Effect of conservation agriculture on soil properties and sesame yield in the sesame-wheat rotation

S. Afzalinia[1], A. Karam[2], and M. J. Rousta[3]

1. Associate Professor, Department of Agricultural Engineering Research, Fars Research and Education Center for Agriculture and Natural Resources, AREEO, Shiraz, Iran. (corresponding author).
2. Asistant Professor, Department of Soil and Water Research, Fars Research and Education Center for Agriculture and Natural Resources, AREEO, Shiraz, Iran. .
3. Associate Professor, Department of Soil Conservation and Watershed Management Research, Fars Research and Education Center for Agriculture and Natural Resources, AREEO, Shiraz, Iran.

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Extended Abstract

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Introduction: Conservation tillage methods offer considerable advantages compared to the conventional tillage; therefore, these tillage methods are widely disseminated throughout the world. Conservation tillage affects soil properties, environment, and crop yield. Results of research studies show that conservation tillage saves water in wheat production compared to the conventional tillage (Erenstein & Laxmi, 2008). Conservation tillage also increases soil organic carbon (Madejon *et al.*, 2009) and sesame yield (Uzun *et al.*, 2012) as compared to the conventional tillage. This study was performed to evaluate the effects of conservation tillage practices on soil properties and sesame yield in sesame-wheat crop rotation under hot climatic condition of Fars province.

Materials and Methods: The study was conducted using a randomized complete block experimental design with five treatments and four replications in Fars province from 2010 to 2013. Treatments included; 1) reduced tillage (T_1), 2) wheat and sesame direct seeding (T_2), 3) sesame direct seeding for four years, wheat direct seeding for the first two years and the fourth year, and conventional planting in the third year (T_3), 4) wheat direct seeding for four years, sesame direct seeding for the first two years and the fourth year, and conventional planting in the third year (T_4), and 5) conventional tillage (T_5). Soil bulk density was measured

Email address of the corresponding author: sja925@mail.usask.ca

at two soil depths including 0 to 10 and 10 to 20 cm using core samplers. Soil moisture content was measured using TDR at the soil depth of 0 to 20 cm. Soil water cumulative infiltration and infiltration rate were determined using double ring method. Soil organic carbon was measured by analyzing mixed soil samples in laboratory, and carbon dioxide emission from the soil was determined in the field using Anderson method. Sesame yield was calculated by harvesting 10 m^2 area of each experimental plot. Collected data were analyzed using SAS software and Duncan's multiple range test was used to compare the treatments means.

Results and Discussion: Results of this research indicated that tillage methods had significant effect on soil moisture content so that the maximum soil moisture content obtained from the no-till method and the conventional tillage gave the lowest soil moisture content. Tillage methods had no significant effect on soil bulk density; therefore, conservation tillage methods did not considerably increase soil compaction. Results also showed that soil water cumulative infiltration and infiltration rate were affected by tillage methods in such a way that conservation tillage practices decreased soil water infiltration rate compared to the conventional tillage. Conservation tillage methods also increased soil organic carbon and decreased carbon dioxide emission from the soil as compared to the conventional tillage. Meanwhile, conservation tillage methods did not significantly decrease sesame yield relative to the conventional tillage. Different soil tillage methods in the first and third years of the experiment did not significantly affect sesame yield and therefore all the sesame yield means fell into the same statistical category. During these years, conservation tillage produced yields which were either close to or sometimes more than those of conventional tillage, indicating that sesame has developed an adaptation to conversation tillage practices. In the second and fourth years, significant differences were observed among soil tillage practices in terms of sesame yield where the reduced tillage produced the highest sesame yield in the second year, which had a significant difference from the yield obtained from direct wheat seeding and conventional sesame planting in the third year (T4), which had given the lowest yield of sesame.

Conclusions: The results showed that conservation tillage methods increased soil moisture retention (at most 50%) and soil organic carbon (138%) relative to the conventional tillage. Soil bulk density was not affected by tillage methods, while conservation tillage methods reduced soil water cumulative infiltration and infiltration rate compared to the conventional tillage by at most 33%. Conservation tillage methods reduced carbon dioxide emission from the soil by 19%. Meanwhile, conservation tillage methods did not reduce sesame yield compared to conventional methods.

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Keywords: Tillage methods, soil bulk density, soil moisture content, soil organic carbon, sesame, soil water infiltration rate

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