THE IMPACTS OF NO-TILLAGE ON GRAIN YIELD OF DURUM WHEAT AND ENERGY REQUIREMENT IN THE MEDITERRANEAN CLIMATE

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1. Introduction
A key principle of no-tillage (NT) system is the retention of crop residues on the soil surface to preserve soil water for crop growth. In response to the negative impact of soil degradation processes under conventional tillage (CT) systems that are based on soil tillage operation, and with protective cover of crop residue being developed in many parts of the world. Apart from the positive effects on soil conservation and sustained land productivity, another major impact of NT is decreasing labor costs, generally leading to a higher income and a better standard of living for the farmers. However NT is a successful system especially in the South of America, but the impacts of this system in the Mediterranean climate especially in the south of France is less well known; so that this study has been carried out within the scope of a European project.

2. Materials and methods
The study has been carried out on Lavalette experimental site in Montpellier (43°40'N, 3°01'E, altitude 35 m), under a Mediterranean climate with 795 mm annual average rainfall, in the south of France. Field experiments and measurements were carried out in 2004/2005 and 2005/2006. Durum wheat was sown for two seasons under two tillage treatments i.e. CT and NT. Two plots were cultivated under DSM (1 ha) and CT (1.7 ha). Time requirement, fuel consumption and yield were measured in these two systems.

The energy requirement for each tillage system was determined by measuring the tractor fuel consumption applying volumetric system. Energy equivalent of 38.7 MJ.L-1 was taken for energy calculation (Cervinka (1980)). Statistical assessment of this experiment was performed by the analysis of variance (ANOVA). The Duncan's test was employed to compare the mean results, after a significant variation had been highlighted by ANOVA. The differences had been considered as significant if P<0.05.

3. Results
The amount of wheat grain yield and response to the tillage systems varied depending on the season.

- In the first growing season, grain yield was significantly higher in CT while no significant difference of grain yield was evident in both NT1 and NT2.
- In the second season, grain yield was lower in all treatments as compared with the first one. In CT, grain yield was significantly higher (Table 1). Similar to the first year of the experiment, no significant impact of soil texture was found in NT treatments.
- The emerged plant number was significantly higher in CT than NT. The unfavorable effects of no-tillage for the development of proper seed placement and emergence. Better plant emergence in CT translated into higher grain yield. Lower yield under NT may have been associated with the development of cereal leaf beetle (Oulema melanopus L.;) been highlighted by ANOVA. The differences had been considered as significant if P<0.05.

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The results of this study indicated that grain yield of durum wheat was higher in CT system. Lower yield under NT may have been associated with the development of cereal leaf beetle and lower emerged plant number. While, NT provided a considerable saving in work duration, fuel consumption and energy required for either crop production or seed bed preparation.

![Figure 1: Energy requirement of two soil tillage methods to prepare the soil for sowing durum wheat with respect to energy requirement to obtain grain yield](image-url)