Response of seed yield and its component of Fenugreek (*Trigonella foenum-graecum* L.) variety to nitrogen fertilizer under rainfed condition

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Abstract:

A field experiment was performed at research area of College of Agricultural Sciences-University of Sulaimani, during the winter season of 2014-2015, to study the response of two (Mithe and EP 101) fenugreek (*Trigonella foenum-graecum* L.) varieties to different level of nitrogen fertilizer (0, 40 and 80 kg N ha^{-1}) for yield and its components. The results of experiment showed the highest seed yield and all traits were obtained by Mithe variety and 40kg N ha^{-1} produce highest seed yield and yield component. The highest seed yield for most of traits were obtained by interaction between Mithe variety and 40kg N ha^{-1} in comparison with the interaction between EP 101 variety and 40kg N ha^{-1}

Keywords: Trigonella foenum-graecum L. variety, Nitrogen fertilizer, Seed yield, Oil yield, Harvest index.

استجابة حاصل البذور و مكونات الحاصل في اصناف الحلبة لمستويات مختلفة من التسميد النيتروجيني تحت الظروف المطرية

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المستخلص:

اجريت تجربة ميدانية في كلية العلوم الزراعية – جامعة السليمانية ، خلال موسم الشتاء 2014–2015 ، لدراسة استجابة الحاصل و مكونات الحاصل لأثنين من أصناف الحلبة (Mithe و EP 101) *Trigonella foenum–graecum* . لمستويات مختلفة من الأسمدة النيتروجينية (0 و 40 و 80 كجم هكتار$^{-1}$) أظهرت نتائج التجربة ان معظم الصفات الحاصل و مكونات الحاصل اعطت أعلى نسبة من قبل التوليفة بين الصنف Mithe و 40 كجم N هكتار$^{-1}$ استجابه معظم الصفات الحاصل ومكونات الحاصل كانت للتوليفة بين صنف Mithe و 40 كجم هكتار$^{-1}$ مقارنة بالتوليفة بين الصنف EP 101

الكلمات المفتاحية: اصناف الحلبة .Trigonella foenum–graecum L، السماد النيتروجيني حاصل البذور، حاصل الزيت، دليل الحصاد.

Introduction:

Many of biochemical products that synthesize and preserve by green plants are extractable and used as raw material or as chemical feed stocks for many different scientific investigations (14) About 35.000 species of the plants used for medical purpose, and the (80%) of the world population use the plants in medicinal treatment. Most of modern pharmacopeias is pure substances that extracted from plants (7). Unfortunately, most of the plants used for this purpose have been collected from nature and production of them is limited Fenugreek (*Trigonella foenum-gaecum* L.) is an annual herb member of Leguminous family (22) it is regularly grown for its leaves which is used as vegetable and seeds that used as a condiment for flavouring of foods (23) this important spice is indigenous to western Asia and southeastern Europe (20). Because of it is medicinal application in our daily life widely cultivated for a long time in Asia Africa and Mediterranean countries (16) Fenugreek mentioned in Ayurvedic system and has a long history of medicinal uses (5) The most common traditional medicinal uses of fenugreek are diabetes for indigestion diarrhea, enlargement of liver and spleen, elevation of lipids and edema (fluid retention) of the legs (1, 11).

Fenugreek seeds contain alkaloid (trigonellin) gives a strong aroma and bitter in taste (19), and it also contains mucilaginous fiber and saponins, coumarin, fenugreekine, nicotinic, lysine and L-tryptophan, acid, sapogenins, phytic acid, scopoletin, proteins (27.7 to 28.6%), essential oil (<0.02%) fatty oil (6.8%), minerals (3.4 to 6.8%) (6, 18) and it is a good source of vitamins especially vitamin C (10) Natural products is considered as a health benefits because its antioxidant properties, such properties were studied in germinated fenugreek seeds which are considered to be more beneficial than dried seeds (24) Fenugreek seeds are locally used as yellow dye in medicinal purposes and cosmetics (22) and it is used as a green manure and it is a good soil renovator (1) he climatic, soil and nutritional requirements of fenugreek plants have been researched by numerous researchers (24) In fenugreek, nitrogen fertilization contributes to intensified growth, deferred maturation, leaf health, stem development and luxuriant foliage with the desired dark-green color. Efforts are being made to improve the yield and qualitative composition of fenugreek to make it amenable to large -scale production (19, 24). The key input in food production is nitrogen fertilization, and it is a common plant nutrition which encourages vegetative production in plants. Nitrogen is a plant nutrient that important for producing herba, folium and seed yields in medicinal and spice plants (22). The aim of this study was to assess the effects of different nitrogen dose on the yield an

Materials and Methods:

A field experiment was conducted at College of Agricultural Sciences-University of Sulaimani located (Latitude: 35˚ 33′; N, Longitude 45˚ 27′; E, at altitude of approximately 830 m) during the winter season of 2014-2015, to study the response of two (Mithe and EP 101) fenugreek (*Trigonella foenum-graecum* L.) varietie to different level of nitrogen fertilizer (0, 40 and 80 kg N ha^{-1}) for yield and its Sowing was conducted during Dec 18 of 2014 according to the recommended seed rates 25Kg ha^{-1} for two used component varieties (19) and the recommended dose of fertilizer was

used by two doses (24) first dose at sowing seeds and the second dose after 30 days of sowing. All plots were fertilized with 20Kg P2O5 ha^{-1} as triple super phosphate, which was broad casted before sowing. This factorial experiment conducted in a Randomized Complete Block Design with three replications All required agricultural practices were used as needed.

At maturity, 5 randomly selected plants were uprooted for data collection. Data were collected on plant height, Number of anthodium plant-1, Number of fruit anthodium $plant^{-1}$, Number of fruit anthodium^{-1}, Number of fruit, $plant^{-1}$, Weight of fruit $plant^{-1}$, 1000 fruit weight (g) Total fruit weight (kg. ha^{-1})

of Determination seed oil:

2 gm of the harvested fruits of each treatment was powdered by electric blender. Digital soxhlet instrument was used for oil distillation, with n-hexane solvent (BDH, UK), (12), the oil content was calculated as follows:

Oil% = [(W2-W1) × 100] / S, W1 = weight of empty flask (g), W2 = weight of flask and the extracted oil (g), S = weight of sample.

Total oil yield (kg. ha^{-1}) = Oil% × total fruit yield (kg. ha^{-1}) (16)

Table 1: Monthly precipitation, maximum and minimum air temperature for Bakrajo During growing season.

Month	Bakrajo			
	Min. Temp.(C°)	Max. Temp.(C°)	Avg. Temp.(C°)	Rainfall (mm)
October	9.1	34.4	20.4	48.8
November	2.9	22.2	12.0	130.4
December	2.2	17.9	9.2	115.3
January	-3.2	16.6	6.8	99.6
February	0.2	19.8	8.8	67.6
March	3.2	22	12.1	101.8
April	5.0	32.2	16.7	23.5
May	11.2	36.9	24.6	17.2
June	22.1	38.1	30.1	0.0
Total rainfall				604.2

Data collected from (Agro-meteorological station at Bakrajo) .

Statistical Analysis:

The data were statistically analyzed according to the methods of analysis of variance as a general test; all possible comparisons among the means were carried out by using Least Significant Difference L.S.D test at significant levels of 5% (4).

Results and Discussions :

Table (2)

showed that most of yield components were significantly responded to fenugreek varieties, with the exception of plant height (cm) at maturity and number of pod. $plant^{-1}$. Concerning pod length, number of seeds pod^{-1}, 1000 seed weight g, seed yield kg. ha^{-1}, biological yield kg. ha^{-1}, oil% and oil yield kg. ha^{-1} recorded maximum values 11.367cm, 12.131, 11.333g, 527.556 kg ha^{-1}, 15.707% and 83.917 kg ha^{-1} respectively, due to Mithe variety, while harvest index recorded maximum value 0.197 due to EP 101 variety. The differences between two varieties in yield components might

be due to their differences in relative performance of each genotype and to favorable weather condition temperature, light intensity and rainfall during growing season Table 1 led to sufficient plant growth and producing more plant vegetative. These results are closely confirmed with the findings of (13, 2).

According to Table 3, different levels of nitrogen fertilizer had significant effects on plant height cm at maturity and most of yield component pod length, number of pod plant^{-1}, number of seeds pod^{-1}, 1000 seed weight g, seed yield kg ha^{-1}, biological yield kg ha^{-1}, oil% and oil yield kg. ha^{-1} , maximum value were obtained by 40 kg N ha^{-1} treatment which were 113.000, 11.965 cm, 509.667, 12.693, 12.015 g, 582.667kg ha^{-1}, 16.343% and 95.734kg ha^{-1} respectively. The minimum value were recorded by no fertilizer treatment which were (96.167) Cm, 10.512Cm, 373.500, 11.042, 10.523g, 439.833 kg. ha^{-1}, 2177.850kg ha^{-1}, 13.625% and 60.073Kg. ha^{-1}, respectively. Regarding harvest index gave maximum value due to no fertilizer treatment with the value of 0.203, and the minimum value was 0.179 recorded by 40 kg ha^{-1} nitrogen fertilizer.

All these parameters significantly increased with increasing adequate of nitrogen fertilizer, nitrogen is a common plant nutrition which encourages vegetative production in plants. This plant nutrient is also important for promoting the production of seed yields and herba, folium in medicinal and spice plants (8) In previous studies related to fenugreek(22, 9, 17) and 21 reported that all growth and yield parameters were significantly affected by nitrogen fertilization. Interaction effect between varieties and nitrogen fertilizer levels had significant effects Table 4 on plant height cm number of pod plant^{-1} and (1000) seed weight g, the maximum value were obtained due to the interaction between Mithe variety wand 40kg ha^{-1} nitrogen fertilizer with the value of 114.667 cm, 538.333 and 12.413 g respectively, and the minimum value were recorded by the interaction between Mithe variety and no fertilizer with the value of 88.333cm, 369.000 and 10.275g respectively. This might be due to the more ability of Mithe variety to benefit from the soil nutrient content or and it has the more nitrogen use efficiency than variety E.P 101, and this was also reported by 22, 15 This might be due to early and abundant availability of nitrogen leading to better nutritional environment in the root zone for growth and development of plant.

Table 2:The effect of cultivars on plant height at maturity, yield and yield components of Fenugreek.

Varieties	Plant Height Cm	Pod Length Cm	No. of Pods Plant^{-1}	No. of Seed in Pod	1000 Seed Weight	Seed Yield Kg ha^{-1}	Biological Yield Kg ha^{-1}	H. I	Oil %	Oil Yield Kg ha^{-1}
Mithe	101.778	11.367	437.444	12.131	11.333	527.556	2867.520	0.187	15.707	83.917
EP 101	105.111	10.753	422.889	11.458	10.902	471.889	2418.227	0.197	13.834	65.868
L.S.D $_{(P\leq0.05)}$	**n.s**	0.341	n.s	0.274	0.332	32.746	216.812	0.007	0.901	7.941

Table 3:The effect of nitrogen fertilizer on plant height at maturity, yield and yiel comp onents of Fenugreek.

Nitrogen Fertilizer Kg ha^{-1}	Plant Height Cm	Pod Length Cm	No. of Pods Plant^{-1}	No. of Seed in Pod	1000 Seed Weight	Seed Yield Kg ha^{-1}	Biological Yield Kg ha^{-1}	H. I	Oil %	Oil Yield Kg ha^{-1}
0 N	96.167	10.512	373.500	11.042	10.523	439.833	2177.850	0.203	13.625	60.073
40 N	113.000	11.965	509.667	12.693	12.015	582.667	3286.804	0.179	16.343	95.734
80 N	101.167	10.703	407.333	11.648	10.815	476.667	2463.966	0.194	14.344	68.871
L.S.D (P≤0.05)	7.561	0.417	25.847	0.336	0.407	40.105	265.540	0.009	1.104	9.726

Table 4:The interaction effect of cultivars and nitrogen fertilizer on plant height at maturity yield and yield components of Fenugreek.

Varieties	Nitrogen Fertilizer Kg ha^{-1}	Plant Height Cm	Pod Length Cm	No. of Pods Plant^{-1}	No. of Seed in Pod	1000 Seed Weight	Seed Yield Kg ha^{-1}	Biological Yield Kg ha^{-1}	H. I	Oil %	Oil Yield Kg ha^{-1}
Mithe	**0 N**	88.333	10.900	369.000	11.293	10.257	449.667	2256.391	0.200	14.112	63.686
	40 N	114.667	12.16 3	538.333	13.103	12.413	623.333	3686.825	0.169	17.162	107.265
	80 N	102.333	11.037	405.000	11.997	11.330	509.667	2659.345	0.192	15.847	80.801
EP 101	**0 N**	104.000	10.123	378.000	10.790	10.790	430.000	2099.310	0.206	13.138	56.460
	40 N	111.333	11.767	481.000	12.283	11.617	542.000	2886.784	0.188	15.523	84.204
	80 N	100.000	10.370	409.667	11.300	10.300	443.667	2268.587	0.196	12.840	56.941
L.S.D (P≤0.05)		10.693	n.s	36.553	n.s	0.575	n.s	n.s	n.s	n.s	n.s

It can be concluded that the Mithe variety performed better than EP 101 variety

Conclusions:

under rainfed condition in Sulaimani region and the effects of different nitrogen doses on the most of yield and yield components of fenugreek were found to be significant. In this study, while increasing nitrogen dose negatively affected most the yield components of fenugreek, but the whole yield components were positively affected by nitrogen applications up to 40 kg N ha^{-1}.

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