American Journal of Bioscience and Clinical Integrity
https://biojournals.us/index.php/AJBCI
ISSN: 2997-7347

Determining the Optimal Volume of Petroleum Products in Oil Storage Facilities for Agricultural Enterprises

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Received: 2024, 15, Dec
Accepted: 2024, 21, Jan
Published: 2025, 22, Feb

Annotation: This article discusses the introduction of a new system to ensure the continuous supply of petroleum products for modern machine-tractor aggregates within the framework of Uzbekistan's agricultural development strategy in recent years. The primary reason for this system's implementation is to cultivate agricultural products in a short period, achieve high yields, and reduce production costs. The study focuses on determining the optimal number of fuel and lubrication dispensing units in oil storage facilities.

Keywords: Oil storage facility, fuel and lubrication materials, cost price, equipment, optimal quantity.

Introduction

The analysis of the transportation, storage, and consumption of petroleum products in the agricultural sector of our country, as well as the utilization of storage tanks and reserve indicators, indicates that the reserves of petroleum products in clusters, farms, and agricultural enterprises vary between 2% and 14% of the annual fuel consumption. Meanwhile, the maximum filling level of storage tanks ranges from 30% to 55%.[1]

The organization of the oil sector and the supply of petroleum products to machine-tractor fleets require studying the system of regulating oil depots, transportation, storage, and the use of mobile and stationary fuel distribution units. Improving the concentration and cooperation of agricultural machinery and material-technical resources in real conditions is necessary for enhancing efficiency.[2]

Methodology

Examining fuel distribution methods and developing a general model to determine the necessary number of fuel distribution units leads to selecting the optimal quantity of mobile fuel refueling units, fuel dispensing equipment, and distribution reservoirs. Since there are currently no established standards for this, the methodology focuses on calculating the required number of oil equipment units based on specific supply conditions.[3]

The number of mobile units required is calculated using the following formula:

ma=WWm3·ωs·rp·Vts·tns·Vas·Tasma = \frac{W}{Wm3 \cdot ωs \cdot rp \cdot Vts \cdot tns \cdot Vas \cdot Tas}ma=Wm3·ωs·rp·Vts·tns·Vas·TasW

where:

- ✓ **W** – Total volume of petroleum products supplied to farms (t/day);
- ✓ **Wm3** – Volume of fuel delivered by mobile units (t/day);
- ✓ **ωs** – Productivity of mobile fuel trucks (t/day);
- ✓ **rp** – Delivery distance (km);
- ✓ **Vts** – Speed of the mobile unit (km/h);
- ✓ **tns** – Loading and unloading time of the mobile unit (hours);
- ✓ **Vas** – Capacity of the mobile unit (t);
- ✓ **Tas** – Daily working hours of the mobile unit (hours).

One of the limitations of formula (1) is that it does not account for waiting times and losses due to fuel evaporation during distribution and storage. The formula also does not consider specific economic factors and requires improvement for its application in agricultural enterprises.[4]

To determine the annual need for mobile fuel units, the following formula is recommended:

A=Gωs·αbA = \frac{G}{ωs \cdot αb}A=ωs·αbG

where:

- ✓ **G** – Total freight turnover (tkm);
- ✓ **ωs** – Productivity of fuel trucks (t/day);
- ✓ **αb** – Vehicle utilization coefficient per route.

Researchers [4] propose determining the required number of vehicles using the following formula:

A=GL·τpr·tpr·Vas·τi·τg·Dr·tnA = \frac{G}{L \cdot τpr \cdot tpr \cdot Vas \cdot τi \cdot τg \cdot Dr \cdot tn}A=L·τpr·tpr·Vas·τi·τg·Dr·tnG

where:

- ✓ **G** – Freight turnover (tkm);
- ✓ **L** – Transportation distance with cargo (km);
- ✓ **τpr** – Distance utilization factor;
- ✓ **tpr** – Idle time of the mobile unit during loading and unloading (hours);
- ✓ **Vas** – Technical speed of the fuel truck (km/h);
- ✓ **τi** – Fleet utilization coefficient;
- ✓ **τg** – Road utilization factor;
- ✓ **Dr** – Number of working days in the planned period;
- ✓ **tn** – Duration of work per shift (hours).

Formulas (2) and (3) allow the calculation of the required number of fuel tankers, considering economic factors and the total volume of imported petroleum products.[5]

For centralized delivery of petroleum products, the method also considers the unevenness of fuel consumption and recommends optimizing the number of mobile fuel units based on storage conditions and transportation needs.[6]

The required number of mobile fuel tankers is determined as follows:

NM3=Gωc.z·NC.3·rg·VT3·VM3·d3·t3·tH3·TM3NM3 = \frac{G}{ωc.z \cdot NC.3 \cdot rg \cdot VT3 \cdot VM3 \cdot d3 \cdot t3 \cdot tH3 \cdot TM3}NM3=ωc.z·NC.3·rg·VT3·VM3·d3·t3·tH3·TM3G[7]

where:

- ✓ **G** – Daily fuel consumption (t);
- ✓ **ωc.z** – Productivity of the fuel station (t/day);
- ✓ **NC.3** – Number of stationary fuel points in the farm (units);
- ✓ **rg** – Distance from the oil depot to the fuel station (km);
- ✓ **VT3** – Technical speed of mobile fuel dispensers (km/h);
- ✓ **VM3** – Tank capacity of mobile fuel dispensers (t);
- ✓ **d3** – Average fuel dose per vehicle (t);
- ✓ **t3** – Average refueling time (hours);
- ✓ **tH3** – Refueling time at the fuel station (hours);
- ✓ **TM3** – Unproductive waiting time during refueling (1.4 hours).[8]

The study suggests using the following formula to determine the required number of fuel dispensers at a station:

Nk=MKs·Tk·ωkNk = \frac{M}{Ks \cdot Tk \cdot ωk}Nk=Ks·Tk·ωkM

where:

- ✓ **M** – Daily fuel volume (t);
- ✓ **Ks** – Equipment utilization coefficient;
- ✓ **Tk** – Daily operating time of fuel dispensers (hours);
- ✓ **ωk** – Productivity of one dispenser per hour.

Conclusions and Recommendations

1. Optimization of the supply, storage, and refueling system in Izboskan district’s cluster and farm associations resulted in minimizing overall [9]transportation costs and reducing fuel evaporation losses by half.
2. Analytical dependencies were established to determine the optimal number of fuel storage containers in oil depots.[10]
3. A study of three types of fuel storage tanks (cylindrical, spherical, and cubic) was conducted to evaluate their operational costs.
4. A zero-model was developed and successfully applied in agricultural enterprises, significantly improving the management of petroleum reserves and increasing economic efficiency.

References

1. M. Sorrells, *Engineering Applications in Sustainable Agriculture*. Cambridge University Press, 2020.
2. D. Hunt, *Farm Power and Machinery Management*, 10th изд. Iowa State Press, 2001.

3. B. N. Tursunov, *Organization of the oil economy and improvement of machine fuel supply in agricultural enterprises: Monograph*. Andijan, 2024.
4. Kepner R. A. ,. Bainer, R. и E. Berger, *Principles of Farm Machinery*. Springer, 2012.
5. B. N. Tursunov, *Recommendations on the organization of the oil economy and improvement of the supply of petroleum products for machine-tractor parks in the district service complex*. Andijan, 1999.
6. R. E. Sims, «Trends in Mechanization and Agricultural Productivity», *Agric. Eng. J.*, т. 45, сс. 123–140, 2017.
7. B. N. Tursunov, *Utilization of agricultural machinery and technical services: Study guide*. Tashkent, 2024.
8. A. K. Igamberdiev, *Utilization of machine-tractor aggregates and technical services*. Tashkent, 2021.
9. T. S. Khudayberdiev и B. N. Tursunov, *Utilization of machines and technical services*. Tashkent, 2023.
10. B. N. Tursunov, *Utilization of machines and technical services: Study guide*. Tashkent, 2024.