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Effect of soil moisture and tractor speed on soil physical properties and Barley yield in Shoushtar region

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Abstract: Improving seed bed condition is one of the basic aims for crop production. Scientists are always working on new research data for developing new planting methods to increase the benefits of agricultural productions. To examine new seeding methods included raised bed planting two different grain drills were designedIn 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. 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 25.41 liters per hectare, soil cone index of 377.53 kPa, weighted aggregate diameter of 6.77 cm and a bulk density of 18.19 grams per cubic centimeter in the treatment of T3C3 (85% field capacity and the speed of 4 km per hour) was achieved. The yield of treated T1C1 (field capacity moisture and speed of 6 miles per hour) with a yield equivalent to 358.17 ton/ ha, was recognized as the superior treatment.

Key words: Wet; Field Capacity; Yield

1. Introduction

The significance of using different plating methods for crop production was identified by attending the agro technique, economic and social situations. Increasing production potential in the area of field, using of machinery technology can be effective in agricultural projects. In recent years using of planting techniques which prepare a suitable seed bed and plant seeds in apparently equaling depth is necessary. Result of the combination of planting irrigation caused a decreased in percentage of the number of seeding in the area of field 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 barley 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 barley 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

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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 (Asoodar, 2009).

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).

2. Materials and methods

The experiment was conducted at Shuoshtar region (49º 14′ E and 23º 2′ N), 90 Km north of Ahvaz, at an average altitude of 670 m. The experiment field (pervious planting) in a 2 year alternative rotation was wheat, and wheat in order be in 2004-2005 was under wheat planting as well. The soil texture was silt and loom for the depth of 0 – 30 cm had possessed silt and loom texture with the electric conductivity (EC) 2/13 and PH 7.12.

2.1. 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.

Table 1: soil analysis results

Texture	potassium uptake p.p.m	Phosphorus uptake p.p.m	Total nitrogen %	Organic carbon%	Neutralizing materials (%) %	Saturation (%)	Electrical conductivity (ds.m)	PH
Loamy-clayey	216	42/11	0/14	25	0.44	31	2.13	7.12

2.2. 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 barley. 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= %45 of farm capacityM3= %90 off arm capacity

b) speed of tractor

S1 = 4 km.h

S2 = 6 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 (Table 2, 3). The following sections describe the results in details.

Table2: ANOVA for effects of various levels of soil humidity and speed of tractors on some soil properties and performance of Alvand barley 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.m3)	Performance of seed (g.m2)
Block	2	87/1**	12/21ns	6*	6ns	32ns	27/23ns
Soil humidity	2	47/54**	1/101**	1ns	1/72**	3/78**	47/26**
Speed	1	37/2**	93/43**	2ns	8/7**	6/7**	57/11**
Speed × humidity	2	15/1**	38/48*	1ns	72**	38/1**	77/22**
error	17	74	47/37	7	22	173	33/74
Variation coefficient	The percent of changes coefficient	57/2	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 barley seeds

Factors	Surface	Fuel consumption (lit.ha)	Soil cone index(k.pa)	Organic carbon (%)	Mean diameter (cm)	Special weight of soil (g.m3)	Performance of seed (g.m2)
Soil humidity	T1	57/14c	371c	877a	875/1c	37/11c	37/37a
	T2	28/17b	95.355b	872.0a	833.4b	3.15b	23.318b
	T3	57.20a	93.392a	870.0a	47.6a	2.18a	32.255c
Speed of tractors	C1	09.17b	04.3455b	875.0a	95.5b	31.15b	86.321a
	C2	875.17a	87.354a	870.0a	77.4a	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.

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

Table4: Comparison of mean of interaction effects of different humidity levels and speed of tractors on some soil properties and performance of Alvand barley seeds

factors		Fuel consumption (lit.ha)	soil cone index(k.pa)	Organic carbon (%)	Mean diameter (cm)	Special weight of soil (g.m3)	Performance of seed (g.m2)
humidity	speed						
T1	1C	44.14d	1.27d	87.0a	07.1e	47.10e	17.788a
T1	2C	64.14d	9.378c	86.0a	64.2d	37.12d	53.768b
T2	1C	17.17c	7.373b	86.0a	77.4c	47.14c	2.719c
T2	2C	4.17c	19.348b	86.0a	97.4c	17.16b	27.317c
T3	1C	67.19b	37.378a	86.0a	05.6b	077.18a	2.2578d

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 25.55 lit.ha, cone index of 372.93 kpas, mean soil aggregates of 6.41 cm and apparent weight of 18.2g.cm3, but in terms of performance of seed, T1 (farm capacity) was the best treatment with mean performance of 378.35 g.cm3. 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 4.77 lit.ha, cone index of 374.87 kpas, mean soil aggregates of 15.56 cm and apparent weight of 18.2g.cm3 were found in C2. The highest performance of seed (371.86 h.cm3) in was observed in T1 (farm capacity).

As shown in Table 3, maximum fuel consumption (21.71 lit.ha), cone index of soil (377.53 kpas), and diameter of aggregates (6.77cm) were seen in T3C3 (%80 of farm capacity and speed of 5km.h). Maximum performance of (378.17) 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.

AhmadiMoghadam 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 andchickpea bychisel plough compared to moldboard plow (Cruz, 1990).

3. 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. 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 barley 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 (fig 1, 2, 3).

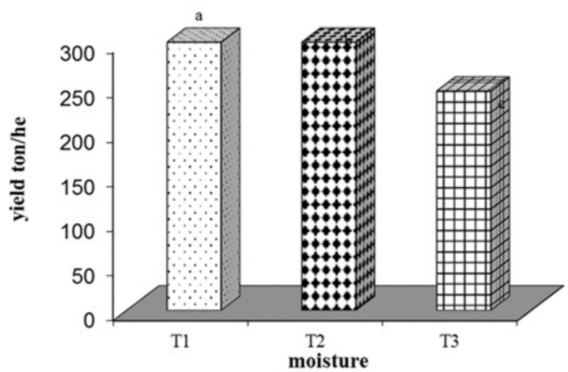

Fig.1: Effect of moisture in yield

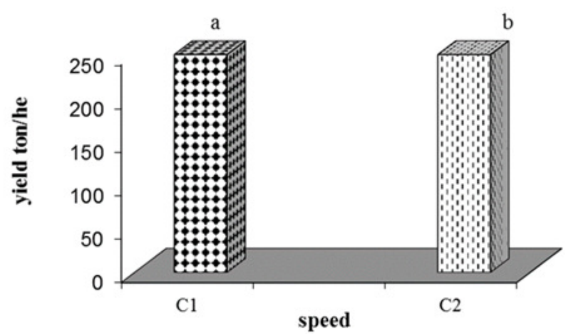

Fig.2: Effect of speeds in yield

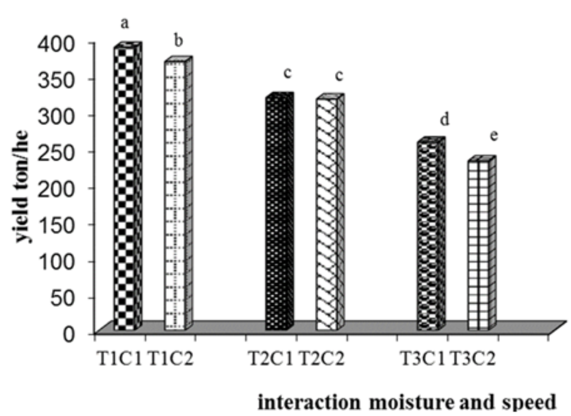

Fig.3: Effect of interaction speed in yield.

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