International Journal of Advanced Biotechnology and Research (IJBR)
ISSN 0976-2612, Online ISSN 2278–599X,
Vol-8, Issue-4, 2017, pp670-676
http://www.bipublication.com

Research Article

Investigating the effect of Iron chelated fertilizer on some quantitative and qualitative characteristics of sesame in ChahGolang in Yazd Province

Mahmoud Boghori

Graduated Master of Science Agriculture
Student.agriculture68@gmail.com

ABSTRACT

In order to investigate the effect of iron chelated fertilizer on the qualitative and quantitative yield of experimental sesame in 2015 in ChahGolang agricultural farm located in Yazd, randomized complete block design with three replications was conducted. The values of 10, 20 and 30 kilogram were investigated in hectares of iron chelate as soil application and foliar with a concentration of one in thousand in stem elongation stage (before flowering), Flowering and control (no fertilization). Each experimental unit includes 4 cultivation rows with a length of 2 meters and a distance of 50 cm. Traits of plant height, number of capsules per plant, the number of seeds per capsule, the weight of one thousand seeds, seed yield, biological yield, seed oil percentage and seed protein percentage were assessed. The results of experiments showed that through using iron chelated fertilizer, some of characteristics in sesame will increase. The characteristics such as the percentage of protein, plant height and thousand seed weight showed significant increase and in some other ones had non-significant increase rather than control. Generally the results of experiment showed that using iron chelate causes increasing some qualitative and quantitative characteristics in sesame because of providing the rate of sesame plant iron and its role in chlorophyll and protein synthesis.

Key words: Protein, iron chelate, soil consumption, foliar, seed yield

INTRODUCTION

Among oil plants, sesame is considered as important edible seed in agriculture and apparently is the oldest oilseed crops in the world (Khajehpur, 2004). This plant is considered as one of the resistant plants in terms of drought resistance and requires a little input for growth (Dadashi et al, 2004). Sesame is one of the most important plants which have many privileges such as Medicinal, nutritional, cosmetic, health properties and high quality of cooking (Sabannavar and Lakshman, 2008). Sesame seed has high nutritional value considering protein high quantity and quality and its edible oil and also because of powerful antioxidants such as Sesamin, Sesamolin and Sesamolhas ultra-high stability therefore sesame oil is able to give other vegetable oils necessary stability and sustainability through being on the side of them (Suja et al, 2004). These days, farmers and agriculture experts' attention has been increasingly drawn to the importance and role of low consumption elements. The main reason of that is raising new problems which are as result of increasing uptake these elements and not returning to the soil, lack of iron which is the origin of a certain paleness, named jaundice can be seen in most of the country's soils and in different plants, its damage will be significant in plants of arid areas and farming plants (Kouchaki et al, 2001). The most common lack which is fought with by foliar in arid areas is lack of iron which can be compensated in semi-arid areas because of the frequency of calcareous soils and high pH of calcareous soils through spraying iron minerals to plant leaves and in this way, overcome the absorption limitations of iron in the soil (Iranmanesh, 2006). In severe deficiencies in

micronutrients elements during the formation of flower, a few flowers are formed and the number of seed and ultimately the yield will decrease (Sarmadania et al, 1993). Iron element plays a role in the formation of chlorophyll, protein synthesis and increased storage of photosynthesis obtained material (Fathi, 2008). (Mohammadinejad et al, 2009) evaluated sesame different genotypes under different levels of iron Sequestrine and in their experiments, the effect of iron micronutrient caused significant increase of thousand seed (Pazoki et al, 2009). In order to investigate the effect of iron foliar on the yield and the components of Canola autumn cultivators yield concluded that foliar with iron chelate can significantly increase the number of the number of pods per plant, number of seeds per pod, thousand seed weight and seed yield and lack of that produces the least rate of seed yield. (Musivand et al, 2009) investigated the effect of iron concentration on the growth and yield components in soybean genotypes and concluded that foliar with iron fertilizer causes the significant increase of yield, biological yield the percentage of protein and oil in soybean. Considering that adequate information about fertilizing requirements of sesame haven't been available in study area, during using chemical fertilizers and plants responds to them is highly dependent on environmental conditions such as area soil and genetic factors and that sesame oil is one of the qualified oils for human consumption and lack of iron can be seen in alkaline soils and no research has been allocated to the mentioned area, therefore doing this research seemed necessary.

MATERIALS AND METHODS

This experiment was performed in order to investigate the fertilize effect of iron chelate on some of sesame characteristics in 2015 in ChahGolang farm located in Yazd province. The farm's agriculture soil was deep enough and it is considered as sandy loam soil in terms of texture (table 1), considering the appropriate depth and texture for growth and expanding sesame root, the soil of farm has been appropriate and crop rotation has been completely met considering the importance of experimental plan. After identifying the exact location of experiment before cultivation and implementing the plan from farm soil which has been as fallow, in order to accurate identification of characteristics of cultivating soil in farm and determining the necessary elements for plant growth and eliminating the existence lack, ten different points of farm have been sampled with zero to 30 cm depth as zigzag and combined and then soil experiment was analyzed in laboratory. Experimental treatments include; control (cultivation without fertilizer), foliarof iron chelate with concentration of one in thousand at stem elongation stage, foliar of iron chelate with concentration of one in flowering stage, soil consumption of iron chelate to 10 kg in hectare, soil consumption of iron chelate to 20 kg in hectare and soil consumption of iron chelate to 30 kg in hectare. A soil sample was taken out of study land and then required fertilizers were added to the soil of experimental farm based on fertilizer recommendations during land preparation. Each plot consisted of 4 cultivator row by row spacing of 50 cm and a length of 2 m and plant distance in each cultivator row with thinning was consideredabout 5 cm. in order to sampling plots and measuring mentioned factor, sampling treatments was implemented at the end of the period. The method of measuring study characteristics is that 10 bushes were selected from middle rows of each experimental unit and characteristics such as plant height, number of capsules per plant, the number of seeds per capsule, the weight of one thousand seeds, seed yield, biological yield, seed oil percentage and seed protein percentage were assessed. Statistical calculations and analyzing the variance of data and comparing the mean of measuring characteristics were done using SAS software and drawing diagrams was accomplished using EXCEL software.

RESULTS AND DISCUSSIONS

Plant height: Based on the table of analyzing the variance of fertilizer treatment of iron chelate on plant height was signifiedin level of 5 percent (table 2). Themost rate of plant height was obtained out of foliar treatment in stem elongation stage (76.56) and the rest of treatments were placed with control in one group (table 3). The priority of this treatment is because of providing adequate amount of available iron for plant in conditions of this element lack in soil and the role of this component in the synthesis of chlorophyll to increase photosynthesis and more supply of products of photosynthesis in plants (Parizimoghaddam et al, 2005). Nazaran et al (2009) concluded in an experiment which they did about the effect of Nano organic fertilizer of iron chelated on quantitative and qualitative characteristics of dryland wheat that foliar in different stages of wheat growth causes significant increase of plant height and foliar is the highest in the stem elongation stages.

The number of seeds per capsule and number of capsules per plant

The results of analyzing variance showed that iron chelate fertilizer treatment on the number of seeds per capsule and the number of capsule per plant has not been signified (table 2). The comparison of data means (table 3) shows that the effect of foliar of iron chelate in a stage before flowering has been the most on these two characteristics and through increasing the height of plant and forming higher inflorescence axis, the number of capsule in plant has been more therefore whatever the stem is longer the number of capsule in plant will be more. Pazoki et al, 2009 showed that through iron foliar on Canola autumn cultivators, the number of capsule will increase in plant. Mousivand et al, 2009 showed that through iron foliar the number of pod will increase in soybean plant but it has not been signified rather than control.

Thousand seed weight

The results of analyzing variance of iron chelate fertilizer treatment effect on the weight of thousand seeds has been signified (table 2). The comparison of data means shows that the highest seed weight was obtained in soil consumption treatments of 30 kg in hectare (3.22) and soil consumption has had more effect than foliar. The least weight is related to control (3.12) (table 3). The results represent that consuming iron causes increasing chlorophyll synthesis and increase the supply of products of photosynthesis in plants. In other studies, Moradizadeh et al (2012) showed in the effect of Nano iron chelate on Nano iron chelate on qualitative and quantitative properties of sunflower that soil consumption is more prior on thousand seed weight than foliar and it has been more significant. Mohammadinejad (2009) showed that through increasing level (soil consumption) iron Sequestrine, the weight of thousand seed increased in sesame and was signified toward control. Rahimi et al (2003) showed that through using micronutrients, the weight of thousand seed will increase in sunflower.

The percentage of seed oil

Based on the table of analyzing variance the effect of iron chelate treatment has not been signified on the percentage of seed oil (table 2). The table of means comparison (table 3) showed that the increase of seed oil percentage has been seen in all treatments. The highest oil content was obtained in foliar in flowering stage (52.28), the least oil percentage was related to control (50.77). The results of Saffari (2005) also represented the existence of positive effects of micronutrients whether as soil consumption or foliar on the percentage of seed oil in oil plants.

Seed yield

The results of analyzing variance showed that the effect of iron chelate fertilizer treatment on seed yield isn't signified (table 2) but the table of comparing means (table 3) shows that there is increasing yield in characteristics so that the most yield was obtained out of soil consumption (1163) and the least one out of control (1114). Considering obtained results seed yield has been

affected by the number of capsule in plant and because the number of capsule in plant is main part of seed yield and has not been signified so seed yield isn't signified as well and through increasing the weight of thousand seeds, the rate of yield has increased as well. The researches of ChanpDerakar, 1994 showed that seed yield in sesame depends on the number of plant in surface unit, the number of tributaries, the number of pod in plant, the number of seed per pod and the weight of thousand seed. In some studies, Saeidi 2008 showed that the number of capsule per plant justified 58 percent of changes in seed yield in plant and it is one of the main components of yield. Moradizadeh et al, 2012 showed that the effect of soil consumption and foliar of Nano iron chelate isn't significant on sunflower seed yield but there was increasing yield toward control. Anderson 1982 reported that Sorghum seed yield increases affected by two or three times of foliar with iron sulfate solution 2.5%.

Biological yield

Based on the table of analyzing variance the effect of iron chelate treatment has not been signified on biological yield (table 1) but showed non-significant increase toward control (table 2). The researches show that iron leaf consumption causes increasing the height of stem in corn and increases the yield of dry material Whitty et al (2005). Mousivand et al (2009) showed that consuming iron foliar causes increasing dry material in soybean. Masonic et al (1996) in Italy investigated the effect of lack of iron on sunflower, corn, wheat and sesame plants and observed that lack of iron has increased chlorophyll and as result decreases yield and plant dry material as well.

Seed protein percentage

The results of analyzing variance showed that the effect of iron chelate fertilizer treatment on seed protein percentage is significant in level of 5 percent (table 2). The highest percentage of protein was obtained out of foliar treatment in flowering stage (22.20) and the least percentage was related to control (19.03) (table 3). The priority of this treatment is because of providing a sufficient amount of iron available to plants in conditions of this element deficiency in soil and the role of this element is effective on protein synthesis and chlorophyll in order to increase photosynthesis and more storage of products of photosynthesis in plants (Parizimoghaddam et al, 2005). In some researches (Tivari et al, 2005) showed that applying iron treatment in the conditions of this element deficiency causes increasing protein synthesis in plants.

Soil properties	
Acidity PH	8.44
Total nitrogen%	0.126
Absorbable Phosphorus ppm	9.46
Available potassium ppm	349.36
Sand percentage %	49
Clay percentage %	16
Silt percentage %	35
Texture	S.L
Iron mg/kg	1.78

Table 1- Farm soil properties

Table 2- analyzing variance and mean squares (MS): investigating the iron chelate fertilizer effect on sesame qualitative and quantitative characteristics

Seed protein percentage	Biological yield	Seed yield	Seed oil percentage	The weight of thousand seeds	The number of capsule per plant	The number of seed per capsule	Plant height	Freedom degree	Change sources
3/80* 6/12^{ns} 2/31	22116/03^{ns} 122206/12^{ns} 22768/57	833/46^{ns} 5508/48^{ns} 1527/71	0/90^{ns} 18/70^{ns} 1/93	003**0/ 0/001** 0/0002	30/49^{ns} 0/26^{ns} 13/47	19/86^{ns} 13/02^{ns} 20/75	13/57* 16/47* 3/09	2 5 10	Block Treatment error
7/38	883/	3/47	292/	0/52	7/05	6/26	2/43	_	CV(٪)

Ns, * and ** respectively show the lack of significant difference and significant different in level of 5 and 1 percent

Table 3- Compare the average iron chelate effect on the properties of quantitative and qualitative traits of sesame
In each column all means that at least have one common letter are not significant statistically

Seed protein percentage	Biological yield (kilogram)	Seed yield (kilogram)	The percentage of seed oil	The weight of thousand seed (kilogram)	The number of capsule per plant	The number of seed per capsule	Plant height (centimeter)	Treatment levels
20/53^{ab}	3943/6^{a}	1163/96^{a}	51/17^{a}	3/20^{ab}	50/26^{ab}	70/93^{a}	71/53^{b}	Soil 10
19/73^{ab}	3980/4^{a}	1146/63^{a}	51/56^{a}	/18^{bc}3	48/63^{b}	69/96^{a}	70/93^{b}	Soil 20
20/75^{ab}	3740/3^{a}	1140/27^{a}	51/49^{a}	3/22^{a}	54/93^{ab}	72/53^{a}	72/63^{b}	Soil 30
21/32^{ab}	3843/6^{a}	1147/56^{a}	51/27^{a}	3/16^{c}	56/90^{a}	77/43^{a}	76/56^{a}	Stemming
22/20^{a}	3901/5^{a}	1130/59^{a}	52/28^{a}	3/16^{c}	51/13^{ab}	72/56^{a}	71/46^{b}	Flowering
19/03^{b}	3923/7^{a}	1114/94^{a}	50/77^{a}	3/12^{d}	50/23^{ab}	72/96^{a}	71/20^{b}	Control

Diagram 1- comparing the mean of plant height in sesame

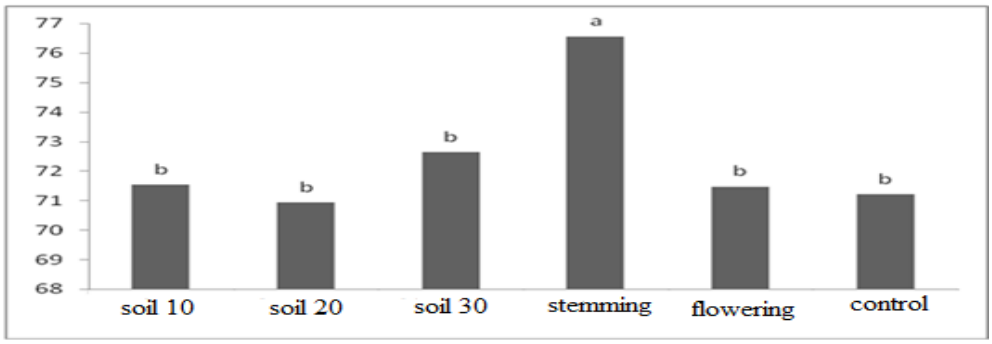
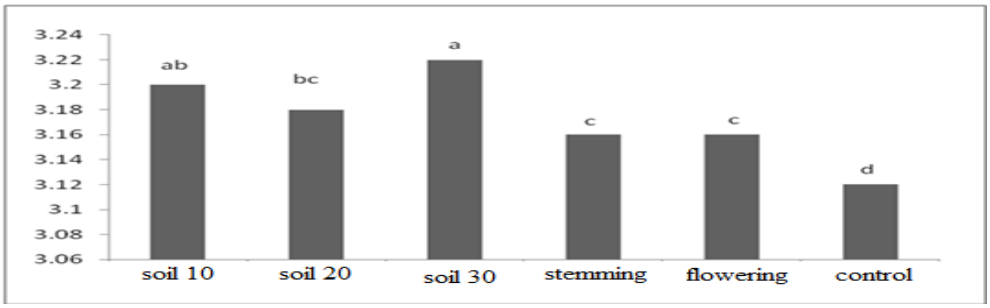


Diagram 2- comparing the mean of thousand seed weight in sesame



CONCLUSION

The obtained results of experiments showed that iron chelate treatment has increased characteristics yield in many traits, this priority can be attributed to the role of iron in chlorophyll synthesis and protein and the role of this element in implementing photosynthesize. Iron element has been significant in traits such as thousand seed weight, plant height and the percentage of protein and whatever the plant has longer stem the number of capsule increases in plant. The protein percentage has had the highest rate in foliar in flowering stage, the reason can be stated as that new leaves on the top of the plant that there are young leaves with more efficiency than older leaves which are in lower levels receive sun light and this feature puts the most efficient leaves in the best position in terms of photosynthesize that causes increasing the efficiency of iron and increases the rate of protein. In some studies

(Mohammad et al, 1964), (Keoshall, 1974) showed that sesame yield has positive correlation with the weight of thousand seed and the number of capsule per plant and plant height. Because the number of capsule per plant has not been signified in this experiment, seed yield has not been signified as well.

REFERENCES

1. Iranmanesh, H, 2006, Effects of Nitrogen on Yield and yield components of sesame in the city of Zarand. Master's thesis, Islamic Azad University, Yazd Branch, Faculty of Agriculture, 94 pages
2. Amin pur, R, Mortazavi, Beck, A and Mobli, M, 2006, The effect of different methods of copper and iron on yield of onion seeds. Journal of Horticultural Science and Technology Volume 7, Issue 4, Pages 265 to 274
3. Pazoki, A, Shirani rad, V and Paknejad, F 2009, The effect of foliar application of iron on yield and yield components of autumn canola in Ray City.
4. Parizimoghaddam, A and Bohrani, J, 2005, The effect of nitrogen and plant density on some agronomic characteristics of sesame. Journal of Science. Agricultural .135: 36-129
5. Khalilimahalleh, J, Roshdi M, 2008, The effect of foliar application of micronutrients on yield and quality of corn silage 704 in the mood. Volume 22, Number 2
6. Khajepur, M 2004, Industrial plants. Publications Jihad Esfahan University. 580 Page
7. Dadashi, N, Khajepur, M 2004, The effect of planting date and cultivar on growth and yield components of safflower in Isfahan. Journal of Science and Technology of Agriculture and Natural Resources, 8 (3): 112-95
8. Dini Torkamani, M and Caraptian, ZH, 2007, The amount and type of protein in seeds of ten cultivars of sesame, Science and Technology Journal of Agriculture and Natural Resources, the eleventh year, number forty (a)
9. Rahimi Arsanjani, M, Mazaheri, D, Tahmasebi, Z 2004, The effect of micronutrients iron and zinc on yield and yield components of two sunflower cultivars. Research and Construction 64: 20-16
10. Sarmadania, A and Kouchaki, A, 1993, Crop Physiology, Mashhad University Jihad
11. Saeidi, Gh, 2008, The effect of macro and micro nutrients on yield and other agronomic traits of sesame. Science and technology, agriculture and natural resources - the twelfth year - Number Forty-five
12. Saffari, H, 2005, Efficacy and optimal intake of micronutrients fertilizers containing iron and zinc on yield and quality and oil content of rapeseed. Seminar Proceedings of scientific and industrial uses vegetable oil .thran page 98
13. Fathi, Gh, 2008, Growth and Plant Nutrition, Mashhad University Jihad Press, page 372
14. Gheshlaghi, A, Bandari, A, The effect of foliar application of iron sulphate and citric acid on quantitative and qualitative properties of the tomato cultivar Science and Technology of Agriculture and Natural Resources Urbana winter 2004
15. Kouchaki, A and Ghsarmadania 2001, Crop Physiology (Translation) .antsharat University of Mashhad 400 Page
16. Mohammadinejad, Gh, Kordestani, R, Tohidinejad, A and Farah bakhshesh, H 2009, Path analysis of sesame seed yield of different genotypes under different levels of iron in Jiroft. First National Conference on oilseeds
17. Malakouti, M and Nafisi, M 1994, Fertilizer on farm land (irrigated and II). TarbiatModarres University Press, pp. 283-282
18. Moradizadeh, M, Shamsi Mahmoudabadi, H and Moravati, L, 2012, Iron chelate qualitative and quantitative nano effect on the properties of sunflower varieties in the region SyrnaMeibod First Conference on sustainable development in arid and semi-arid Abarkouh, Iran, May 2012
19. Moazam, A, 2009, The effects of planting date on yield and yield components of sesame varieties. Master's thesis, Master's thesis, Faculty of Agriculture, Islamic Azad University, Yazd Branch. 75 pages.
20. Mousivand, Khorgami, A and Rafeie, M, 2009, The effect of iron concentration on the growth and yield components in different soybean genotypes. Journal of Crop Physiology, University of Ahvaz, the first year, the fourth number
21. Nazaran, M, Khalaj, H, Labbafi, M, shamsabadi, M and Razazi, A 2009,

Investigating the timing and effect of nano iron chelated organic fertilizer on quantitative and qualitative properties of dryland wheat 16 to 15 October .Plant Improvement Institute Conference seed salon , Karaj

22. Anderson,W.B.1982. Diagnosis and correction of iron deficiency in fild crop-an overview.j.plant Nutr.15:785-795
23. Chanbdrakar, B.L., Sekhar, N., Tuteja, S.S. and Tripathi, R.S., 1994. Effect of irrigation and nitrogen on growth and yield of summer sesame (Sesamumindicum) Indian. J. Agron39:701-702.
24. Chung, J., Lee, J., Choe, E. 2004. Oxidative stability of soybean and sesame oil mixture during frying of flour dough. Journal Food Science, 69: 574–578.
25. Kaushal., P.K, SHRIVASTAR., P.S SHRIVAS .S.R. AND GOSWAMI. G1974. Study on correlation and path analysis of and some yield attributing characters inerect type of sesam.jnkvvRes.j.8:113-117.
26. MUHAMMED,S.V.and DORAIVA, S. M. 1964. correlation studies between yield and certainyield components in different groups of sesamumindicum based on seed colour.madras agric.j.51:73-74
27. Masonic.A.A.Evacoli.and.M. 1996.Spectral of leaves deficient in iron sulphur. Magnesium and magnese Agronomy Journal.88(6):937-943 Mavoti.
28. Sabannavar,S. J., and Lakshman, H. C. 2008. Interactions between Azotobacter, Pseudomonas and ArbuscularMycorrhizal Fungi on Two Varieties of(*Sesamumindicum* L.). JournalAgronomy and Crop Science, 194:470-478.
29. Tewari,R.K.Kumar .p.andsharrmar p.n.(2005) sign of oxidative stress in the cholorotic leaves of iron steravedplants.plant science 169:1037-1045.
30. Whitty, E. N., and Chambliss, C. G. 2005. Fertilization of Field and Forage Crops.Nevada State University Publication. 21pp.