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Research Article

Spraying Fenugreek Seed Extract and Thiamin on Vegetative & Flowering of Zinnia elegans L: Effects

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Abstract

Nursery experiment was conducted at the College of Agriculture, University of Kufa, Najaf, Iraq during 2012 to 2013, to study the impact of foliar application of the fenugreek seeds extract and thiamin on growth and flowers of zinnia plants. Experiment was carried out in a randomized complete block design (RCBD). Three levels of fenugreek seeds extract (that is, 0, 1.5 and 3 g l-1) and three levels of thiamin (that is, 0, 35 and 70 mg l-1) were used. Results showed that the spraying of fenugreek seeds extract at 3 g l-1 with thiamin at 35 mg/L showed encouraging impact especially on plant height (cm), number of leaves/ plant, number of branches/plant, dry weight leaf chlorophyll content (mg/100 g), leaf carbohydrates content (mg g-1), root length (cm) and roots dry weight (g) and flowering (flowers number/ plant, flower diameter (cm), number of petals/ flower and flower dry weight (g).

Key words: Foliar application, fenugreek seeds extract, thiamin, Zinnia elegans L

Introduction

Zinnias are annuals shrubs, belonging to the compositae family. It ranges in height from 15 to 100 cm; the leaves are lance-shaped and sandpapery in texture and pale to medium green color (Sultan, 1992). Flowers are single and double, having a diameter of 12 cm and colors including white, yellow, orange and gold (Shehata, 2002). Growing zinnia plants can be inexpensive. Seeds can be planted directly in the permanent site. Zinnias are tolerant of all, but wet poorly aerated soils can cause root rot. Plants may be used as cut flowers in beds, public and private gardens, borders and containers. In addition, it can be used for beautification in rear or middle panels according to the height of plant (Al-Batal, 2010).

For the purpose of improving growth and flowering of plant, attention should be given to operations, including fertilization, soil or foliar fertilizer application of nutrients to soil or the plant. Plant extracts should be considered as a secure alternative to chemical fertilizer (Al-Issawi, 2004; Hasan et al., 2014).

In the present time, researchers are looking for the natural alternatives that have similar impact to the chemical compound and protect the environment from pollution. There are several plants that can be used such as natural extracts for foliar application on plant, either the extract from the whole plant or parts of it, which has important effect on the growth and development of plants. These extracts include extracted seeds of Fenugreek (Trigonella foenum-graecum L.) belonging to the leguminosae family (El-Shahat, 1986).

Fenugreek is an herbal plant-based plant-like clover roots with erect stem and white-yellowish leaves and a plant with hard yellowish brown seeds (Hussein, 1979). The

plants are used in popular medicine. The most effective part of the plant is the seeds, which contains alkaloids and are a group of naturally occurring chemical compounds that contain mostly basic nitrogen atoms, including choline and trigonelline used in plants metabolism (Newall et al., 1998l; Barnes et al., 2002).

Seeds contain 22% protein, 28% jel materials, 6% fixed oils and saponins materials (Hussein, 1979). Seeds are also widely used in the cosmetics and medical industry (Leon and Bermejow, 1994) to treat a number of diseases such as diabetes and hypertension.

Earlier studies showed that foliar application improved growth parameters. Lazim et al. (2013) explained that the spray of the fenugreek seeds extract at a concentration of 2 g/L on snapdragons (Antirrhinum Majus) plant significantly increased plant height (49.91 cm), number of branches (9.08) and flowers per plant (18.66). Compared to control treatment (45.16, 6.75 and 14.91) respectively. Vitamins have been reported to increase plant growth including thiamine (B1), which is a white crystalline solid that easily dissolve in water, but do not dissolve in organic solvents such as ether and smelly yeast. It features a thermal stability at solid state, which has up to 120°C for 24 h.

Component	Unit (%)	Element	Unit µg/g
Moisture	9.82	K	240.2
Total ash	5.58	Na	68.02
Ash soluble in water	2.51	Mg	3.20
Ash soluble in acid	2.10	Mn	2.76
Extract soluble in water	34.96	Fe	1.07
Protein	22.80	Zn	1.58
Reduced sugars	7.76	Cu	0.17
Fixed oil	6.25		
Volatile oil	1.04		
Fibers	5.19		
Jel material	26.20		

Table 1: The most important content in fenugreek seed.

Property	Texture	pH	EC	Ca++	K+	Mg++	N	OM
			(dS/m)	mmc/l			ppm	g/kg
	Loamy sand	8.1	2.38	22.8	1.85	15.8	20.2	8.3

Table 2: Selected physical – chemical properties of soil.

B1 is part of Co-carboxylase or Thymine pyrophosphate (TPP) important in the process of photosynthesis and also an anti-oxidant (Rindi, 1996). The creation of this vitamin is in the leaves in the existence of light and then moves to the root (Blokhin et al., 2003); it has a role in improving plant growth through its impact on increasing cytokinins, gibberellins and metabolism of carbohydrate and amino acids in plants (Talaat and Yousief, 2003). In addition, it increases the environmental stress of the plant (Ahn et al., 2005). Similarly, Abdel-Aziz et al. (2007) reported that the foliar application of thiamin at concentrations of 50 and 100 mg/L to the Syngonium (Syngonium

podophyllum) plant improved plant height, number of leaves and carbohydrate leaf content. Similar results about foliar application of thiamin at 40 mg/L to Marigold (Alendula officialis) plant were reported by Hassan (2013). The result was also in line with the study of Talaat and Aziz (2007) who found out that foliar application of thiamin at 100 mg/L to Chamomile (Matricaria chamomilla) plant significantly increased plant height, number of leaves and flowers. The objectives of this study were to find out the suitable level of fenugreek seeds extract and thiamin and the proper combination of both so as to achieve a higher plant growth and maximum flower production with high quality Zinnia plant.

Materials And Methods

Zinnia plants were grown at a nursery of Faculty of Agriculture, University of Kufa, Najaf, Iraq, with no control on temperature and humidity during 2012 to 2013. The soil was loamy sand in texture with pH of 8.1 and an electrical conductivity of 2.38 dS/m. Seeds were planted in treated soil in 150 mm diameter plastic pots and 200 mm deep. Each pot contained 1 kg soil with one plant. The experiment was carried out using a randomized complete block design (RCBD) with three replicates per treatment with two factors tested:

- Two (2) types of extracts (fenugreek seeds extract and thiamin); - Three (3) concentrations of fenugreek seeds extract (0, 1.5 and 3 g/L); - Three (3) concentrations of thiamin (0, 35 and 70 mg/L).

Results

Effect of fenugreek seeds extract

Table 3 shows the effect of Fenugreek seeds extract on vegetative parameters. Fenugreek seeds extract significantly increased plant height (61.69 cm), number of leaves per plant (54.33), branches per plant (10.67), shoot dry weight (18.03 g), leaf chlorophyll content (52.38 mg 100 g-1, fresh weight) and leaf carbohydrate content (10.90 mg 100g-1, dry weight).

Treatments			Plant height (cm)	Number of leaves plant^{-1}	Number of branches plant^{-1}	Shoot dry weight (g)	Chlorophyll (mg 100 g^{-1})	Carbohydrates (mg g^{-1})
Fenugreek extract (g l^{-1})		0	50.67	42.11	7.78	14.47	49.81	7.16
		1.5	54.40	47.78	9.67	16.53	51.15	9.18
		3	61.69	54.33	10.67	18.03	52.38	10.90
LSD 0.05			1.136	2.036	1.216	1.307	0.736	1.226
Thiamine (mg l^{-1})		0	56.09	46.56	9.11	16.15	50.36	8.63
		35	57.47	50.44	10.00	16.82	51.40	9.74
		70	53.20	47.22	9.00	16.06	51.02	8.86
LSD 0.05			1.136	2.036	1.216	1.307	0.736	1.226
Fenugreek extract (g l^{-1}) × Thiamine (mg l^{-1})	0	0	53.57	40.33	7.33	13.91	48.19	6.53
		35	48.60	42.67	7.67	14.35	48.69	6.93
		70	49.83	43.33	8.33	15.14	52.56	8.00
	1.5	0	51.50	44.67	9.00	16.02	50.01	8.27
		35	53.60	47.67	9.67	16.21	51.10	9.30
		70	58.10	51.00	10.33	17.37	52.34	9.97
	3	0	63.20	54.67	11.00	18.52	52.88	11.10
		35	70.20	61.00	12.67	19.90	54.42	13.00
		70	51.67	47.33	8.33	15.67	49.82	8.60
LSD 0.05			2.527	3.529	2.669	2.459	1.236	2.059

Science Academique
AlZurfy MTH and Bhiah KM.
Pages: 97-102

Table 3: Effects of foliar application of fenugreek seeds and thiamine on vegetative growth.

The impact of spraying al thiamin on plant growth Table 3 shows the positive impact of thiamin at concentration of 35 mg l-1 on vegetation growth. Thiamin addition increased plant height (57.47 cm), number of leaves per plant (50.44), number of branches per plant (10), shoot dry weight (16.82), leaf chlorophyll content (51.40 mg 100 g-1, fresh weight), total dissolve carbohydrate (9.74 mg g-1, dry weight), while control treatment had minimum plant height (56.09 cm), number of leaves per plant (46.56), number of branches per plant (9.11), shoot dry weight (16.15), leaf chlorophyll content (50.36 mg 100 g-1, fresh weight) and total dissolve carbohydrate (8.63 mg g-1,dry weight), Table 4 shows that the addition of thiamin at 35 mg L-1 increased the length of root (24.11 cm) and root dry weight (0.84 g), while unfertilized plant (control) had minimum root length and root dry weight (22.51 and 0.18, respectively). At the same concentration (35 mg l-1), thiamin also increased number of flowers (8.22), flower diameter (3.46 cm), number of petals per plant (37.78) and flowers dry weight (3.52 g). However, control treatment obtained the lowest value of number of flowers (7.22), flower diameter (3.20 cm), number of petals per plant (35.44 and flowers dry weight (2.66 g).

The interaction effects of fenugreek seeds extract and thiamin on growth

Table 3 shows the positive impact of the spraying of Fenugreek seeds extract (3 g l-1) and thiamin (35 mg l-1) on plant height (70.20 cm), number of leaves plant-1 (61), number of branches (12.67), shoot dry weight (19.90 g), leaf chlorophyll content (54.42 mg 100 g-1, fresh weight) and total dissolve carbohydrates (13 mg g-1); however, the unfertilized plants (control) had minimum values (53.57 cm, 40.33 leaves, 7.33 branches, 13.91 g, 48.19 mg 100 g-1 and 6.53 mg g-1, respectively) of the aforementioned parameters. In addition, the foliar application of fenugreek seeds extract (3 g l-1) and thiamin (35 mg l-1) increased root length (29.17 cm) and shoot dry weight (1.87 g), while the control treatment obtained minimum root length (19.83 cm) and shoot dry weight (0.12 g), (Table 4). Similarly, the foliar application of fenugreek seeds extract (3 g l-1) and thiamin (35 mg l-1) increased number of flowers (10.67), flower diameter (4.47 cm), number of petals per plant (44) and flowers dry weight (4.38 g). However, unfertilized plants (control) obtained the lowest value of number of flowers (6), flower diameter (2.30 cm), number of petals per plant (30.33) and flowers dry weight (2.29 g) .

DISCUSSION Data presented in Tables 3, shows the positive impact of fenugreek seeds extract on vegetative root system and flowering. This may be attributed to the extract including important nutrients, such as potassium (K), which plays an important role in enzyme activation and increase in carbohydrate accumulation as well as cells division thereby resulting in high plant growth (Mengle and Kirkby, 2005).

Furthermore, the extract includes magnesium (Mg), which is important in activation of enzymes such as dehydrogenasea and enolase. In addition, it is essential to obtain the ATP energy, as it is linked to a protein of enzyme with a phosphate group belonging to the ATP that plays an important role in the formation of proteins (AbuDhahi, 1989). In addition, iron (Fe) element positively affects photosynthesis and chlorophyll building which leads to an increase of food manufacturer in the plant and in turn, may contribute to the operations of cell division and an increase in the number of leaves and branches (Abu-Dhahi and Al-younis, 1988).

Zinc (Zn) also has an important role in the industrialization of Indole-3-acetic acid (IAA), which has an impact on increasing plant cell division and an increase in its number and as a result, increases and improves plant growth (Awad and Atawi, 1995). As to the impact of thiamin in increasing plant growth characteristics, this may be attributed to the role in increasing the efficiency of the photosynthesis process, improving nutrients uptake and increasing growth hormones such as

cytokinins and gibberellins which are of a clear influence of the increase of the growth vegetation plant (Talaat and Yousief, 2003). In addition, thiamin has a role in increasing growth of roots which help to absorb the largest amount of nutrients as well as its role in the production of amino and nuclear acids, which will reflect positively on the manufacture and transfer of carbohydrates from leaves to the branches and the possibility of a state of balance between carbohydrates and protein materials with clear effect of differentiation and an increase in the number of flowers (Florent, 1986). These results also corroborate the findings of Al-Abdali (2012) who reported that spraying gladiolus plants with thiamin at concentration of 100 mg l-1 increased plant height and number of flowers per plant.

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