**A Method for Energy Efficiency Rating of Low-power Tractors Based Also on Intensity of Use**

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**Abstract.** The efficiency of the so-called “low-power tractors” is affected not only by their engine and transmission design evolution but also by the usage modes adopted. Especially in specialized crops, such as vineyards and orchards, many tasks do not require high engine power and traction pull. The entire tractor power could be often engaged to the hydraulic system. A customizable method to analyze and evaluate the real efficiency of narrow tractors (N-TRE) have been developed in 2019, taking into account different tractor models working in different scenarios. These scenarios have been characterized in working activity and intensity of usage, along the growing season. The working conditions and the power requirement of the main operations carried out in viticulture were considered on some narrow tractor models, simulated in a stationary mode using electromagnetic dynamometers, integrated with devices for measuring the fuel consumption. The basic output has been a series of engine performance curves (power, torque and Specific Fuel Consumption, SFC), both at full and partial loads. On these curves, some characteristic working points were identified, simulating the typical tractor running conditions in vineyard. The aim of this study is to validate the N-TRE model by testing its robustness with a increasing number of tractors, to build a suitable database, to classify the machines in some efficiency classes identified with letters from A to G, similarly to what happens for example in several electric and electronic household appliances. Furthermore, for each tractor the classes A-G were considered also in relation to the intensity of use (light, medium, heavy), i.e. the power engagement and the working time. The output has been a sort of “alphabetical code” based on 3 letters for each tractor model. These codes could immediately and easily show a comprehensive efficiency in different operating scenarios. Moreover, the codes should be added with a tag in “traffic light” colours (green, yellow and red) to indicate at a glance both the gaseous pollutant emissions level and the environmental efficiency.

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| --- | --- | --- |
| Tractor model | Scenario | Colour codes |
| light  | medium  | heavy  |
| 1 | C | B | A |  |
| 2 | G | D | C |  |
| … | .. | .. | .. | … |
| *n* | *F* | *D* | *B* |  |

*An example of colour codes related to the tractors’ efficiency in different scenarios.*