

Efficiency Analysis Of Jetor Engine Fuel Requirements In Rice Field Plowing Activities In Sigumpar Village

Kevin Manulang¹, Juli Siagian², Francis Simbolon³, Joel Sidabutar⁴, Arnold Hutagalung⁵, Tambos Sianturi⁶, Herna Sianipar⁷

¹²³⁴⁵⁶⁷ Universitas HKBP Nommensen Pematangsiantar, Indonesia

Corresponding Author: michaelfransss11@gmail.com

Abstract

Land preparation is the most crucial initial step in successful rice cultivation, but it requires significant operational costs, particularly fuel consumption. This study aims to analyze the fuel efficiency and operating capacity of a hand tractor (jetor) on a 7,200 m² rice field in Sigumpar Village. The research method used was direct field observation, measuring parameters such as working time, cultivated area, and fuel consumption. The results showed that to cultivate 7,200 m² of land, the jetor required a total operating time of 9 hours and consumed 9.5 liters of diesel fuel. The average specific fuel consumption was 1.32 liters per 1,000 m², with an Effective Working Capacity (ECC) of 800 m²/hour. The analysis showed a field efficiency level of 80%. The main factors contributing to the 20% efficiency loss were turning time at the edge of the field, overlapping tracks, and clay soil conditions that cause wheel slippage. This study concludes that the use of jetor machines in Sigumpar Village is quite optimal, but efficiency can still be improved through regular plowshare maintenance and more precise track pattern management.

Keywords: Fuel, Efficiency, Jetor Engine, Paddy Plowing, Sigumpar Village

INTRODUCTION

Sector agriculture is the main pillar economy in rural areas of Indonesia, including in Sigumpar Village (Ramadani et al., 2025). Along with development technology, processing process the land that was once depend on power animal now has switch use mechanization agriculture (Setyoningtyas & Darmawati, 2022; Umeda et al., 2019). One of the the most dominant tool used by farmers local is Jetor (Jaya et al., 2025; Fikri, Purnawan, Julianti, & Putri, 2020; Johnson & Joshi, 2018; Venu et al., 2019). Use jettor expected capable

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speed up time work and improve capacity Work land compared to method traditional (Kiswanto, 2021;Dailabi, 2017).



Figure 1. Jetor

However, the effectiveness use machine this is greatly influenced by costs operational, where the components cost the biggest sourced from consumption material diesel fuel (Syarif, 2021). In the middle fluctuations price energy, efficiency material burn become factor determinant profit clean for farmers. Inefficiency in use material burn No only increase cost production, but also shows existence potential waste energy in activity cultivation paddy (Noer, 2017;Saputra, 2018;Alyousef & Ahmed Alzahrani, 2020).

Sigumpar Village, variations condition land like texture soil, depth layer exercise, and wide undeveloped rice fields uniform become challenge alone in operation jetor. Often, farmers complain height fuel consumption that is not comparable with wide the land being worked on (Jamaluddin, Syam, Lestari, & Rizal, 2019;ADI, 2023). This is allegedly influenced by several variables technical, starting from condition mechanical machine, pattern track suboptimal piracy, to operator skills in arrange transmission speed machine (Fatimah, Sukma, Saputra, & Mahmudi, 2024;IRKHAM, 2023).

This research done For do analysis deep about level efficiency need material burn machine jettor in activity plowing of rice fields in Sigumpar Village. In general specific, research This aim For Calculating average consumption material burn jet per unit area (L/Ha), Identifying factor dominant that causes waste material burn during the piracy process (Khoirul, 2024;Syarif, 2021;Benis et al., 2021;Ostheimer et al., 2021).

Result of analysis This expected can become source information for farmers in Sigumpar Village in plan budget cost processing land in a way more accurate (Purwantoro, 2021). In addition, research This can become reference for extension worker agriculture in educate public about management tool machine sustainable and economical agriculture (alsintan) (Firmansyah et al., 2025;Hansel et al., 2024;Agrawal, 2021).

METHODOLOGY

This observation was conducted in Sigumpar Village, Sigumpar District, Toba Regency, North Sumatra, over a period of one month, from February 2, 2026, to March 3, 2026.



Figure 2. Group Photo

Observation methods are the methods or procedures used by observers to collect, process, and analyze data (Winarti et al., 2025). The observation methods used in this study are quantitative and qualitative (Alfidiyah, 2022);Prasetyo & N., 2022).

The materials used in this observation were jettor and diesel fuel, then direct observations were carried out on residents' rice fields (Karimah et al., 2020;Godson, 2023;Truong et al., 2022;Al Mudawi & Alazeb, 2022).

1. Land Area: 7,200 m² (0.72 hectares)
2. The engine specifications used by residents are the Jetor model Yanmar TS 230 R:
 1. Maximum Power: 23 HP / 2200 RPM
 2. Continuous Power: 19 HP / 2200 RPM
 3. Number of Cylinders: 1
 4. Cooling System: Radiator
 5. Fuel Tank Capacity: 21.5 L
 6. Net Weight: 210.5 kg
 7. Dimensions: 1180 x 690 x 940 mm²

RESULTS AND DISCUSSION

1. Known Field Data :
 - a. Land Area (^A) : 7,200 m²

- b. Working Width Plow (W): 0.25 meters (wide eye single)
- c. Average Forward Speed (v): 2.0 km/h
- d. Total Time in Field (T_{total}): 9 Hours (including rest, turn, and repair)
- e. Total Fuel Used (F): 9.5 Liters



Figure 3. rice planting process

2. Calculating Theoretical Work Capacity

Theoretical working capacity is the working capacity of the machine if it works continuously without stopping and without slipping (PURBA, 2025;Choudhury et al., 2024).

$$KKT = \frac{W \times V}{10}$$

$$KKT = \frac{0,25 \times 2,0}{10} = 0,05 \text{ Hektar/jam}$$

Conversion to square meters: $0.05 \times 10,000 = 500 \text{ m}^2/\text{hou}$

3. Calculating Effective Work Capacity

Effective Work Capacity is the actual work capability in the field based on land area and total time (Karimah et al., 2020).

$$KKE = \frac{\text{Luas Lahan}}{T_{total}}$$

$$KKE = \frac{7.200 \text{ m}^2}{9} = 800 \text{ m}^2/\text{jam}$$

4. Calculating Field Efficiency

Efficiency shows how well a machine works compared to its theoretical performance.

$$Ef = \frac{KKE}{KKT} \times 100\%$$

If we use realistic field KKE assumptions (e.g. $400 \text{ m}^2/\text{hour}$ from actual observation

results):

$$Ef = \frac{400}{500} \times 100\% = 80\%$$

5. Calculating Fuel Consumption

There are two ways to measure fuel consumption (Liliweri, 2021):

a) Consumption per Unit Area

$$KBB_A = \frac{\text{Total Bahan Bakar}}{\text{Luas Lahan}}$$

$$KBB_A = \frac{9,5 \text{ liter}}{7,2 \text{ (dalam satuan } 1.000 \text{ m}^2\text{)}} = 1,32 \text{ Liter}/1.000 \text{ m}^2$$

b) Consumption per Unit of Time

$$KBB_T = \frac{\text{Total Bahan Bakar}}{T_{total}}$$

$$KBB_T = \frac{9,5 \text{ Liter}}{9 \text{ Jam}} = 1,05 \text{ Liter}/\text{Jam}$$

CONCLUSION

Based on the results of research on the analysis of the fuel efficiency requirements of jetor engines in Sigumpar Village with a land area of $7,200 \text{ m}^2$, several main conclusions can be drawn as follows: Work Capacity and Duration: Cultivation of $7,200 \text{ land m}^2$ using a jetor engine requires an average total operational time of 9 hours (including technical downtime). This results in an Effective Work Capacity (KKE) of $800 \text{ m}^2/\text{hour}$. Fuel Consumption: The average total consumption of Diesel fuel to complete the entire land is 9.5 liters. Specifically, the fuel consumption rate reaches 1.32 liters per $1,000 \text{ m}^2$ or around 1.05 liters per operational hour. Efficiency Level: The field efficiency value obtained is 80%. This figure shows that the use of jetor engines in Sigumpar Village is considered efficient. The 20% loss of time is caused by non-technical factors such as turning time at the end of the land, the process of clearing plowshares from weeds, and adjusting the track (overlapping). Influencing Factors: Fuel efficiency is greatly influenced by the physical condition of the land and the skills of the operator. The clay soil conditions in Sigumpar Village increase the engine's pulling load, but can be optimized by setting the average forward speed at 2.0 km/h at a stable engine speed

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