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The Scrutiny of Interaction between Iron Nano Chelate and Chlophony Hydrogel on Soil Chemical and Nutritional Properties

Ali Gholami*, Mehrnoush Taghizadeh and Nooralah Moalemi

Department of Soil Science,Science and Research Branch, Islamic Azad University, Khouzestan, Iran

Corresponding author: Ali Gholami

ABSTRACT: About one million hectares of lands in Khuzestan are salty and a great part of agricultural lands under cultivation of corn at the south of Khuzestan are located in this region. This investigation was conducted in a farm located in Ramhormoz in 2011 in order to investigate the interaction of iron nano and chlophony hydrogel as a superabsorbent on the yield of grain corn (Zea Mays L.) and some chemical and nutritional properties of soil in rather salty soils in completely randomize design with four treatments and four repetitions experimental treatments consisted of: first treatment: conventional farmers (control), second treatment: iron nano chelate fertilizer (10 kgha-1), third treatment: super-absorbent polymer(40 kgha-1), fourth treatment : second treatment + third treatment. Results showed that the most increase in yield was obtained as a result of iron nano chelate consumption by 5517.667 kg/ha and the least increase was seen in control treatment by 4256.33 kgha-1.The results of data variance analysis showed that iron nano chelate treatment and the treatment of simultaneous consumption nano and superabsorbent has a remarkable impact on weight features of a thousand grains, grains in ear and grains in ear raw. Raw in ear and bush height features were not considerable under the treatments. Chemical properties of soil including saltiness, acidity and saturation percentage were not remarkable in tow depths, except for saturation percentage which showed a significant difference, between superabsorbent treatment and control treatment in depth of 30-60 cm. All absorbable nutritional elements of soil were not considerable in the tow measured depths except phosphorus and manganese which showed remarkable difference in depth of 0-30 cm in level 5% of Duncan test. According to the results of this test and of nano and superabsorbent has a remarkable impact on weight features of a thousand grains, grains in maize and grains in maize raw. Raw in maize and bush height features were not considerable under the treatments. Chemical properties of soil including saltiness, acidity and saturation percentage were not remarkable in two depths, except for saturation percentage which showed a significant difference Between superabsorbent treatment and control treatments in depth of 30–60 cm. All absorbable nutritional elements of soil were not considerable in the two measured depths except phosphorus and manganese which showed remarkable difference in depth of 0–30 cm in level 5% of Duncan test. According to the results ti the results of this test and computation of expenses of materials used in the test it is suggested to use iron nano chelate fertilizer in order to gain better yield in grain maize.

***Keywords*:** Chemical and nutritional features, iron nano chelate, superabsorbent, Ramhormoz.

INTRODUCTION

Introduce the Problem

Soil salinity is likely the most important problem which restricts agriculture in dry and semi-dry areas after water deficiency. According to available statistics, total amount of saline soils in Iran is estimated 44 million hectars which comprises about 50% of lands under aquaculture (Malakooti et al., 2002).High actidity of saline and calcareous soils results in decreased usibility of micronutrients particularly iron and zinc. Maize is rather sensible to salinity and

its yield decreases by 10% in salinity of 4ds/m.This problem intensifies with salinity increases, so that maize encounters decreased yield whit salinity of 6 ds/m. Salinity may have physiologically adverse effects on usability, absorption , transmission , distribution and inactivation of nutritional elements.Although, the impact of salinity tension on the concentration of microelements is different, there are instances which indicate that cloro sodium leads to iron and zinc dificiency. The findings indicate applying micronutrients such as iron declines salinity adverse effects.(Hussain et al.,1980). (Helal et al., 1996) proved through greenhouse researchs and in salinity conditions that increase in salinity levels leads to decreased absorption of elements such as copper, iron , manganese , phosphorus and potassium, and significant and rapid increase of sodium. The deficiency of micronutrients in lands under cultivation of cereals has a universal growth and million hectars of cultivable lands in the world lack one or several micro nutrients (Welch et al., 1991). Corn is rather sensitive to iron deficiency. (Sharafi at al., 2001) studied and computed maximum yield of maize 704 in the treatment of 60kg of zinc sulfate with 50kg of iron chelate. Nowadays, world's attention (permanent agriculture) to stable agriculture and applying new technology and science in farms to minimize damage to resources and maximum utilization of it is considered. (Karimi, 1993) reported that superabsorbent polymers result in optimum use of water resources and their preservation and improving soil structure it leads to increased plant growth, reduced water and wind erosion, increased soil moisture and nutrients absorption including micro- nutrients essential in soil. (Li, 2003) concluded through his experiments that superabsorbent hydrogels are effective in absorption and releasing micro nutrients. He introduced an enriched hydrogel with micro nutrients which gradually releases nutrients. Substituting nano-fertilizers for traditional fertilizers, nutrients of the fertilizer are released in the soil gradually and in a controlled manner; therefore waterlogging of still waters and and contamination of drinking water is prevented. Infact, nano-technology has created new opportunities to increase efficiency of nutrients consumption and decrease environment protection expenses (Naderi and Shahraki, 2012). Regarding the point that a major part of Khuzestan lands encounters the problem of shortage and fixation of micro nutrients, soil salinity in most of the cultivated lands is another problem. Hence, investigating strategies to encounter these problems and conducting related researches seems essential in order to constant agricultural development and improve crops yield. In this research the researcher studied the effects of using superabsorbent and iron nano chelate on the increase in flint maize yield and nutritional and chemical properties of soil in studied erea with rather saline soil.

MATERIALS AND METHODS

This research was conducted in the pattern of random complete blocks including four treatments and three repetitions in a farm located in the village Kmtvlh in city Ramhormoz in 2011. The treatments consist of O: Control treatment, A: iron nano chelate Khzra treatments (10 kg/ha) B: superabsorbent chlophony treatment (40 kg/ha) and AB: simultaneous consumption of superabsorbent chlophony and iron nano chelate Khzra treatment with 10 and 40 kg/ha respectively. Before planting, compound soil samples were gathered from the depth of 0-30 cm and 30-60 cm from the farm and the samples were analyzed chemically and nutritionally. Each experiment plot consisted of three 3-meter rows and the distances between raws and between shrubs were 75cm and 15 cm respectively. Before implementing the plan, during culture bed preparation, basic fertilizers include Nitrogen from urea amounting 400 kg/ha, phosphorus from triple super phosphate amounting 150 kg/ha were added to soil after filtration according to soil analysis (potassium was not consumed because of high absorbable potassium according to soil test). 33% Nitrogenous fertilizer was consumed as the base and rest of it was used equally as excess in 4-5 leaf and 8-9 leaf stages(Nour Mohamadi et al., 1998). The single cross number of consumed seeds was 704. The seeds were planted on 20 August (2011), before conducting the treatments , preliminaries were done as follows : After choosing treatment places randomly, superabsorbent chlophony was weighed by 24g for each plot and was strewed equally into cultivation furrows under seed locations and after distributing a small amount of fine soil on it, the seeds were planted . For iron nano chelate treatments, 3g of iron nano chelate Khzra fertilizer was weighed and after planting seeds, this amount was mixed in a bucket full of water. Then it was poured on the seeds and into the plots after first watering of seeds. Another 1.5g of iron nano chelate Khzra was sprayed during the 3-4 leaf stage and the next 1.5g of it were sprayed while male cluster was appearing .At the end of the experiment after omitting side effects, maize yield and its elements were measured. Besides, compound soil samples were gathered from the depth of 0-30cm and 30-60cm from each plot and the samples were analyzed chemically and nutritionally. Total nitrogen Kjldal method, phosphorus by Olsen (extract making the sodium carbonate) and oxides of blue color intensity measured with a spectrophotometer respectively. Absorbable potassium was defined by extraction with acetate ammonium, and the amount of potassium in that extract was measured using flame ¬ photometry, soluble calcium by titration, saturated soil EC by electric conduction system, saturated soil acidity by pH meter, T.N.V percentage by back titration using acid, sulphur by titration method, In order to measure micronutrients, at first

absorbable iron , manganse zinc and cupper were extracted using DTPA solution, then were read by an atomic absorption device(Ehyaie, 1997). Statistical calculations were conducted using spss software and averages of each feature were compared using multi-dimension Doncan test with probability level of 5%.

RESULTS AND DISCUSSION

The analysis of soil testing for some soil chemical and nutriation properties at before planting showed in table 1.

Table 1. Analysis of soil testing before planting

Cu ($mgkg^{-1}$)	Zn	Mn	Fe	Ca ($meqL^{-1}$)	S	K ($mgkg^{-1}$)	P	Nt (%)	TNV %	pH	EC ($ds.m^{-1}$)	Sample depth
2.4	1.6	1.7	15	32	84.7	320	8	0.05	25	7.7	7.6	0-30cm
2.4	1.6	1.1	17	28	60.4	280	6	0.01	8	34	7.8	5.6 30-60cm

Effects of treatments on yield

After harvesting , calculation and comparing average yield of the treatments showed significant differences (Table2) among iron nano chelate treatments equal to 29.64% and between simultaneous consumption of iron nano chelate and superabsorbent polymer equal to 20.6% and control treatment.The results correspound to the results of (Nazaran et al., 2009).Investigating the impact of iron nano chelate fertilizer on quantitative and qualitative properties of dryland wheat in (Nazaran et al., 2009). Found out that spraying organic iron nano chelate fertilizer increases quantitative and qualitative properties of crop than control treatment. (Siadat et al., 1999) and (Sedri et al., 1998) reported that the effect of fertilizers including micro nutrients on the yield of wheat grain was significant. The results of different experiments showed that applying micro-nutrients in sunflower cultivation has a considerable effect on stem height , head diameter, seeds per head , thousand – kernel weight, sead oil percent, number of leaves and sead yield (Sepehr et al., 2004). (Li, 2003) found out in his experiments that superabsorbent hydrogels are effective in absorption and releasing micronutrients. The minimum yield associated with control treatment and it seemed that high salinity and micronutrients deficiency were its reasons. Yield drop was well observable in all treatments because of nearly high salinity , but it was more obvious for control treatment. The main impact of salinity is disturbance in plant growth. (Dehghan and Naderi. 2007) reported that the amount of yield drop per unit of salinity increase comparing control treatment was 13,13 and 12.5 percent respectively for 704, 711, and 641 , and their average was 13%.

Table 2. Results of factor analysis of variance of some chemical properties of soil nutrition

Mean-square						Degrees of freedom	Variable Source
% Saturation.		pH		EC(dsm^{-1})			
cm 30-60	0-30cm	cm 30-60	0-30cm	cm 30-60	0-30cm		
^{ns}1.411	^{ns}0.355	^{ns}0.724	^{ns}0.446	^{ns}0.101	^{ns}0.342	2	Replication
**2.473	^{ns}0.049	^{ns}1.457	^{ns}0.277	^{ns}0.975	^{ns}1.727	3	Treatments

*,** and ns significant at 5 and 1 percent, respectively, and ns means that there is no statistically significant difference

Effects of treatments on yield components

According to table 3 thousand – kernel weight, ear length, seeds ear, seeds per row of the ear has significant increase in both iron nano chelate treatment and simultaneous consumption of iron nano chelate and superabsorbent polymer treatment than control treatment. (Mazaherinia et al., 2010) reported based on an experiment on wheat that oxid iron nano treatment has significant increase than oxid iron modest treatment by 1% in iron concentration increase in plant and increase of plant yield elements (ear length , plant height, seed weight per ear , total dry weight of straw and stubble). (Yazdani, 2005) reported the effect of different amounts of superabsorbant on hundred –kernel weight of soya was statistically significant, such that hundred – kernel weight had linear increase by increasing the amount of superabsorbant. The reason of low yield elements in control treatment than other treatments was probably higher effects of salinity and micro-nutrients deficiency in soil. Seed rows per ear was not significant in level 5%. (Barut Zadeh et al., 2009) stated that the element of yield is less influenced by environmental conditions and is more controlled by genetic factors. More over, the effect of the treatments on the height of the shrubs was not significant . (Keshavarz et al., 2011) resulted from their experiment that the effect of spraying iron nano chelate fertilizer on the heigh of the wheat stem was not significant and was at the same level with the control treatment. (Peyvandi et al., 2011) showed that increasing the concentration of iron

chelate and iron nano , the longitudinal growth of shoot and root of savory decreased and that decline was much more in iron nano treatment than iron chelate. In their investigation on the effects of hydrogel on hydraulic properties of soil and the growth and hardening of Atroplex sapling influenced by saline water, (Zangooei Nasab et al., 2011) showed that applying superabsorbant leaded to the significant increase of the plant height , such that the plant height was 1-8 times higher than the control treatment in the upper level(0-4% polymer treatment) , but it was not significantly different from 0.3% polymer treatment.

Table 3. Analysis of variance mean squares for grain yield

Mean-square							Degrees of freedom	Variable Source
Height	Seed rows per ear	seeds per row of the ear	Grains per ear	Over the ear	Seed weight	Yield		
^{ns} 0.051	^{ns} 0.20	^{ns} 1	^{ns} 0.306	^{ns} 0.059	^{ns} 0.512	^{ns} 0.318	2	Replication
**0.363	^{ns} 0.00	** 10.25	** 80.327	**20.765	**27.512	*9.674	1	Treatments

*, ** and ^{ns} significant at 5 and 1 percent, respectively, and ns means that there is no statistically significant difference

Effects of the treatments on the chemical properties of soil

In this research was more saline soil in the depth 0-30 cm than the depth 30-60 cm. In both depthes the control treatment was the most saline treatment. However, the amount of its salinity was not as high so the data were not significant.The level of soil saturation was not considerable in the depth 0-30 cm, but it was significant by 5% between control and superabsorbant polymer treatments in the depth 30-60 cm according to Donken test. (Hussain et al., 1980) showed that application of micronutrients such as zinc and iron plants declines the effects of salinity. (Baybordi, 2004) emphasized the impact of iron, manganese, zinc and copper on decreasing salinity stress in plants.

Table 4. Comparison of macro and micro nutrients out of the soil

Cu^{+2}		Mn^{+2}		Zn^{+2}		Fe^{+2}		S		Ca^{+2}		K		P		Nt		Degrees of freedom	Vari. Source
($mgkg^{-1}$)								($meqL^{-1}$)				($mgkg^{-1}$)				(%)			
30-60cm	0-30cm	30-60cm	0-30cm	30-60cm	0-30cm	30-60cm	0-30cm	30-60cm	0-30cm	30-60cm	0-30cm	30-60cm	0-30cm	30-60cm	0-30cm	30-60cm	0-30cm		
1.405^{ns}	0.473^{ns}	2.898^{ns}	2.973^{ns}	1.132^{ns}	0.705^{ns}	0.757^{ns}	3.869^{ns}	0.275^{ns}	3^{ns}	0.35^{ns}	6.306^{ns}	0.813^{ns}	2.263^{ns}	0.577^{ns}	0.999^{ns}	1.484^{ns}	3.68^{ns}	2	Rep.
2.491^{ns}	0.09^{ns}	0.911^{ns}	2.639*	1.944^{ns}	0.313^{ns}	1.588^{ns}	1.844^{ns}	0.203^{ns}	1.213^{ns}	0.459^{ns}	1.857^{ns}	1.135^{ns}	0.998^{ns}	0.434^{ns}	3.294^{ns}	0.42^{ns}	0.584^{ns}	3	Treat.

Numbers in each column with common letters are not statistically significant at the 5% level by Duncan test are

The effects of treatments on nutritional properties of soil

All of the absorbable nutritional elements of soil were not significant in both of the measured depths except phosphorus and manganese which showed significant difference in the depth of 0-30 cm by 5% level of Donken test. The absorbable phosphorus found in control treatment and the least amount of phosphorus found in iron nano chelate treatment was 11.23 and 7.7 ppm respectively. The amounts of absorbable phosphorus in iron nano chelate and superabsorbent treatments were nearly the same and less than other treatments. In treatments consisting superabsorbent element, the amount of absorbable phosphorus is higher because of their ability to absorb and maintain nutrients, regarding the fact that the yield is increased in comparision with control treatment. The decrease of absorbable phosphorus in iron nano chelate treatment is possibly because of increased yield of its product. It seems that salinity and decreased yield control treatment leads to increased absorbable phosphorus in root. (Sojeka et al., 2007) reported that hydrogel is effective in activation of total phosphorus and absorption of Oxid phosphor (active phosphorus). (Behbahani et al., 2004) also concluded that hydrogel could maintain phosphorus 1.1 ppm more that control. (Martinez and Lauchli, 1991) reported that phosphorus transmission from root to shoots decreases due to salinity. Salinity inhibits phosphor absorption through root, its transmission from root to shoot and its movement from old leaves to young ones in low concentrations of phosphorus in root invironment, which is a result of decreased movement of phosphorus restored in vacuoles (Martinez et al., 1996). The table comparing the averages showed that there is a significant difference between absorbable manganese of superabsorbent and control treatment by 5%. (Michelson et al., 1995) observed the amount of manganese increased up to 89% in soyaleaf by increasing superabsorbants in comperision with control treatment without using superabsorbants, and

stated that applying superabsorbants we can consume less manganese or increase the intervals of its consumption.

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