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Research Article

EVALUATION THE EFFECT OF SOIL MOISTURE AND TRACTOR FORWARD SPEED ON SOIL PHYSICAL PROPERTIES AND WHEAT YIELD IN YASOOJ REGION

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ABSTRACT
In order to investigate the effect of soil moisture and the tractor speed, on fuel consumption, soil physical properties and yield of Alvand wheat, a factorial experiment in a completely randomized block design in three replications was done. Soil moisture levels were field capacity, 50% field capacity and 80% field capacity and the forward speed of the tractor includes two levels were 4 km per hour and 5 km per hour calculated. After the experimental procedures, data analysis was performed calculations and operations of variance analyses. The results showed that effect of soil moisture levels on the studied factors except soil organic carbon was significantly. Tractor forward speed effects on the studied factors except soil organic carbon was significantly. The interaction between soil moisture and the tractor forward speed on all the traits under study were significant, except on organic carbon. The maximum amount of fuel consumption of 21.41 liters per hectare, soil cone index of 397.53 kPa, weighted aggregate diameter of 6.77 cm and a bulk density of 18.19 grams per cubic centimeter in the treatment of T3C3 (80% field capacity and the speed of 5 km per hour) was achieved. The yield of treated T1C1 (field capacity moisture and speed of 4 miles per hour) with a yield equivalent to 388.17 ton/ ha, was recognized as the superior treatment.

Keywords: *Moisture, Field Capacity, Forward Speed, Yield*

INTRODUCTION
In most parts of Iran, tillage is operated by moldboard plough without plant residues. Use of Moldboard plough was initiated in 60s concurrent with emergence of tractors and it is now used by the farmers as the most conventional tool. Its ability to turn over the soil has made ploughing by this tool different from other ploughs. This capability allows disposal of plant residues in depths lower than those of seed bed, and supports root growth by soil turnover, aeration and mixing nutrient layer with the development layer. Also by burying weed seeds, soil turnover plays a significant role in reduction of weed population for the next cropping (Afshar, 2003).
In the beginning of third millennium and with a population of 6 billion persons living in the world and its increasing growth especially in developing countries, how to meet demands for food is among the most important challenges the man is facing. Thus, qualitative and quantitative increase in production of agricultural products is a necessity, which compelled many countries to allocate a considerable part of their budget to agriculture and related research leading to notable achievements. In Iran, although agriculture was prioritized in the second and third Development Plans, policies on an increase in agricultural products found not much success (Farkhojasteh, 2011). One way to increase agricultural products is by increasing performance on the surface unit. Use of modified cultivars, preparation of favorable seed beds, appropriate date and method of cropping, quantity of seeding, alternative agriculture, etc. increase the performance on surface unit (Asiudo, 2003). Grains are plants of a particular importance and their cultivation lands throughout the world are the highest compared other crops. They are a main food source for the man due to many factor including adaptation to various climates, easy transportation and maintenance, and relatively good performance (Emam, 2005). Some grains are produced as fodders; therefore cropping grain for animal feeding is also highly important. For this purpose, high-performance as well as high-quality plants are needed. Grain is mostly suited to production of dry fodders. The dry fodder produced in a grain farm is much higher than other fodder plants. Having a variety of factors, Grains can produce desirable amounts of fodders when fodder plants are short or affected by harsh growth

conditions (Al-Kaisi *et al.*, 2004). Due to value and importance of wheat as an agricultural plant, rational selection of best soil humidity for cropping and most optimal speed of tractors in order to reach higher performances are essential with regard to farming land limitations. Recently tillage techniques have received more attention because they can reduce production costs (Salco and Jangio, 1990; Alexi and Yin, 2004). In addition, soil erosion and farming operation costs and seed bed preparation time are lower in low-till farming than high-till farming (Tsatsaris and Kiko, 2005). Delay in greening of plants and reduction of plant quantity is a challenge in conventional tillage. Increased wheat residues can increase the performance and height of seeds in the growth season (Swanton *et al.*, 1995). Along with agricultural management, tillage operation is especially important in which mechanized tillage system includes one or more primary and secondary tilling devices or both. With regard to harness of work, high energy demand for land preparation, mechanization degree (mechanized surface to total cultivated area ratio) is %100 in many regions. According to the research, almost %60 of mechanical energy in agricultural operations is used for tilling and cropping (Lamporlans *et al.*, 2001). Physical properties of soil are determinants of shrub's growth until it emerges from soil (greening) (Tahan *et al.*, 2005). Policy making, planning and proper and optimal use of machineries for farming poses many different challenges to countries of the third world, and the need for a comprehensive look is tangible in such communities so that the emphasis is mainly on selection of strategies and technologies coupled with proper planning. In Iran, it also faces many tops and downs, and it is too far to attain a real position (Amini, 1996). There are a lot of factors and causes involved originated from various economic, social, cultural, technical and environmental aspects. Any progress, alternative suggestion and planning activity requires the analysis of existing conditions of our agricultural sector, since following a solution, based on what is carried out in developed countries, does not necessarily lead to desirable results. Mechanization and use of mechanical devices and machineries in agriculture is inevitable today. Despite introduction of tractors to Iran in 60s and its ascending trends, mechanization has not been in good conditions in recent years, and the goals of first, second and third Development Plans have been met (Afshar, 2003). Organic contents of soil increase humidity range suitable for movement of farming machines. For example, in a soil with %7 organic material, humanity %52.2 weight. Weight is maximum desirable humidity for a tillage operation. But, if the soil contains no organic material, in %27.7 humidity it becomes sensitive to density (4). Compressibility of soil depends not only on its organic content but on the type of it (Tompkins *et al.*, 1988). Concentration of organic carbon in the soil surface improves soil structure and its reaction to density (Swanton *et al.*, 1995).

Goal of this Research

1. Evaluate and compare of effects of soil humidity on performance of wheat seeds
2. Examine the effects of tractors' speed on physical properties of soil
3. Study the interactions of soil humanity and tractors' speed on physical properties of soil as well as performance of wheat seeds

MATERIALS AND METHODS

This experiment was conducted in Yasooj (2013-14). Geographically, this area was located 4km south west of Yasoudge-22° 13' latitude, 34° 11' longitude- 1823 m above sea level. The distance between these lands and the main road in 1km.

Table 1: Soil analysis results

Texture	**potassium uptake p.p.m**	**Phosphorus uptake p.p.m**	**Total nitrogen** %	**Organic carbon** %	**Neutralizing materials (%)**%	**Saturtion (%)**	**Electrical conductivity (ds.m)**	**ph**
Loamy-clayey	206	44/11	0/13	22	0.64	41	2.03	7.02

Characteristics of the Site

To study physical and chemical properties of soil, 3 samples were taken from experiment iterations in 3cm-30cm depths. Then, the samples were crushed, screened and put is plastic bags to be sent to pedology laboratory in Dashte Golshan, Yasooj. Table 1 shows the results.

Statistical Calculations

The experiment was conducted in the form of factorial (the factors were soil humidity and tractor speed when ploughing) within 3 iterations in fully randomized blocks on wheat. There existed 8 terraces. After the data were collected and calculated there were analyzed using SAS and were compared using Duncan test. The diagrams were drawn by MS Excel. Finally, the results were statistically analyzed.

Treatments:

a) soil humidity including M1= Farm capacity M2= %50 of farm capacityM3= %80 offarm capacity
b) speed of tractor

S1= 4 km.h
S2= 5 km.h

Results

Table 2 shows the results of Analysis of Variance (ANOVA) for factors under study, which were in fully randomized blocks. To examine the significant variation between various treatments for the factors, comparison of means was done using Duncan's multiple range on %1 and %5 probability level (Table2 and 3). The following sections describe the results in details.

Table 2: ANOVA for effects of various levels of soil humidity and speed of tractors on some soil properties and performance of Alvand wheat seeds

Variation sources	Degree of freedom	Mean square					
		Fuel consumption (lit.ha)	soil cone index(kpa)	Organic carbon (%)	Mean diameter (cm)	Special weight of soil ($g.m^3$)	Performance of seed ($g.m^2$)
Block	2	88/1**	12/21ns	6*	6ns	32ns	28/23ns
Soil humidity	2	43/54**	1/101**	1ns	1/32**	3/68**	43/26**
Speed	1	32/2**	93/43**	2ns	8/3**	6/7**	54/11**
Speed ×humidity	2	15/1**	38/48*	1ns	72**	38/1**	77/22**
error	17	74	42/37	7	22	123	33/14
Variation coefficient	The percent of changes coefficient	56/2	75/1	7/2	39/3	35/2	2/2

*ns= non-significant *=significant at the level of %5**= significant at the level of %5*

Table 3: Comparison of mean of main effects of different humidity levels and speed of tractors on some soil properties and performance of Alvand wheat seeds

Factors	Surface	Fuel consumption (lit.ha)	Soil cone index(k.pa)	Organic carbon (%)	Mean diameter (cm)	Special weight of soil ($g.m^3$)	Performance of seed ($g.m^2$)
Soil humidity	T1	53/14c	311c	867a	855/1c	39/11c	35/37a
	T2	28/17b	95.345b	862.0a	833.4b	3.15b	23.318b
	T3	55.20a	93.392a	860.0a	41.6a	2.18a	32.245c
Speed of tractors	C1	09.17b	04.345b	865.0a	95.4b	31.14b	86.321a
	C2	814.17a	87.354a	860.0a	78.4a	56.15a	07.306b

T_1=farm capacity, T_2= %50 of farm capacity, T_3= %80 of farm capacityC1= 4 km.h C2= 5 km.h

In each column, each two means having a letter in common are not statistically significant.

Table 4: Comparison of mean of interaction effects of different humidity levels and speed of tractors on some soil properties and performance of Alvand wheat seeds

Factors		Fuel consumption (lit.ha)	soil cone index(k.pa)	Organic carbon (%)	Mean diameter (cm)	Special weight of soil ($g.m^3$)	Performance of seed ($g.m^2$)
Humidity	Speed						
T1	C1	43.14d	1.202d	87.0a	07.1e	43.10e	17.388a
T1	C2	63.14d	9.318c	86.0a	64.2d	36.12d	53.368b
T2	C1	17.17c	7.343b	86.0a	73.4c	47.14c	2.319c
T2	C2	4.17c	19.348b	86.0a	93.4c	13.16b	27.317c
T3	C1	68.19b	33.388a	86.0a	05.6b	03.18a	2.258d

T_1=farm capacity, T_2= %50 of farm capacity, T_3= %80 of farm capacityC1= 4 km.h C2= 5 km.h

In each column, each two means having a letter in common are not statistically significant.

Analysis of the obtained results from ANOVA (Table 4), comparison of mean of main effects (Table 2.4) and comparison of mean of interaction effects (Table 3.4) suggested that the effects of various humidity levels of soil was significant on all factors except organic carbon. This effect was significant at %1. The effect of speed of tractors was also significant at the level of %1, except for organic carbon.

Also, interactive effect of soil humidity and speed of tractors on all factors were significant except for organic carbon. The effect of these two on mean cone index of soil was significant at the level of %5 and at % on other factors.

Comparison of mean of main effects (Table 2) showed that in humidity treatment of soil in terms of fuel consumption, T3 (%80 of farm capacity) was identified as the best treatment with average consumption of 20.55 lit.ha, cone index of 392.93 kpas, mean soil aggregates of 6.41 cm and apparent weight of 18.2g.cm^3, but in terms of performance of seed, T1 (farm capacity) was the best treatment with mean performance of 378.35 g.cm^3. About mean diameter of aggregates it can be said that its reduction results in soil porosity and its increase make heavy agglomerates. Therefore, its average value, i.e. the value obtained in T1 (farm capacity) is suitable for ground for seed growth. The less cone index, the better conditions for crop growth, thus, the lowest value (311 kpas) was found in T1 (farm capacity). About speed of tractor, fuel consumption of 4.78 lit.ha, cone index of 354.87 kpas, mean soil aggregates of 15.56 cm and apparent weight of 18.2g.cm^3 were found in C2. The highest performance of seed (321.86 h.cm^3) in was observed in T1 (farm capacity).

As shown in Table 3, maximum fuel consumption (21.41 lit.ha), cone index of soil (397.53 kpas), and diameter of aggregates (6.77cm) were seen in T3C3 (%80 of farm capacity and speed of 5km.h). Maximum performance of (388.17) seed was in T1C1 (farm capacity and speed of 4km.h).

Based on Behaeen and Davoodi (2002), effect of speed of tractors on crushing and turnover of soil was highly significant and as speed decreased both factors decreased. Increased speed and surmount of the lid decreases the efficiency of steady ploughing and increases negativity of sliding.

Ahmadi *et al.*, (2005) suggested that humidity treatments of soil and frequency of tractor movements affecting density and aggregate diameter were significant at the level of %5.

The experiments also showed that fuel consumption, harness potential, harness energy, and operation speed are lower when seed beds are prepared for cropping sugar beet, maize and chickpea by chisel plough compared to moldboard plow (Cruz, 1990).

RESULTS AND DISCUSSSION

Result

In another experiment Matts *et al.,* (1982) reported that the effects of tractor speed of fuel consumption and soil properties were significant. They announced that at higher speeds, fuel consumption, cone index and apparent special weight of soil increase.

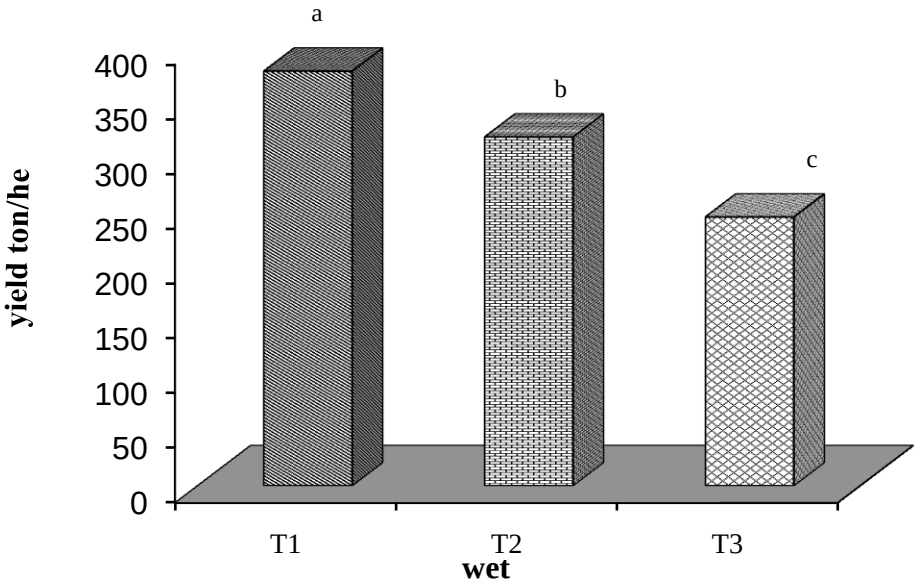

Figure 1: Effect of wet in yield

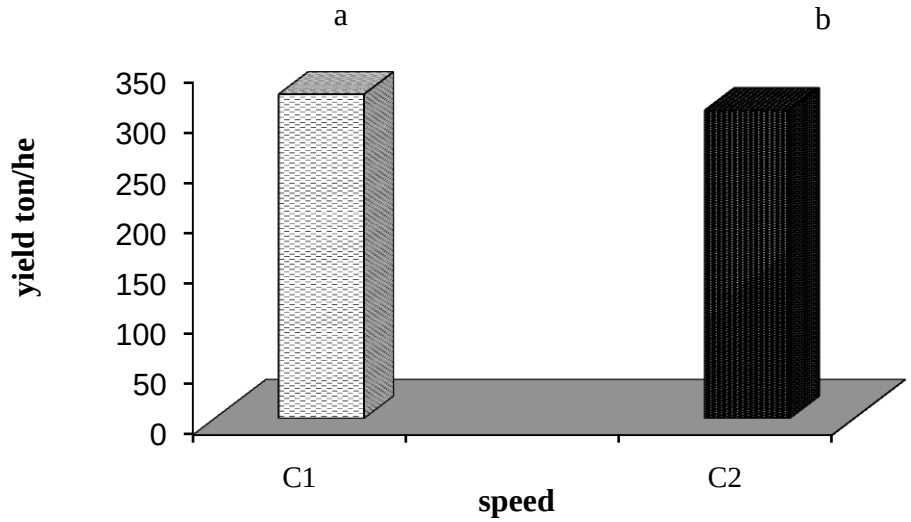

Figure 2: Effect of speeds in yield

Therefore, based on these findings, the results are: The most optimal levels of soil humidity from the viewpoint of the factors under study were in T1 (farm capacity) in which least amount of fuels was consumed and wheat performance was the highest. The most optimal levels of plant residues were found

in C1 (4km.h). T1C1 treatment (farm capacity and 4km.h) was the best in terms of the factors under study (figure 1, 2, 3).

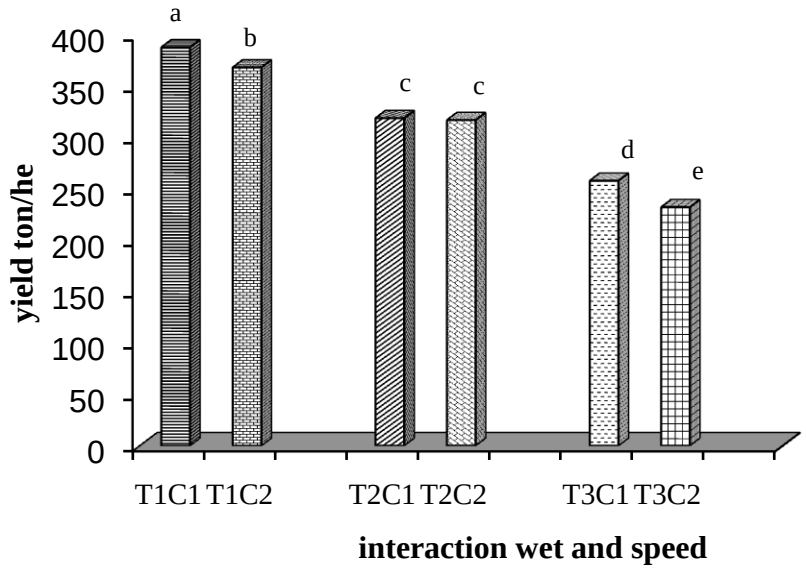

Figure 3: Effect of interaction speed in yield

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