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Research Article

THE EVALUATION ON EFFECT OF NITROGEN FERTILIZER AND CHELATED ZINC ON THE YIELD OF PEANUT (*ARACHIS HYPOGAE*)

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ABSTRACT
Oilseeds have a particular place among the agricultural products in respect of supplying the needed calorie and energy for human and it is considered as most valuable products of agricultural sector. Peanut is one of most important, popular and cost- tropical oilseeds in the tropical and semi- tropical region. Following the soybean and colza, it is accounted as the third annual oilseed world wild. Present study was performed to study the effects of nitrogen fertilizer and Chelated zinc fertilizer on the peanut yield during 2012 agricultural season in Astaneh Ashrafieh city, Guilan province. The study was implemented as a factorial test in complete randomized blocks design in 2012 agricultural season. Factors of this design were considered as 3 nitrogen fertilizer levels of 0, 30, 60 k/ h^1 and Chelated zinc fertilizer as spraying including 4 levels of 0, 1, 2, 3 g/l zinc. Results of this study indicated that effect of nitrogen fertilizer and Chelated zinc on the seed yield, pod yield, the number of intact pod per plant the number of seed per bush and weight of 100 seeds and harvest index was significant. The highest yield was achieved with applying 60 kg/ h^1 nitrogen and 3 g/ h^1 zinc. Interactions of nitrogen and Chelated zinc was significant only on the seed Chelated zinc was significant only on the seed yield and the number of intact pods and No significant interactions with other characters.

Key Words: *Peanut, Chelated Zinc Fertilizer, Nitrogen Fertilizer, Yield*

INTRODUCTION
World population increase rate is currently very high and predictions indicate that the population growth during oncoming 40 years will be more than increase in the human population since the early creation of the world until now. This rapid growth of population will cause the increasing need to the more food and agricultural products (Rastegar, 1993; Safarzade, 1999). Oilseeds have a particular place among the agricultural products in respect of supplying the needed calorie and energy for human and it is considered as most valuable products of agricultural sector. Peanut is one of most important, popular and cost-tropical oilseeds in the tropical and semi- tropical region. Following the soybean and colza, it is accounted as the third annual oilseed world wild (Annis *et al.*, 2001).
Oilseed is rich of nutritional elements and materials, and in the same proportion their need to these elements is high. In the roots of peanut nitrogen fixation occurs. On the other hand, adequate nitrogen absorption by the plant will increase the nitrogen amount in the seeds, largeness of the fruits, and the size of cereal and grain seed. The more is the nitrogen concentration in the leaves, the more will be the carbon taking intensity. Since, nitrogen, in addition to being present as the protein in the plant, is the major component of chlorophyll in plant and the major factor in carbon taking process in the green plants. In addition, it is involved in the formation of plant hormones and vectors and energy and adenosine triphosphate vectors (Mohamady, 2006). Suitable usage of nitrogen will increase the total nitrogen in the plant and its excessive usage will cause negative effects on the nitrogen fixing bacteria (Majnoon, 1993). Zinc also is an element, its shortage is apparent in most region world wild. Based on the studies performed in the peanut cultivation areas in Guilan province, zinc rate in the soil is lower than required amount for peanut. Several factors affect on the absorbable zinc rate in the peanut cultivated lands. Among the most important factors of zinc shortage in the peanut cultivated lands is the paucity of the minerals containing zinc in these soils, presence of alkaline ptt, high rate of calcium carbonate and light weight of the soil texture in the peanut fields in the area (Pilevar *et al.*, 1987). Some reports indicated that

by consumption of zinc, log concentration of hemoglobin in the knots, iron and zinc concentration in the root, activity of reductase nitrate in the leaves and the concentration of nitrogen in the roots and aerial parts of the peanut also will increase (Fojeria, 2009). Based on the studied, the highest limitation of crops yield of the shortage of trace elements was related to the shortage of zinc (Fojeria, 2009).while plants demand for zinc is small but if there is not adequate amount of it available, the plants will suffer from physiologic stresses resulting from various enzymic and other metabolic operations malfunction related to zinc (Beibordy, 2006). By decreased moisture of the soil, zinc mobility in the soil solution will decrease and shortage of these elements will be compensated by spraying (Hamen, 1996). In the peanut cultivation areas in Guilan province, zinc rate in the soil is lower than demand. Several factors affect on the absorbable amount of zinc in the peanut cultivation soils. These factors are including paucity of zinc containing minerals in the soils, presence of alkaline pH, and high amount of calcium carbonate and light weight of the soil texture in the peanut fields (Pilevary *et al.*, 2008).

Additionally many studies indicated that by applying the zinc containing fertilizers, the yield of the pod, yield of the seed and peanut oil seed will increase. This was through the increase in the pod growth rate and greater absorption of other nutritional elements by the pods (Grifits *et al.*, 1995). Pendashteh *et al.*, (2011) have utilized the factorial design with three replication including 3 levels of zinc spraying and 6 levels of nitrogen fertilizer to study the effect of nitrogen fertilizer and zinc spraying on the seed yield in peanut. Results indicated that the greatest seed yield, pod yield plant height, weight of 100 seeds, seed width and length was 1 g/l for zinc spraying treatment and 80 kg/ h^1 fertilizer for nitrogen fertilizer treatment. An interaction was also meaningful and its highest rate was acquired by applying 1 g/l zinc spraying and kg/l^1 nitrogen fertilizer. Azarpoor *et al.*, (2011) have performed factorial experiment based on complete randomized blocks design with 3 replication including 2 levels of zinc spray (0 and 1 g/l) and 4 levels of pure nitrogen to study the effect of applying zinc spray and various levels of nitrogen fertilizer on the yield and yield components of bean. Results indicated that the greatest yield of seed, the weight of 100 seeds, the number of pod per plant, the number of seed per pod and plant height was including the use of zinc spraying and applying 0 kh/l^1 fertilizer and interaction was also significant. Bozorgy *et al.*, (2011), by studying on the effect of zinc spraying and various amounts of nitrogen on yield and some traits of peanut reported that the greatest rates of seed yield, pod yield, plant height, weight of 100 seeds, the seeds width and length will be achieved by 80 kh/l^1 nitrogen fertilizer and the greatest zinc fertilizer level that is 1g/l zinc.

Abdzad and Noorhosseiny (2010) in a study to evaluate the effect of iron and nitrogen fertilizer on the yield and yield components of peanuts in Astaneh Ashrafieh utilized the factorial test in the complete randomized blocks design. Results of this study including 4 levels of nitrogen fertilizer and 4 levels of iron fertilizer with 3 replications indicated that the greatest seed and pod yield was achieved for 4.5 g/l iron and 60 kg/h nitrogen fertilizer. Boyduck *et al.*, (2010) yield a study to evaluate the effects of nitrogen fertilizer amounts and irrigation rates on the peanut oil fatty acid content. Results indicated that applying the nitrogen fertilizer and irrigation influenced on all the studied factors expect for oleic acid and effect of these 2 factors was not constantly descending or ascending.

Based on the studies of various authors, zinc spraying depending on the consumption of this element in the soil may be a better technique to compensate the zinc shortage in the plant (Davis, 1993; Malvar *et al.*, 1992; Malvar, 1993). Reported that zinc spraying will adjust the zinc spraying will adjust the zinc shortage and increase the peanut seed quality and product. Ali and Moufy (2003) found that zinc spraying in 2 % rate will increase the peanut yield relatively which it was related to its quality improvement. Also many studied indicated that by applying the zinc containing fertilizers and sulphur fertilizers, not only the yield of pod, seed and oil will increase but also in most cases particularly in respect of pod yield, it has increased the pod growth rate and greater absorption of other nutritional elements by the pods (Grifits *et al.*, 1995).

According to the world wide food crisis and importance of oilseeds to supply the energy required for people as well as the need to reach the maximum yield in the existing condition and limitation and lack of

adequate information on the interaction of nitrogen fertilizer and Chelated zinc, present study was performed to study the optimization of nitrogen and Chelated zinc fertilizer and to define their adequate amounts to reach the maximum yield.

MATERIALS AND METHODS

Present study was performed to study the effects of nitrogen fertilizer and Chelated zinc fertilizer on the peanut yield during 2012 agricultural season in Astaneh Ashrafieh city, Guilan province. The study was implemented as a factorial test in complete randomized blocks design in 2012 agricultural season. Factors of this design were considered as 3 nitrogen fertilizer levels of 0, 30, 60 k/ h^1 and Chelated zinc fertilizer as spraying including 4 levels of 0, 1, 2, 3 g/l zinc. In May 2012, the soil was plowed using the tractor. Then clogs were cracked using disk and cultivator so that the soil was prepared to implement the plan. To implement the plan, plots with 2×5 m dimension were prepared and after implementing the designated plan on the land. Seeds were sown at the late May. Before plantation seed were disinfected in the carboxin tiram fungicide with 2: 1000 ratios. The cultivar used in this study was NC_2 (North Carolina). Weed control was performed mechanically using Shovel. After physiologic mature, harvesting was performed at the early October.

For proper sampling and removing the marginal effects, side rows of each plot as well as the bushes located in the start and end of middle rows were excluded. 2 meters space of each plot was selected for sampling and measuring the study traits and 10 bushes per plot from the middle row were picked after excluding half a meter marginal effects (Bel *et al.,* 1987), then the picked bushes per plot were placed inside the pocket. After recording the traits of each treatment on the pocket, it was placed in the oven with 72^0c temperature for 48 hours until drying. This was performed for each plot and each treatment was performed separately. Studied traits were seed yield, pod yield, the number of intact pod per bush, the number of seeds per push, weight of 100 seeds and harvesting index. SAS and MSTATC were used to analyze the data. Mean comparison was performed using Duncan multi domain test.

RESULTS AND DISCUSSION

Seed Yield

Results of variance analysis table (table1) demonstrate that effect of nitrogen fertilizer and Chelated on the seed yield was significant in 1% probability level. So that there was significant difference between all three treatment of nitrogen fertilizer and four treatments of Chelated zinc fertilizer. The highest seed yield was achieved in N3 fertilizer treatment as 2844 kg/h and the lowest seed yield was achieved in N1 fertilizer treatment as 2025 kg/h. in addition the highest seed yield was achieved in Z4 fertilizer treatment with 2758 kg/h and the lowest seed yield was achieved in Z1 fertilizer treatment with 2044 kg/ h^1 (table 2).

Meanwhile, effect of nitrogen and Chelated zinc on the seed yield was significant (table 3). Fertilizer treatment of N3Z4, N3Z3, N3Z2 with 2943, 2927, 2804 kh/g means, respectively had the highest and yield rate and there was no significant difference between the treatments. In addition the lowest seed yield related to N1Z1, N2Z1, N1Z2 fertilizer treatments was achieved as 1635, 1793, 1803 means respectively and there was no significant difference between the treatments.

It seems that applying the nitrogen fertilizer as the initial fertilizer before starting the nitrogen biologic fixation process is useful for peanut yield (Lanier *et al.,* 2005; Benet *et al.,* 1998). Abedzadeh and Noor (2010) in an experiment on peanut including 4 nitrogen level indicated that the highest seed yield and pod yield was achieved for 60 kg/ h^1 nitrogen fertilizer. Abdzadeh *et al.,* (2010) claimed the highest seed yield rate in 60 kg/ h^1 nitrogen fertilizer. Bozorgy *et al.,* (2011), Kandil *et al.,* (2007), Barrik *et al.,* (1998), Gogoy *et al.,* (2011), Pendashteh *et al.,* (2011), Azarpour *et al.,* (2011) and Altab and Hamid (2007) also reported that increase nitrogen consumption will increase the seed yield.

It was found that the highest limitation of crops yield related to the shortage of trace element was related to the shortage of zinc (Fajerya, 2009). Pendashteh *et al.,* (2011), to study on the effect of nitrogen

fertilizer and zinc spraying in peanut seed yield indicated that the highest seed yield for zinc spraying treatment was achieved in the highest zinc level. Azrpour *et al.*, (2011), Pilehvary *et al.*, (2008), Kakmak *et al.,* (1996), Rengel and Goram (1995) and Malakouty (1996) also reported that by applying the zinc fertilizer, seed yield increased.

In addition Azarpour *et al.,* (2011) noted that interaction of nitrogen and zinc on the bean plant increased yield which is consistent to the results of this study.

Pod Yield

Results of variance analysis table (table 1) indicate that nitrogen and Chelated zinc fertilizer level is significant in 1% probability level on the pod yield. According to the results of mean comparison, the highest pod yield was achieved in N3 fertilizer treatment with 4389 kg/h^1 and the lowest pod yield was achieved in N1 fertilizer treatment with 2909kg/h^1 and there was significant difference between the applied fertilizer treatments. In addition, the greatest pod yield was related to Z4 fertilizer treatment with 4152 kg/h^1 and the lowest pod yield was related to Z1 fertilizer treatment with 3086 kg/h^1. On the other hand, there was no significant difference between Z2 and Z3 fertilizer treatments with 3603 and 3767 means, respectively. But there was significant difference between these 2 treatments and Z4, Z1 fertilizer treatments respectively with greatest and lowest pod yield rate (table 2).

Abeszadeh Gohary and Noor Hosseiny Niaky (2010), Altab and Hamid (2007), Sing and Sing (2001), Abd Zad Gohary *et al.,* (2011) indicated in their studies that the highest pod yield rate in peanut was achieved by applying 60 kg/ h^1 nitrogen. Pendashteh *et al.,* (2011) also found that applying nitrogen increase the pod prefromance. Also Pendadhteh *et al.,* (2011) and Pileh *et al.,* (2008) indicated in their study that the pod yield increases by increase in the zinc spraying ratio. Ali and Mofy (2003) also achived similar results. Grifitz *et al.,* (1995) indicated that phosphor fertilizers and zinc containing fertilizers increase the pod yield.

The Number of Intact Pods per Plant

Results of variance table (table 1) indicates that effect of N and Chelated zinc fertilizer on the number of intact pod per plant has become significant in 1 % probability level and interaction of nitrogen and Chelated zinc fertilizer levels became significant in 1 % probability level. Mean comparison indicated that the greatest number of pod per plant was related to N3 fertilizer treatment with 23.40 and lowest number of pod per plant was related to N1 fertilizer treatment with 15.32. Additionally the greatest number of intact pod per bush was related to Z4 fertilizer treatment with 23.24 and the lowest number was related to Z1 fertilizer treatment with 15.54 (table 2).

also interaction of nitrogen and Chelated zinc fertilizer was achieved in N2Z4 and N3Z4 fertilizer treatments, respectively with 26.16 and 25.39 means and there was no significant difference between them and the lowest rate was related to N1Z1 fertilizer treatment with 11.44 Kandil *et al.,* (2007) indicated in their results that increase in nitrogen rate increases the number of pod per peanut bush (table 3).

Also studies of Salehin and Rahman (2012), Bozrgy *et al.,* (2011) and Azapour *et al.,* (2011) indicated that by increasing the nitrogen and zinc fertilizer levels the number of pods per plant increased. Reza *et al.,* (2008) indicated that by increasing the application of zinc spraying on peanut, the number of harvestable pods increased.

The Number of Seeds per Bush

Results of varicne analysis table (table 1) indicate that effect of nitrogen per bush has become significant in 1 % probability level. The greatest number of seed per bush was related in N3 fertilizer treatment with 46.18 and the lowest number was related to N1 fertilizer treatment with 29.47 mean. There was significant difference between nitrogen fertilizer treatments. Also the greatest number of seed per bush was achieved in Z4 fertilizer treatment with 41.69 and the lowest number was achieved in Z1 fertilizer treatment with 29.79 (table 2).

Bozorgy *et al.,* (2011), Azarpour *et al.,* (2011) and Salehin and Rahman (2012) indicated in their studies that by increase in the nitrogen fertilizer consumption and zinc spraying, the number of the seed per pod in plant increase.

The Weight of 100 Seeds

Results of variance analysis table (table1) indicate that effect of nitrogen and Chelated zinc fertilizer on the weight of 100 seeds was significant in 1 % probability level. Results of mean comparison indicated that the greatest weight of 100 seeds was achieved in N3 fertilizer treatment with 81.13 and the lowest weight of 100 seeds was related to N1, N2 fertilizer treatment, respectively with 74.72 and 77.51 and there was no significant difference between 2 treatments. The maximum weight of 100-seed was in Z4 and Z3 with 80.89 and 79.26, respectively and there was no significant difference between the two treatments. Also Z1 and Z2 fertilizer treatments respectively with 75.13 and 75.87 mean the lowest weight of 100 seeds and there was no significant difference between two treatments (table 2).

Abdzad Gohary *et al.,* (2011), Abdzad Gohary and Noor Hosseiny Niaky (2010) and Abdzad Gohary *et al.,* (2010) mentioned in their studies that the greatest weight of 100 seeds is achived with applying 60 kg/ h^1 nitrogen fertilizer. Bozorgy *et al.,* (2011), Pendashteh *et al.,* (2011), Azarpour *et al.,* (2011), Salehin and Rahman (2012) and Kandil *et al.,* (2007) indicated that increase in nitrogen rate will increase in nitrogen rate will increase the weight of 100 seeds.

Pilehvary *et al.,* (2008) indicated in their studied on peanut that by increasing the zinc spraying , the weight of 100 seeds will increase Salehin and Rahman (2012), Azarpour *et al.,* (2011), Bozorfy *et al.,* (2011) and Pendashteh *et al.,* (2011)also mentioned in their study that by increasing the zinc spraying the weight of 100 seeds will increase.

Harvesting Index

Results of variance analysis table (table 1) indicated that effect of nitrogen and Chelated zinc effect on the harvesting index has become significant in 1 % probability level. According to the results of mean comparison, greatest harvest index was achieved in N3 fertilizer treatment with 31.11 % and the lowest harvest index was achieved in N1 fertilizer treatment with 17.57 %. In addition, the greatest harvest, index was achieved in Z4 and Z3 fertilizer treatments respectively with 30.62 % and 26.95 %. These treatments didn't indicate significant difference. The lowest harvest index in Z2 and Z 1 treatments was 19.49 % and18.03 %, respectively; there was no significant difference between these treatments (table 2).

Morady (2012) and Abdzad Gohary *et al.,* (2011) reported that by increasing the nitrogen fertilizer rate, harvest index in the peanut will increase. Bozorgy *et al.,* (2011) indicated in there that by increasing the nitrogen fertilizer level and increasing the zinc spraying, harvest index in bean plant increased.

Table 1: Analysis of variance table properties measured

Source changes	df	seed yield	pod yield	number of intact pod per bush	number of seeds per bush	weight of 100 seeds	harvesting index
Block (B)	2	80622.333^{ns}	47579.528^{ns}	5.465^{ns}	27.444^{ns}	16.340^{ns}	29.184^{ns}
Nitrogen (N)	2	2028069.333^{**}	6570992.86^{**}	169.181^{**}	409.629^{**}	123.574^{**}	561.606^{**}
Zinc (Zn)	3	832133.213^{**}	1756869.880^{**}	91.951^{**}	758.370^{**}	67.524^{**}	324.841^{**}
Nitrogen × Zinc	6	143171.630^{*}	230490.380^{ns}	15.713^{**}	42.060^{ns}	27.771^{ns}	15.739^{ns}
Error	22	49996.545	96933.801	4.030	16.903	11.903	26.655
CV (%)		9.27	8.52	10.41	10.83	4.44	21.72

*ns, **, *: the difference is meaningless, statistically significant at 1% and 5%*

Table 2: Comparison of measured average characteristics

Treatments	seed yield	pod yield	number of intact pod per bush	number of seeds per bush	weight of 100 seeds	harvesting index
Nitrogen (N)						
Non-application of nitrogen fertilizer (N1)	2025c	2909c	15.32c	29.47c	74.72b	17.57c
30 kg N ha (N2)	2369b	3660b	19.14b	35.60b	77.51b	22.64b
60 kg N ha (N3)	2844a	4389a	23.40a	46.18a	81.13a	31.11a
Zinc (Zn)						
Non-application of chelated zinc (Z1)	2044c	3086c	15.54c	29.79c	75.13b	18.03b
1 gr per liter of zinc chelate (Z2)	2320b	3606b	18.50b	37.04b	75.87b	19.49b
2 gr per liter of zinc chelate (Z3)	2529b	3767b	19.87b	39.82b	79.26a	26.95a
3 gr per liter of zinc chelate (Z4)	2758a	4152a	23.24a	41.69a	80.89a	30.62a

The numbers in each column having at least one common letter are not significantly different at the 5% level

Table 3: Characteristics are measured in terms of the interaction of nitrogen and zinc Chelated

Treatments		Seed Yield	number of intact pods per plant
Non-application of nitrogen fertilizer	Non-application of chelated zinc (Z1)	1635d	11.44f
	1 gr per liter of zinc chelate (Z2)	1803d	15.33de
	2 gr per liter of zinc chelate (Z3)	2028cd	16.34de
	3 gr per liter of zinc chelate (Z4)	2635ab	18.17cd
30 kg N ha (N1)	Non-application of chelated zinc (Z1)	1793d	13.5ef
	1 gr per liter of zinc chelate (Z2)	2354bc	20.67bc
	2 gr per liter of zinc chelate (Z3)	2631ab	16.22de
	3 gr per liter of zinc chelate (Z4)	2696ab	26.16a
60 kg N ha	Non-application of chelated zinc (Z1)	2702ab	21.67bc
	1 gr per liter of zinc chelate (Z2)	2804a	23.61ab
	2 gr per liter of zinc chelate (Z3)	2927a	22.94ab
	3 gr per liter of zinc chelate (Z4)	2943a	25.39a

The numbers in each column having at least one common letter are not significantly different at the 5% level

Conclusion

Results of this study indicated that effect of nitrogen fertilizer and Chelated zinc on the seed yield, pod yield, the number of intact pod per pant, and the number of seed per bush. The weight of 100 seeds and harvest index was significant. The highest yield was achieved with applying 60 kg/ h^1 nitrogen and 3 g/ h^1 zinc. Greatest seed and pod yield mean was achieved in 60 kg/ h nitrogen with 2844 and 4389 kg/h. the greatest seed and pod yield mean was achieved in 3 g/l zinc treatment with 2758 and 4152, respectively.

Interactions of nitrogen and Chelated zinc was significant only on the seed Chelated zinc was significant only on the seed yield and the number of intact pods and greatest seed yield mean was achieved in 60 kg/h nitrogen treatment and 3 g/l Chelated zinc (N3z4) with 2943 mean to achieve a high yield it is required to increase the dry matter in surface unit. Thus, the techniques to increase the CO_2 fixation in the plants are very important. Shortage of nitrogen may cause serious effects on the plants yield and development. Shortage of N will restrain the protein and chlorophyll synthesis and plant growth and will chloride the leaves. Shortage of chlorophyll limit the plant's capacity to absorb CO_2 and carbohydrate synthesis which leads to weak, premature flowering accompanied to shortage the growth cycle. Adequate

adsorption of nitrogen by the plant increases the protein and the fruits sizes and seeds size in cereals and grains. The more is nitrogen concentration in the leaves the carbon taking intensity will be higher. Because nitrogen in addition to being present as the protein plant is are major component of chlorophyll in plant and the major factor in carbon taking process in green plants. In addition it contributes to formation of plant hormones and energy and adenosine thriphosphate vectors which play an important role in the plant materials synthesis (Mohamady, 2006). Nitrogen also is a key nutritional matter stimulating the root and stalk growth. on the other hand excessive nitrogen stimulated the vegetative growth of the plant and consequently flowers are grown in a upper height from the soil surface and don't have opportunity to from the pod.

Many studies indicated that by applying the zinc containing fertilizers, pod yield, seed yield and peanut seed oil increased. This occurred through increase in the pod growth rate and higher adsorption of other nutritional elements by the pods (Rstegar, 1993). Since, zinc has a positive contribution on the vital activities of the plant such as enzymes functions, it could be concluded that zinc spraying will increase the plant growth rate, pod growth rate and raises the segmentation coefficient through increasing the photosynthetic range, thus it will increase the pod yield. Increasing the seed yield also may be due to increase in segmentation coefficient, increased weight of 100 seeds, the number of number of empty pods, this results to allocation of more photosynthetic nurtured materials to the growing pods and leads to production of larger and more seeds.

Recommendations

1. It is recommended that other micronutrients are examined and tests are reported in the places and years.
2. According to the trace elements shortage rate in the cultivating soils and humans need to these elements it is suggested that necessary micronutrients be provide for the plant in adequate amounts.
3. Since zinc will increase the nitrogen adoption and thus increases the yield elements, it is recommended that two fertilizer treatment to nitrogen and zinc being utilized with suitable rates alongside each other due to their positive effects.

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