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Reaction of Wheat Yield to Soil Physical and Chemical Characteristics in Arak Fields

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Abstract: In order to evaluate the impact of physical and chemical properties of soil on Bekras kind wheat yield in the city of Arak, a completely randomized block experimental plan has been implemented with three replications in the1390 crop year. Treatments include the overall condition and qualifications of wheat field 's soil in 18 wheat farms, which were randomly selected. Traits in this experiment was including the physical and chemical properties of soil associated with wheat yield. The results show that farms with balanced percent age of clay particles, silt and sand, rich inorganic material, having a neutral pH and low electrical conductivity of soil solution, The need for increased microbial activity and nutrient availability in soil solution and improve in nutrient up take by roots has provided and thus favorable conditions for plant growth will be prepared. According to the results of variance analysis and compared average characteristics, farm number 14 has entitled better conditions than the others. And Maximum yield is allocated to this farm by creating better soil condition, more fertility and better absorption of nutrients and low consumption of soil by plant.

Key words: Wheat Bekras · Soil solution · Variance analysis · Yield

INTRODUCTION

Wheat is from Graminea and is one of most important plants which allocate about 17 percent of world cultivation arable lands to itself. On the other hand it is the staple food of more than 35 percent of the world's poor. And has the highest energy and protein compared to other plants [1]. One of Environmental factors affecting growth and development of plants is soil which its characteristics are usually different indifferent areas. one of characteristics that influences plant growth in soil, is its acid and alkali amount so that at pH less than4 and more than 9, plants have difficulties in absorbing their required mineral elements. In Temperate and forest soil with high rainfall, Cations that are present in the soil, are subjected to washing. But hydrogen remained in the soil and causes to lower the pH and lowered pH is also impaired the activity of microorganisms. In arid areas,due to high salt, soil pH is increased and it causes problems in the absorption of nutrients in to the soil. Appropriate pH for most plants is usually between6 to 7.Other functions of the soil is to afford required nutrients for plant growth and crop production [2]. Quoted from Padole [3] Absorption of nitrogen, phosphorus, potassium, calcium, magnesium, zinc, manganese, copper and iron is reduced by soil and irrigation water salinity. The electrical conductivity of soil is increased by water salinity [3] Mohammad [4] reported that with lowering ph in calcareous soils, nitrogen use efficiency is increased. Also due to participate in the metabolism of nitrogen, potassium improves nitrogen use efficiency [4]. Information about soil nutrient status is one of the most important factors in increasing the quality and quantity of crops.wheat is one of the most important corps in Iran and the world. In recent years, the improvement of crop management techniques has successfully increased crop yield [5, 6]. Wheat research is important in order to achieve high performance and its increased quality in particular, the amount of protein, providing nutrients and especially nitrogen [7]. Plant growth and crop production depend on Balanced combination of soil nutrients and climatic conditions suitable for the area..plant root feeding depends on plant

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Genetic characteristics,soil specification Such as planning and coarse soil texture, type of soil colloids, percent organic matter, soil pH and amount of soil nutrient and the capability of absorbance [8] due to the constructive effects on physical, chemical and biological properties of soil, Soil organic matter are considered as good indicators of fertility, health and soil quality. The amount of organic matter in more than 60% of under cultivation soils in Iran is less than 1% and in a significant proportion is less than 0/5% which this matter is effective in reducing crop yield and the necessity of more attention to organic fertilizer is inevitable [9]. Nitrogen is one of the most important elements which Iran's wheat under cultivation lands are facing to its shortage [10, 11] at different growth stages, Nitrogen causes increase in grain yield by increasing the number of tillers per plant, number of spikes per unit area,number of grains per spike, grain weight and more accumulation of dry matter yield [10-12]. Stored Carbon and nitrogen in soils have an important role before flowering ingrain filling under conditions that plants are facing with moisture stress after flowering [12]. M. [4] reported, that moderate consumption of nitrogen in wheat caused decreasing in drought and salinity stress effects in the climate of Pakistan [4]. Phosphorus stimulates growth and better establishment of plant and well penetration of roots. This initial plant growth stimulation may cause faster and deeper penetration of roots in the lower layers of soil So that the plant will be able to use lower layer's water more effectively [13]. Potassium is not an integral part of plant organs but its role is mainly catalytic. With lowering potassium optical metabolism decreased and respiration rate increased and its result is to reduce carbohydrates. plants with high amount of Potassium has stronger holder tissues and due to this tissues, the stability of corps increased against viruses and striking to the fungal diseases reduced. Potassium also plays an important role in maintaining sufficient water in the plant organs. The relationship between potassium and protein is of special importance in plant metabolism [14].

MATERIAL AND METHOD

To investigate the effect of soil physical and chemical properties on Bekras wheat yield, a test was implemented in three replications in 18 irrigated wheat lands with randomized complete block design performed in the city of Arakincropyear 1390. Test traits were physical and chemical properties of soil of 18 farms and was measurement of the fields grain yield. After determining the desired 18 fields and coordination With their owners, the first sampling was done of 30-0cmdepth of the land soil. and With conventional laboratory methods, physical and chemical characteristics of soils were measured. After passing the duration of growth and maturation time, Average grain yield per unit area per farm was measured and recorded. And direct and in direct physical and chemical properties of soil were surveyed and analyzed in 18 grain yield farms. Data were analyzed using statistical software MSTAT-C and The averages of measured characteristics were compared And evaluated using Duncan test at the level of five percent probability.

RESULTS AND DISCUSSION

Considering The measured variance composition table, the effect of various treatments on the characteristics of the clay, silt and sand percentage in the level of one percentage probability is significant. Considering to the experimental treatments average Comparison table, the highest average of Clay, silt and sand were farms number 15 and3 and 7 respectively. And the percentage of clay in the fields number 15 and14 and1 are also placed in one statistical category. the Amount of clay which is one of important soil colloids and has a very effective role in nutrient up take and soil water content, were, 47/36 and 44/44 percent respectively in farms number 15 and 14. Considering The correlation coefficients desired traits table, positive and significant correlation (*0/31 = r) is observed between the clay soil percentage and wheat grain yield.Considering to the experimental treatments average Comparison table, the highest wheat grain yield (5000kg ha) was got from farm number 14 which this land had high percent clay. On the other hand, the farm number 14 with 20% sand content and 44% Sylyt content, have a relative ventilation through intermediation of 20% sand,Beside having a good proportion of clay and Silt, percentage. So by considering the mentioned physical properties, it seems that Such soil causes growth and Better developed root systems of plants through proper ventilation and plant has greater volume of soil and by increasing water absorption and required nutrient in mycorrhizal root, it has optimum growth conditions through the high amount of clay in this region and could create a good canopy volume and has used the best from the environmental conditions and finally has achieved the most favorable grain yield. Considering the measured variance decomposition table, the effect of different soil properties treatments on the percentage of elements such as potassium, phosphorus and nitrogen are significant at the level of one percentage probability (Table 1).

Table 1: Analysis variance of measured traits

S. O. V	df	Clay	Silt	Sand	K	P	N%	OC	T.N.V	pH	EC	Sp	Grain yield
Replication	2	4.7 ^{ns}	0.000 ^{ns}	0.001 ^{ns}	190.74 ^{ns}	1.57 *	0.00 ^{ns}	0.013 ^{ns}	5.28 ^{ns}	0.001 ^{ns}	0.029 ^{ns}	7.43^{ns}	320000 ^{ns}
Treatment	17	80.96**	225.61**	494.99**	12219.17**	155.09**	0.009**	0.881 **	214.56**	0.097**	0.113**	43.16**	700196.08**
Error	34	1.74	0.265	0.201	348.58	0.352	0.000	0.005	2.102	0.01	0.016	2.413	111764.71
C.V (%)		4.47	1.18	1.66	8.25	5.73	10.29	6.91	5.76	1.23	8.45	3.97	8.44

ns,*and**;Non significant. Significant at the 5% and 1%levels probability, respectively

Considering the comparison of average experimental treatments, the highest percentage of Potassium is equivalentto 320 which is related to the farms number 14, 12, 8 and the lowest percentage of potassium is also obtained from the farms number 17, 13, 11 and 6.

Maximum grain yield is 5,000 kgper hectare which was obtained from the farm number 14 which with considering correlation coefficient table of considered traits, a positive and significant correlation (r=0.31*) is existed between potassium of the soil and grain yield. It seems that potassium has provided appropriate field for achieving optimum performance Through maintenance of sufficient water in plant organs and adjustment of Plant osmotic potential, adjusting opening and closing of stomata, increase in plant holder tissues strength and helping for accelerating the transfer of nutrition in plant and preventing contamination in the plant and fungal diseases.

Considering the comparison table of average experimental treatments, the maximum amount of soil phosphorus was related to the farmnumber 14 with 35.53 percent. It seems that phosphorus has participated in the structure of plant vital ingredients and provides the required energy of plant and by this plant can do it s metabolic activity. Also phosphorus provides suitable field for production with high performance in plant by producing abundant roots, stimulating tiller percussive, increasing seed weight.

The highest percentage of nitrogen is equivalent to 0.28 related to the farm number 14. Considering the correlation coefficients of measured traits table, a significant positive correlation (** 0.44 = r) is exist between the percentage of soil nitrogen and grain yield. It seems that the nitrogen element is effective as the main Food element in plant growth stages. Existence of proper source of Nitrogen in the soil causes the development of aerial plant organs in proper time and followed by the maximum usage of environmental conditions. Since the consumption of nitrogen is effective on the Biochemical interaction, photosynthesis and increasing the duration of growth period and accumulation of most aerial dry matter and grain yield components It seems, its effect on grain yield is dramatic [15, 16]. Also due to the relative balance of the high Consumption elements in environment around the root, provide a proper absorption field for other nutrient elements and therefore plant uses water, light and food sources with high performance proper growth [17].

And finally, an appropriate area is provided to create reproductive reservoirs.

And considering to the existing potential in the soil and proper physical characteristics of soil,the field of proper nutrition transport to the reservoirs has provided and as a conclusion, reservoirs has been filled in proper time and in following, grains gain suitable weight and therefore achieve optimum performance [18].

According to the analysis of variance table, the effect of different properties of lands soil on the percentage of organic matter is significant at the level of 1% probability.

Considering to the Comparison of experimental treatment stable, the highest percentage of soil carbon is equivalent to 2.8 percent which is related to the farm number 14. The highest grain yield which is equivalent to 5,000 kgper hectare is obtained from this farm and according to the table with correlation coefficients of traits, positive and significant correlation (**0.59= r) is exist between the percentage of soil organic matter sand grain yield. It seems that the soil organic matter helps in enhancing the soil biochemical activities by providing a proper substrate for The activity of soil microorganisms so it can be obtained that Increase in soil organic fertilizer is a major factor in improving the soil quality and increasing the product yield.on the other hand, in addition to the improvement of soil physical and biomedical conditions, organic matters can enhance the exchange absorption capacity of soil which it can also enhance soil fertility. This is the exchange capacity of soil's nitrogen, phosphorus, potassium elements with increase in increased organic carbon which is very important for the fertility of soil. According to Table 2 it can be seen that with increasing organic carbon, pH of soil has decreased due to the production of organic acids during decomposition of the organic matter which reduces the acidity of soil and this matter is important in calcareous soils which are in trouble in soil acidity and nutrient solution and uptake. Considering to the Comparison table of mean measured traits, farms which has organic matters in their soils more than one percent, produce acceptable

Table 2: Means comparison of measured traits of 18 fields in Arak city

Treatment	Clay%	Silt%	Sand%	K(ppm)	P(ppm)	N%	OC%	TNV%	pH	EC(ds.m^{-1})	Sp	Grain yield(t.ha $^{-1}$)
1	35.87 ab	56 b	8.13 k	250 b	7.47 fg	0.12 d	1.2 cd	28.4 de	8.3 a	4.17 b	44.37 a	4233 b
2	28 ef	38 h	34 e	200 cd	12.4 d	0.15 b	1.48 b	16 h	7.7 d	3.1 d	36.6 cd	4100 bc
3	34 bc	60 a	6 l	250 b	6.40 hi	0.08 g	0.84 gi	15 hi	7.7 d	3.7 c	44.6 a	3500 c-e
4	26 f	38 h	36 d	180 de	9.6 e	0.09 f	0.87 fh	23 f	8.1 b	1.2 e	35.30 cd	3900 bd
5	26 f	38 h	36 d	250 b	6.4 hi	0.06 i	0.61 jk	13 i	7.9 c	0.62 h-j	36.6 cd	4200 b
6	28 ef	30 g	42 b	120 fg	4.2 k	0.04 k	0.42 m	35 b	8.1 b	0.77 f-h	37.9 c	4150 b
7	26 f	30 g	44 a	200 cd	5.4 ij	0.07 h	0.72 ij	17 gh	8 b	0.43 j	36.47 cd	4000 bc
8	30 de	44 f	26 f	320 a	14 c	0.09 f	0.85 fg	15.5 hi	8.1 b	0.82 f-h	37.7 cd	3500 c-e
9	28 ef	38 h	34 e	220 bc	10 e	0.11 e	1.1 de	31 c	8.1 b	0.77 f-h	37.60 cd	4333 b
10	32 cd	50 d	18 h	286.7 a	12.20 d	0.13 c	1.3 c	26 e	7.9 c	0.87 fg	44.30 a	4500 ab
11	30 de	52 c	18 h	150 ef	4.8 jk	0.09 f	0.99 ef	19 g	8.1 b	0.47 ij	40.67 b	3250 e
12	34 bc	50 d	16 i	320 a	13 c	0.13 c	1.3 c	28 de	7.9 c	0.89 fg	43.90 a	4500 ab
13	26 f	36 i	38 c	180 de	8 f	0.05 j	0.46 lm	35 b	8.6 bc	0.67 g-i	31.80 e	3333 de
14	36 ab	44 f	20 g	320 a	35.53 a	0.28 a	2.8 a	27 de	7.7 d	1.4 e	41 b	5000 a
15	38 a	52 c	10 j	250 b	9 e	0.11 e	1.1 de	30 cd	8.1 bc	0.67 gi	40 b	4000 bc
16	34 bc	48 e	18 h	250 b	16 b	0.08 g	0.80 hi	17 gh	8.2 ab	0.99 f	42.40 ab	3300 de
17	20 g	42 g	38 c	110 g	4.97 jk	0.06 i	0.57 kl	40 a	7.9 c	5.00 a	37.60 cd	4000 bc
18	20 g	36 i	44 a	216.7 bc	6.77 gk	0.06 i	0.61 jk	36 b	8.2 ab	5.9 h-j	34.90 d	3500 c-e

Mean followed by the same letters in each column are not significantly (Duncan multiple rang test 5%)

Table 3: Correlation coefficients of traits

Traits	1	2	3	4	5	6	7	8	9	10	11
Clay%	1										
Silt%	0.68**	1									
Sand%	-0.85**	-0.95**	1								
Potassium	0.59**	0.42**	-0.53**	1							
Phosphor	0.46**	0.12 ^{ns}	-0.27*	0.61**	1						
Nitrogen	0.53**	0.27*	-0.40**	0.56**	0.86**	1					
OC	0.56**	0.29*	-0.42**	0.56**	0.87**	0.98**	1				
T.N.V	-.23**	-0.20^{ns}	0.24ns	-0.34*	-0.07^{ns}	-0.06 ^{ns}	-0.08 ns	1			
PH	-0.08^{ns}	-0.10^{ns}	0.12ns	-0.15^{ns}	-0.35**	-0.37**	-0.42**	0.22 ^{ns}	1		
EC	-0.01^{ns}	0.36**	-0.24 ns	-0.18^{ns}	-0.09^{ns}	0.07 ns	0.06^{ns}	0.13^{ns}	-0.26 ^{ns}	1	
Sp	0.68**	0.77**	-0.81**	0.44**	0.21^{ns}	0.34*	0.36**	-0.20^{ns}	-0.17 ^{ns}	0.25^{ns}	1
Grain Yield	0.31*	-0.30^{ns}	-0.06 ns	0.31*	0.44**	0.61**	0.59**	0.22^{ns}	-0.16 ns	0.10 ^{ns}	0.17 ^{ns}

performance due to the positive effects of these compounds on the Activities in the soil. According to the measured decomposition variance of traits in the table. soil pH, soil electrical conductivity and basal saturated soil has been significant at the level of one percent probability in various farms. Considering to the Comparison table of mean measured traits and according to the classification of soil acidity, farms have poor alkaline pH (7-8) to alkaline (8-9). Therefore, due to alkaline soil, farms have relatively good percentage of basal saturation. According to Comparison table of mean measured traits, fieldnumber 14 which has high performance has 7.7 = pH, low alkalinity and basal saturation percentage equivalent to41%. Since soil pH is an effective factor in chemical and biological feeding of plant. And in this ph, solubility and absorption capability of most nutrition elements is in desirable level. And due to the weak alkaline pH, it has desirable percentage of basal saturation and a favorable effect on plant growth and nutrition.

Considering to the table compares the average of the measured traits, various farms are in confine of non-saline soils, (farms with less than 2mmmouseECon cm) and low salinity (Ecbetween 2 to 8) according to the soils division. According to the table of correlation coefficients of traits, anon-significant correlation (0.10 ns = r) exists between the EC and performance. Farms that have acceptable performance (performance over 4,500 kgper hectare), has low EC. Farms with high EC values have more soluble salts in the soil and so are saltier. Abundance of soluble salts in the soils increase the osmotic potential of soil solution and the competition between plant roots and soil is raised to absorb and hold water. soil and plants will soon in constant relative humidity of soil and Followed by that, water and nutrient absorption reduced and on the other hand the plant growth rate will decreased and Besides this in direct salinity stress and dehydration and thirst will happen as a consequence.According to the table compares the average of the measured traits, farm number 18 which has high pH and EC has allocated low performance. Survey results are conformed with the results of Ragab [2] and [3] have reported that increasing in soil pH and electrical conductivity and irrigation water cause Reduced nutrient uptake and grain yield [2, 3].

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