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EFFECTS OF HUMIC ACID FOLIAR SPRAYING AND NITROGEN FERTILIZER MANAGEMENT ON YIELD OF PEANUT (*Arachis hypogaea* L.) IN IRAN

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ABSTRACT

In order to study effects of humic acid foliar spraying and nitrogen fertilizer management on yield and yield components of peanut (*Arachis hypogaea* L.). An experiment in factorial format based on randomized complete block design with three replications, during 2011 year in Astaneh Ashrafiyeh (north of Iran) was conducted. Factors of experiment includes two levels of foliar humic acid spraying (H_1: 0 (control) and H_2: 40 mg/l) and four levels of nitrogen fertilizer levels consist of (n_1: 0 (control), n_2: 25 kg/ha, n_3: 50 kg/ha, n_4: 75 kg/ha pure nitrogen from source of urea). In maturity time, seed yield, straw yield, biological yield and harvest index were measured. Effects of humic acid foliar spraying and nitrogen management on all traits were significant at 1% probability level. Interaction effect of humic acid and nitrogen management on seed yield, straw yield and harvest index showed significant differences at 5% probability level. Also, on biological yield was non significant. With attention to results of experiment, with increase nitrogen application up to 75 kg/ha all studied traits were increased. In all measured traits, the treatment of 40 mg/l humic acid foliar spraying was superior.

Keywords: peanut, humic acid, nitrogen, yield, Iran.

INTRODUCTION

Peanut (*Arachis hypogaea* L.) is one of the most important leguminous crops. It is a leguminous crop which is grown in all tropical and subtropical countries, up to 40° N and S. of the equator (Westphal *et al*., 1985). The peanut seed contains about 25% to 30% digestible protein, 45 to 50% oil, 20% carbohydrate and 5% fiber and ash which make a substantial contribution to human nutrition (Fageria *et al*., 1997; Nath and Alam., 2002; Ahmad and Rahim., 2007). To improve the organic contents of soils for growing crops there are some applications such as planting rotation, various plough techniques, green fertilizer application and animal fertilizer application. In addition to these practices, utilization of organic-mineral fertilizers in agriculture has increased in recent years (Doran, 2003). One of the used organic-mineral fertilizers is humic acid. Humic acid is a commercial product contains many elements which improve the soil fertility and increase the availability of nutrients and consequently increase plant growth and yield. It particularly is used to ameliorate or reduce the negative effect of salt stress. Abd El- Al., (2005) and Erik *et al*., (2000), on onion plant and Hafez, (2003), on squash reported that humic acid applications led to a significant increase in soil organic matter which is improves plant growth and crop production. Magdi *et al*., (2011), with study effects of bio and mineral fertilizers and humic substances on growth and yield of cowpea were reported that, combination of chemical fertilizer with application of humic substances improve growth and yield of cowpea. Nitrogen is required by plants in comparatively larger amounts than other elements (Marschner, 1995). Nitrogen, a plant nutrient is required by plants in comparatively larger amounts than other elements. Nitrogen is essential component of many compounds of plant, such as chlorophyll, nucleotides, proteins, alkaloids, enzymes, hormones and vitamins (Marschner, 1995). Nitrogen deficiency generally results in stunted growth, chlorotic leaves because lack of N limits the synthesis of proteins and chlorophyll. This leads to poor assimilate formation and results in premature flowering and shortening of the growth cycle. The presence of N in excess promotes development of the above ground organs with relatively poor root growth. Synthesis of proteins and formation of new tissues are stimulated, resulting in abundant dark green (high chlorophyll) tissues of soft consistency. This increases the risk of lodging and reduces the plants resistance to harsh climatic conditions and to foliar diseases (Lincoln and Edvardo, 2006). Nitrogen (N) fertilizer use has played a significant role in increase of crop yield (Modhej *et al*., 2008). Bozorgi *et al*., (2011) with study effects of nitrogen fertilization on seed yield and several attributes of peanut was reported that the highest seed yield was obtained by 80 kg/ha nitrogen fertilizer. The current study aim was to investigate the influence of foliar application of humic acid and different levels of nitrogen fertilizer management on yield and yield components of peanut.

MATERIALS AND METHODS

For study effects of humic acid foliar spraying and nitrogen fertilizer management on yield and yield components of peanut (*Arachis hypogaea* L.). An experiment in factorial format based on Randomized Complete Block Design (RCBD) with three replications, during 2011 year in Astaneh Ashrafiyeh Township located in 37° 16 ' latitude and 49° 56' longitude in north of Iran was conducted. The physical and chemical properties of the experimental soil were shown in Table-1. Soil texture

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was loamy clay with 7.2 pH value. The factors of experiment include two levels of foliar humic acid spraying (H_1: 0 (control) and H_2: 40 mg/liter humic acid foliar spraying) and four levels of nitrogen fertilizer management levels consist of (n_1: 0 (control), n_2: 25 kg/ha, n_3: 50 kg/ha, n_4: 75 kg/ha pure nitrogen from source of urea (46% pure nitrogen)).The cultivar that used for experiment was an indigenous cultivar namely Guilbadam (NC_2). Foliar spraying with humic acid was done twice at vegetative stage (30 days after sowing) and at blooming period. During growth period, cultivate cares such as weeding and combating with pests were done ordinarily. Peanut was manually harvested on September 22. In maturity time, seed yield, straw yield, biological yield and harvest index were measured. The seed yield and measured attributes components were analyzed by using MSTATC software. The Duncan's multiple range tests was used to compare the means at 5% of significant. In order to drawing of diagrams, Excel 2003 software was used. Harvest index (%) were determined as follows:

$$\text{Harvest index (\%)} = \frac{\text{Seed yield (kg/ha)}}{\text{Biological yield (kg/ha)}} \times 100$$

RESULTS AND DISCUSSIONS

Seed yield

With attention to variance analysis results (Table-2), the effect of humic acid foliar spraying and nitrogen fertilizer management on seed yield of peanut was significant at 1% probability level. On the other hand, interaction effect of humic acid foliar spraying and nitrogen fertilizer management on seed yield was significant in 5% probability level. The highest seed yield with 1856.8 kg/ha was recorded from 40 mg/l humic acid foliar spraying and the lowest amount of seed yield was recorded from control treatment (without foliar spraying of humic acid) with 1011.5 kg/ha (Table-3). Between nitrogen fertilizer management levels, the highest seed yield with 2195 kg/ha was obtained by 75 kg/ha pure nitrogen application. Also, the lowest seed yield with 859.7 kg/ha was recorded from control treatment (without nitrogen fertilizer application). Among interaction effect levels, H_2N_4 treatment (40 mg/l foliar spraying of humic acid and 75 kg/ha pure nitrogen application) with 2858 kg/ha seed yield was superior. And the H_1N_1 treatment (without foliar spraying of humic acid and without nitrogen application) with 629 kg/ha seed yield was minimum (Figure-1). Similar results were obtained by Raj and Rao, 1996; Hafez and. Magda, 2003; Hossain *et al*., 2007; Bozorgi *et al*., 2011.

Straw yield

Results of variance analysis showed that (Table-2), the effect of humic acid foliar spraying and nitrogen fertilizer management on straw yield was significant at 1% probability level. But, the interaction effect of humic acid foliar spraying and nitrogen fertilizer management on straw yield was significant at 5% probability level. Among humic acid foliar spraying levels, the highest straw yield with 6000.4 kg/ha was recorded from use of 40 mg/l humic acid foliar spraying (Table-3). On the other hand the lowest straw yield with 5061.8 kg/ha was recorded from control treatment (without foliar spraying of humic acid). Between nitrogen fertilizer management levels, the maximum amount of straw yield with 6689 kg/ha was obtained from N_4 treatment (75 kg/ha pure nitrogen application). Also, the minimum amounts of this trait was recorded from N_1 treatment (without nitrogen fertilizer application) with 4106 kg/ha. Among interaction effect levels the H_2N_4 treatment (40 mg/l foliar spraying of humic acid and 75 kg/ha pure nitrogen application) with 7039 kg/ha was obtained the highest straw yield. On the other hand the lowest straw yield with 3244 kg/ha was recorded from H_1N_1 (without foliar spraying of humic acid and without nitrogen application) treatment (Figure-2). Similar results were obtained by Hossain *et al*., 2007; Abdzad Gohari and Noorhosseini Niyaki., 2010; Bozorgi *et al*., 2011.

Biological yield

The effect of humic acid foliar spraying and nitrogen fertilizer management on biological yield showed significant differences at 1% probability level (Table-2). The interaction effect of humic acid foliar spraying and nitrogen fertilizer management on biological yield was non significant. Comparison of mean between humic acid foliar spraying and nitrogen fertilizer management levels showed that (Table-3), the highest amount of biological yield among humic acid foliar spraying levels with 7857.3 kg/ha was found from H_2 treatment (40 mg/l humic acid foliar spraying). Also, the lowest biological yield with 6073.3 kg/ha was recorded from H_1 treatment. Between nitrogen fertilizer management levels the N_4 treatment (75 kg/ha pure nitrogen application) with 8885 kg/ha was recorded the maximum biological yield. On the other hand the minimum biological yield was recorded from N_1 treatment (without nitrogen fertilizer application) with 4966 kg/ha. Similar results were reported by Raj and Rao, 1996; Khan *et al*., 2009; Hartz and Bottoms, 2010; Amiri and Gohari, 2010.

Harvest index

Results of variance analysis showed that (Table-2), the effect of humic acid foliar spraying and nitrogen fertilizer management showed significant differences at 1% probability level on harvest index. The interaction effect of humic acid foliar spraying and nitrogen fertilizer management on harvest index showed significant differences at 5% probability level. Among humic acid foliar spraying levels the highest yield was recorded from H_2 treatment (40 mg/l foliar spraying of humic acid) with 22.88 %. On the other hand the lowest harvest index with 16.34 % was recorded from H_1 (without foliar spraying of humic acid) treatment (Table-3). Between nitrogen fertilizer management levels the highest harvest index with 24.11 % was recorded from N_4 treatment (75 kg/ha pure

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nitrogen). Also, the minimum amount of harvest index was obtained by N_1 treatment (without nitrogen fertilizer application) with 17.09 %. With attention to Figure-3, the highest harvest index among interaction effect levels was recorded from H_2N_4 treatment (40 mg/l foliar spraying of humic acid and 75 kg/ha pure nitrogen application) with 28.89 %. Also, the minimum harvest index with 14.15 % was recorded from H_1N_2 (without humic acid foliar spraying and 25 kg/ha pure nitrogen application) treatment. Similar results were reported by Abdzad Gohari and Noorhosseini Niyaki., 2010; Bozorgi *et al*., 2011.

Table-1. Soil analysis results of the experimental sites.

Depth	**0-30 cm**	**Soil texture**	**Loam clay**
Clay (%)	46.58	E.C. (mmhos/cm)	1.32
Silt (%)	29.97	Total nitrogen (%)	0.194
Sand (%)	23.45	P (ppm)	9.1
pH	7.2	K (ppm)	197

Table-2. Analysis of variance studied traits of peanut under foliar spraying of humic acid and nitrogen management.

Source of variance	**df**	**Seed yield** (kg/ha)	**Straw yield** (kg/ha)	**Biological yield** (kg/ha)	**Harvest index** (%)
		Ms			
Humic acid(H)	1	4287530.667**	5286570.667**	19095936**	256.433**
Nitrogen (N)	3	1998094.333**	7496442.278**	16822743.278**	61.578**
H×N	3	205873*	411186.778*	227401.111^{ns}	17.203*
Error	14	42951.149	74529.423	95569.024	4.851
Cv%		14.45	4.94	4.44	11.23

Ns, ** and * respectively: non significant, significant in 1% and 5%

Table-3. Comparison of mean effect of foliar spraying of humic acid and nitrogen management.

Treatments	**Seed yield** (kg/ha)	**Straw yield** (kg/ha)	**Biological yield** (kg/ha)	**Harvest index** (%)
Humic acid				
H1	1011.5b	5062b	6073.3b	16.34b
H2	1857a	6000.4a	7857.3a	22.88a
Nitrogen				
N1	859.7d	4106d	4966d	17.09b
N2	1151c	5252c	6403c	17.57b
N3	1531b	6077b	7608b	19.68b
N4	2195a	6689a	8885a	24.11a

Within each column, means followed by the same letter do not differ significantly at P<0.05

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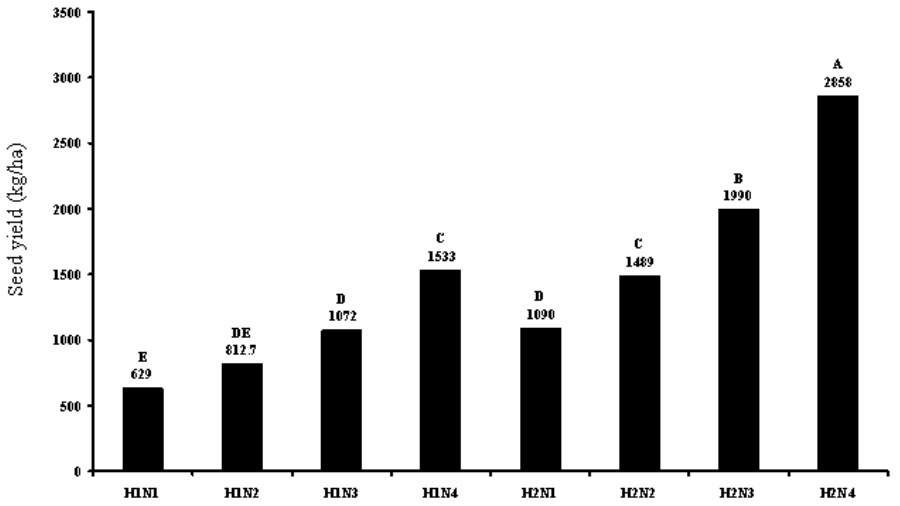

Figure-1. Interaction effect of humic acid and nitrogen management on seed yield.

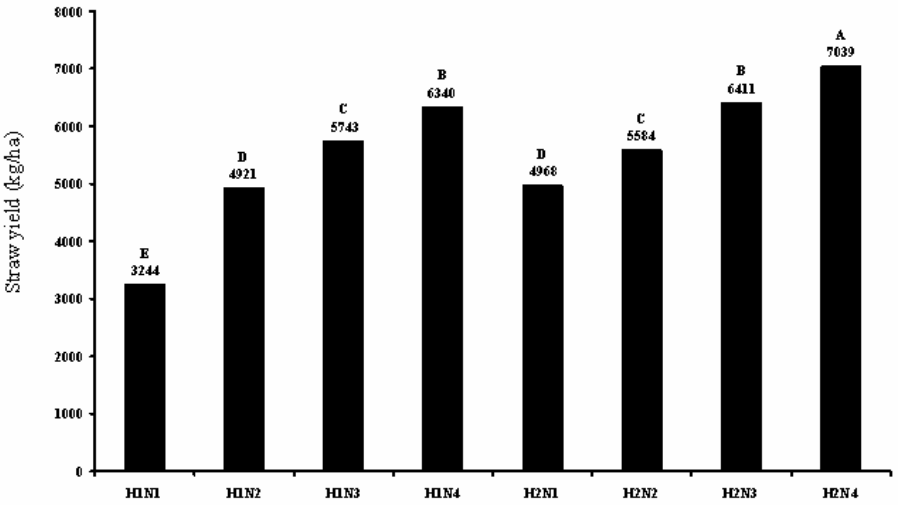

Figure-2. Interaction effect of humic acid and nitrogen management on straw yield.

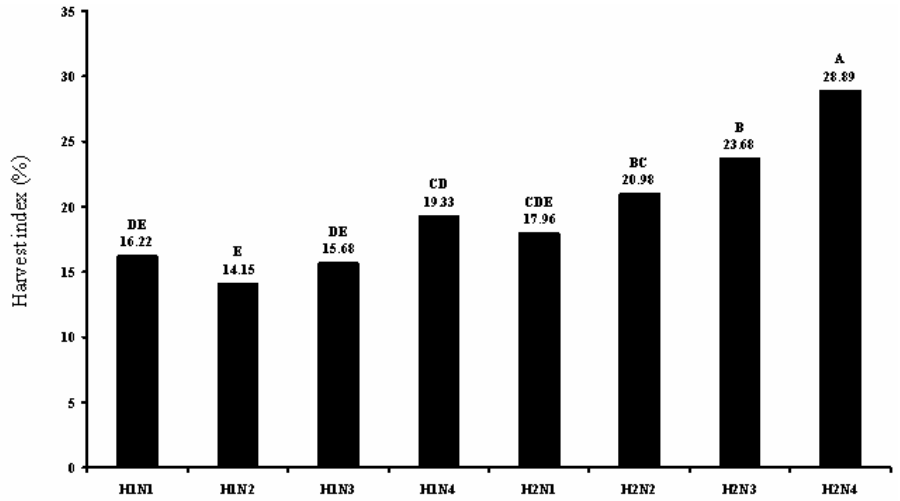

Figure-1. Interaction effect of humic acid and nitrogen management on harvest index.

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