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Economic assessment of winter wheat in loess soils with diffuse double layers and '120' mm water consumption

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Abstract:

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(fertilizers). As subplots, flood, sprinkle and drip irrigations were factored in main plots. Each plots irrigated with 120 mm. irrigation intensity for flood, sprinkle and drop were 252,168,102 mm/hour. Flood and Drip irrigation methods still improved yield slightly with fertilizer application which may go less interactions. Increasing humidity by soil reduced mechanical resistance may also cause improved roots development potassium absorption, number of clusters and yield at unit of area. Surface irrigation was the highest yield to calculate the costs and comparison with the treatment of dry-farming economic efficiency was found. In loess soils just watering the soils could create high added value.

Keywords: Wheat – Loess soils – Economic-

Introduction:

Today, water scarcity and high cost of water has led in many cultures there is no economic efficiency.

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 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% [7]. 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. And speed refers to a synthetic factor, which display potassium transfer speed from capacity to intensity [2]. 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 [5]. Illite clay layers may be blocked by drying and this causes 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 [1], [4], [6] and [8]. 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.

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 [3].

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 4×6 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 m3 that equal 12 cm water per m2.The seeds were sown on Jan28. Specific surface was measured (132 m2/gr) [3]. 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 Conclusion:

Table 1- 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 d **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

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 [5] 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 1).

Table 2 - 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 crucible 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

Yield components of wheat based on the analysis of variance (Table 2), 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**.**

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Table 3 - 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	Biological yield Kg/hr	straw yield Kg/hr	grain yield Kg/hr	Biological 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}

According to Table 3, 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 cause 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 - Average effect of irrigation and fertilizer levels on yield and yield components

Irrigation	no fertilizer							(equal 200 kgr/ hr of fertilizer)							(equal 300 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.	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}	3.1^{b}	35.4^{b}	22.9^{c}	32.22^{a}	10150^{a}	4760^{a}	14910^{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}	3.6^{a}	44.4^{a}	22.1^{c}	34.47^{a}	10030^{a}	4120^{b}	14150^{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}	2.5^{c}	35.8^{b}	29.1^{b}	32.46^{a}	8250^{b}	3711^{b}	11961^{b}
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}	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

According to Table 4, 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. 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 5 Comparison of costs (no fertilizer)

treatment		Seed income) In thousands (		Residual income) In thousands (	Costs) In thousands of rials (							The difference between income and expenses	Treatment difference of treatment dry-farming
	Seed Yield Kg/hr	Seed Kg **10,000 Rials**	Chaffs Yield Kg/hr	**Straw Kg 500 Rials**	Land clearing1000	Ground rent	Water pricing600	Seed buying 100	fertilizer 0	Working 6000	Equipment		
Water flooding	4050a	40500	9600a	480	1000	-	600	100	0	6000	2000	31280	8970
Drip irrigation	3900a	39000	8743b	437	1000	-	600	100	0	6000	20000	11737	-10573
Sprinkler	3420b	34200	7220d	361	1000	-	600	100	0	6000	5000	21861	--449
Without irrigation(dry)	2900c	29000	8207c	410	1000	-	-	100	0	6000	0	22310	0

Table 6 Comparison of costs (200 Kg/hr fertilizer)

treatment		Seed income) In thousands (		Residual income) In thousands (	Costs) In thousands of rials (							The difference between income and expenses	Treatment difference of treatment dry-farming
	Seed Yield Kg/hr	Seed Kg **10,000 Rials**	Chaffs Yield Kg/hr	**Straw Kg 500 Rials**	Land clearing1000	Ground rent	Water pricing600	Seed buying 100	fertilizer 200	Working 6000	Equipment		
Water flooding	4650a	46500	10950a	547	1000	-	600	100	200	6000	2000	37147	4536
Drip irrigation	3950b	39500	9980a	499	1000	-	600	100	200	6000	5000	27099	-5512
Sprinkler	3746b	37460	7096b	354	1000	-	600	100	200	6000	20000	9914	-22697
Without irrigation(dry)	3950ab	39500	8220b	411	1000	-	-	100	200	6000	0	32611	0

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Table 7 Comparison of costs (300 Kg/hr fertilizer)

treatment		Seed income) In thousands (		Residual income) In thousands (	Costs) In thousands of rials (							The difference between income and expenses	Treatment difference of treatment dry-farming
	Seed Yield Kg/hr	Seed Kg **10,000 Rials**	Chaffs Yield Kg/hr	**Straw Kg 500 Rials**	Land clearing 1000	Ground rent	Water pricing 1500	Seed buying 100	fertilizer 300	Working 6000	Equipment		
Water flooding	4760a	47600	10150a	507	1000	-	600	100	300	6000	2000	38107	5280
Drip irrigation	4120b	41200	10030a	501	1000	-	600	100	300	6000	5000	28701	-4126
Sprinkler	3711b	37110	8250b	412	1000	-	600	100	300	6000	20000	9522	-23305
Without irrigation(dry)	3970b	39700	8560b	428	1000	-	-	100	300	6000	0	32827	0

Conclusion:

Tables 5, 6 and 7 showed that the treated water would cost only surface irrigation in all subplots. Positive amounts 8970, 4536, 5280 of sub plots without fertilizer and normal amount of fertilizer and 3/2 times the normal were observed.it means in loess soils just watering the soils could create high added value. Using equipment and irrigation systems greatly reduced the economic value of the product.

References:

[1] Amini, S., (2006). "Review of waste materials of paper-making factory on soil productivity and wheat growth", MA Thesis, Gorgan University of Agriculture Sciences & Natural Resources.

[2] Barber, S.A. 1972.The Influence of Moisture and Temperature on Phosphorous and Potassium availability. Plant. Int. congr. Soil sci. 7th

[3] Carter et al , 1986.The Technical Paper of soil specific surface

[4] Faeznia, F., (2004). "Study on impact of compost of mulch organic materials and mixture with soil, zeolite and likasite on soil productivity and wheat growth", MA Dissertation, Gorgan University of Agriculture Sciences & Natural Resources.

[5] Havlin, J.L., Beaton, J.D., Tisdale, S.L. 2005. Soil Fertility and Fertilizers: An introduction to nutrient management. Prentice Hall. USA.

[6] Talebizadeh, A., (2009). "Review on application of phosphorus fertilizers with calcium, aluminum and potassium- bases and their impact on potassium absorption by dry- farmed winter wheat crop". MA Dissertation, Gorgan University of Agriculture Sciences & Natural Resources.

[7] Sparks, D.L., and Huang, M. 1985. Physical chemistry of soil potassium. P .201-276. in R. D. Munson. Ed. Potassium in Agriculture. ASA. CSSA.SSSA. Madison. WI.

[8] Sebti, M., Movahedi Naeinee, S.A.R., Ghorbani Nasrabadi, R., Roshani, GH. A., Shahriari, GH. and M., Movahed (2009). "To determine potassium appropriate alembic in a loessal soil with dominantly Illite clay and impact of azotobacter and vermin compost on absorbable potassium density and quantity and yield of dry- farming wheat ", Journal of herbal production studies, 16th year, fourth Vol.