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Effect of Pulverization Tools and Deficit Irrigation Treatments on II. Machinery Group, Some Soil Physical Properties, Growth and Yield of Barley

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Abstract: *Field experiment was conducted during autumn season of 2011-2012 at the experimental farm, Department of Agriculture Machines Science, Collage of Agriculture –University of Baghdad. A field study was carried out to determine the effect of pulverization tools and irrigation scheduling on growth parameters of barley crops for optimum production and some machinery group, physical properties. Pulverization tools treatments were (rotivator, disk harrow and spring cultivator). Deficit irrigation including* omitting two irrigation at *growth stage (T_1), flowering stage (T_2) and growth grain stage (T_3), as well as the full irrigation treatment (control) (T_0). Irrigation was imposed at 55% depletion of available water. Plant growth parameter of barley was significantly affected by the different pulverization tools. The mean values of the pulverization tools show that the plant height (cm) decreased from 86 to 79 and 76, No. of spike/ m^2 from 582 to 569 and 530, biological yield (t/ha) from 16.64 to 16.13 and 14.72 and the grain yield (t/ha) from 5.36 to 4.81 and 4.22 at spring cultivator, disk harrow and rotivator, respectively. The treatment of pulverization using spring cultivator gave heights value of field efficiency recorded 79.92% compared with disk harrow and rotivator. The effect of pulverization tools in disturbed soil volume, where by the spring cultivator superiority to disk harrow and rotivator, the results were as follow:- 1154, 740 and 712 m^3/hour, respectively. The highest values of MWD and HC were found in spring cultivator record 0.772 mm, 7.625 cm/hr., compared with disk harrow recording 0.623 mm and 5.582 cm/hr and rotivator 0.331 mm and 3.787 cm/hr.*

I. Introduction

Tillage process works to dismantling of the soil and mixing, and lead to change some of the physical properties of the soil related to the growth of roots and penetration the soil, which affects the productivity of crops due to the impact of those processes in porous soil and water characteristics and the movement of water and air (***Baver et al., 1977***). Also, a repeated tillage processes increases slippage percentage of tractor wheels and add to the problem of compaction. There are different Reviews about the positive and negative processes in soil tillage. Researchers have attributed the positive effects as caused by mixing of crop residues and the jungles of the soil, which helps to improve soil structure (***Hill, 1990 and Cassel et al., 1995***). The negative effects have been attributed to the direct effects of plowing in breaking soil aggregates as a result of crushed and compaction at the passage of agricultural machinery (***Edwards et al., 1992***).

Tillage generally improves soil conditions for plant growth, especially under the circumstances where the soil presents zones of high strength and compaction. However, tillage may also exert adverse effect on soil conditions when it is performed in less than adequate soil moisture, or when inadequate tillage implements are used. Tillage and pulverization tools were an indirect effect on soil water content during the growth cycle of plant, particularly areas with an Iraq climate. The rotivator, disk harrow and spring cultivator are a valuable implement. In this state where farming is carried on under so many different climate, altitude and moisture it has an especial value to the farmer who makes use of it intelligently.

Barley (*Hordeum vulgare* L.) is the most widely grown cereal crop in Iraq and other west Asian countries. The barley-based farming system exists in wide areas along the dry margins (200-300 mm annual rainfall) in cultivation in Syria, Jordan and Iraq (***Jaradat and Haddad, 1994***). The present study was focused on evaluation of the effect of pulverization tools on machinery group, some physical properties and growth parameters, yield of Barely in middle region of Iraq.

II. Materials and Methods

The experiment was conducted at the Experimental Farm, Department of Agricultural Machines Science, Collage of Agriculture of Abu-Graib- Baghdad-Iraq (33º 20´ N, 44º 12´ E; elev. 34.1 m) during Autumn season 2011-2012. The soil texture was clay loam with pH= 7.8, EC = 4.8 $dS.m^{-1}$, FC = 32%, PWP = 16.5% and bulk density = 1.45 g cm^{-3}. Experiment was laid out in randomized complete block design with three

replications. Conventional primary tillage equipment with moldboard ploughs with depth 25 cm for all fields. Pulverization tools treatments were kept as main plots and deficit irrigation treatments as sub plots. Pulverization tools treatments were (rotivator, disk harrow and spring cultivator). Deficit irrigation including omitting two irrigation at growth stage (T_1), flowering stage (T_2) and growth grain stage (T_3), as well as the full irrigation treatment (control) (T_0). Irrigation was imposed at 55% depletion of available water. Season length and seasonal weather parameters in Abu-Graib- Baghdad are included in Table (1).

Irrigation system was surface flow irrigation through line pipe provided with meter gages for measuring water applied. The total soil water, calculated between field capacity and wilting point for an assumed *Horidium vulagri* L. root extracting depth from 0.15 to o.45 m. Seeds of *Horidium vulagri* L. was sown at a rate of 120 kg/ha, with recommended dose of 200 kg/ha phosphorus fertilizer were applied as a form of calcium super phosphate. Recommended rate of nitrogen (200 kg N/ha) was applied as a form of urea in two split equal doses (at sowing, beginning of flowering stage). Planting took place on 29th November, 2011 harvesting date 9th of May 2012. Each experimental unit consisted of 14 rows 4 meters in length within 25 cm; total plot area was 16 m^2. All plots were irrigated with river water an ECi = 1.1 $dS.m^{-1}$. Irrigation were scheduled when soil water content in the root zone was depleted by the crop to specific fraction of available water (irrigation was imposed at 55% depletion of available water). The soil depth of the effective root zone is increased from 0.15 m at planting to 0.45 m in flowering and beginning grain stages. At harvest time, two central rows in each plot were harvested to determining grain yield and then; grain yield per hectare was calculated. Sub sample of 10 plants was taken from each plot to measuring plant height in cm, No. of spike (m^2) spike length (cm) biological yield (t/ha) and grain yield (t/ha).

Table 1. Monthly temperature (maximum, minimum and mean), relative humidity and total amount of rainfall, mm. in the period from November to May during 2011/2012 season

Month	Month length (days)	Temperature (^{0}C)		Mean R.H (%)	Total amount of rainfall (mm)
		Maximum	Minimum		
29-31 November/2011	30	21.25	6.82	51.61	0.9
December/2011	31	17.81	2.91	58.16	6.4
January/2012	31	16.91	3.15	65.06	4.1
February/2012	29	18.48	5.55	50.74	7.5
March/2012	31	22.49	7.51	38.59	1.8
April/2012	30	32.83	16.54	32.19	6.5
1 to 15 May/2012	15	38.05	22.09	24.55	0.0

Laboratory determination of K_{sat} was done using the constant head method as described by ***Klute (1986)***. The size distribution of aggregate was measured by the wet sieving method ***(Yoder, 1936)***. Field efficiency was measured by ***Yaya (1998).*** The disturbed soil volume was measured by ***Hunt (1980).*** Analysis of variance (ANOVA) was conducted to evaluate the effects of the treatments on the yield and water use efficiency. Least significant differences method (L.S.D) was used to differentiate means at the 0.05 level ***(SAS, 2002).***

III. Results And Discussion

Machinery group, Some Physical Properties

The results of Table 2 show the field efficiency, disturbed soil volume, saturated hydraulic conductivity and mean weight diameter values for all treatments. The influence of pulverization tools in field efficiency showed in Table 2, the treatment of pulverization using spring cultivator gave heights value of field efficiency recorded 79.92% compared with another treatments. That's due to increasing in practical productivity which leads to increasing in field efficiency (***Al-Ajeli, 2008***).

The effect of pulverization tools in disturbed soil volume, where by the spring cultivator superiority to disk harrow and rotivator, the results were as follow:- 1154, 740 and 712 m^3/hour, respectively. This may be caused by the differences between the cultivators that used in the experiment; these results correspond with the results of ***Al- Zubaidi (2004).***

Table 2. Effects of pulverization tools on Machinery group, Some Physical Properties

Pulverization Tools	Treatment	Field efficiency (%)	Disturbed soil volume (m^3/hr.)	Saturated hydraulic conductivity (cm/hr)	Mean weight diameter (mm)
Rotivator	T_0	73.66	712.34	3.762	0.321
	T_1	75.45	711.76	3.754	0.311
	T_2	75.21	714.21	3.811	0.341
	T_3	75.78	711.65	3.821	0.352
Mean		75.23	712.49	3.787	0.331
Disk harrow	T_0	76.23	745.33	5.641	0.611
	T_1	76.77	741.22	5.511	0.621
	T_2	77.21	738.66	5.523	0.627
	T_3	77.32	737.87	5.654	0.631
Mean		76.88	740.77	5.582	0.623
Spring cultivator	T_0	79.22	1155.22	7.625	0.765
	T_1	79.33	1151.67	7.762	0.766
	T_2	80.82	1152.55	7.882	0.775
	T_3	80.31	1158.61	7.231	0.781
Mean		79.92	1154.51	7.625	0.772
LSD (0.05)		1.22	2.120	0.322	0.001

The highest values of MWD and HC were found in spring cultivator record 0.772 mm, 7.625 cm/hr., compared with disk harrow recording 0.623 mm and 5.582 cm/hr and rotivator 0.331 mm and 3.787 cm/hr. The reason of disking may impact negatively on the physical characteristics, and that disking caused decrease in both saturated hydraulic conductivity and mean weight diameter. The reason for this is that repeated the disking process increases the friction discs with the soil, which works to break up the aggregate as a result of the power pressure authoritarian rule and tablets disking machine on soil aggregates leading weakened the links between particle making it easier to break during irrigation or rainfall (***Carter, 1992***).

Growth, Yield and Its Components

Different plant growth and yield parameters such as plant height (cm), No. of spike/ m^2, spike length (cm), biological yield (t/ha) and grain yield (t/ha) of barley crop were significantly affected by different pulverization tools treatments during the crop season (Table 3). There was no significant difference in spike length among the treatments. The mean values of the pulverization tools show that the plant height (cm) decreased from 86 to 79 and 76, No. of spike/ m^2 from 582 to 569 and 530, biological yield (t/ha) from 16.64 to 16.13 and 14.72 and the grain yield (t/ha) from 5.36 to 4.81 and 4.22 at spring cultivator, disk harrow and rotivator, respectively. The reason for this is due to disking caused an increase in bulk density and decrease in mean weight diameter and saturated hydraulic conductivity. The reason of disking may impact negatively on the growth and production characteristics, such as the spread and growth of roots. And the differences in crop response occur through pulverization tools effects on soil physical, chemical and biological processes and occurrence of crop diseases and may also differ among crop and soil (***Chang and Lindwall, 1979 and Karlen, 1990***).

IV. Conclusion

Conventional primary tillage equipment with moldboard ploughs + spring cultivator (pulverization tools) is the best tillage system was found to be more appropriate and profitable tillage system treatment in improving grain yield of Barley as compared to other pulverization tools treatments. And will be successful under a wide range of soil conditions especially on medium and fine texture.

Table 3. Effects of pulverization tools on Barley yield and yield components

Pulverization Tools	Treatment	Plant Height (cm)	No. of Spike (m^2)	Spike Length (cm)	Biological Yield (t/ha)	Grain Yield (t/ha)
Rotivator	T_0	78	550	5.5	16.10	4.75
	T_1	78	538	5.5	14.87	4.36
	T_2	70	500	5.3	13.00	3.64
	T_3	77	532	5.4	14.89	4.13
Mean		76	530	5.4	14.72	4.22
Disk harrow	T_0	81	600	5.8	18.00	5.25
	T_1	80	575	5.8	16.26	5.00
	T_2	74	530	5.5	14.15	4.10
	T_3	80	571	5.7	16.11	4.88
Mean		79	569	5.7	16.13	4.81
Spring cultivator	T_0	89	602	5.9	18.23	5.85
	T_1	86	588	5.9	16.89	5.72
	T_2	82	552	5.7	14.67	4.55
	T_3	86	584	5.8	16.77	5.32
Mean		86	582	5.8	16.64	5.36
LSD (0.05)		1.2	9.2	ns	0.54	0.51

Reference

[1]. ***Al- Zubaidi, A. 2004***. Influence of the system of irrigation and soil pulverization in some soil physical characteristics and growth of corn crop. PhD Thesis in Agricultural Machines. University of Baghdad.

[2]. ***Al-Ajeli, S. D. 2008***. Effect of ploughnhing system, pulverization tools and tractor speed on the machinery group, mean weight diameter and saturated hydraulic conductivity. MS. Thesis in Agricultural Machines. University of Baghdad.

[3]. ***Baver, L., W. Gardner and W. R. Gardner. 1977.*** Soil physical. 4th ed. John Wiley and Sons Inc., New York.

[4]. ***Carter, M. R. 1992***. Characterizing the soil physical condition in reduced tillage systems for winter wheat on a fine sandy loam using small cores. Canda J. Soil Sci. 72(4):395-402.

[5]. ***Cassel, D., C. Rachzkowski and H. Denton. 1995***. Tillage effect on corn production and soil physical conditions. Soil Sci. Soc. Am. J. 59:1433-1436.

[6]. ***Chang, C., and C. Lindwall. 1979***. Effect of long – term minimum tillage practices on some physical properties of a Chernozemic clay loam. J. Soil Sci. 69:443-449.

[7]. ***Edwards, J., C. Wood, D. Thurlow and M. Ruf. 1992***. Tillage and crop rotation effect on fertility status of Hapludult soil. Soil Sci. Soc. Am. J.56: 1577-1582.

[8]. ***Hill, R. 1990.*** Long-term conventional and no tillage effects on selected soil physical properties. Soil Sci. Soc. Am. J. 54:161-166.

[9]. ***Hunt, D. 1980***. Farm Power and Machinery Management. The laboratory manual and work book Iowa State Univ. IOWA.

[10]. ***Jaradat, A. and N. Haddad. 1994***. Analysis and interpretation of mashreq project findings (1990-92). Special report: increased productivity of barley, pasture and sheep (RAB/89/026). ICARDA- West Asia Regional Program, Amman, Jordan.

[11]. ***Karlen, D. 1990.*** Conservation tillage needs. J. Soil Water Conserv. 45: 365-369.

[12]. ***Klute, A. 1986***. Water Retention: Laboratory Methods. In Klute, A. ed., "Methods of Soil Analysis". Part (1).2nd. Physical & Mineralogical Properties. Agron. Mon. 9: 687 - 734.

[13]. ***SAS, SAS Users guide. 2002***. Statistics SAS, Inst.Gary, N.C.,U.S.A.

[14]. ***Shone, M. and A. Flood. 1988***. Effect of period of localized water stress on subsequent nutrient uptake by barley root and their adaption by osmotic adjustment. New Phytologist, 94(4): 561-577.

[15]. ***Yaya, A. 1998***. Loading the tractor with two ploughs, moldboard and disc plough measuring the indicators under dry land condition, PhD Thesis in Agricultural Machines. University of Al- Mosul.

[16]. ***Yoder, R.E. 1936.*** *A direct method of aggregate analysis and study of the physical nature of erosion losses. Soil Sci. Soc. Am. Proc. 28:337 – 351.*