

The Effect of the Irrigation Water Quality and Different Fertilizers on Quantitative and Qualitative Characteristics of Wheat in Kerman Orzoyie Plain

¹Hassan Etesami, ¹Ali Keshavarzi, ²Abbas Ahmadi, ¹Neda Raiszadeh and ³Heidar Soltani

¹Department of Soil Science, University of Tehran, Iran

²Member of Scientific Board, Islamic Azad University, Arak Branch, Iran

³Department of Civil Engineering, Islamic Azad University, Teharn Center Branch, Iran

Abstract: The study were conducted To evaluate the effect of quality of irrigation water and different levels of the main nutrient on quantitative and qualitative characteristics of wheat plateau, a plan with 3 separate experiments as split plot in three replications. The plan with three salinity levels ($w_1=2.28$, $w_2=5.5$, $w_3=9$ dSm⁻¹) and 9 fertilizer treatments included four levels of nitrogen (0, 70, 100 and 130 kg ha⁻¹), phosphorus levels (0, 30 and 50 kg ha⁻¹) and potassium levels (0 and 50 kg ha⁻¹) were studied in mohamadabad farm in kerman arzoyie. In the studing of effect of each element,two other elements were used in recommended amount based on soil test. in this project 5 times irrigation and after the harvest, yield, 1000 grain's weight and the percentage of protein in different treatments were determined. The Studing of results show that the average yield in w_1 is higher than w_2 and this treatment is more than w_3 and also effects of different levels of nitrogen fertilizer and three levels of irrigation water on yield at 1% level have significant differences. The yield difference with work of three phosphorus treatment and various quality of water have been significant at 1% level and with increasing salinity and using phosphorus fertilizer the yield will be reduced. The yield of water's treatments in 1% level showed significant differences, but fertilizers treatment's yield are not significant. Generally for tap water, w_1 formula fertilizer (0, 30, 70), for salty water, w_2 (0-30-70) and salt water w_3 (50-30-70) kg pure element is proposed in each hectares that amount of nitrogen is less than recommendations amount based on soil tests, phosphorus is equal with considered amount based on soil test and for potassium for the waters w_1 and w_2 is equal and w_3 is more than the recommended amount. Results of analysis 1000grains weight and percentage of protein show that different levels of nitrogen with high quality irrigation waters have the most effect on weight of 1000grains and protein rather than other fertilizer levels. Overall for the optimum use of water resources and saline soils, Special management, correct fertilization and research projects in the field of land reform (especially washing before planting) should performed.

Key words: Saline water • Protein • Yield • The main fertilizers • Wheat

INTRODUCTION

The major part of iran's area have semi-arid and arid climate that they have little rainfall and high evaporation and ultimately these factors lead to salt accumulation in soil.

In these areas a huge part of soils are faced with limitations of salinity that irrigating these lands with poor quality waters can be aggravated problem. But in any case such resources (saline soils) in these areas are considered as a common job that finding a suitable solution for optimum use of these resources is important. For saline water a special management should be applied and use of fertilizers need to attention and observe aspects of

precautions. In these circumstances with selecting plant's model, resistant plants to salinity should be considered [1,2].

Special conditions of the province of Kerman have tensed the salinity problem, which it makes water use and soil the error. arzoyie plains are one of the important areas for crop cultivation that deficit precipitation, severe evaporation and indiscriminate withdrawal of ground water table makes water quality poor in recent years. Evaluating and comparing results of zone water's analysis shows that the intensity of salinity waters is increased in 1998 but in consumption agricultural inputs (especially chemical fertilizers...) and irrigation management we have no changes so for studying the potions of

chemical fertilizers consumption (nitrogen, potassium and phosphorus) in different conditions of salinity of irrigation waters this project is accomplished in arzoie plain.

Studies of Gupta (1990) show that the different plants tolerance of salinity is different and the amount of a particular plant tolerance of salinity at different stages is different. Also salinity is effective on growth and yield of plants thorough increasing osmotic pressure and concentration of specific ions [3].

Studies of Frakoys(1989) that is done on sugar beet, wheat, barley and tomato shows that sugar beet in germination stage and wheat, barley and tomatoes in the next stage of germination are sensitive to salinity [4].

Studies showed the in salinity of saturation extract 12-16, 16-24, 24-16 and 7.5 dSm⁻¹ respectively, sugar beet, wheat, barley and tomato 50% of their seeds is budding [5].

Researches of Frida (1996) distinguished that effects of irrigation water's salinity are different. When salinity is more than 1 dS/m unfavorable effects on seed germination starts so in these cases special management should be applied. Some adverse effects of salinity are spots in the field, delayed growth, inadequate size of plants and bluish green leaves [6]. Also, studies on the germination and growth of wheat in saline soils shows that leaching before planting and apply special management, in the use of saline waters can reduced a considerable percentage of damage due to salinity. Since now many studies about using of saline waters is accomplished [7].

Studies indicate that irrigating cotton with sprinkler system with salinity of 5 dS/m is possible that symptoms of burning on the sidelines of leaves are seen, but it has no effect on yield reduction [1].

The purpose of this research is examine into water's salinity effects on yield, protein percentage and 1000grains weight of plateau wheat in one of the main family of arzoie soil and determining fertilizer formula for the main elements in waters with different salinity.

MATERIALS AND METHODS

With due attention to arzoie Plain in kerman province is the most important region for crop cultivation (especially wheat) that are encountered whit the problem of irrigation water quality. Therefore, this project was carried out in the mohamad abad field in arzoie. Figure1, shows the study area in Kerman province and Iran.

Plan includes three experiments with different treatments of nitrogen, phosphorus and potassium and three quality of irrigation water which is conducted on plateau wheat. This plan in three Separate point with three salinity levels (9 and 5.5 and 2.28 dSm⁻¹) and 9 fertilizer treatments (recommended based on soil test), including four levels of nitrogen (0, 70, 100 and 130 kg ha⁻¹), three levels of phosphorus (0, 30 and 50 kg ha⁻¹) and two levels of potassium (0 and 50 kg ha⁻¹) respectively from Ammonium sulfate, triple super phosphate, potassium sulfate with three replicate in 2 m square plots was conducted as split plot.

In studying of each elements effect, two others elements were used in recommended amount based on soil test. Phosphor and potassium and 1/4 of nitrogen fertilizers were distributed uniformly in plots before planting and other Nitrogen fertilizers were used on three occasions. Experimental plots with mentioned three irrigation water quality in the first place of tap water (research station's water), second place brackish water

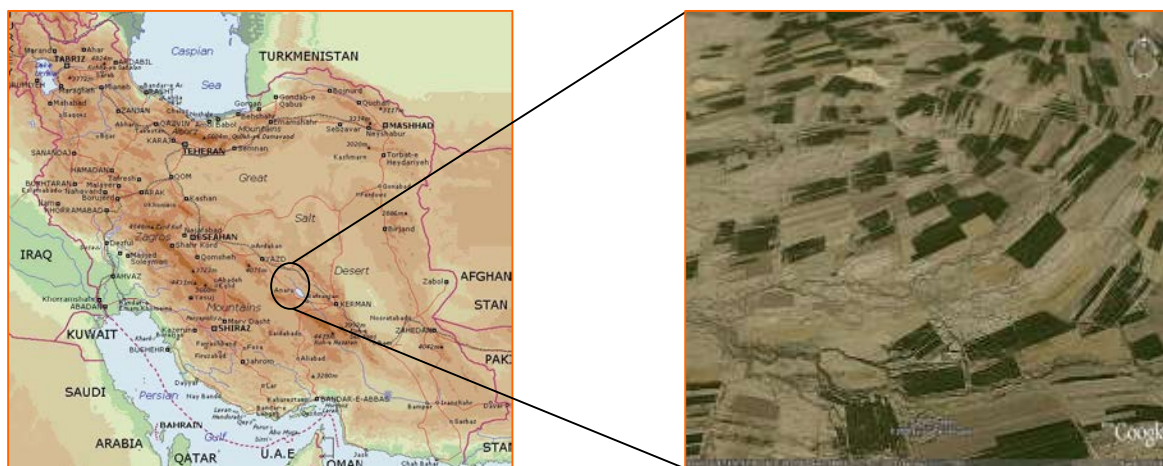


Fig. 1. Location of the study area

(rural motor pump's water) and third place saline water (mohamadabad motor pump's water) that water locations 1 and 2 were carried by Tanker and plan irrigated 5 times.

Before the plans implementation, soil samples were prepared from field and analyzed. Also the sample of water consumed was prepared and analyzed and in each turn of irrigation the water salinity was determined. After harvesting wheat, yield, weight of 1000grains and protein's percentage in different treatments were determined and analyzed.

RESULTS AND DISCUSSION

Overall, the studying of results indicate that the average yield (for all levels of fertilizer consumption) in W_1 treatment is more than W_2 and also the average yield in this treatment (W_2) is more than W_3 treatments. The results of yield's variance analysis with consumption 4 levels nitrogen (N_1, N_2, N_3, N_4) and three levels of irrigation water (W_1, W_2, W_3) showed that the effects of consumption different levels of Nitrogen fertilizer on yield had significant difference at 1% level statistically and also three qualities of irrigation water were caused a significant difference on yield at 1% level.

The results of comparing interaction effects mean between nitrogen fertilizer and irrigation water quality showed that the yield's mean (W_1N_2) with the amount of 4100 kg ha^{-1} have had the highest yield and with increase and non-use of nitrogen and water salinity, yield mean will decrease significantly, so that the yield's mean (W_3N_4) and (W_3N_1), respectively 1900 and 1700 kg ha^{-1} are lower than other treatments. So for three water samples used (W_1, W_2, W_3) 70 kg ha^{-1} of nitrogen is recommended that is less than the recommended amount based on soil test.

From analysis of variance can be concluded that performance differences by applying three phosphor fertilizer treatments (P_1, P_2, P_3) is significant at 1% level. These results also indicate that performance differences of different water qualities (W_1, W_2, W_3) is significant at 1% level statistically. On the other hand applying different phosphor treatments and irrigation water have interaction effect on yield that can be seen at 1% level statistically. Comparison results indicate that the yield's mean with using three different levels of irrigation water quality are treated in three groups and differences between them are significant so that the yield (W_1P_2) is the highest (3590 kg ha^{-1}) and with increasing electrical conductivity of water (W_2, W_3) yield decreased significantly, so that the treatments yield mean (W_3) is lowest (about 2050 kg ha^{-1}).

Accuracy in comparison with results of operations will be determined by increasing electrical conductivity of irrigation water and consumption of phosphor fertilizer the yield will be decreased so that yields mean of consumption three levels of phosphor fertilizer (P_2, P_1, P_3) in the saline irrigation water (W_3) have no significant difference it means in irrigation water (W_3) use or non-use of fertilizer has no effect on yield.

Tables of analysis of variance indicated treatments yield's differences (W_1, W_2, W_3) with potassium levels are significant at 1% level statistically, but yield of treatments (K_1) and (K_2) is not significant. Also consumption of potassium fertilizer and irrigation water quality in 1%-level indicated interaction effect on yield. In general we can say that in waters (W_1) and (W_2) level (K_1 - non-use of potassium fertilizer) and for water (W_3) treatment (K_2 - consumption $50 \text{ kg per potassium ha}$) recommended that for normal waters and brackish water is equal with recommended amount based on soil test and for saline water is more than the recommended amount. The results

Table 1: Soil's physical and chemical characteristics in experiment's area

Texture	SAR	$\text{Ca}^{2+}+\text{Mg}^{2+}$ (meq.lit ⁻¹)	Na^+ (meq.lit ⁻¹)	K_{ava} (mg.kg ⁻¹)	P_{ava} (mg.kg ⁻¹)	OC (%)	TNV (%)	pH	ECe (dSm ⁻¹)	Soil Depth (cm)
Silty Loam	15.1	106	110	222	12	0.5	28.7	8.3	19.9	0-30

Table 2: Applying water's chemical characteristic in study area

Location of motor pump's water	ECe		meq.lit ⁻¹							SAR
	(dSm ⁻¹)	pH	Cl^-	HCO_3^-	SO_4^{2-}	$\text{Ca}^{2+}+\text{Mg}^{2+}$	Na^+	Ca^{2+}	K^+	
rural	2.28	7.5	13.6	4.2	9.3	11.2	16.2	-	-	6.84
research station's water	5.5	7.5	36.2	4.8	29.3	32	39.5	-	-	9.87
Mohammad Abad	9	7.2	18	8.4	92	65	53.6	-	-	9.4

Table 3: Comparison the average of different amount of nitrogen consumption's effect in wheat yield in different levels water's salinity

Nitrogen consumption (Kg.ha ⁻¹)	Water's Salinity (dSm ⁻¹)				
	ECw = 4	ECw <6.3 > 4.1	ECw <8.7 > 6.4	8.8>ECw<11	11<ECw
0	2833c	2027c	1760c	1580c	1376c
70	4100a	2757a	2407a	2100a	1945a
100	3600b	2383b	2110b	1970b	1743b
130	3423b	2240bc	1890bc	1674b	1458bc
Average	3487A	2352B	2042C	1831B	1630B

Table 4: Comparison the average of different amount of nitrogen consumption's effect in biologic yield of wheat in different levels of water's salinity

Nitrogen Consumption (Kg.ha ⁻¹)	Water's Salinity (dSm ⁻¹)				
	ECw = 4	ECw <6.3 > 4.1	ECw <8.7 > 6.4	8.8>ECw<11	11<ECw
0	5933c	4702c	4100c	3577c	3190c
70	8475a	5647a	5234a	4987a	4573a
100	7150b	4815b	4600b	4440b	4067b
130	7148b	4715bc	4357bc	4065bc	3800bc
Average	7177A	2352B	4573C	4267C	3900B

Table 5: comparison the average of different amount of phosphor consumption's effect in wheat yield in different levels water's salinity

Phosphor Consumption (Kg.ha ⁻¹)	water's salinity (dSm ⁻¹)				
	ECw = 4	ECw <6.3 > 4.1	ECw <8.7 > 6.4	8.8>ECw<11	11<ECw
0	2567b	2210b	2033a	1904c	1875c
30	3590a	2633a	2083a	1874c	1673b
50	3543a	2600ab	2040a	1680b	1452b
average	3233A	2481B	2052A	1832C	1670B

Table 6: Comparison the average of different amount of potassium consumption's effect in wheat yield in different levels water's salinity

Potassium Consumption (Kg.ha ⁻¹)	water's salinity (dSm ⁻¹)				
	ECw = 4	ECw <6.3 > 4.1	ECw <8.7 > 6.4	8.8>ECw<11	11<ECw
0	3060a	2170a	2033a	1930b	1875c
50	2940a	2180a	2083a	2240a	1673b
Average	3000A	2175B	2058B	2085B	1774C

of variance Analysis showed that if the weight of 1000grains were in all three experiments in three water treatments (w_1, w_2, w_3) irrigations have significant difference at 1% level. in the used fertilizers treatments the effects of treatments on 1000grains weight is which applying four nitrogen levels (N_1, N_2, N_3, N_4) at the 1% level show significant effect on 1000grains weight but this effect about 3 levels of phosphorus fertilizer (P_2, P_1, P_3 is significant at 5% level and in using of the potassium fertilizer (K_1, K_2) a significant difference between 1000 grains weight is

not seen. In addition, in all three experiment between different fertilizer treatments and irrigation water, the results of variance analysis of protein of consisting samples of wheat indicate that generally, in different waters (W_1, W_2, W_3) the applying nitrogen treatments have highest protein percentage rather than phosphorus and potassium(the highest protein nitrogen treatments (W_1N_1) – 14.88%, phosphorus (W_3P_3) 14.63% and potassium 14.65%,)also in normal waters the amount of protein in (W_1N_4) -14.88%) treatment is higher than other treatments.

CONCLUSION

Overall, the studies show that there are too differences between the recommended fertilizer formulas that obtained with the amount of consuming fertilizer farms. Consumption of fertilizer in various fields with different salinity and alkalinity and physical characteristics is almost the same. In case the needs of different products to fertilizer are different in soil.

This study was done in a (Coarse loamy, Mixed, Hyperthermic, Typic Torrifluvents) soil and for tap water (W_1) fertilizer formula (0-30-70), for brackish water (W_2) (0-30-70) and for salt water (W_3) (50-30-70) kg pure element per ha is obtained.

According to research conducted in this area the following is recommended:

- Study of soil salinity location plans ($EC=19.9 \text{ dSm}^{-1}$) and other samples of analyzed soil from the farms shows that soil salinity is high so for reducing the damages of salinity and more products in area of projects about Land reform, especially washing the soil before planting is recommended [2]
- With due attention to the process of plain water salinity a complete study about the quality and speed of damages should be done.
- Cropping pattern in the fields should be selected based on soil characteristics and water quality.
- Consumption of chemical fertilizers must be conducted based on plants needs and the results of research projects.

For saline water special management should be applied and intercept indiscriminate using of fertilizers.

REFERENCES

1. Haghnia, G., 1996. plants tolerance for salinity (translate), mashad university jahad publication
2. National committee of irrigation iran 2003 using saline and brackish water for irrigating number 26 magazine.
3. Gupta, I.C., 1990. Use of saline water in Agriculture, A study of arid and semiarid zones of India, Revised edition oxford & IBH publishing co, Pvt. Ltd.
4. Fracois, L.E., T. Donovan, K. Lorenz and E.V. Maas, 1989. Salinity effects on grain yield, quality, vegetative growth and emergence Agron. J., 81: 707-712.
5. Alizadeh, A., 1984 waters quality in irrigation (translation) Astan Ghodse Razavi publication. Third edition. pp: 93.
6. Ayers, R.S. and D.W. Westcot, 1985. Water quality for Agriculture, FAO. Irrigation and Drainage paper No. 7. Rome.
7. Samadi, H., 2001. studying the effect of waters chemical combination on absorption and transmission elements in two genotype of pistachio sapling and their growth. Ph.D dissertation in soil science, Agriculture Faculty of Tehran University. pp: 300.