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The Effect of Conservation Tillage, Planting and Irrigating Methods On Water Use Efficiency and Wheat Grain Yield in North of Ahwaz

M. Ghazanfar, M.A. Asoodar and Kh. Alami Saeed
Department of Agricultural Machinery Engineering,
Ramin University of Agriculture and Natural Resources, Ahwaz, Iran

Abstract: One of the factors affecting yield crops is application of suitable tillage and planting methods. Considering that Iran is a semiarid area and the water crisis is one of the limiting factors in agriculture. The study was conducted to evaluate the effect of tillage and planting methods on WUE and yield in wheat in 2008 in Ramin Agricultural University Research Farm. This study was performed as split plot in the form of completely randomized block design in three replication. Tillage treatments include reduced tillage (chisel once pensive) reduced tillage (twice chisel pensive) no-tillage and conventional tillage (moldboard plow and twice disk two times) in the main plots and planting treatments included 60 and 75 cm on beds and flat planting. The effect of tillage and planting method, on water use efficiency was significant wit tillage, 19.5 L m^{-2} on reduced tillage water consumption was shown. In planting methods, bed planting 60 cm with 25.9 L m^{-2} was the lowest water consumption. WUE of no tillage with 1.67 kg m^{-3} showed the highest value. In wheat yield among tillage treatments and planting no significant difference was observed. While grain yield in conventional tillage with the amount of 5657 kg ha^{-1} was the highest rate among tillage methods. Also, in methods of planting, flat planting with 6510 kg ha^{-1} was the highest grain yield.

Key words: Tillage and planting methods, water use efficiency, wheat, agriculture, production, Iran

INTRODUCTION

One of the factors limiting agricultural production in the world, particularly Iran is water shortage. About 93% of the country's renewable water resources in agriculture will be refurbished while consumption of agricultural products from countries that meet food needs is not. Special geological conditions and distribution of land development inappropriate to require rain water saving in agriculture is clearly expressed. Therefore, improved food production depends on proper and reasonable use of limited water resources of the country. By the same token we can say that one of the major irrigation water agricultural inputs. results and various studies indicate that average is water total irrigation efficiency was 35% in value from the global average (45% of developing countries, developed and 60%) is lower. About 70% of the water to evaporation, deep percolation, surface drainage and flows through rivers into the sea or thrown out of the borders are (Heidari and Keshavarz, 2004). In the highest water consumption in agriculture is therefore, optimize utilization and reducing it can remove water restrictions to be effective role. Different tillage practices and planting through changes in the physical conditions of the seedbed, the thermal characteristics, moisture, air and soil resistance, how can the green plant to be effective (McMaster *et al*., 2002). One of the important is agronomic operations in most plants, tillage. Tillage equipment must be suitable for germination and root growth with minimal energy consumption to prepare so that the final soil conditions are acceptable and desirable (Shafiee, 2005). More than half the energy used to produce agricultural products will be spent on tillage. Low tillage with an expenditure of less than optimal diet and water for physical plant and provides activities that micro Homos participates in the synthesis, increases. Every continent and every region of the soil, rainfall, ground water depth, the amount of evapotranspiration from soil and plants. Tillage machines should be used to vary the most suitable soil machine intern in each region is specified (Shams Abad and Rafiee, 2006).

Factors on the rate of productivity of water are affecting the pattern and density of seed is cultivated. Seed density of the most important factor in yield is that if the rate reduction is less than optimal product and follow the reverse if the optimum amount is higher due to increased competition, spike weaker and thus less product is obtained. Considering the initial cost of planting seed

Corresponding Author: M. Ghazanfar, Department of Agricultural Machinery Engineering,
Ramin University of Agriculture and Natural Resources, Ahwaz, Iran

density rises (Shams Abad and Rafiee, 2006). Traditionally wheat in Iran on the ground flat and linear work using traditional seeds or spraying and hand spraying as occurs in proportion to its method of flood irrigation which also has a very low efficiency and distribution uniformity. Planting wheat on the stack is one of the ways that widely used in developed countries.

The system also increase irrigation efficiency and reduce water consumption due to leakage irrigation method (atmospheric and stack), significantly increased the yield per unit area (Talukder *et al*., 2004). To achieve greater performance and revenue, including new methods of cultivation and climate nesting and protective methods have been popular and prosperous (Knowler and Bradshaw, 2007).

So study the effect of conservation tillage practices and planting to reduce water consumption and irrigation, farm research Ramin University of Agriculture and Natural Resources and the project was essential to evaluate water productivity in wheat production was affected by tillage and seeding machines were implemented.

MATERIALS AND METHODS

In this experiment 2008-09 Farming Research Station University of Agriculture and Natural Resources Ramin in Khuzestan was performed. This study as a split plot in randomized complete block design in three replicates was carried out.

Tillage treatments include reduced tillage (chisel once pensive), reduced tillage (twice chisel pensive), no-tillage and conventional tillage (moldboard plow and disk two times), respectively. Treatments include planting, planting on ridges 60 and 75 cm and that of flat planting plots were located. Parameter investigated in this project was to plot the amount of water input and yield of wheat.

Measurement to water, irrigation project recollect siphon method was used. To transfer water from the creek to the bore diameter of the plastic siphon 3.8 cm was used. Micro savings measures for grain yield, first one side plots μ and 2 m high and low for Kurt μ eliminate border effect was removed.

Then the rest of the level needed of Crete Tuesday m^2 area using a square area frames randomly selected plants available in this level of accuracy and without seed loss is suffered almost were harvested from the floor, after weighing and thrashing, seeds were separated and were weighed. Micro size for making biological yield, after harvesting ($3m^2$ of each plot) and spike weight, straw and stalk of seed micro scale carefully μ 1 g size was monitored. In order to calculate WUE Eq. 1 were used:

$$WUE = \frac{Y}{WU} \quad (1)$$

Where:

WUE = Water use efficiency (kg m^{-3})
Y = Yield (kg)
WU = Amount of water consumption (m^{-3})

Statistical calculation and analysis of the data using SAS software and charting using Excel software were performed to compare mean from a Duncan multiple range test was used.

RESULTS AND DISCUSSION

Mean of different levels of tillage methods on water consumption and irrigation in the Table 1 is shown. That no tillage with 19.5 L m^{-2} minimum water consumption and chisel twice with 37.7 Lm^{-2} is the highest water consumption.

Oleary (1996), Hatfield *et al*. (2001), Shukla *et al*. (2003) and Karamanos *et al*. (2004) showed that conservation tillage systems generally cause more stored moisture in the soil that reduce water consumption. This system compared with conventional tillage system due to residue on the soil surface reduces evaporation of soil moisture and increase water infiltration and reduce slavery.

Planting, irrigation water consumption is shown in the Fig. 1. Planting, three lines with 360 cm culture line had the lowest water consumption. Effect of planting methods in relation to consumption of irrigation water, Hossain *et al*. (2004), Talukder *et al*. (2004), Fahong *et al*. (2004), Hassan *et al*. (2006), Su *et al*. (2007) and De Vita *et al*. (2007) showed that the atmospheric pattern has through the stack and effective in reducing water consumption.

Analysis of variance effect of tillage and planting on irrigation water use efficiency as shown in Table 2. The only factor affecting water use efficiency, tillage is the 5% level is significant. Cresswell *et al*. (1993) found that no tillage with preserved plant remains in the soil surface,

Table 1: Comparison of average tillage methods on water use

Tillage methods	Water use (L m^{-2})
Reduced tillage (twice chisel0	37.7[a]
Conventional tillage	32.9[a]
Reduced tillage (one pass chisel)	32.5[a]
No-tillage	19.5[a]

Similar letters indicate no significant difference ($p \leq 5\%$)

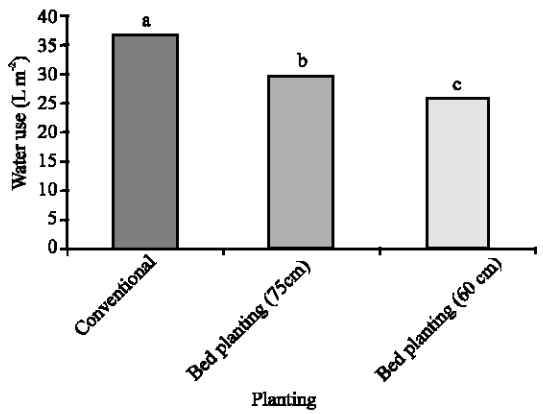

Fig. 1: Effect of planting methods on water use

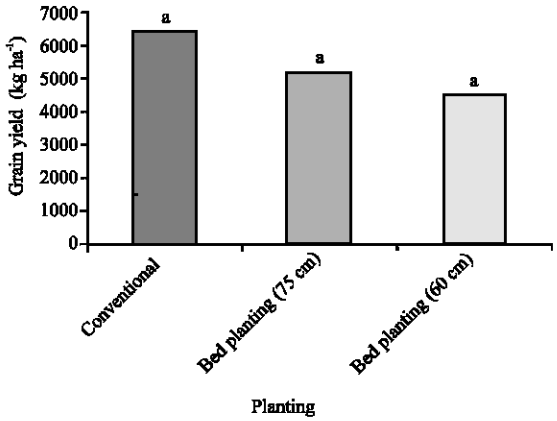

Fig. 2: The effect of planting methods on yield

Table 2 : Analysis of variance WUE

		Water use efficiency (kg m^{-3})	
Source of differences	df	F	MS
Replication	3.000	2.42^{ns}	2.537
Tillage	3.000	4.15*	6.536
Error	9.000	1.50^{ns}	1.573
Planting	2.000	1.50^{ns}	0.230
(TxP)interaction	6.000	0.77^{ns}	0.811
Error	24.000	-	1.050
CV	9.158		

*, **Ns, respectively shows significant difference in the level of 5, 1% and no significant difference

Table 3: Comparison of average tillage methods on water use efficiency

Tillage	Water use efficiency (kg m^{-2})
No tillage	1.67^{a}
Conventional tillage	1.47^{ab}
One pass chisel	1.38^{b}
Twice chisel	1.22^{b}

Similar letters indicate no significant difference (p≤5%)

Table 4: Performance analysis of variance

		Yield (kg ha^{-3})	
Source of differences	df	F	MS
Replication	3.000	2.17^{ns}	213387263.90
Tillage	3.000	0.96^{ns}	13606454.10
Error	9.000	1.44^{ns}	14113587.00
Planting	2.000	1.13^{ns}	11120014.20
(TxP) interaction	6.000	0.77^{ns}	6060496.50
Error	24.000	-	9814232.67
CV	20.344		

*, **Ns, respectively significant difference in the level of 5 and 1% and no significant difference shows

Table 5: Comparison of average tillage on wheat yield

Tillage	Yield (kg ha^{-3})
Conventional tillage	5541^{a}
No tillage	5121^{a}
Twice chisel	5074^{a}
One pass chisel	5053^{a}

Similar letters indicate no significant difference (p≤5%)

soil temperature, soil radiation reflected with reduced moisture and store, it reduces evaporation and increases water infiltration into the soil to further and require less water during irrigation and consequently shows higher efficiency.

Mean different levels of tillage methods in Table 3 shows that no tillage with 1.67 kg^{-3} property is highest WUE. With the effect of tillage methods on water use efficiency, Azooz and Arshad (1995) showed that no tillage increased water use efficiency.

Based on analysis of variance Table 4 in terms of wheat yield between different treatments and planting and tillage interactions are no significant differences were observed.

The results with findings Khosrovani *et al.* (1999) and Lithourgidis *et al.* (2006) is consistent, Gill and Aulakh (1990) about the effect of different tillage methods on wheat yield and its components of water which suggests that grain weight under effect of tillage but plant height and grain weight did not show respond to different tillage treatments. Table 5 is observed in the absence of significant difference, with the highest yield average 5657 related conventional tillage and this result is due to play more softly and the soil is vestigial and the establishment of better seed germination and conventional tillage treatment which is a Moldboard was used.

Tanaka (1989) described the evaluation of product in pea than tillage machinery used that phrase was: no low-tillage and tillage and moldboard plow (conventional method) and compared the difference in reaching out to yield these tillage methods were not significant even without tillage methods tend to yield indicated. Hammett and Asadi (1997) found that use of the moldboard plow wheat amount of water than other methods of tillage had a significant amount of performance has increased.

Mahboubi *et al.* (1993) and Shams-Abad and Rafiee (2006) shown that the ineffective kind of tillage on yield, economically and saves time preparing ground operations and tend to no tillage, one of two method to prepare the ground plow or pruning chisel dish is recommended.

Figure 2 shows that the highest yield flat culture method with the average 6510 kg ha^{-1} is allocated to and from the highest water consumption rate is if the performance difference is not significant.

CONCLUSION

The results showed that no tillage method with 19.5 Lm^{-2} had the lowest rate and planting techniques, methods and atmospheric stack 60 cm with 25.90 L m^{-2} has the lowest water consumption. Also, no tillage the highest water use efficiency 1.67 kg m^{-3}. Conventional tillage with 1.47, once Chisel 1.38 and twice chisel 1.32 kg m^{-3}. The highest yield in tillage methods to conventional tillage has 5657 kg ha^{-1} and planting techniques has traditional culture with 6510 kg ha^{-1}.

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