

THE IMPACT OF WEATHER CONDITIONS ON FUEL CONSUMPTION OF PRODUCTION OF WOOD CHIPS IN ESTONIAN CONDITIONS

Marek Irdla, Allar Padari, Peeter Muiste

Estonian University of Life Sciences, Kreutzwaldi 5, 51014 Tartu, Estonia, phone: +372 53062624, e-mail: marek.irdla@emu.ee

INTRODUCTION

Estonia has ratified the Paris Agreement on Climate Change and contributing the EU commitment to a 40 percent reduction in emissions by 2030. Our national goal according to the Long-term Development Programme for the Estonian Energy Sector up to year 2030+ is to decrease the GHG emissions by year 2050 by 80% compared with the year 1990. To supply the increasing number of consumers, the production of wood fuels should be carried out perennially and efficiency of production becomes especially essential.

Among different factors influencing the supply chain is the air temperature. During mild winters the processing and local transport of wood fuels is taking place on soft and unfrozen soils, which increases the fuel consumption of machines. But higher temperature may create more favourable conditions for processing of unfrozen raw material. The aim of this study was to analyse the impact of precipitation and air temperature to the price formation of whole chain of production of comminuted wood fuels in Estonian conditions.

MATERIAL AND METHODS

The initial data from companies TMK Energy Lõuna OÜ and Lumbar OÜ covered 2 different types of chippers (Jenz HEM 582, Jenz HEM 593) and 4 different types trucks (Volvo FH 460, Volvo FH 500,). All machines were equipped with a GPS tracking device (Dynafleet by Volvo and Navirec) which records the route and the fuel consumption.

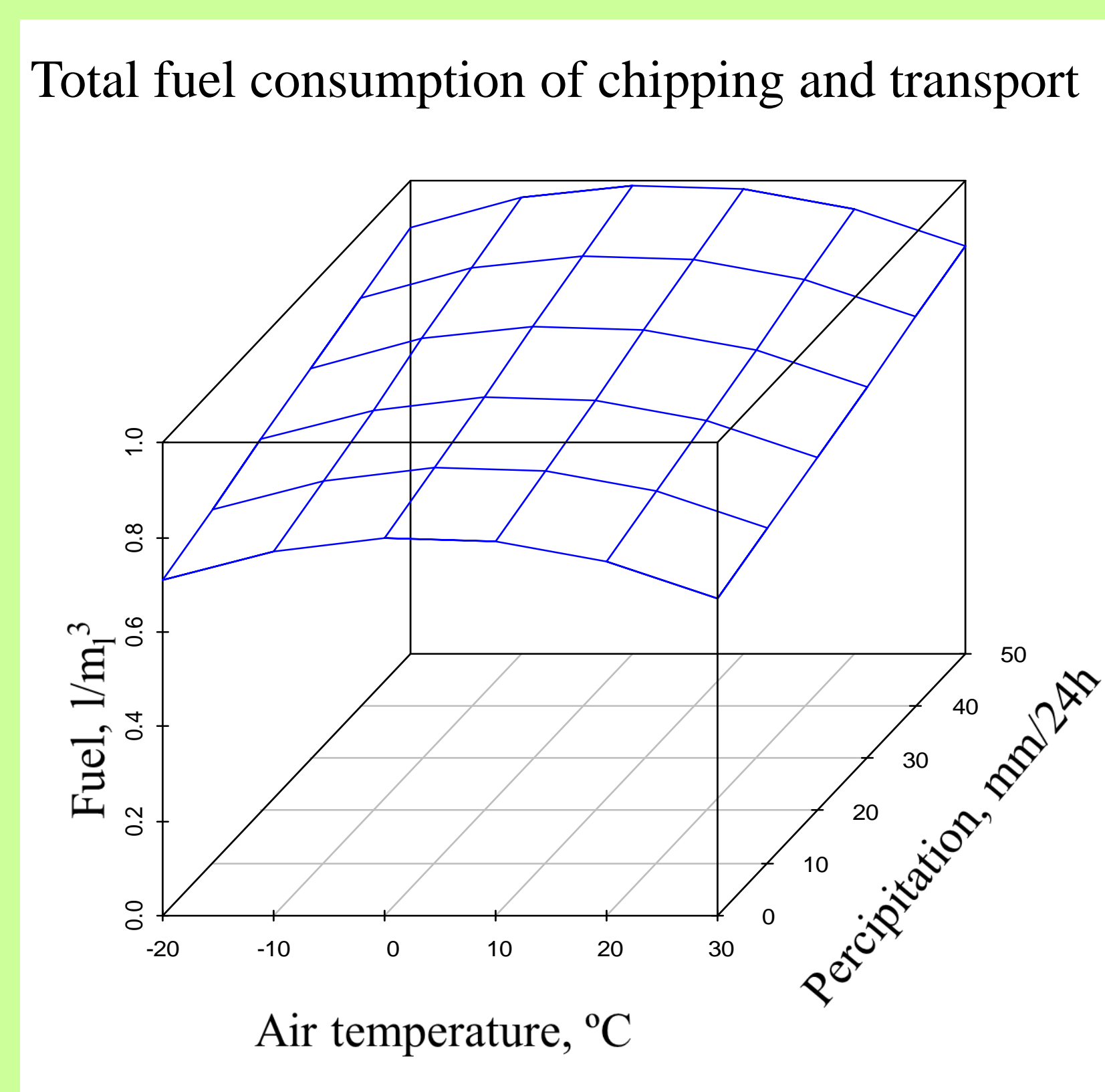
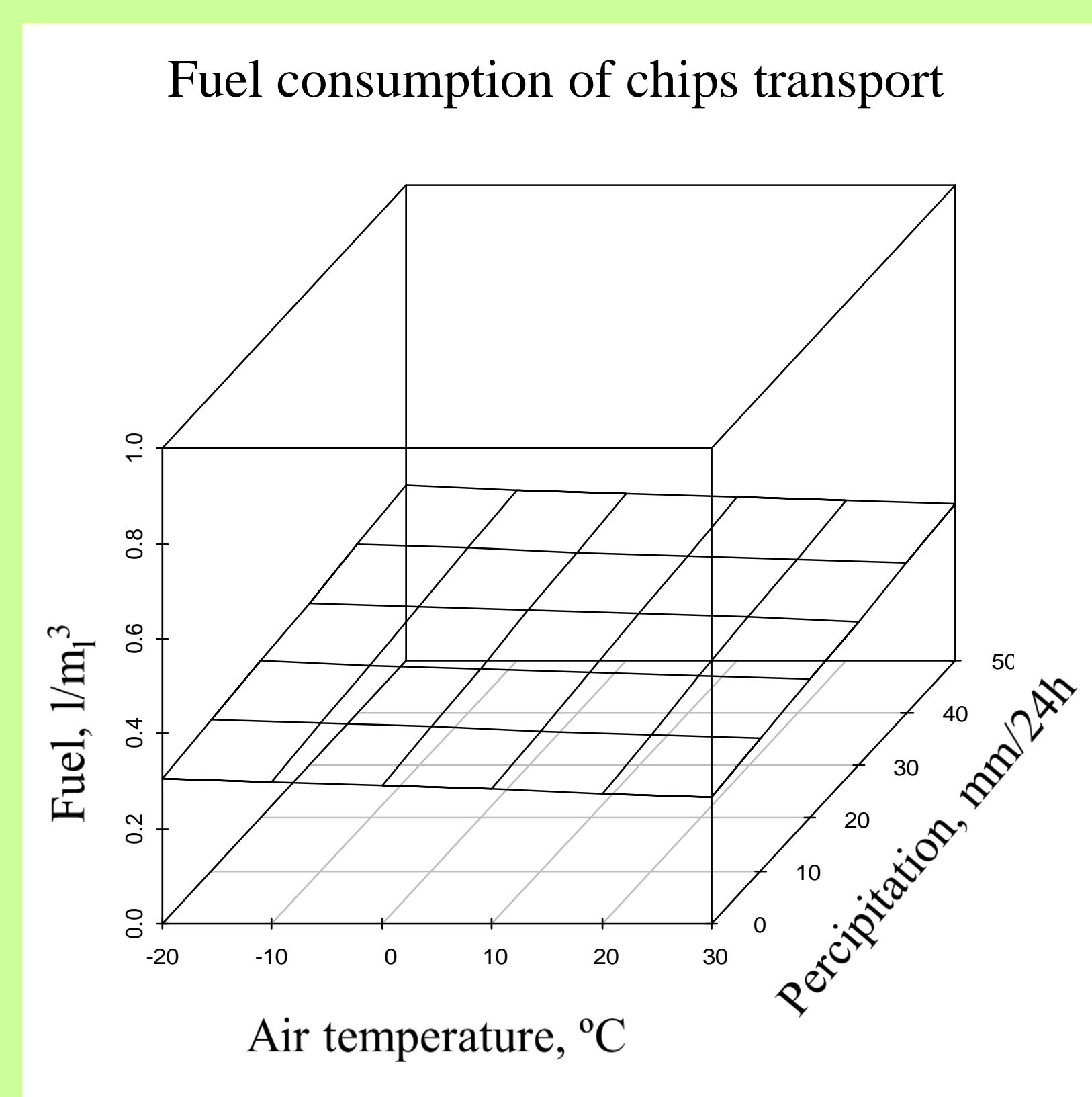
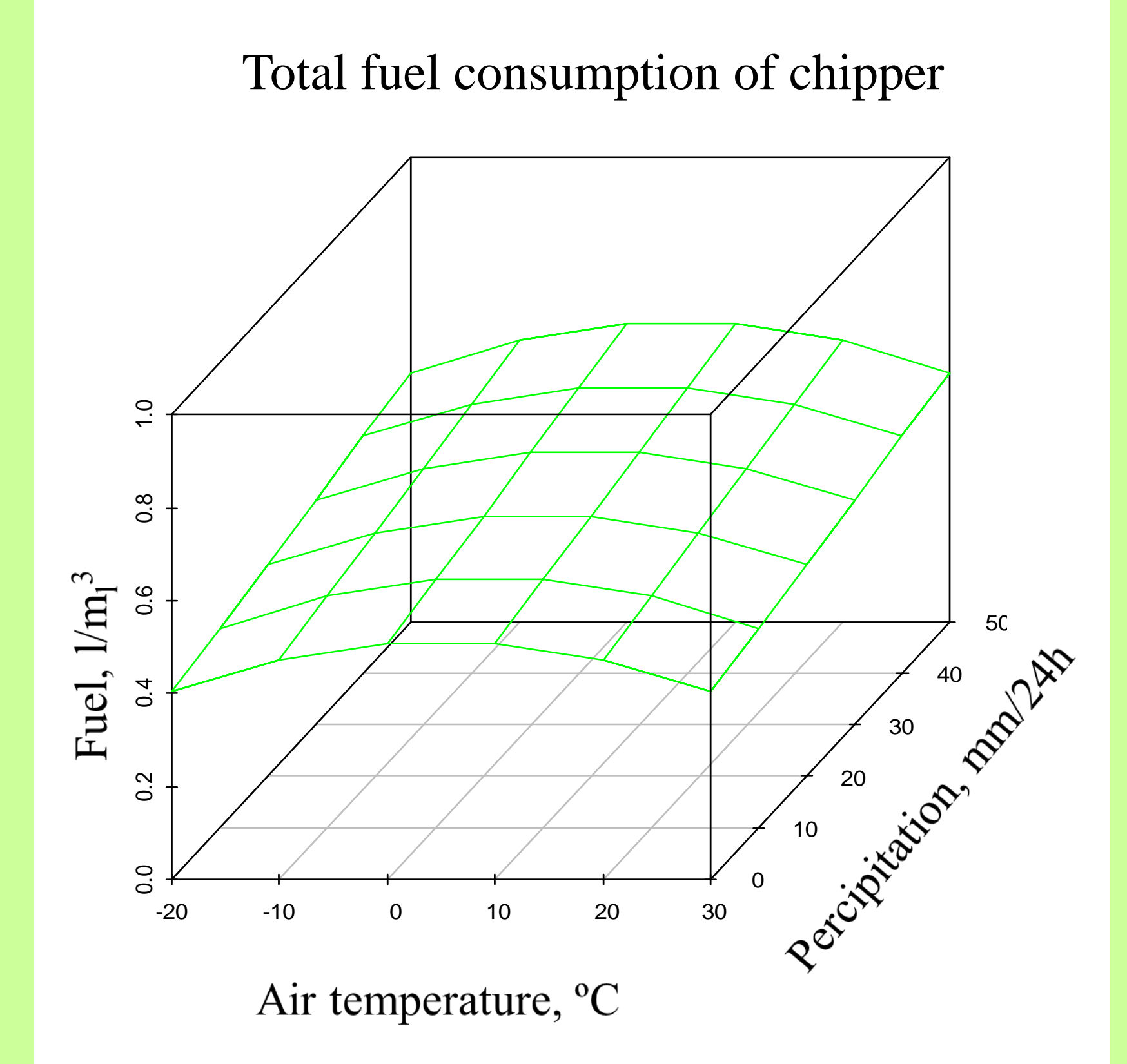
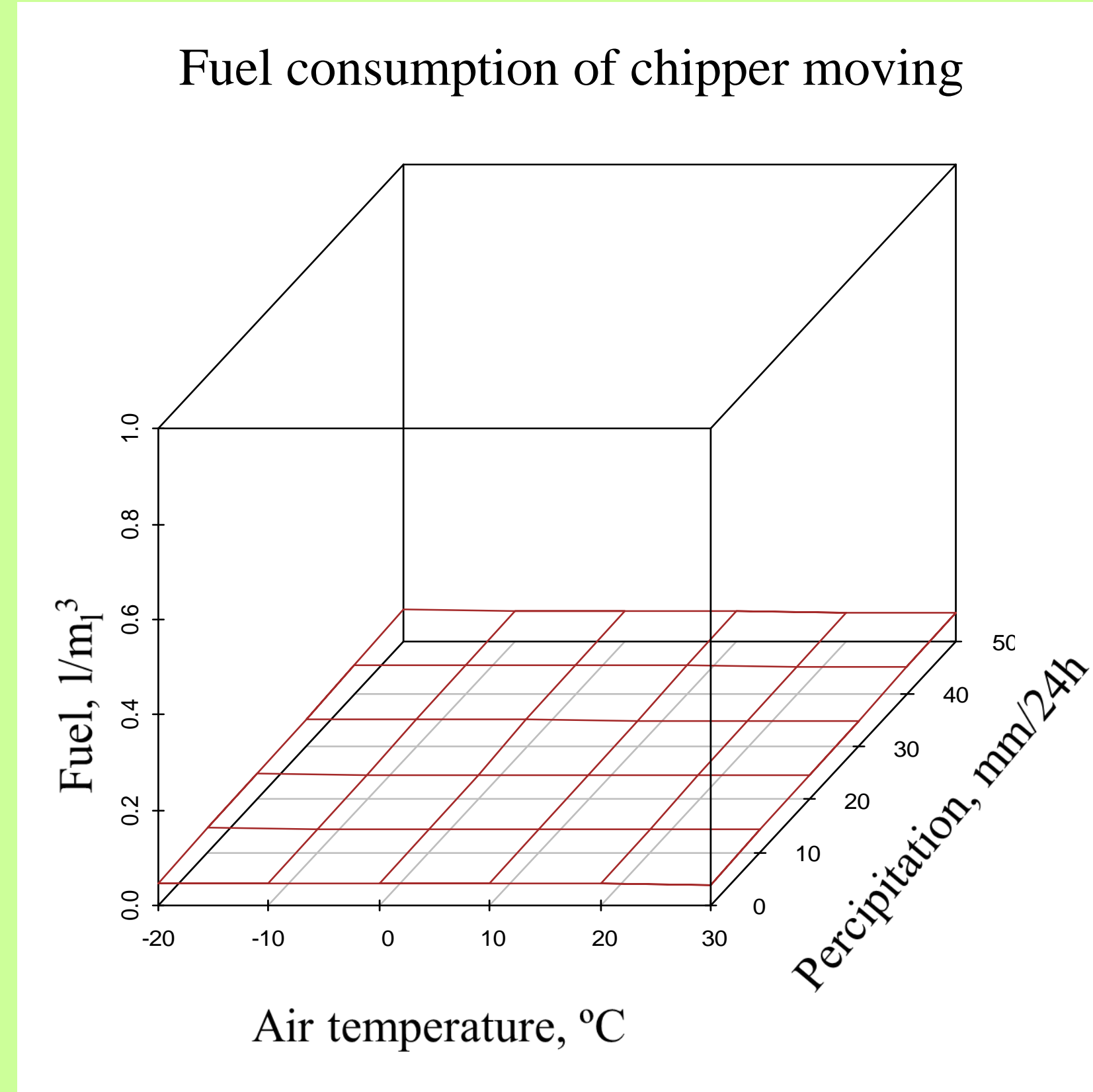
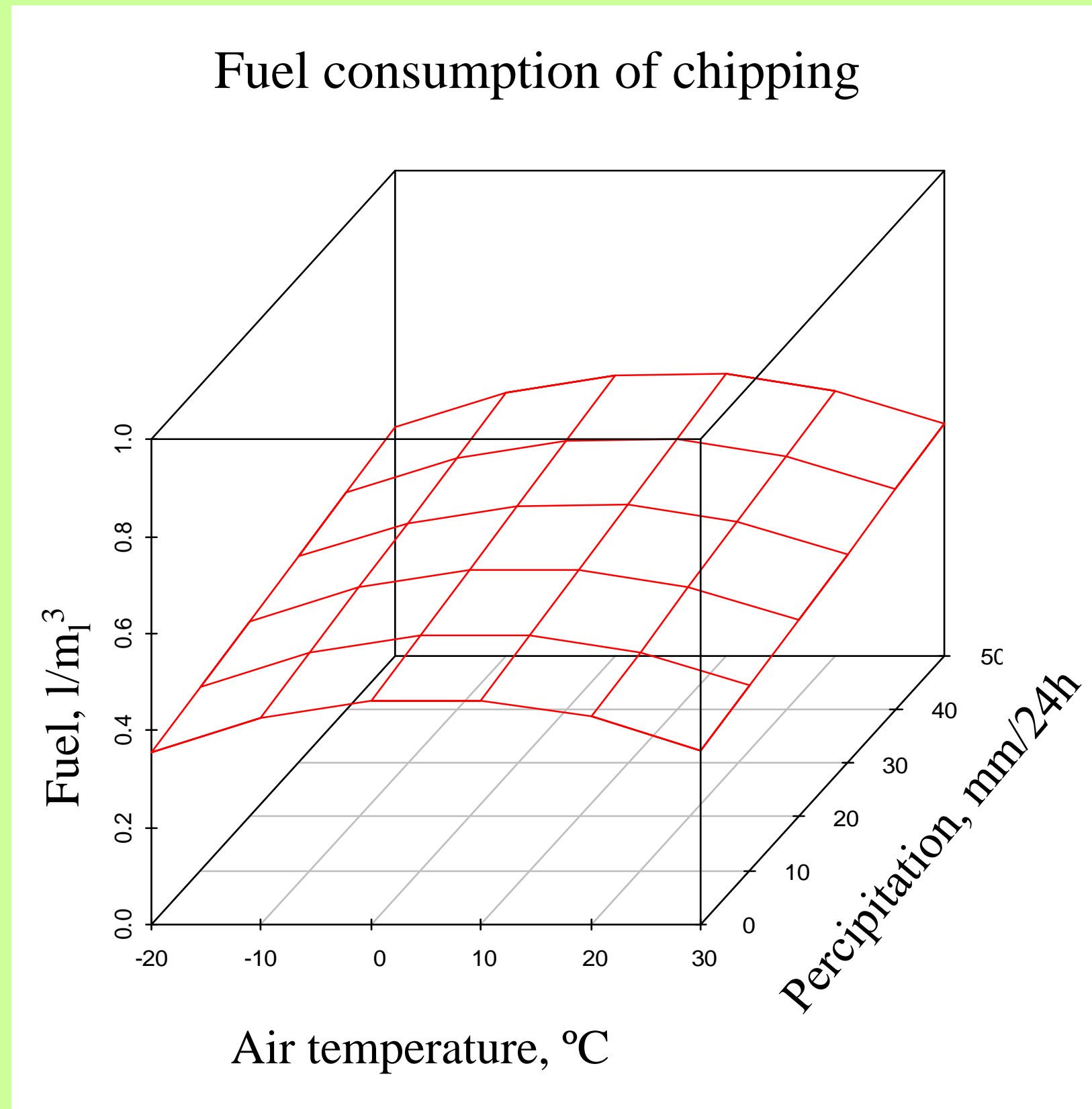
The data about the precipitation and air temperatures were got from the Estonian Weather Service. As a result of analysis of meteorological data and the data of the machines, the impact of weather conditions on production costs of wood fuels was determined.

To find the fuel consumption dependency was used linear modelling. In the case of truck driving, fuel consumption was found to depend on average speed, of stops per 100 km, loads per day, air temperature and precipitation. The fuel consumption of chipping were split into two. The amount of fuel consumed by the chipper drive was calculated using the formula found above. For chipping, fuel consumption was found to depend on chipping time, air temperature and precipitation.



RESULTS

In the figure used average data TMK Energy Lõuna OÜ and Lumbar OÜ: average transport distance – 60 km; average chipping time per day – 530 min; average transport speed – 35 km/h; average stops per 100 km – 40; average daily load per truck – 2; load capacity – 90 m³.



CONCLUSIONS

Average fuel consumption of chipping and transport was 0,84 l/m³. Average fuel consumption was lower as the outdoor temperature dropped and increased, but as the precipitation increased, the average fuel consumption also increased, especially in woodchips transport.