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EFFECT OF DIFFERENT SOURCES OF NITROGEN FERTILIZER ON YIELD & YIELD COMPONENTS OF SUNFLOWER (*Helianthus annuus* L.)

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Abstract

In order to evaluation of yield and yield components of sunflower in response to different nitrogen fertilizer sources, an experiment was conducted with different chemical and biological nitrogen fertilizers and one cultivar of sunflower cv. Master . These treatments were arranged into a factorial experiment based on RCBD design with four replications. Chemical nitrogen treatments were: No using of nitrogen, Urea application, Ammonium sulphate, and Ammonium nitrate phosphate application. Biological nitrogen based fertilizers was included of application and no applied of "Nitroxin" in combination with all chemical nitrogen treatments. Results showed that, Ammonium sulphate produced the highest seed yield. Integrated application of this fertilizer with Nitroxin, produced less yield than Ammonium sulfate alone. But in the other treatments, Nitroxin increased the seed yield.

Key words*: Helianthous annus, nitrogen sources, nitroxin, biological nitrogen.*

INTRODUCTION

Sunflower (*Helianthus annuus* L.) is one of the most important oilseeds that contributes considerably to edible oil in the world with an intermediate water requirement and adapted to a wide range of climatic conditions.

Fertilization needs to be used rationally in order to avoid a negative ecological impact and undesirable effects on the sustainability of agricultural production systems. Excessive application of fertilizers also affects the farmer's economy (Zubillaga et al., 2002). Nutrients play an important role in crop growth and development. Among the nutrients, Nitrogen (N) is one of the important nutrients that enhance the metabolic processes based on protein, leads to increases in vegetative, reproductive growth and yield of the crop, thus is required in the largest amount from soil (Nasim et al., 2012). Nitrogen is readily absorbed by the plants in the forms of nitrate (NO3), urea ($CO(NH_2)_2$) and ammonium ion (NH_4^+). Nitrogen is the major nutrient required by sunflowers, and has the greatest impact on seed size, leaf size and number of leaves, test weight and yield. Insufficient N will limit crop yield, however, excess N applications can reduce oil content, and result in tall plants with large leaves more prone to lodging and disease. Nutrients play an important role in crop growth and development.

This study was carried out to evaluate the effects of different sources of nitrogen fertilizer on yield & yield components of sunflower in Mashhad, Iran.

MATERIALS AND METHODS

In order of evaluation of yield and yield components of sunflower in response to different nitrogen fertilizer sources, an experiment was conducted at the Khorasan Razavi Agricultural and Natural Resources Research Center, Mashhad, Iran.

The experiments were established with different chemical and biological nitrogen fertilizers and one cultivar of sunflower cv. Master. These treatments were arranged into a factorial experiment based on RCBD design with four replications. Chemical nitrogen treatments were: No using of nitrogen, Urea application, Ammonium sulphate, and Ammonium nitrate phosphate application.

Treatment levels in this study were: without chemical fertilizer, nitrogen in form of Urea, nitrogen in form of Ammonium sulphate and Ammonium nitrate- phosphate that combined with use Nitroxin biological fertilizer and without use biological fertilizer treatments. Soil

samples were collected before planting and soil analysis on composite sample of collected soil, was done to know the nutrient status and physico-chemical characteristics of the soil, prior to experiment

According to soil analysis and sunflower fertilizer requirements, Phosphorus was applied at a rate of 50 kg P/ha using calcium super phosphate (15.5% P_2O_5). Potassium was applied at a rate of 50 kg/ha using potassium sulfate (48% K_2O). The rate of nitrogen for each plot based on soil analysis and sunflower fertilizer requirements was calculated 396 gr/plot pure nitrogen and it was equal of 1.886 kg/plot of Ammonium sulfate, 1.636 kg/plot Ammonium nitrate- sulfate and 0.861 kg/plot Urea. One half of nitrogen, all phosphorous and potassium fertilizers was applied before planting in strips with 5 centimeter distance with seeds in each plot.

Germinating sunflower seed is very sensitive to seed-placed fertilizer, and fertilizer should therefore be placed away from the seed.

The second half of nitrogen was applied when plants were at 6-8 leaf stage. The manufacturer's recommended rate of Nitroxin was 1.2 millilitre for seed treatment and 0.8 millilitre with irrigation for each plot. One part of Nitrioxin was treated with seeds in shadow situation and immediately was planted and second part was applied with irrigated water when plants were at 6-8 leaf stage. Sunflower variety used was Master.

During growth stages, date of star stage, flowering date, plant height, stem diameter and dry weight were recorded. Period to harvesting, from middle rows equal to 3.6 m^2 harvested for measurements. The data analyses were conducted by using the software package SAS and EXCEL.

RESULTS AND DISCUSSIONS

Result of analysis variance (Table 1) showed that the nitrogen fertilizer had a significant simple effect on seed yield but no significant simple effects were observed from the biological fertilizer on seed yield (Table 2). Based on results interaction effects of biological fertilizer and chemical fertilizers on seed yield was significant at ($p<0.05$) by Duncan test. Mahmoud et al. (1979) and Sahi (1979) reported that the biological fertilizer significantly increased seed yield of rainfed wheat. The increase in seed yield with the increase of ammonium sulphat might be due to the role of nitrogen in activating the growth and yield components. Similar results were obtained by Kasem & El-Mesilhy (1992), Salisbury and Ross (1994), Mojiri and Arzani (2003), Killi (2004), Özer et al. (2004) and Osman and Awed (2010).

Table 1. Analysis variance of different sources of nitrogen fertilizer on yield & yield components of sunflower

S.O.V	df	F		
		seed yield	1000 seed weight	seed /head
Rep	3	0.72^{ns}	1.6^{ns}	2.43^{*}
Nitrogen	3	4.06^{*}	2.8^{*}	6.85^{**}
Biological fertilizer	1	0.01^{ns}	5.49^{*}	1.23^{ns}
Interaction effects	3	2.97^{*}	3.23^{*}	1.89^{ns}
Error	21	-	-	-
%CV		15.30	16.82	16.83

Table 1. *(cont.)*

S.O.V	df	F	
		Stem diameter	Seed weight/head
Rep	3	1.66^{ns}	3.05^{*}
Nitrogen	3	0.27^{ns}	6.17
Biological fertilizer	1	2.43^{ns}	3.21^{*}
Interaction effects	3	1.70^{ns}	2.46^{*}
Error	21	-	-
%CV		10.79	26.102

^{ns} nonsignificant, *significant at 0.05 significance, **significant at 0.01 significance

Results showed that the chemical fertilizers did not affect 1000 seed weight significantly. According to Table 1 and 2 simple effect of Nitroxin significantly increased 1000 seed weight. Malik et al. (1996) reported that to compare between effect of urea and ammonium sulphate on 1000 seed weight of Highsun-33, all treatments with ammonium sulphate produced higher weight to compare the other treatments that treated with urea. Soleymani et al. (2013) reported that 1000 grain weight of sunflower, was significantly Influenced by nitrogen.

Results (Tables 1 and 2) indicated that simple effect of different sources of nitrogen significantly affected number of seed per head

but no significant differences was observed when we used Nitroxin. Interaction effects of chemical fertilizer and Nitroxin also was not affect on seed per head. These results same to results of Marlik et al. (1996). Abrar and Singh (2010) and Bange et al. (1997) reported that the number of seeds per head depended on genotypes and environment.

Table 2. Effects of different sources of nitrogen fertilizer on yield & yield components of sunflower

S.O.V	Yield	1000 seed weight	Seed/head
Chemical fertilizer			
N_1	2675 b	63.9 b	733.5 b
N_2	3110 ab	74.1 ab	843.9 b
N_3	3485 a	81.4 a	1020.4 a
N_4	3274 a	76.5 ab	1019.2 a
Biological fertilizer			
O_1	3130 a	68.8 b	874.5 a
O_2	3130 a	79.2 a	934.0 a

Table 2. *(cont.)*

S.O.V	Stem diameter	Plant height	Head diameter
Chemical fertilizer			
N_1	1.9 b	173.9 ab	19.7 a
N_2	2.2 a	169.7 b	19.0 a
N_3	2.3 a	173.1 a	19.9 a
N_4	2.3 a	177.2 a	19.5 a
Biological fertilizer			
O_1	2.2 a	174.6 a	20.1 a
O_2	2.2 a	172.4 a	19.0 a

Figures followed by the same letters are not significantly different at $p<0.05$

Simple effect of chemical fertilizer strongly affected on seed weight per head but simple effect of Nitroxin and interaction effects of chemical fertilizer and Nitroxin increased the weight of seed per head but it was not significant. Effects of chemical and biological fertilizers on head diameter and plant height were not significant.

Based on results simple effect of different chemical nitrogen sources specially ammonium sulphat significantly increased stem diameter but no significant differences were observed when Nitroxin treated. Osman and Awed (2010) reported that by increasing amount of nitrogen stem diameter significantly increased.

CONCLUSIONS

Although based on our results seed yield was not affected by simple effects of Nitroxin with ammonium sulphate, in the rest treatments biological fertilizer increased the yield of sunflower. Even though the increasing of yield was not significant but it is recommended because of the high prices of sunflower seeds and it seems profitable with the economic point.

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