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ORIGINAL ARTICLE

Effects of Kinetin on Seed Germination of Some Lines of Fenugreek (*Trigonella foenum graecum* L.)

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Erman BEYZİ Ali İrfan İLBAŞ: Effects of Kinetin on Seed Germination of Some Lines of Fenugreek (*Trigonella foenum graecum* L.)

ABSTRACT

This study was carried out to investigate effects of kinetin on seed germination of Fenugreek in Erciyes University Seyrani Agriculture Faculty in 2010. In this study, 7 Fenugreek lines, obtained from Dicle University Agricultural Faculty Field Crops Department, (Line 1, Line 3, Line 18, Line 23, Line 29, Line 33, Line 34) were used. Dosages of kinetin were determined as 100 mM, 200 mM and distilled water was used as control treatments. Results indicated that increased dosages of kinetin effected root length, root fresh and dry weights negatively. Effects of kinetin applications on germination rates were not significant. Increasing dosages of kinetin decreased shoot length but increased shoot fresh and dry weights.

Key words: Fenugreek, germination, kinetin, *Trigonella foenum graecum* L.

Introduction

Giriş:

There are about 50 different species of *Trigonella* mostly widespread around Mediterranean and 45 of them naturally grow in Turkey. Among these species, *Trigonella foenum graecum* L. Cultured in Turkey [2].

Fenugreek is cultured around the world in India, Egypt, Morocco, Algeria, Italy, Spain, France and Greece [8].

Both vegetative parts and seeds of fenugreek are used for vairous purposes. Seeds contain 25% protein, 7-10% permanent oil, nitrogenous compounds and flavonoid [1].

Fenugreek seeds are used in bakery and meat products, alcoholic beverages, cadies, flavoring products, ice cream, syrup and sweet sauces, gelatin, puddings gums and sweet creams. Seed can either be used as dry appetizer or be used as spice in pickles, soups, salads, sauces and meet products [12].

Fenugreek is a legume crop and used for soil stabilization as a green manure within various cropping patterns. It is a significant nutrition source both human and livestock feeding [11].

Plant hormones are chemical stimulators regulating or modifying growth and development of plants [3].

Plant growth regulators are chemical substances having direct or indirect impacts over plant yield and quality. These plant growth regulators are usually used to stimulate to plant growth, to prevent the plant lie downs, to stimulate a balanced growth among various plant parts and to increase the yield and quality [11].

Plant growth hormones can be classified as oxens, sitokinins, gibberellins, absisic acid and ethylene. Oxen group hormones (like IAA, 2,4-D, NAA, IBA, IPA) stimulate plant cell growth, differentiation, adventive root development, partemocarpic fruit formation, fruit growth, leaf and fruit patch off, maintenance of apical dormancy; gibberellins group hormones (GA series) stimulate cytokinesis, cell growth, plant growth, dormancy termination, vernelization demand, flowering, fruit formation and amylase synthesis of cereal kernels; sitokinins (IPA, Z, BAP, K) stimulate cytokinesis, lateral bud development and apical dormancy

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termination; ethylene group hormones (ethylene gas) stimulate fruit maturation, aging, lateral bud and root development, leaf patch off; abcicic acid group hormones (ABA) stimulate seed dormancy, stoma control, leaf and fruit patch off, growth and development, drought compliance [9,14,10,15].

In this study, impacts of different doses of kinetin, a sitokinins group growth stimulator, over germination of some fenugreek lines were investigated.

Material and Method

This study was carried out in laboratories of Field Crops Department of Erciyes University Seyrani Agricultural Faculty in the year 2010. The fenucreek lines used in this study was supplied from Field Crops Department of Dicle University Agricultural Faculty. Different doses (100 mM ve 200 mM) of kinetin plant growth stimulator were applied over fenugreek lines and distilled water was used as control treatment.

In this study, a total of 84 glass 250 ml beakers were used for 7 fenugreek lines, 3 kinetin doses and 4 reputations. 50 fenugreek seeds, exhibiting close morphological characteristics to each other, were placed into each beaker. 10 kinetin solutions prepared for each doses were also added over these seeds in each beaker. Seeds were preserved in this kinetin solution for 6 hours. Distilled water was used as control treatment. Then, the seed were removed from the beakers, dried and put into 20x20 cm 3 germination papers and placed into totally dark germination cabins at 25ºC. 8 ml distilled water was added over each germination paper and they were placed into locked plastic bags. Germination counts were recorded in each day for 15 days and the seed having 1 mm root length was assumed as germinated. To determine the rate of germination, Mean Germination Times (MGT) was calculated in accordance with Ellis and Roberts [7] by using the following equation:

$$AGT = \sum (f_x) / \sum f$$

Where;
f = number of germinated seed at day of germination count,

x = number of counting day.

Root length, shoot length, plant fresh and dry weights were measured at 15th day. Randomized selected 10 seedlings were used for root length, shoot length, plant fresh and dry weight measurements. Dry weights were measured after drying the samples at 70ºC for 2 days.

Data obtained from this study was statistically analyzed for variance analysis by using MSTAT-C software for randomized factorial block design with 4 reputations. Significance levels of differences among treatments were determined by using Least Significant Difference Test [6].

Results and Discussion

The relations among lines, doses and line x dose interactions were found to be statistically significant for rooth length, shoot length, root fresh weight and root dry weight and mean germination time (MGT) (Table 1). While the relations among lines and line x dose interactions were found to be significant for shoot fresh weight, relations among lines and doses were found to be significant for shoot dry weight. Relations among lines, doses and line x dose interactions for mean germination time and relations among line x dose interactions were not found to be significant.

Germination Rate (%) and Mean Germination Time (day)

While the lines 1 and 34 had the highest rate of germination with 99.167% , line 29 had the longest mean germination time with 1.550 day. The lines had the shortest mean germination times (1.216 day) at 100 µM kinetin dose (Table 2).

Shoot and Root Length:

Shoot lengths of lines decreased with increasing kinetin doses. While the line 29 was the least impacted line from the kinetin doses, line 1 was the highest impacted one. Line 3 had the highest shoot length level with 76.845 mm in control treatment.
Root lengths also decreased with increasing kinetin doses. Line 34 was the most impacted line with regard to root length from kinetin doses. A regular decrease was observed in root lengths of other lines with increasing kinetin doses and control treatment had the highest root lengths. The highest root and shoot lengths at line 34 was observed under 100 µM dose. The highest negative impaction over root and shoot lengths of the lines was observed at 200 µM dose.

Shoot Fresh and Dry Weights

Line 34 was the least impacted one form kinetin doses with regard to shoot fresh weights. The highest shoot fresh weight was observed in line 34 with 157.700 mg/plant under 100 µM dose.

Mean shoot dry weights increased with increasing kinetin doses. Line 23 had the lowest shoot dry weight with 6.000 mg/plant and impacted from kinetin doses at highest level.

Table 1: Results of variance analysis

V.K	S.D	K.O.							
		Shoot Length	Root Length	Shoot Fresh Weight	Shoot Dry Weight	Root Fresh Weight	Root Dry Weight	Germination Rate	MGT
General	83	-	-	-	-	-	-	-	-
Lines (H)	6	193.970**	211.346**	1786.822**	5.395**	92.836**	0.263**	5.095	0.328**
Doses(D)	2	775.400**	11406.913**	238.182	11.667**	1105.470**	2.975**	0.190	0.081**
H x D	12	83.473**	595.614**	359.963*	0.598	114.898**	0.304**	1.857	0.084**
Error	60	10.599	42.968	162.875	0.618	19.129	0.055	5.081	0.009

Significant at *: 5%,**: 1% significance level.

Table 2: Impacts of different kinetin doses over germination rates and mean germination times of fenugreek lines

	Germination Rate (%)			
Lines	Kinetin Doses			
	Control	100 µM	200 µM	Mean
Line 1	99.000	99.500	99.000	99.167
Line 3	98.500	98.000	97.000	97.833
Line 18	97.500	97.500	98.500	97.833
Line 23	98.500	97.000	98.000	97.833
Line 29	97.500	98.500	98.500	98.167
Line 33	98.500	97.000	97.500	97.667
Line 34	98.500	99.500	99.500	99.167
Mean	98.286	98.143	98.286	-
	Mean Germination Time (day)			
Lines	Kinetin Doses			
	Control	100 µM	200 µM	Mean
Line 1	1.116^{fg}	1.060^{g}	1.081^{g}	1.086^{c}
Line 3	1.091^{g}	1.030^{g}	1.160^{efg}	1.094^{c}
Line 18	1.307^{cde}	1.292^{c-f}	1.335^{cde}	1.311^{b}
Line 23	1.338^{cd}	1.386^{c}	1.318^{cde}	1.348^{b}
Line 29	1.596^{ab}	1.593^{ab}	1.461^{bc}	1.550^{a}
Line 33	1.194^{d-g}	1.083^{g}	1.189^{d-g}	1.155^{c}
Line 34	1.087^{g}	1.066^{g}	1.698^{a}	1.284^{b}
Mean	1.247^{b}	1.216^{b}	1.320^{a}	-

a-g: Difference among means of treatments having the same letter is not significant at 1% level.

Table 3: Impacts of different kinetin doses over shoot and root lengths fenugreek lines

	Shoot Length (mm)			
Lines	Kinetin Doses			
	Control	100 µM	200 µM	Mean
Hat 1	66.49^{cde}	55.74^{h}	54.17^{h}	58.80^{d}
Hat 3	76.85^{a}	63.96^{d-g}	60.16^{fgh}	66.99^{bc}
Hat 18	74.61^{a}	71.94^{abc}	62.71^{d-g}	69.75^{ab}
Hat 23	68.39^{bcd}	63.63^{d-g}	64.57^{d-g}	65.53^{c}
Hat 29	75.17^{a}	72.67^{ab}	66.15^{c-f}	71.33^{a}
Hat 33	75.43^{a}	63.72^{d-g}	58.79^{gh}	65.98^{c}
Hat 34	62.05^{efg}	73.27^{ab}	58.83^{gh}	64.71^{c}
Mean	71.28^{a}	66.42^{b}	60.77^{c}	-
Root Length (mm)				
Lines	Kinetin Doses			
	Control	100 µM	200 µM	Mean
Hat 1	70.58^{a}	32.08^{def}	24.08^{f}	42.24^{b}
Hat 3	67.28^{a}	38.09^{cde}	22.66^{f}	42.67^{b}
Hat 18	79.37^{a}	47.68^{bc}	28.68^{ef}	51.91^{a}
Hat 23	68.01^{a}	43.01^{bcd}	30.16^{ef}	47.06^{ab}
Hat 29	71.74^{a}	53.92^{b}	28.41^{ef}	51.35^{a}
Hat 33	76.94^{a}	34.83^{def}	32.42^{def}	48.07^{ab}
Hat 34	47.37^{bc}	76.13^{a}	32.80^{def}	52.10^{a}
Mean	68.76^{a}	46.53^{b}	28.46^{c}	-

a-h: Difference among means of treatments having the same letter is not significant at 1% level.

Table 3: Impacts of different kinetin doses over fresh and dry shoot weights

	Shoot Fresh Weight (mg/plant)			
Lines	Kinetin Doses			
	Control	100 µM	200 µM	Mean
Line 1	122.8^{EF}	99.85^{G}	124.6^{DEF}	115.8^{d}
Line 3	146.3^{ABC}	134.6^{C-F}	154.7^{AB}	145.2^{ab}
Line 18	133.4^{C-F}	148.3^{ABC}	136.7^{B-E}	139.5^{ab}
Line 23	125.6^{DEF}	121.3^{EF}	125.2^{DEF}	124.0^{cd}
Line 29	132.5^{C-F}	141.6^{A-D}	136.3^{C-F}	136.8^{bc}
Line 33	146.0^{ABC}	118.6^{F}	133.3^{C-F}	132.7^{bc}
Line 34	147.3^{ABC}	157.7^{A}	149.1^{ABC}	151.4^{a}
Mean	136.282	131.707	137.129	-
Shoot Dry Weight (mg/plant)				
Lines	Kinetin Doses			
	Control	100 µM	200 µM	Mean
Line 1	5.750	5.350	7.125	6.075^{de}
Line 3	6.850	7.675	8.825	7.783^{a}
Line 18	6.350	7.000	7.300	6.883^{bcd}
Line 23	5.225	5.700	7.075	6.000^{e}
Line 29	6.175	6.700	7.025	6.633^{cde}
Line 33	7.050	6.425	7.700	7.058^{abc}
Line 34	7.225	7.225	8.025	7.492^{ab}
Mean	6.375^{b}	6.582^{b}	7.582^{a}	-

a-e: Difference among means of treatments having the same letter is not significant at 1% level.
A-F: Difference among means of treatments having the same letter is not significant at 5% level.

Table 4: Impacts of different kinetin doses over fresh and dry root weights

	Root Fresh Weight (mg/plant)			
Lines	Kinetin Doses			
	Control	100 µM	200 µM	Mean
Line 1	42.70^{abc}	26.98^{gh}	22.42^{h}	30.70^{c}
Line 3	42.38^{abc}	37.58^{b-e}	32.88^{d-g}	37.61^{ab}
Line 18	43.38^{ab}	28.75^{fgh}	27.65^{gh}	33.26^{bc}
Line 23	39.83^{bcd}	33.92^{d-g}	27.70^{gh}	33.82^{bc}
Line 29	34.78^{c-g}	35.97^{b-f}	27.33^{gh}	32.69^{c}
Line 33	42.83^{abc}	31.38^{efg}	30.95^{efg}	35.05^{abc}
Line 34	38.17^{b-e}	50.28^{a}	27.33^{gh}	38.59^{a}
Mean	40.58^{a}	34.98^{b}	28.04^{c}	-
	Root Dry Weight (mg/plant)			
Lines	Kinetin Doses			
	Control	100 µM	200 µM	Mean
Line 1	2.100^{b-e}	1.500$^{gh\imath}$	1.425$^{\imath}$	1.675^{c}
Line 3	2.200^{a-d}	2.100^{b-e}	1.475$^{h\imath}$	1.925^{abc}
Line 18	2.350^{abc}	1.550$^{gh\imath}$	1.675$^{e-\imath}$	1.858^{bc}
Line 23	1.875^{d-h}	2.025^{c-f}	1.600$^{f-\imath}$	1.833^{bc}
Line 29	2.150^{bcd}	2.000^{c-f}	1.425$^{\imath}$	1.858^{bc}
Line 33	2.625^{a}	1.925^{c-g}	1.925^{c-g}	2.158^{a}
Line 34	2.075^{cde}	2.525^{ab}	1.325$^{\imath}$	1.975^{ab}
Mean	2.196^{a}	1.946^{b}	1.550^{c}	-

a-ı: Difference among means of treatments having the same letter is not significant at 1% level.

Root Fresh and Dry Weights:

Root fresh and dry weights decreased with increasing kinetin doses. Line 1 was negatively impacted from kinetin doses at the highest level with regard to both root fresh and dry wieghts. The highest root fresh weight was observed in line 34 with 50.275 mg/plant under 100 µM dose and the highest root dry weight was observed in line 33 with 2.625 mg/plant.

Discussion and Conclusions:

In this study, germination rates of fenugreek lines were found to be closer to each other with increasing kinetin doses. The highest mean germination time was observed in line 34 with 1.698 day under 200 µM dose. Root and shoot lengths, root fresh and dry weighs were negatively affected from increasing kinetin doses. Line 1 was negatively affected from increasing kinetin doses at highest level with regard to root and shoot length. Line 1 was also the negatively affected from increasing kinetin doses with regard to shoot fresh weight and line 23 with regard to shoot dry weight. Çavuşoğlu ve Kabar [4] investigated the impacts of giberillic acid, kinetin, benzyladenine, ethylene, triakontanal, 24-epibrassinolite and polyamines (kadaverine,

putressine, spermidine, spermine) both alone and in combination over germination and seedling growth of barley under saline conditions and found that pre-applications of combination were able to decrease salt inhibition over both germination rates and seedling growth parameters. Baydar ve Erdal [3] investigated impacts of gibberellic acid (GA_3), absisic acid (ABA), indol-3-asetic acid (IAA) and 6-benzyl-amino purine (BAP) over volatile oil content, volatile oil compounds, protein content and nutritional elements of Izmir thyme *(Origanum onites)* under ecological conditions of Isparta Province and indicated that GA3 and IAA applications decreased the volatile oil content and BAP and ABA applications increased the volatile oil content compared to control treatments.

Finally, it was concluded that a growth regulating hormone of kinetin doses negatively affected the germination and growth of fenugreek seedlings and the earliest germinations were observed at 100 µM dose.

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