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"The Effect of 12 Centimeters Irrigation with Potassium Efficacy and Increased Yield of Wheat Autumn Cultivation in Loess Soils with High Specific Surface and Electrical Truncated Diffuse Double Layers"

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ABSTRACT

Because of existing the truncated diffuse double layer (TDDL) in lossal soil of land that the project performed and due to fixation of potassium in this minerals. an investigation has done into the effect of irrigation on wheat yield with a high specific surface area in a soil and comprising illite Clay, which causes usability of potassium for wheat and loss in potassium absorption and yield, after using fertilizer. Three rate of Urea, Potassium Sulfate and Di-Ammonium Phosphate were **a**. 0,0,0, **b**. 200,200 and 350 and **c**. 300,300 and 525 kg/ha respectively. As subplots, flood, sprinkle and drip irrigations were factored in main plots (fertilizers). Each plots irrigated with 120 mm. irrigation intensity for flood, sprinkle and drop were 252,168,102 mm/hour. Irrigated treatments increased potassium uptake and yield in nil fertilizer. Fertilizers also improved nutrient uptake and yield with dry plan which may mean irrigation substitutes fertilizer application. Flood and Drip irrigation methods still improved yield slightly with fertilizer application which may go less interactions. It is likely that moisture may improve potassium diffusion intensity toward roots and increase in its usability. Increasing humidity by soil reduced mechanical resistance may also cause improved roots development potassium absorption, number of clusters and yield at unit of area. In this study we find that irrigation with 120 cm was so useful in release the potassium from (DDL) and other irrigation depth could be tried later.

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INTRODUCTION

On may refer to using potential of producing water and soil sources and their survey for production, sustainable development and making effort to improve yield and enrichment of farming crops, as one of the priority aims of the countries in third millennium, in order to improve food quality in the case of achieving standards of health principles in society. Since soil plays several roles in plant's life, so no one can ignore soil-plant mutual effect. Soil is a location for plant's roots and provides air (oxygen), water and other elements for the plant. Potassium (K) is mostly consuming essential element and it is assume as the most frequent cations in higher plants. In addition to vital physiologic tasks which this element has in plant, it has allocated special position by itself in improving quality of agricultural crops as well so that it is called quality element. Potassium is the fourth nutrient and frequent element in soil that forms about 2.5% of lithosphere. Real density of this element varies in soil within a wide range and its range is approximately 0.04-3% (Sparks, D.L., *et al*,1985). This nutrient is found within four different forms in soil; soluble potassium in soil, exchanged and non-exchanged potassium and the existing potassium within mineral network (Syres, J. K. 1998). Availability of potassium for plants depends on intensity, capacity and speed of it renewability in soil. Intensity includes potassium density in soluble soil. Capacity designates total existing potassium on soil CEC (Cation Exchange Capacity) that is converted into usable substance for the plant by entrance into soil solution (Hillel, D. 1980). And speed refers to a synthetic factor, which display potassium transfer speed from capacity to intensity (Rezaei, M., *et al*. 2010). Unfortunately, unsuitable consumption of azotic and phosphate fertilizers and non-devotion of other nutrients to fertilizer compounds have caused more deficiencies and reduce fertilization of soils. Clay in most of the tested loessal soils with clay origin has a lot of illite. This clay can provide the needed potassium for plant in production of farming crops at medium level; however, potash fertilizer should be used for high level production (Sparks, D.L., *et al*,1985). Illite clay layers may be blocked by drying and this causes

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limited use of potassium for the plant. With regard to potassium higher quantities for extraction by ammonium acetate and its higher densities (concentrations) within the soils with specific surface area in test site, potassium slow diffusion (exchange potassium) and the existing synthetic exchange potassium in diffusion double layer (DDL) cause plant inadequate absorption and lead to reduced yield (Amini, S. 2006), (Faez Nia, F. 2004), (Sebti, M., *et al*, 2008). and (Talebzadeh, A. 2009). In the present study, through exertion of irrigation different intensities by means of flooding, but rain water and dropping techniques of irrigation as well as using black and transparent mulches, potassium absorption and wheat yield have been assessed. Irrigation and mulch may affect availability to elements to be provided for the plant by creating different humid and thermal environments.

The present research was leaded to answer for this question that which one might still increase wheat yield through saturated and unsaturated irrigations at different intensities by consuming fertilizers.

MATERIALS AND METHODS

This study was performed in research farmland of Gorgan University of Agricultural Sciences and Natural Resources, which is situated on 54° 30´E and 37° 45´N. This study was carried out in farmland not in glasshouse (vase) because hydrothermal properties differ in farmland conditions from vase environment. There is no draining operation in vase and moisture is reduced more slowly than in lands and rate of potassium diffusion and its usability extremely depend on soil humidity and heat. Thus it is possible that potassium does not act as a restriction factor in vase conditions. Field soil has been classified according to American classification (*Type Haploxerept*). By application of ethylene glycol mono ethyl ether, soil specific surface area was measured (Carter *et al* , 1986).

After selecting the plot and plowing by disk on Dec 29nd 2009, a composed sample was prepare from zero depth to 30cm from ground level and it was dried after transfer to air lab where physical and chemical experiments were carried out on them. On the same date, Zagros wheat seed were planted in some plots with 4×6m dimensions. Seeds were sprouted on 29nd. Fertilizers were Urea, Potassium Sulfate and Di-ammonium phosphate and rates for nil, optimum and high applications were **a**. 0,0,0, **b**. 200,200 and 350 and **c**. 300,300 and 525 kg/ha respectively. As subplots, flood, sprinkling and drip irrigations were factored in main plots (fertilizers). Each application used 120 mm to minimize leaching and more rainfall reduced number of irrigations to three. Irrigation treatments increased potassium uptake and yield with no fertilizer application. Fertilizers also improved nutrient uptake and yield with dry land culture which may mean irrigation substitutes fertilizer application. Flood and drip irrigation methods still improved yield slightly with fertilizer application which may show some minor interactions. Nitrate leaching was not significant in the second year with lower irrigation depth.

The Zagros wheat seed in plots with 6×4 m in length and width were performed. Split plot experimental design, 4 Irrigation and 3 rate of compound fertilizer. The main plots with fertilizer urea, potassium Sulphate and Di-ammonium Phosphate at a level of a: 0, 0,0, kg/ha b: 200,200 and 350 kg/hr, and c: 1.5 times of this amount, is 300, 300 and 525 kg per hectare in the 29 Dec 2009 was added to the soil. Four subplots include flood, sprinkle, drop and dry were performed. Plots were irrigated 0.75 m^3 that equal 12 cm water per m^2.The seeds were sown on Jan28. Specific surface was measured 132 m^2/gr (Carter *et al* , 1986).Due to the abundant rainfall this year, the plot only three times were irrigated (First, two weeks before heading on 4 Apr 2010 and the other, two irrigation after heading on 24 Apr 2010 and 19 May 2010). Upper leaves, seeds and straw were examined. Sampling was done on 17 April and 7Jun 2010 on depth of 0 to 30 cm for salinity, pH, organic carbon, exchange capacity and texture , nitrogen, phosphorus, potassium, magnesium and calcium and other elements in accordance with Tables 1 and 2 (Aliehyaei, M., 1993)and (Emami, A. 1996).

To determine wheat yield and its elements, sampling was done of each plot. The given design was carried out within completely random blocks and data analysis by SAS software and through comparison of mean data according to Fisher's Least Significant Difference (LSD) test at 5% level.

RESULTS AND DISCUSSION

Regional water supply wells that were used in the experiment of electrical conductivity (EC) water on the 2009-Jun-09 , 0.65 dS/m, residual sodium carbonate (RSC) 0.5 meq/lit, sodium absorption (SAR) 0.2 $mmol^2$/ lit^2 (Table 1). Soil Salinity Laboratory classification of America (1954), the electrical conductivity of the water was 0.25 to 0.75, water salinity is classified as medium risk.

Some physicochemical analysis results of plot at depth 0-30 cm. PH values, electrical conductivity of soil phosphorus and nitrate levels are favorable for wheat growth. Havlin work's [5], with 13 to 15 mg/kg of soil nitrate from zero to 30 cm in depth, to produce 6 tons per acre of wheat requires nitrogen and phosphorus 12 mg/kg of phosphorus fertilizer is needed. Potassium 350 mg/kg of ammonium acetate was absorbed with the things that Havlin (Havlin, J.L., *et al*.,2005) with more than 160 mg/kg of potassium fertilizer is needed. We tested the soil and clay due to particularly high levels of illite, fertilization with yield increases. Zero to 30 cm soil depth in the wheat root development is silt clay loam (Table 2).

Table 1: Chemical properties of water.

classified	Residual sodium carbonate R.S.C. meq/l	sodium absorption ratio S.A.R.	Consistence ppm	Total Cations meq/l	Mili eq. / liter								acidity	T.D.S mg/l	EC ds/m
					Na^+	Mg^{++}	Ca^{++}	Total anions	$SO4^{--}$	Cl^-	$HCO3^-$	$CO3^{--}$			
C2S1	0.5	0.2	280	5.9	0.3	2.4	3.2	6.7	0	0.6	6.1	0	7.5	416	0.65

Table 2: Physical and chemical properties of soil (zero to 30 cm depth).

Soil Texture	%Sand	%Silt	%Clay	Nitrate-N (ppm)	Ammonium-N (ppm)	Absorbed potassium with the tetra-phenyl Brown sodium (ppm)	Organic carbon (%O.C.)	Nutralised material %T.N.V.	potassium absorbe with ammonium acetate(ppm)	phosphorus absorbed (ppm)	saturated muddy acidity	EC (ds/m)
Si.C.L	10	56	34	13.3	0	620	0.96	24	350	11.2	7.3	0.7

Yield components of wheat based on the analysis of variance (Table 3), the average number of fertile stems, the average number of grains per spike, straw yield, total grain and straw + seed was significant at 99 percent.

Table 3: Analysis of variance on yield and yield components of wheat.

Changing of sources	degrees of freedom	mean square							
		Fertile stems per plant average	spikelets per cluster average	stem length average (cm)	The average number of seeds per spike	The weight of thousand seeds (gr)	straw yield (Kg/hr)	grain yield (Kg/hr)	Biologic al yield (Kg/hr)
Block	2	0.146^{**}	1.0006^{ns}	75.67^{ns}	49.29^{**}	9.94^{ns}	1944358^{**}	1178600^{**}	5874149^{**}
Treatment	3	2.669^{**}	172.78^{**}	42.88^{ns}	101.60^{**}	19.43^{**}	11240763^{**}	1531090^{**}	20088836.07^{**}
Treatment × block	6	0.667^{**}	5.78^{ns}	6.78^{ns}	106.38^{**}	52.51^{**}	410293^{**}	173258^{*}	213698.66^{**}
Error	24	0.0096	6.694	47.41	0.321	3.57	34222.9	48720.9	160576.47
Coefficient of variation		3	6.9	7.7	2	5	2	5.6	3.1

* One star significant at 5% Two stars ** significant at 1% ns: no significant difference

According to Table 4, along with consideration of various methods of irrigation and dry farming, increased use of fertilizer increased grain yield, straw and biological yield were. This increase in yield with normal and high amounts of fertilizer to produce grain and straw was significant compared to controls. Along with consideration of all rate of fertilizer, grain, straw and biologic yield by flood irrigation was highest into other treatments .Water flooding treatment was highest yield in grain and straw but sprinkler cultivation was less than control. This may caused by less infiltration on flood irrigation and diffuse the roots and increase the absorption of element in soil. Yield of grain, straw and biologic in drip irrigation into the sprinkler and dry treatment was further.

Table 4: Comparison of Average main effect of irrigation and fertilization on yield and yield components of wheat.

Treatment	Fertile stems per plant average	spikelet per crucible average	stem length average cm	The average number of seeds per spike	The weight of thousand seeds gr	Biologic al yield Kg/hr	straw yield Kg/hr	grain yield Kg/hr	Biologic al yield Kg/hr	Index percent %
Fertilization effect										
Normal fertilization(200kg/hr)	2.78^b	37.56^a	90.16^a	27.51^a	426.93^b	33.81^a	8836.6^b	4074.1^a	12910.9^b	31.7^a
Extra fertilization(300kg/hr)	2.75^b	37.28^a	89.56^a	27.35^a	461.9^a	33.67^{ab}	9347.5^a	4140.3^a	13387.9^a	31.0^b
With out fertilizer(control)	2.95^a	36.98^a	85.54^a	23.92^b	442.1^{ab}	32.17^b	8442.5^c	3567.5^b	12010^b	29.7^c
Irrigation Effect										
Water flooding	3.126^b	36.38^b	87.77^a	22.10^d	537.47^a	31.91^b	9933.3^a	4486.7^a	14420^a	31.3^b
Drip irrigation	3.346^a	43.48^a	91.11^a	25.31^c	481.53^b	34.07^a	9584.4^b	3990^b	13574.4^b	29.3^d
Sprinkler	2.746^c	36.06^b	85.89^a	27.67^b	401.3^c	34.85^a	7522.3^d	3626.1^c	11148.3^d	32.6^a
Without irrigation(dry)	2.103^d	33.18^c	88.93^a	29.96^a	354.3^d	32.03^b	8329^c	3606.7^c	11935.7^c	30.0^c

Similar letters in each column indicate no significant differences based on LSD test at 5% level.

According to Table 5, yield without fertilizer significantly has increased in all irrigation treatments than the rainfed plat. With normal and high amount of fertilizer, yield in dry farming was respectively 2900, 3950 and 3970 kg /hr. Therefore, irrigation is likely to increase nutrient uptake and grain yield can be increased. With sprinkler irrigation, grain yield without fertilization with conventional fertilizer and manure are respectively 3420, 3746 and 3711 kg /hr with irrigation and flooding, respectively, 4050, 4650 and 4760 kg /hr respectively.

The importance of irrigation to increase yield in terms of fertilization is very significant. Regard to low access the yield by using fertilizer especially in irrigations plats it seems other mutual effect such as potassium diffusion and azote massive movement may be occurred. Beside the massive movement of elements and potassium diffusion, root developing and spread may cause in absorption and increment in the grain yield. More increase in yield was got only in irrigation treatment except sprinkle. With flood irrigation even without fertilizer, grain and biological yield had increased significantly. The absorption of nitrogen and potassium by seed with the high correlation is seen (Table 13) and the irrigation increases the absorption and usage capability of nitrogen and potassium in both, but the priority importance of nitrogen and potassium on the yield of this research is not possible.

With a drop of water with the least expected and most of the washing water are nitrates. At harvest, the soil nitrate concentration with dry farming and irrigation methods of flooding and the drop was lower (Table 7).Irrigation in the last 7 JUN 2010 was 18 days before harvesting.

Table 5: Average effect of irrigation and fertilizer levels on yield and yield components.

0.1	no fertilizer							(equal 200 kgr/ hr of fertilizer)						
Changing of sources	m.s.b	m.s.	m.d.	w.h	Kol.	Dan.	Bio.	m.s.b	m.s.	m.d.	w.h	Kol.	Dan	Bio.
Water flooding	3.15^{a}	37.9^{b}	20.2^{c}	31.1^{b}	9600^{a}	4050^{a}	13650^{a}	3.1^{b}	35.7^{b}	23.0^{c}	32.3^{a}	10950^{a}	4650^{a}	14700^{a}
Drip irrigation	2.75^{a}	41.2^{b}	31.5^{a}	33.1^{b}	8743^{b}	3900^{a}	12643^{b}	3.6^{a}	44.8^{a}	22.2^{c}	34.6^{a}	9980^{a}	3950^{b}	13930^{a}
Sprinkler	3.20^{a}	36.2^{ab}	24.5^{b}	39.5^{a}	7220^{d}	3420^{b}	10640^{c}	2.5^{c}	36.1^{b}	29.3^{b}	32.5^{a}	7096^{b}	3746^{b}	10843^{c}
Without irrigation(dry)	2.73^{a}	32.6^{b}	19.4^{d}	24.8^{c}	8207^{c}	2900^{c}	11107^{c}	1.8^{d}	33.6^{b}	35.3^{a}	35.6^{a}	8220^{b}	3950^{ab}	12170^{b}

Table 5: Continue

0.1	(equal 300 kgr/ hr of fertilizer)						
Changing of sources	m.s.b	m.s.	m.d.	w.h	Kol.	Dan.	Bio.
Water flooding	3.1^{b}	35.4^{b}	22.9^{c}	32.22^{a}	10150^{a}	4760^{a}	14910^{a}
Drip irrigation	3.6^{a}	44.4^{a}	22.1^{c}	34.47^{a}	10030^{a}	4120^{b}	14150^{a}
Sprinkler	2.5^{c}	35.8^{b}	29.1^{b}	32.46^{a}	8250^{b}	3711^{b}	11961^{b}
Without irrigation(dry)	1.7^{d}	33.3^{b}	35.1^{a}	35.55^{a}	8560^{b}	3970^{b}	12530^{b}

(m.s.b.) mean of fertile stem (m.s.) mean of spikelet (m.d.) mean of grains in spike (w.h.) weight of one thousand grains (kol) yield straw (dan.) grain yield (bio.) biological yield

Table 6 shows nitrate concentration decrease in all irrigation treatments relatively to dry farming. Thus in the this year probably nitrate concentration decrease before formation of cluster level with density of root and absorption by plant, and significance of absorption is more important than leaching. In harvest level, concentration of nitrate wasn't coordinated with irrigation treatment (table7). Despite of nitrate concentration decreasing before formation of cluster level in irrigate treatment, but yield was more in dry farming, and there wasn't any positive correlation between the nitrate concentration and yield (table13).

Table 6: Comparison of average main effect of irrigation and fertilizer on the soil concentrations of elements in the stage of formation clusters (mg/kg).

Treatment	Potassium (Ammonium acetate method)	Phosphorus (Absorbable)	Ammonium (Absorbable)	Nitrate (Absorbable)	Potassium (sodium tetra-phenyl boron method)	Calcium (Exchange and solution)	Magnesium (Exchange and solution)	Potassium (ammonium nitrate method)
Fertilization Effect								
Normal fertilization(200kg/hr)	321.25^{b}	9.1^{b}	3.812^{c}	4.59^{b}	581.25^{a}	2085.02^{b}	256.2^{c}	198.75^{b}
Extra fertilization(300kg/hr)	333.75^{a}	9.57^{a}	4.812^{a}	5.00^{a}	603.31^{a}	2332.51^{a}	321.2^{a}	218.75^{a}
With out fertilizer(control)	313.49^{b}	8.77^{b}	4.25^{b}	4.45^{b}	543.72^{b}	2118.26^{b}	282.4^{b}	199.85^{b}
Irrigation Effect								
Water flooding	324.72^{ab}	9.12^{b}	4.67^{a}	4.41^{bc}	573.23^{a}	1826.11^{c}	260.7^{c}	210.15^{a}
Drip irrigation	329.72^{a}	10.09^{a}	4.17^{b}	4.73^{b}	580.04^{a}	$2022.71b^{c}$	283^{b}	217.34^{a}
Sprinkler	322.02^{ab}	8.26^{c}	3.80^{c}	4.16^{c}	589.27^{a}	2181.09^{b}	289^{b}	207.98^{a}
Without irrigation(dry)	314.84^{b}	9.11^{b}	4.52^{a}	5.42^{a}	561.82^{a}	2648.47^{a}	313.7^{a}	181.66^{b}

Table 7: Comparison of Average main effect of irrigation and fertilizer on the soil concentrations of elements in the wheat harvest (mg/kg)

Treatment	Potassium (Ammonium acetate method)	Phosphorus (Absorbable)	Ammonium (Absorbable)	Nitrate (Absorbable)	Potassium (sodium tetra-phenyl boran method)	Calcium (Exchange and solution)	Magnesium (Exchange and solution)	Potassium (ammonium nitrate method)
Fertilization Effect								
Normal fertilization(200kg/hr)	345^{b}	7^{b}	3.10^{b}	7.57^{b}	507.5^{b}	2380^{b}	275^{b}	180^{c}
Extra fertilization(300kg/hr)	402.5^{a}	9.17^{a}	3.84^{a}	9.82^{a}	542.5^{a}	2700^{a}	326.22^{a}	225.5^{a}
With out fertilizer(control)	333.75^{c}	6.35^{c}	2.24^{c}	6.45^{b}	500^{b}	2080^{c}	252.5^{c}	207.5^{b}
Irrigation Effect								
Water flooding	343.3^{b}	6.86^{b}	3.68^{a}	11.36^{a}	540^{a}	1970^{c}	243.3^{d}	210^{a}
Drip irrigation	383.3^{a}	10.83^{a}	2.03^{c}	7.65^{b}	466.6^{c}	2440^{b}	275^{c}	220^{a}
Sprinkler	341.6^{b}	5^{c}	2.88^{b}	5.97^{c}	500^{a}	2430^{b}	293.3^{b}	186.6^{b}
Without irrigation(dry)	373.3^{a}	7.33^{b}	3.66^{a}	6.81^{bc}	510^{b}	2706^{a}	326.6^{a}	196.6^{b}

Similar letters in each column indicate no significant differences based on LSD test at 5% level.

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Element concentration in plant tissues:

The results of analysis and compare of average in harvest wheat chaff have shown that the nitrogen concentration in irrigate treatment was less than dry farming, may be due to increase of moisture and dilution effect (Tables 8). Soil nitrate increased in flood and dripping treatment in harvest phase because of leaching of this element wasn't considerable and probably high access of soil azot in rainfed treatment be due to low growth of roots because of decrease of irrigation and access of soil compaction. (Tables 8 and 9).

Table 8: Comparison of irrigation and fertilizer main effects on the concentration of elements in wheat straw at harvest.

Treatment	Potassium (percent)	Phosphorus (percent)	Magnesium (percent)	Calcium (percent)	Total nitrogen (percent)
Fertilization Effect					
Normal fertilization(200kg/hr)	2.125^{b}	0.182^{b}	0.110^{c}	0.277^{ab}	0.867^{b}
Extra fertilization(300kg/hr)	2.442^{a}	0.202^{a}	0.120^{a}	0.245^{b}	0.968^{a}
With out fertilizer(control)	2.05^{c}	0.172^{b}	0.135^{a}	0.307^{a}	0.862^{b}
Irrigation Effect					
Water flooding	2.63^{a}	0.196^{a}	0.116^{b}	0.33^{a}	0.98b
Drip irrigation	2.22^{c}	0.196^{a}	0.126^{a}	0.28^{ab}	0.95c
Sprinkler	1.58^{d}	0.176^{b}	0.120^{ab}	0.23^{c}	0.65d
Without irrigation(dry)	2.38^{b}	0.173^{b}	0.123^{ab}	0.25^{bc}	1.01a

Table 9: Average effect of irrigation method and amount of fertilizer on the concentration of elements in wheat straw at harvest.

Irrigation	no fertilizer					(equal 200 kgr/ hr of fertilizer)					(equal 300 kgr/ hr of fertilizer)				
Changing of sources	%K	%Ph	%Mg	%Ca	%N	%K	%Ph	%Mg	%Ca	%N	%K	%Ph	%Mg	%Ca	%N
Water flooding	2.45^{a}	0.18^{a}	0.11^{c}	0.33^{a}	0.98^{b}	2.65^{a}	0.20^{a}	0.13^{a}	0.4^{a}	0.96^{a}	2.8^{a}	0.21^{a}	0.11^{b}	0.260^{a}	1.00^{b}
Drip irrigation	2.05^{b}	0.18^{a}	0.15^{a}	0.33^{a}	0.95^{a}	2.15^{c}	0.20^{a}	0.11^{b}	0.28^{b}	0.93^{a}	2.47^{b}	0.21^{a}	0.12^{b}	0.246^{a}	0.98^{b}
Sprinkler	1.40^{c}	0.17^{ab}	0.13^{b}	0.27^{c}	0.52^{b}	1.40^{d}	0.16^{b}	0.09^{c}	0.17^{c}	0.60^{b}	1.96^{c}	0.20^{a}	0.14^{a}	0.260^{a}	0.84^{c}
Without irrigation(dry)	2.30^{a}	0.16^{b}	0.15^{a}	0.30^{b}	1.00^{a}	2.30^{b}	0.17^{b}	0.11^{b}	0.26^{b}	0.98^{a}	2.54^{b}	0.19^{a}	0.11^{b}	0.216^{a}	1.05^{a}

Similar letters in each column indicate no significant differences based on LSD test at 5% level

Table 10: Average effect of irrigation method and amount of fertilizer concentration in wheat plants from the cluster level.

Irrigation	no fertilizer					(equal 200 kgr/ hr of fertilizer)					(equal 300 kgr/ hr of fertilizer)				
Changing of sources	%K	%Ph	%Mg	%Ca	%N	%K	%Ph	%Mg	%Ca	%N	%K	%Ph	%Mg	%Ca	%N
Water flooding	2.99^{ab}	0.38^{a}	0.20^{bc}	0.43^{b}	3.11^{b}	3.11^{ab}	0.39^{a}	0.20^{b}	0.40^{b}	3.25^{b}	3.35^{bc}	0.41^{a}	0.18^{bc}	0.37^{a}	3.45^{b}
Drip irrigation	3.10^{a}	0.38^{a}	0.19^{c}	0.38^{c}	2.88^{c}	3.15^{ab}	0.39^{a}	0.16^{c}	0.35^{c}	2.91^{c}	3.44^{b}	0.42^{a}	0.16^{c}	0.26^{a}	3.24^{c}
Sprinkler	3.13^{a}	0.37^{a}	0.22^{b}	0.40^{bc}	2.99^{c}	3.26^{a}	0.38^{a}	0.21^{b}	0.37^{bc}	3.11^{bc}	3.65^{a}	0.41^{a}	0.20^{ab}	0.29^{a}	3.36^{bc}
Without irrigation(dry)	2.80^{b}	0.36^{a}	0.27^{a}	0.49^{a}	3.35^{a}	2.99^{b}	0.36^{a}	0.26^{a}	0.50^{a}	3.55^{a}	3.25^{c}	0.38^{a}	0.22^{a}	0.35^{a}	3.86^{a}

In no fertilizer with irrigation treatment in cluster phase be shown that leaf tissue potassium increase. In rainfed treatment with no fertilizer leaf potassium was 2.8%, consequently in sprinkle, dripping and flood irrigation was been 3.13, 3.10 and 2.99%. In rainfed irrigation follow fertilizing leaf tissue potassium increased in cluster stage, 2.99 % and 3.25% in normal and high fertilizer.

Soil moisture increased by irrigation (table12). The rate of moisture be seen in flood and drip treatment in each deep 0-15 and 15-30 centimeter. Flood irrigation with maximum moisture and intensity was shown high absorption of element and yield was in the highest level than the other especially rainfed treatment (table 8). In period of wheat growth in Gorgan city weather condition moisture inadequacy, adsorption and evaporation high late be not important limiting factor because by using mineral fertilizers we can get increase in rainfied treatment yield . limitation of soil moisture in rainfied treatment cause decrease the potassium diffusion and increase the soil resistance and decrease the root growth and decrease the absorption of potassium.

Irrigation also increased the moisture in the plant tissue this moisture in saturated irrigation was more than unsaturated irrigation and rainfed treatment (table 13, 8)

Table 11: Comparison of irrigation and fertilizer main effects of moisture in the 0-15 and 15-30 cm depths of soil.

Treatment	0-15 cm				15-30 cm			
	17apr2010	8may2010	15may2010	24may2010	17apr2010	8may2010	15may2010	24may2010
Fertilization Effect								
Normal fertilization(200kg/hr)	21.14^{a}	24.25^{a}	18.54^{b}	20.68^{a}	22.08^{a}	22.89^{a}	17.57^{a}	22.71^{a}
Extra fertilization(300kg/hr)	20.35^{b}	23.56^{a}	19.20^{b}	21.23^{a}	20.04^{c}	22.84^{a}	17.42^{a}	23.24^{a}
With out fertilizer(control)	20.81^{ab}	23.65^{a}	20.29^{a}	18.81^{a}	20.94^{b}	22.82^{a}	15.75^{b}	19.46^{b}
Irrigation Effect								

Water flooding	22.63^{a}	26.01^{a}	23.38^{a}	20.60^{b}	24.73^{a}	26.98^{a}	18.25^{a}	23.08^{a}
Drip irrigation	20.20^{c}	24.90^{a}	19.38^{b}	21.91^{a}	19.77^{c}	22.86^{b}	17.15^{b}	21.33^{b}
Sprinkler	21.67^{b}	25.07^{a}	18.72^{b}	21.05^{b}	21.30^{b}	22.91^{b}	17.46^{ab}	24.46^{a}
Without irrigation(dry)	18.57^{d}	19.30^{c}	15.89^{c}	17.40^{c}	18.28^{d}	18.63^{c}	14.80^{c}	18.34^{c}

Table 12: Comparison of Average main effect of irrigation and fertilizer levels on plant moisture at different growth stages of wheat plant.

Treatment	15mar2009	17apr2010	8may2010	24may2010
Fertilization Effect				
Normal fertilization(200kg/hr)	60.57^{b}	77.42^{a}	67.2^{a}	43.70^{ab}
Extra fertilization(300kg/hr)	65.22^{a}	78.45^{a}	67.67^{a}	46.10^{a}
With out fertilizer(control)	56.47^{c}	78.05^{a}	66.45^{a}	41.29^{b}
Irrigation Effect				
Water flooding	60.63^{a}	77.93^{a}	67.16^{a}	46.80^{a}
Drip irrigation	60.83^{a}	78.03^{a}	67.23^{a}	46.49^{a}
Sprinkler	60.86^{a}	77.73^{a}	67.20^{a}	45.00^{b}
Without irrigation(dry)	60.70^{a}	78.20^{a}	66.83^{a}	36.50^{b}

Similar letters in each column indicate no significant differences based on LSD test at 5% level.

Table 13: Correlation between the concentration of the element potassium in the soil to a third of the harvest and the concentration of nitrogen, ammonia and nitrate. uptake of potassium, seed potassium, straw, uptake of potassium, biological uptake of grains nitrogen, straw and uptake of total nitrogen and the straw grain and biological yield.

14	13	12	11	10	9	8	7	6	5	4	3	2	1		
Bio .y.	g.y.	d.m.	n. bio.	N. straw	N. seed	k. bio.	k. straw	K. seed	No3	Nh4	k.ni.	k.tet.	k.ac.		
													1	k.ac.	1
												1	-0.35*	k.tet.	2
											1	-0.421*	0.4**	k.ni.	3
										1	-0.6**	0.424*	-0.34	Nh4 soil	4
									1	0.27	0.01	-0.33	0.22	No3 soil	5
								1	0.75**	0.32	-0.05	0.01	-0.04	K. seed	6
							1	0.48**	0.72**	0.42*	0.06	-0.44*	-.11	k. straw	7
						1	0.99**	0.52**	0.75**	0.43*	0.05	-0.43*	-0.11	k. bio.	8
					1	0.7**	0.67**	0.86**	0.87**	0.64**	-0.22	0.02	0.01	N. seed	9
				1	0.57**	0.96**	0.96**	0.39*	0.69**	0.3	0.21	-0.6**	0.02	N. straw	10
			1	-0.33	0.3	-.23	-0.27	0.44*	0.27	-0.05	-0.13	0.25	0.29	n. bio.	11
		1	-0.1	0.91**	0.68**	0.94**	0.93**	0.54**	0.85**	0.21	0.12	-0.54	0.051	d.m.	12
	1	0.62**	0.44*	0.46*	0.96**	0.59**	0.56**	0.93**	0.88**	0.47	-0.21	-0.009	0.053	g.y.	13
1	0.82**	0.94**	0.11	0.82**	0.86**	0.89**	0.88**	0.74**	0.94**	0.34	0.08	-0.35	0.11	Bio. Y.	14

*significant at 5% **significance at 1% ns: no significant difference negative mark: vice versa effect
(K.ac) measured potassium ammonium citrate extract (k.tet.) Measurement of potassium by sodium phenyl boron extractor (k.ni.) Measurement of potassium by ammonium nitrate extract (N. straw) nitrogen straw (d.m.) dry matter - (g.y.) grain yield (bio. y) biological yield

Conclusion

This investigation with 12 cm irrigation and more frequently can improve uptake the potassium and nitrogen, in free fertilizer field. Irrigation can replace fertilizer. Yield had less significantly correlation in treatment with irrigation and fertilizer together. Increase the uptake of element may create by high potassium diffusivity and low soil mechanical resistance. Less increase in yield by drip and special by flood irrigation with fertilizer may be dependent to extend of roots and decrease vertical influence of water due to decrease of water intensity or other interact effects. Increase of nitrate in harvest stage may due to decrease of leaching by flood and drip irrigation and increase of nitrate in pre cluster stage for rainfed treatment probably due to soil compaction, reduce of root distribution and in the end decrease the nitrate absorption. Mobile element immigrate from exchangeable layers toward soil solution. Increase the grain yield in the field of flood treatment probably was due to reduction of leaching and root compaction and uptake by plant at last.

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