.D. Osunde — 2/12/2008 Date

Head of Department

External Examiner — 18/4 Date

DEDICATION

I dedicate this project work to Almighty Allah (S.W.T.) and all the messengers (P.B.H.T).

ACKNOWLEDGEMENT

My sincere thanks and glory goes to almighty Allah (S.W.T) for giving me the strength, courage and perseverance especially, through out the period of my academic pursue and more importantly, in writing this project work.

I acknowledge with profound gratitude, for the kindness and able assistance offered to me by my supervisor, ENGR. PETER IDAH and my humble H.O.D Dr. Z.D. Osunde for there untiring effort in going through this research study and making necessary corrections and supplying relevant informations which would have been left out, that made this project a reality today.

I also give my acknowledgement to all my lecturers, in the department and also in the university at large, who have impacted knowledge on me and contributed immensely towards achieving my Bachelor Degree in Engineering (B.ENG), may Almighty Allah reward all of them abundantly.

My special appreciation also goes to my parent, my wife (AISHA ALFA) and friends for there prayers and support towards achieving my desire goal.

May Almighty Allah (S.W.T.) help you all and have mercy on you all (Amen).

DECLARATION

I here by declare that this work is an original work of mine and has never been presented else where for the award of certificate. Information deprived from publish and unpublished work of others have been acknowledged in this text.

.....

Student signature

Date .....

The above declaration is confirmed

.....

ENG'R PETER IDAH

DATE.....

CHAPTER FOUR

4.0 Results And Discussions

4.1 The table (4.1) below shows the results obtained from the experiment conducted. The Table shows the fuel consumption rate of the different tractors and their speed (Km/h), moisture content.

Table 4.1:- Fuel Consumption Rate of The Different Tractors.

Replications	Speed (km/h)	Fuel consumption Rate(l/h)			% moisture content
		Fiat-666	MF-185	Steyr-8075	
R1	2.5	1.0	1.20	7.00	19.3
R2	2.70	1.1	1.25	7.03	17.8
R3	2.72	1.7	1.30	7.08	91.3
R4	2.84	1.8	1.35	7.10	29.7
R5	2.88	2.0	1.20	6.50	39.9
Mean	2.74	1.52	1.26	6.90	39.6

APPENDIX

1. Total time spent = 15.40min = hr.

(1) Speed (km/h) = $\frac{\text{length of plough (m)}}{1000} \times \frac{60}{\text{Time taken (min)}}$

R1 = $\frac{155}{1000} \times \frac{60}{3.02}$ = 2.88 KM/H

R2 = $\frac{155}{1000} \times \frac{60}{3.40}$ = 2.56 KM/H

R3 = $\frac{155}{1000} \times \frac{60}{3.20}$ = 2.84 KM/H

R4 = $\frac{155}{1000} \times \frac{60}{3.20}$ = 2.72 KM/H

R5 = $\frac{155}{1000} \times \frac{60}{3.22}$ = 2.70 KM/H

2. Determination of soil moisture content of test soil.

Moisture content = $\frac{\text{weight of wet soil (g)} - \text{weight of dry soil (g)}}{\text{Weight of wet soil (g)}} \times 100$

Soil sample 1 = $\frac{200.6 - 210.4}{260.6} \times 100$ = 19.3%

Soil Sample 2 = $\frac{280.5}{280.5} \times 100$ = 17.8%

Soil sample 3 = $\frac{295.4 - 205.7}{295.4} \times 100$ = 91.3 %

Soil sample 4 $= \frac{320.00 - 225.1}{320.50} \times 100 = 29.7\%$

Soil sample 5 $= \frac{350.50 - 210.5}{350.50} \times 100 = 39.9\%$

Soil sample 6 $= \frac{395.6 - 223.4}{395.6} \times 100 = 43.5\%$

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4.2 DISCUSSION

The Table (4.1) above shows the fuel consumption rate of the different tractors and the speed at which the replications were carried out. It indicated that increase in speed of operation resulted in increasing the fuel consumption rates of the tractors. From the Table (4.1) Fiat – 666 tractors. From the Table (4.1) Fiat – 666 tractor consumed about 1.52L/h while Mf-185 and Steyr-8075 consumed about 1.26 and 6.9L/h respectively. This results shows that, Steyr – 8075 tractors has the highest fuel consumption rate when compared to the other two tractors.

It was actually observed from the results obtained that, the fuel consumed by Mf-185 tractor was actually the lowest or minimal and from this observation we can say that, Mf-185 and Fiat-666 tractors are more economical than Steyr – 8075 tractors

4.3 Conclusion

From the results obtained in this experiments, it can generally be concluded that, the Fiat-666 and Mf-185 Tractors can be considered as most Fuel on Idle operation. While Steyr-8075 can be considered as less fuel economic when compared to the other two tractors.

It can also be concluded that the difference in their diesel fuel consumption was due to variation in different engine type model, engine design, speed of operation and the soil working conditions (soil structure, soil texture).

So also, it was understood that, as the age of the tractor, depth of cuts, width of cut increases, the fuel consumption rate also increases.

4.4 Recommendation

It is recommended that, the tractor users should always use Fiat - 666 tractor and Mf – 185 tractor for carrying out ploughing operations. This is because they are less fuel economical than Steyr-8075 tractor.

It is also, recommended that the fuel system of the tractors and the age, speed should always be taking into consideration before using them for ploughing operation. This is because they have significant effects on the fuel consumption rate of the tractors.

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CHAPTER FOUR

CHAPTER ONE

1.0 Introduction

Fuel consumption of farm tractor is governed by the amount of energy demanded at the drawbar or through the power take –off. With the increasing use of farm machinery, farm tractor paly an important role in enhancing the agriculturally productivity. The fuel consumption of tractor constitutes major portion of tractor operating cost and this is usually neglected by commercial farmers.

Diesel consumption of tractors depends on the age of tractor, annual usage and maintenance. However most farmers do not take this aspect of cost seriously thus, making it difficult to estimate annual operating cost and fuel budgeting for a particular operation.

In tractor, the ability of an engine to convert fuel into useful work varies with engine type, design, speed and loading.

This variation is more readily appreciated in terms of annual expenditure on fuel for farm tractors with similar power rating. Diesel fuel consumption of tractor is often determine along with power measurement. This is done by measuring the rate which the fuel is released to the engine.

When the fuel consumed by the tractor is measured in volume, the consumption units are litre/kw hour that is measured fuel consumption in litre

per kilo watt hour (L/KWhrs), and if measured by mass, the consumption units are kg/kw hour.

In economic evaluation of tractors operation in Nigeria, tractor values depreciate with age, which invariably affects the rate of fuel consumption by the tractors. Among the variable factors that are directly proportional to the tractor usage and which influence on fuel consumption by the tractors are: speed of operation, depth of cut, width of cut, soil conditions (soil moisture, texture and structure) and the tractors operator's skill.

1.1 Objectives of the study

The objectives of the study is:

1. To compare the rate of fuel consumption of three makes of tractors (Marseyfergusson (MF)-185, Fiat 666 and Steyr-8075 tractor).
2. To estimate precisely the amount and/or range of fuel used in litre/hour or litre/hectare on a typical farm operation.
3. To estimate the cost of operation as far as fuel is concerned during such operations

1.2 Justification of the study

One major problem facing farmers and tractor operators is estimating cost of operation on the field and hence the entire budget of farm operation. comparative assessment of fuel consumption by different tractors can greatly provide such information.

Such comparative assessment can help the farmers in selecting tractors that will give optimum performance under field operations.

CHAPTER TWO

2.0 Literature Review

In most mechanized farms economic management of power and machinery (tractors) is often over looked as a factor in farm profits, yet it is one of the almost significant factors. Many mechanized farms operate at losses and the farmers find it very difficult to identify factors which lead to these losses. Even, many of them can not state with degree of accuracy, the total annual cost of operating especially fuel equipment in preparing farm budget to ensure timeliness of field operation.

Research has shown that both fixed costs and variable costs contributed to farmers' losses and among theses costs of tractor operation, that f fuel is a major item which is a direct out of pocket expenses on the part of the farmers.

Igbeka (1986) investigated the economics evaluation of tillage in some mechanized farms in Nigeria using questionnaires and unexpected random visits to the sites. The results revealed that out of the variable costs affecting the farm economy fuel had greater share and it is directly affected in the machine machines usage. The author concluded that cost of ploughing was highest, while that of ridging was marginally higher than that of harrowing. The results were linked to the rate of fuel consumption and the implemented weight.

Bhattachanga (1981), carried out a research study on standardizing tractor

field test with matching implement namely: three bottom mould board plough, mounted/trailed disk harrow and a 9 – tine cultivator. The ploughing operation was carried out on a soil with moisture range of 6 to 14%. It was concluded that the drawbar specific fuel consumption of the tractor was 1.22 to 157l/h unit for ploughing, 1.07 to 1.76 l/h for harrowing and 1.32 to 2.29 l/h for cultivation operation.

Frisby and summer (1979) carried out a study on energy related data for selected implements using a john deere 2630 diesel tractor. It was discovered that a three bottom mould board plough which has a 1.07cm width of cut and 20.5cm depth of cut at operating speed of 5.95km/h on loamy soil consumed 20.62L/h. the random disk harrow having width of cut at speed of 6.14km/h on loamy soil consumed 23.62uh.

Shetton et at (1979) studied the farm fuel use in Nebraska and found that the mean diesel fuel consumed for pluoghing was 17.49L/ha; disking 7.39L/ha; and for harrowing 552L/ha

Bukhari and Baloch (1982) carried out a study on determination of fuel consumption of tillage implements. The authors found that the mould board plough consumed less fuel when operating on hard soil at almost the same speed of operation. Mould board plough proved to be more economical than disk plough on soft at almost the same speed of operation while disk plough

gave better performance on hard soil than the mould board plough at reasonable higher speed of operation. The results also show that the work rate of the disk harrow was much faster than the mould board plough and dsik plough on both soils.

The authors concluded that it would be better to operate the mould board plough and disk harrow combination on soft soil and disk harrow on hard soil.

Ancheta and Bautista conducted a test on work capacities and fuel consumption of hand tractor manufactured in the Philippines. Results shows that the actual pluoghing capacity ranged from 0.098ha/h to 0.25ha/h with an average of 0.14ha/h and field efficiencies ranged from 53.6 to 94.4% with an average of 83.6%. six of the hand tractor tested were gasoline –fed and the average fuel consumption of 1.89L/hp. The four diesel fed hand tractors had an average fuel consumption of 1.22l/hp.

The authors concluded that the hand tractors with diesel engines have lower fuel consumption rate.

In a survey conducted by Johnson as reported by Ancheta and Bautista (1986) on the performance and economies of small equipments in the Philippines, results showed an average fuel consumption of 15.3L/ha and an average actual field capacity of 12.9h/ha (0.08ha/h) for ploughing operation.

Ancheta and Buatista (1986) also reported on the study carried out by

Orcino on the economic aspects of imported hand tractors and ownership in Philippines. It is reported that data on the fuel and oil consumption costs were based mostly on the recollections and estimates of the respondents as none of them made records of machine and labour performance. The study showed that the actual field capacity of the machine (ploughing and harrowing) was 44.1h/ha and 0.02ha. Respectively and an average fuel consumption of 1.18L/h, was recorded.

In test conducted by AMTECT on a front related power – drive type tractor it was reported (Ancheter & Bautista 1986) that pudding work out put was 16.7h/ha. The average fuel consumption was 1.04L/ha.

Kasmi and Ahmad (1996) developed mathematical models for diesel consumption of farm tractors in Allahabad district India using Hmtzetor-2511, Escort 335, Massey Fergusson - 1035 and international B-275. It was concluded that all the models for different makes of tractor are adequate at 5% level significance between age of tractor and diesel consumption.

As the age of this tractor increases, the diesel consumption increases. Ajade and Babatunde (1998) developed a model for fuel consumption rate of tractors during tillage operations using two wheel drive tractor with a 2 bottom disc plough. The authors found that the speed, width and depth of cut have significant effects on fuel consumption of the tractor during the ploughing operation. Increase in speed and width of cut during ploughing

significantly increased fuel consumption of tractors. The model equation for estimating fuel consumption for ploughing operation is simple to use as it depends on a predetermined area and rate of work.

Brain (1988) stated that the amount of fuel consumption of a tractor is govern med by the amount of energy demanded at the drawbar or through the power take off, and even for ploughing, the fuel consumption is only two thirds of the fuel consumption for peak power. It was concluded that the required fuel for, ploughing is 15L/ha, and heavy and light cultivation are 13L/ha and 8L/ha respectively.

CHAPTER THREE

3.0 Materials And Methods

3.1 Materials And Equipment

The following listed materials and equipment were used in order to successfully carried out this experiment and their full description are given below.

1. Steyr - 8075 tractor.
2. Massey Ferguson (MF) - 185 tractor.
3. Fiat-666 tractor.
4. Disc plough
5. Diesel fuel.
6. Fuel flow meter.
7. Stop watch.
8. Scale rule and meter rule.
9. Electronic weighing balance.
10. Air circulated oven.

3.2 Measurement of Speed Of Operation

The particular speed of the given operation was actually determined by the time taken for the given tractor to travel through a given length (m). This is given as the ratio of the distance traveled in (m) to time taken in (minutes).

3.3 Experimental Procedure

The following three makes of tractors, Massey Ferguson (MF) - 185, Fiat - 666 and Steyr - 8075 respectively were used to carry out the experiment at idle operation. A field operation was carried out using Fiat - 666 tractor mounted MF - 3 - bottom disc plough. The site of this particular experiment was located in Federal Polytechnic Bida, 6 soil samples were actually collected in order to determine the moisture content of the given soil by oven dry method. In this process, a fuel flow meter which is calibrated in litres served as tractor's fuel supply tank. This particular fuel meter was mounted on the tractor and connected directly through fuel supply line into the tractor's fuel lifting pump while the remaining line (return line) was connected to the injector/atomizer to return the excess fuel to the fuel flow meter. During the experiment, three replications at 30min were successfully carried out for each tractor at an idle operation, the time taken during this process was recorded in minutes using the

stop watch and the mean fuel consumed for each tractor was found in litre per (L/h).

In the field operation, (ploughing operation), six (6) test of 155mm field length were performed with slightly varying the particular tractor's speed.

Finally, for each replication, the time taken was recorded in minutes and also five (5) different depth of cut "cm" and width of cut "cm" were actually determined with the help of meter rule and scale rule respectively.

The average values was determined, the time taken per each trip during the operation was used to determined the tractor's speed in (Km/h) and the fuel used was read directly from the fuel flow meter (L/min) then calculated to the fuel consumed in (L/h).