

## The effect of conservation tillage forward speed and depth on farm fuel consumption

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**Introduction:** In recent years, production techniques and equipment have been developed for conservation tillage systems that have been adopted by many farmers. With proper management, overall yield averages for conventional and reduced tillage systems are nearly identical. Sometimes, field operations can be combined by connecting two or more implements. Much research has focused on either reducing or eliminating tillage operations to develop sustainable crop production methods. The greatest costs in farm operations are associated with tillage due to greater specific energy requirement in tillage and the high fuel costs. Combined operations reduce both fuel consumption and time and labor requirements by eliminating at least one individual trip over the field. Light tillage, spraying, or fertilizing operations can be combined with either primary or secondary tillage or planting operations. The amount of fuel saved depends on the combined operations. Generally, light tillage, spraying, and fertilizing operations consume between 0.25 and 0.50 gallons of diesel fuel per acre. Fuel savings of 0.12 to 0.33 gallons per acre can usually be expected from combining operations. Eliminating one primary tillage operation and combining one light tillage, spraying, or fertilizing operation with another tillage or planting operation can usually save at least a gallon of diesel fuel per acre. Combining operations has the added benefit of reducing wheel traffic and compaction. To improve the tillage energy efficiency, implementing effective and agronomic strategies should be improved. Different tillage systems should be tested to determine the most energy efficient ones. Tillage helps seed growth and germination through providing appropriate conditions for soil to absorb sufficient temperature and humidity. Tillage is a time consuming and expensive procedure. With the application of agricultural operations, we can save considerable amounts of fuel, time and energy consumption. Mankind has been tilling agricultural soils for thousands of years to loosen them, to improve their tilth for water use and plant growth and to cover pests. Tillage is a process of creating a desired final soil condition for seeds from some undesirable initial soil conditions through manipulation of soil with the purpose of increasing crop yield. The aim of conservation tillage is to improve soil structure. Considering the advantages of conservation tillage and less scientific research works on imported conservation tillage devices and those which are made inside the country, and considering the importance of tillage depth and speed in different tiller performance, this investigation was carried out.

**Materials and methods:** This investigation was carried out based on random blocks in the form of split plot experimental design. The main factor, tillage depth, (was 10 and 20cm at both levels) and the second factor is tillage forward speed, (was 6, 8, 10, 12 km h<sup>-1</sup> in four levels for Bostan-Abad and 8, 10, 12, 14 km h<sup>-1</sup> for Hashtroud) with 4 repetitions. It was carried out by using complex tillager made in the Sazeh Keshte Bukan Company, which is mostly used in Eastern Azerbaijan and using Massey Ferguson 285 and 399 tractors and its fuel consumption was studied.

**Results and Discussion:** In this study, the effect of both factors on the feature of fuel consumption was examined. Regarding tillage speed effect for studies characteristic in Bostan-Abad at 1% probability level ( $p < 0.01$ ) fuel consumption was effective. The effect of tillage depth has significance at 5% probability level ( $p < 0.05$ ) on fuel consumption. The interaction effect of tillage speed and depth on fuel consumption was significant at probability level of 1% ( $p < 0.01$ ). In Hashtroud, the effect of tillage speed was significant on fuel consumption at probability level of 1% ( $p < 0.01$ ), and also tillage depth effect was significant on fuel consumption amount at probability of 1% ( $p < 0.01$ ). The interaction effect of tillage speed and depth on fuel consumption was significant at 1% level of probability ( $p < 0.01$ ).

**Conclusions:** In this study, the effect of both factors on fuel consumption was examined. In Bostan-Abad and Hashtroud on the whole, the results indicated that with the increase in the speed of tillage, fuel consumption, was reduced per hectare. The speed of 10 kilometers per hour was the best for this implemented work. Also, with an increasing depth of tillage, the fuel consumption increased. Through an increase in tillage speed, fuel consumption mass reduced at unit

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level. Moreover, the optimum speed was concluded to be 10km per hour. The best tillage depth using this machine is 10cm.

**Keywords:** Conservation tillage, Depth, Fuel consumption, Soil, Speed