EE&AE
2025 10th International Conference
on Energy Efficiency and Agricultural Engineering
5-7 November 2025, Starozagorski Bani, Bulgaria
IEEE

Operational studies of a soil-protecting machine-tractor unit for soil loosening

Petar Dimitrov, Hristo Beloev, Kaloyan Stoyanov, Atanas Atanasov, Todor Delikostov, Evgeni Enchev, Vladimir Donev

University of Ruse "Angel Kanchev", kes@uni-ruse.bg

GOAL OF THE STUDY

The objective of the present study is to examine the procedure for conducting an operational evaluation of the newly configured machine-tractor unit, consisting of the John Deere 8R280 tractor and the Maschio-Gaspardo Artiglio 300/7 subsoiler-loosener, as well as to analyze the results obtained for its main operational parameters during field operation under specific soil and terrain conditions.

METHODOLOGY OF THE INVESTIGATION

The study used a method of timed observations and control shifts, approved by standard methodology in the Republic of Bulgaria.

MAIN RESULTS FROM THE STUDY

These data indicate that the tested soil-protecting machine-tractor unit Fig.1., operates normally within the specified agronomic timeframes and under typical soil, climatic, and terrain conditions. The unit performs soil loosening at a depth of 0.40 m, with a speed of 10.08 km.h^{-1}, achieving a normal operational productivity of 26.50 da.h^{-1}. The obtained coefficients of technological and technical reliability range from 1.0 to 0.99, which meet the technical requirements and demonstrate that the machine-tractor unit is reliable in operation. Fuel consumption is 1.620 kg.da^{-1}.

Fig. 1. Machine-tractor unit - tractor "John Deere 8R280" and subsoiler-cultivator "Maschio-Gaspardo", model "Artiglio 300/7"

Table 1. Indicators for the operation of the machine-tractor unit for loosening the soil, as a basic tillage, with a machine-tractor unit - tractor "John Deere 8R280" and cultivator "Maschio-Gaspardo", model "Artiglio 300/7"

№	Indicators	Symbols	Values
1	Technological reliability coefficient	K_{41}	1.0
2	Technical reliability coefficient	K_{42}	0.99
3	Productivity per 1 hour of effective working time, da.h^{-1}	W_{02}	30.24
4	Productivity per 1 hour of operational time, da.h^{-1}	W_{07}	26.50
5	Fuel consumption, kg.da^{-1}	Hr	1.620

PLACE OF THE EXPERIMENTS

The operational studies were carried out using a standardized and approved methodology developed in Bulgaria. They were conducted during the period November 7 - 9, 2023, in the land of the town of Kubrat, Razgrad district, on flat areas - a field with stubble, before main tillage. The location of the work area is indicated in the image (Fig 2), with coordinates 43.806902, 26.458568.

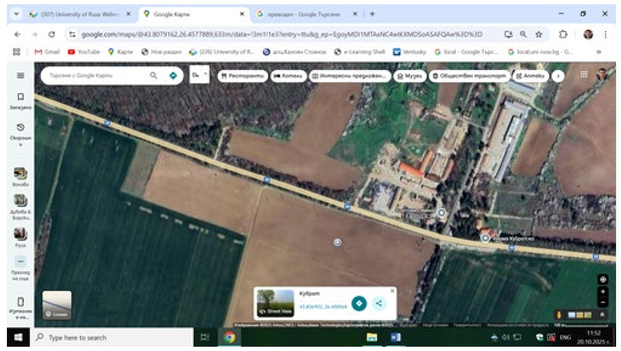

Fig. 2. Image of the working area of the experiment

CONCLUSIONS

Based on the conducted operational studies, the following conclusion can be drawn:

- The machine-tractor unit used in the Republic of Bulgaria — consisting of the John Deere 8R280 tractor and the Maschio-Gaspardo Artiglio 300/7 subsoiler-loosener, performing soil loosening as a primary tillage operation is reliable in operation and ensures the timely execution of the corresponding technological process. It achieves a normal operational productivity of 26.50 da.h^{-1} at a unit speed of 10.08 km.h^{-1}, with coefficients of technological and technical reliability ranging from 1.0 to 0.99, and a fuel consumption of 1.620 kg.da^{-1}, under conditions of carbonate chernozem soil on agricultural lands.
- The results obtained from this study, their analysis and the can be used in future comparative experiments with similar soil tillage machine-tractor aggregates.

ACKNOWLEDGMENT

This study is financed by the European Union-NextGenerationEU, through the National Recovery and Resilience Plan of the Republic of Bulgaria, project № BG-RRP-2.013-0001-C01.