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Annals of Biological Research, 2013, 4 (7):35-40
(http://scholarsresearchlibrary.com/archive.html)

Annals of Biological Research
Scholars Research Library
ISSN 0976-1233
CODEN (USA): ABRNBW

Studying the effects of zinc and manganese on crop characteristics and rice yield the variety of Rice (*Oriza sative* L.)

Azadeh Deilami, Hamid Reza Mobaser and Amiri Abbas Musavi

Department of Agriculture, Chaloos Branch, Islamic Azad University, Chaloos, Iran

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ABSTRACT

An experiment was done in crop year 2011, in Tonekabon city, in the form of factorial and in the frame of randomized complete block design, with four replication to study the effects of some micro- nutritive elements on yield and yield components of rice grain, the variety of Oriza sative.l. There were two micro- nutritive elements of zinc and manganese that zinc sulphates included three leaves without consumption, with consumption of 20 and 40 kg. hectare and manganese in two levels that included: without consumption, and with consumption of 30Kgm.hectar. The obtained results showed that straw yield with consuming zinc sulphates to the amount of 20kgm.hectar is 14% more than the time when it is not consumed, but straw yield increased 9.2% when manganese sulphates were used to the among of 30kgm.hectar. The most grain yield obtained under double interaction effects for the treatment of consuming 20kgm zinc sulphates and 30 kgm manganese sulphates per hectar (329.6gm per square meter), that it was because of the increase in total triller number, fertilized triller in pile, total number in cluster and being more full in cluster. The most amount of grain manganese (30.2mgm.kgm of grain) will consumption of 20 kgm zinc sulphate per hectar, obtained. The most amount of grain manganese obtained under interaction of two elements (32.25 mgm. kgm of grain) for plot with consumption of 20 kgm zinc sulphate and 30kgm manganese sulphate.hectare. As a whole, the consumption of both 20kgm zinc sulphate and 30kgm manganese sulphate.hectare is recommended through increasing grain yield and absorbing more manganese.

Key words: Rice, micro- nutritive elements, grain yield.

INTRODUCTION

Generally, the role of little- consumption elements in agricultural productions can be summarized as follows: (malkuti, 2004).
1)The increase of production in level unit, the development of the quality of productions. (Increasing protein of wheat grain, increasing the quality of ware housing of onion and potato.
2)To enrich agricultural productions with increasing the viscosity of iron, manganese, copper, zinc, etc which are effective in humans' nourishment and their health?
3)The production of seed with germination power and more growth for later cultures, the decrease of viscosity of some pollutants such as: Nitrate and cadmium in eatable agricultural productions.

Zinc element is one of the most important elements of micro, that it's usable amount in soils is usually decreased and it's deficiency is probably the most important factor that limits rice. Researchers have also stated that, in Asia, only 2 million hectars of soils have deficiency of zinc. This event exists spreadingly in relatively circumneutral

soils and basification ones particularly in soils. The deficiency of zinc in rice causes the decrease of producing Exin, chlorphile and the activity of carbonic Anhidaz in leaves. (Indalkar& melvar 1989). In rice plant, it's absorbing and it's being available in high PH of 7 will decrease. (Ald 2000).manganese acts as an active factor in plant that almost makes 35 different in plants active. Manganese is effective in making photosynthesis oxygen free during breaking water molecule, and because of this reason the deficiency of manganese like potassium causes the decrease of photosynthesis and so the decrease of grain number and eventually the decrease of yield (marsencher,1995).

MATTERS AND METHODS

An experiment was done in crop year 2011, on a farm located in Tonekabon, to study the effects of zinc and manganese on crop characteristics and rice yield the variety of oriza sative. L.

This experiment performed in factorial form and in the frame of randomized complete block design, in 24 plots with 4 replications that the amounts of soiling are as follows:

- Zinc in 3 levels to the amount of 40, 20, 0 kgm, zinc sulphate. hectar.
- Manganese in two levels to the amount of 30.0 kgm, manganese sulphate. hectar.

Sulphur along with basal dressing have been giving to the above- mentioned farm to reduce soil PH for more absorbing of elements and micro- nutritive elements.
Sampling was done randomly from each plot to determine qualitative and crop characteristics:

- With counting 12 bushes in each court, some characteristics such as: bush height, the length of spike, total tiller number, and fertilized tiller number in bush.
- Total cluster number and the number of full cluster in each cluster obtained with counting 120 clusters in each plot.
- Grain and straw yield performed with harvesting bushes from two square meters in the middle of each plot with deleting marginal effect.
- Index harvest obtained out of grain yield ratio to biologic yield.
- 1000 grain weight obtained with counting 10 samples out of 100 ones.
- The obtained data were analyzed by MSTATC statistical soft- ware and the mean comparison performed with Duncan's multiple range tests in probable level of 5%.

RESULTS AND DISCUSSION

The components of grain yield

Total tiller number and fertilized tiller in spot

Total tiller number and fertilized tiller in spot were not influenced by any one of treatments, statistically, (table 1) but the mean comparisons of interaction effects made these characteristics significant, so that, the most of total tiller number and fertilized tiller in spot obtained in treatment of using both 20kgm zinc sulphate and 30kgm manganese sulphate per hectare, 8.91& 9.06 tiller in spot respectively, and the least amount of total tiller number and fertilized tiller in spot obtained in treatment without using manganese sulphate and with using 40kgm zinc sulphate. hectare (7.45& 7.66 tiller, respectively) (Table 3). Obkima et al (1997) reported that zinc element because of having an influence on Exin production causes the increase of fertilized tiller number in rice bush. Hosseini (2011) found out the most fertilized tiller number in spot is obtained under the interaction of zinc and manganese for treatment with Using 20kgm zinc sulphate and without using manganese.

The number of full cluster in cluster

As it is observed in table 1, the number of full cluster in cluster is only influenced by interaction of zinc with manganese in 5% level, statistically, so that the most number of full cluster in cluster obtained for treatment with using both 20kgm zinc sulphate and 30kgm manganese sulphate. hectar (70.85 full cluster in cluster) and the least number of full cluster in cluster obtained with using 40kgm zinc sulphate. hectare and without using manganese sulphate (52.45 full cluster in cluster). Table 3. Although simple effects of zinc and manganese on the number of full cluster in cluster didn't make any significant difference, the use of 20kgm zinc sulphate. hectare in comparison with caused the increase of 11.4% in the number full cluster in cluster, and the number of full cluster in cluster increased more to 8.2% with the use of 30kgm manganese sulphat. hectare, (table 2). Salem et al (1996) and Alizadeh found out that the consumption of zinc sulphate causes the increase of full cluster number in rice cluster. Babu A'zami reported that the consumption of manganese sulphate doesn't have any significant effect on full cluster number in

cluster. Hosseini (2011) stated that the consumption of zinc sulphate to the amount of 20kgm. hectar causes the increase of full cluster in cluster.

Total number of cluster and 1000 grain weight

As it is seen in table 1, total cluster number in cluster and 1000 grain weight were not influenced by any one of treatments, statistically. The most total number of cluster obtained under interactions of zinc with manganese for treatment with using both 20kgm zinc sulphate and 30kgm manganese sulphate (72.7 clusters) and the least number obtained for plot without using manganese and with using 40kgm zinc sulphate, hectar (54.22 cluster), (Table 3). Although simple effects of zinc and manganese were not significant on total number cluster, it's most number obtained with using 20kgm zinc sulphat (67.66 cluster) and using 30kgm manganese sulphate. hectar (64.96 cluster) Table (2). Salem et al (1996) and Alizadeh found out that the consumption of zinc sulphat causes the increase of total number of cluster in rice cluster. Hosseini (2011) found out that the consumption of zinc sulphat to the amount of 20kgm. hectar causes the increase of total number of cluster in rice cluster. Hassan Shokri (2008) found out that 1000 grain weight with using different basal dressings consist of micro- elements increased.

Straw, grain yield and harvest index

Straw yield

As it is observed in table 1, the yield of straw was influenced by simple effects of manganese and zinc, statistically, in probable level of 5%, so that, the most yield of straw obtained with using 20kgm zinc sulphat, hectar (240.2gm. square meter), that it showed an increase to the amount of 14.0. Straw yield increased to the amount of 9.2% with using 30kgm manganese sulphate. hectare (237.52gm. square meter). Table2. The most straw yield obtained under double interactions for treatment with using both 20kgm zinc sulphate and 30kgm manganese sulphate. hectare which is equal to 257.6gm. square meter. (Table3). Alizadeh (2010) stated that the element of zinc doesn't have any significant effect on straw yield. Babu A'zami (2007) found out the consumption of manganese sulphate causes the increase of straw yield.

Grain yield

Grain yield was just influenced by interaction of zinc with manganese in probable level of 5% (table 1), so that, the most grain yield under double interactions for treatment with using both 20kgm zinc sulphate and 30kgm manganese sulphate, hectar (229.6gm. square meter), but the least grain yield obtained with using 40kgm zinc sulphat and without using manganese (167.7gm.square meter). Table3. Salem et al (1996) found out that the consumption of zinc sulphate caused the increase of grain yield by increasing fertilized tiller number, the number of cluster and 1000 grain weight. Alizadeh (2010) showed that the consumption of zinc sulphate increases grain yield because of increasing cluster length, fertilized tiller number other researchers reported that the consumption of zinc sulphate increases grain yield (Seyyed Sharifi et al, 2007, Tind et al 1993). Babu A'zami stated that manganese sulphate increases grain yield by decreasing fertilized tiller number, and empty cluster number.

Harvest index

Although harvest index was not influenced by any of treatments, statistically (table 1) but the most harvest index obtained under the interactions of zinc with manganese for treatment with using both 20kgm zinc sulphate and 30kgm manganese sulphate, hectare (47.47) and the least harvest index obtained for treatment without using zinc and with using 30kgm manganese sulfate. hectare (43.43%), Table 3. Salem et al (1996) reported that the consumption of zinc sulphate increases harvest index by increasing grain yield.

Table 1: Mean squares of yield and yield components of rice under zinc and manganese treatments

Changes of sources	Freedom degree	Total number of tiller in spot	Total number of fertilized tiller in spot	Total number of cluster	Total number of full cluster	1000 grain weight	Straw yield	Grain yield	Harvest index
Block	3	2.349*	2.375*	11.958	5.875	0.383	1914.04	1406.78	10436
zinc	2	1.116	1.391	122.382	172.932	0.086	2536.89*	2112.98	14.344
manganese	1	0.286	0.510	223.68	171.020	0.002	2893.01	882.94	19.856
zinc×manganese	2	1.344	0.902	204.900	191.727	0.040	1165.60	3608.38*	7.390
Total error	15	0.596	0.691	79.780	84.574	0.449	684.83	1084.74	9.099
Coefficient changes (%)		9,40	10.39	14.94	14.76	2.75	11.55	16.72	6.60

Table 2: Mean comparison of effects of zinc& manganese on yield and yield components of rice

Changes of sources	Total number of tiller in spot	Total number of fertilized tiller in spot	Total number of cluster	Total number of full cluster	1000 grain weight	Straw yield	Grain yield	Harvest index
Zinc sulphate 20kg. hectare	8.256a	7.891a	61.09a	5994a	24.46a	206.4ab	185.7a	44.78a
40kgm. hectar	8.569a	8.456a	67.96a	67.66a	24.36a	240.2a	215.6a	47.26a
Manganese sulphate 30kgm. hectar	7.825a	7.642a	61.28a	59.74a	24.25a	233ab	189.5a	45.15a
	8.107a	7.815a	60.386a	59.62a	24.34a	215.56b	190.86a	46.64a
	8.326a	8.142a	66.492a	64.96a	24.36a	237.52a	203a	44.82a

Those means that have, at least, one common letter in each column, lacking significant difference in probable level of 5%.

Table 3: Mean comparison of interactions MN×Zn on yield and yield components of rice

Changes of sources	Total number of tiller in spot	Total number of fertilized tiller in spot	Total number of cluster	Total number of full cluster	1000 grain weight	Straw yield	Grain yield	Harvest index
$Zn^0 \times MN^0$	8.58Ab	8.100ab	63.72ab	61.95ab	24.38a	209.4c	203.7ab	46.23a
$Zn^0 \times MN^0$	7.93ab	7.68ab	58.45ab	57.03ab	24.54a	203.5c	167.7b	43.34a
$Zn^0 \times MN^0$	8.07ab	7.99ab	63.21ab	64.47ab	24.42a	222.8abc	201.5ab	47.6a
$Zn^0 \times MN^0$	9.6a	8.91a	72.70a	70.85a	24.30a	257.6a	229.6a	47.47a
$Zn^0 \times MN^0$	7.66b	7.45b	54.22b	52.45b	24.24a	214.5bc	167.4fb	46.64a
$Zn^0 \times MN^0$	7.96ab	77.83b	68.32ab	67.03a	24.27a	251.5ab	211.7ab	43.67a

Means lacking similar letters have significant statistical difference in probable level of 5%.

The amount of absorbing elements in grain the amount of zinc in grain

Although the amount of zinc in grain was not influenced by any one of treatments (table 4), the amount of zinc in grain was the most under the interaction of zinc with manganese for treatment with using 20kgm zinc sulphate and without using manganese (6.248mgm. kgm of grain) and the least amount obtained for treatment with using both 20kgm zinc sulphate and 30kgm manganese sulphate. hectar (3.99mg. kgm of grain), table 6. Alizadeh (2010) stated that the consumption of zinc sulphate in rice plant, by increasing production organs and the number of tiller in bush, is able to increase grain yield and the thickness of zinc in rice grain had a significant increase about 19.8%, Ming et al (1992) reported that the consumption of zinc sulphate, in solution scattering form, increases grain yield and zinc thickness in grain as well as the richness of wheat. Seyyed Sharifi et al (2007) found out that by increasing zinc sulphate consumption, grain yield and protein percentage became more, and also the amount of zinc in grain will increase to the amount of 14.8%.

The amount of absorbing elements in grain

The amount of zinc in grain

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The amount of manganese in grain

The simple effect of zinc and the interaction of zinc with manganese were significant on the amount of manganese in grain in probable level of 5% (table 4). The most amount of grain manganese obtained just by using 20kgm zinc sulphat.hectar (30.2mg.kgm of grain), table 5. The most amount of grain manganese obtained under double interaction for treatment with using both 20kgm zinc sulphat and 30kgm manganese sulphat. hectare (32.25mgm.kgm of grain) and the least amount of grain manganese obtained for treatment without manganese consumption and with consumption of 40kgm zinc sulphat. hectare (22.94 mgm.kgm).Table 6. Hassan Zadeh Azar et al (2009) indicated that with using zinc and manganese basa. Dressing we added the amount of gland yield and the yield of pure sugar and the percentage of pure sugar of beetroot. Babu A'zami (2010) found out that the

consumption of manganese sulphat, by increasing grain weight and the percentage of full clusters, caused the increase of grain yield and the amount of grain manganese increased significantly with using manganese sulphate in comparison with it's not- using.

Table 4: mean squares of the amounts zinc& manganese in rice grain the variety of *Oriza sative* L. under the treatment of zinc and manganese

Source of changes	Freedom degree	The amount of zinc in grain (ppm)	The amount of manganese in grain (ppm)
block	3	0.201	4.487
zinc	2	1.468	48.590*
manganese	1	0.001	1.916
Zinc × manganese	2	10.341	56.219*
Total error	15	6.782	9.113
Coefficient changes (%)		55.38	11.03

& show significance, respectively in 5& 1% level.*

Table 5: the mean comparison of simple effects of zinc& manganese on thickness of elements in rice grain, the variety *Oriza sative* L

Sources of changes	Grain zinc (mgm. kgm)	Grain manganeses (mgm.kgm)
Zinc sulphat 0	4.266a	25.77b
20 kgm.hectar	5.122a	30.20a
40 kgm.hectar	4.718a	26.11b
Manganese sulphat 0	4.697a	25.71a
30kgm.hectar	4.707a	27.34a

The means that don't have similar letters have significant difference, statistically in probable level of 5%.

Table 6: The mean comparison of interactions of Mn×Zn on thickness of elements in rice grain, the variety of *Oriza sative* L

treatment	The amount of grain zinc	The amount of grain manganese
Zn0×Mn0	3.118a	26.04bc
Zn0×Mn30	5.413a	25.50bc
Zn20×Mn0	6.248a	28.15ab
Zn20×Mn30	3.99a	32.25a
Zn40×Mn0	4.725a	22.94c
Zn30×Mn40	4.712a	29.28ab

The means that don't have similar letters have significant difference, statistically, in probable level of 5%.

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