

Effect of turbo charger system on engine fuel consumption and tractor power and traction (ITM475, ITM485 and ITM800)

Kh. PashaiHulasu¹- B. Mohammadi-Alasti^{2*}- M. A. Haddad Derafshi³- M. Abbasgholipour⁴

Received: 22-11-2013

Accepted: 25-01-2014

Introduction: Tractors are considered as the main power generators in mechanized agriculture. Hence, the experts and engineers in tractor manufacturing of the country, are required to focus on developing and designing new features in tractor manufacturing. This must be, of course, paralleled with the economic aspects. Achieving this goal, Iran Tractor Manufactories Co., (ITMCO) has designed and developed tractors equipped with turbochargers. This has been performed on ITM800 & ITM485 models, according to world standards. The turbocharger system, with harnessing of lost energy in engine output fumes, compresses the air entering the engine and more air enters the cylinder. This will cause the engine to burn fuel more efficiently and thus produce more power.

Materials and Methods: This study has been carried out on ITM485 & ITM800 tractors (with turbocharger system) and ITM285 & ITM475 tractors (without turbocharger system) to assure the improvement of engine performance and compare them employing OECD world standards. Experiments were performed in the concrete runway of Tabriz Tractor Manufacturing Company. For experiments, a dynamometer was used to measure the traction force between two tractors, a measuring unit for fuel, a thermometer unit and a timer to measure the quantities of fuel consumption, drawbar force and power. For drawbar traction test, each of the tested tractors pulled the rear tractor in different gears and the dynamometer between these 2 tractors recorded the tractors traction force by data loggers. To measure tractors fuel consumption, a measuring unit of fuel (VDO - EDM 1404) was used that calculated the flow rate in the path of fuel from the fuel tank to the engine and the return path from the engine to the fuel tank and showed the quantity of fuel consumption in liters per hour digitally.

Results and Discussion: In comparison of traction power and force of tractors with turbochargers and without turbochargers in different gears, the results of variance analysis showed that the effect of tractor was significant. Traction power and force at tractors with turbochargers ITM485 and ITM800 and without turbocharger ITM475 have a significant difference in the level of one percent. Tukey post hoc test results also indicate that traction power and force in tractors with turbochargers ITM485 and ITM800 are significantly more than the tractor without turbocharger ITM475. The gear effect is also significant. Traction power and force in different gears have significant difference at the probability of one percent. Tukey post hoc test results indicate that power quantity is highest in the gears: (1+H, 2*H, 1*H, 3+L) and minimum in the gears: (1*L, 1+L, 2*L), (* Turtle and + Rabbit). But Tukey post hoc test results indicate that traction force quantity is highest in the gears: (1*L, 2*L, 1+L) and minimum in the gears: (2*H, 1+H). In the comparison of specific fuel consumption of tractors with turbochargers and without turbochargers in different gears, the results of variance analysis showed that the effect of tractor was significant. The amount of specific fuel consumption at tractors with turbochargers ITM485 and ITM800 and without turbocharger ITM475 has a significant difference in the level of one percent. Tukey post hoc test results also indicate that specific fuel consumption quantity in tractors with turbochargers ITM485 and ITM800 in the level of one percent is significantly less than the tractor without turbocharger ITM475. The gear effect is also significant. The specific fuel consumption quantity in different gears has significant difference at the probability of one percent. Tukey post hoc test results indicate that specific fuel consumption quantity is highest in the gears: (1*L, 1+L, 2*L) and minimum in the gears: (1+H, 2*H, 1*H).

Conclusions: The tests were performed on tractor drawbar traction. Results of variance analysis in this experiment on a concrete surface, indicated that the calculated traction power and force of ITM485 and ITM800 tractors (with turbocharger system) were higher than the ITM475 & ITM285 tractors (without turbocharger) and this difference was significant at the one percent level of probability. Meanwhile specific fuel consumption in the ITM485 and ITM800 tractors (with turbocharger system) was lower than that of the ITM475 & ITM285 tractors (without turbocharger) and

1- MSc student, Department of Mechanical Engineering of Agricultural Biosystem, Bonab Branch, Islamic Azad University, Bonab, Iran

2, 3 & 4- Assistant Professors, Department of Mechanical Engineering of Agricultural Biosystem, Bonab Branch, Islamic Azad University, Bonab, Iran

(*- Corresponding Author Email: Behzad.alasti@gmail.com)

this difference was significant at the one percent level of probability. This will lead to significant savings in fuel consumption.

Keywords: Fuel consumption, OECD standard, Power and traction, Tractor, Turbo charger