



Effect of Planting Times on the Yield and Quality of Fenugreek (*Trigonella Foenum-Graecum* L.) Under the Conditions of Kahramanmaraş

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ABSTRACT

This study was performed in the 2013-2014 cultivation season with the purpose of determining the most suitable planting season of fenugreek under the ecological conditions of Kahramanmaraş. The trial was established in two different cultivation periods as winter and spring at the Eastern Mediterranean Transition Zone Agricultural Research Station in according to factorial randomized block design with three replications. In the study, the Gürarlan fenugreek variety as well as Candidate Line-1 and Genotype-1 fenugreek genotypes were used as material. In the study, features such as plant height, first pod height, number of branches per plant, pod length, number of pods per plant, number of seeds per pod, seed yield per plant, seed yield per decare, thousand seed weight, mucilage rate, fixed oil ratio, fixed oil yield, crude protein ratio, humidity, raw ash ratio, and the rates of linoleic acid, alpha linoleic acid, oleic acid, palmitic acid, stearic acid as important fatty acids were studied. Variance analysis made on the data obtained by using SPSS statistical package program. In the comparison of the means, Duncan multiple comparison test was used. As a result, in this study, was found that in the region where the study was performed, the most suitable planting season for fenugreek cultivators is the winter planting dated winter planting when the highest values of plant height, number of pods per plant, seed yield per plant were obtained. From the features studied in the research the difference between genotypes was found significant only from the perspective of seed yield per plant and fixed oil ratio. While the best results were obtained from Genotype-1 for seed yield per plant, the best results for fixed oil yield were obtained from Candidate Line-1.

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Introduction

Türkiye is one of the richest countries in the world in terms of medicinal and aromatic plants. Important medicinal and aromatic plants such as basil, fenugreek, fennel, anise, poppy, cumin, coriander, saffron and laurel are cultivated in our country. Fenugreek has an important place among these plants (Beyzi, 2011). Fenugreek is in the genus *Trigonella* of Fabales family, Fabaceae (Legumes) family. This plant, known as "buy grass" among the people, has a wide spread area in the world. The genus *Trigonella* includes about 50 species, mostly distributed around the Mediterranean, and 45 of these species are naturally found in Türkiye, of which *Trigonella foenum-graecum* L. "is cultured (Arslan et al., 1989; Davis, 1982). Fenugreek seeds contain fixed oil, mucilage, phosphorus compounds, phytin, choline, trigonelin, a saponin that yields diosgenin by hydrolysis, protein, essential oil and nicotine amide.

According to 2021 data, fenugreek plant in our country; the production amount is 816 tons, the cultivation area is

732.6 da, and the yield is 112 kg da⁻¹. Our fenugreek production increased from 713 tons in 2020 to 816 tons in 2021. While our fenugreek cultivation area was 652.1 da in 2020, it increased to 732.6 ha in 2021, and the seed yield increased from 109 kg da⁻¹ in 2020 to 112 kg da⁻¹ in 2021 (TSI, 2021).

Although fenugreek has many uses and can be easily grown in our country's ecology, the production and export of fenugreek in our country has not reached the desired levels. Consequently, in order to increase the production of fenugreek and the export of fenugreek, importance should be given to the promotion of this plant, its usage areas should be expanded and it should be ensured that our people gain more place in their consumption habits. Improving the standards of the products obtained from the fenugreek plant and determining the best growing conditions will also increase the importance of this plant. As with all plants, one of the cultural practices that affect

the seed yield increase in annual fenugreek is to determine the appropriate planting time. Planting date varies according to varieties, as well as according to ecological regions. In this study, the effect of different planting dates on the seed yield of one-year fenugreek in our region was investigated. In this study, the effects of two different planting times (winter and spring) on the yield and quality characteristics of fenugreek plants were tried to be determined in Kahramanmaraş ecological conditions by using Genotype-1 genotype, Candidate Line-1 fenugreek line and a registered fenugreek variety Gürarlan.

Materials and Methods

Plant Materials

In the experiment, Candidate Line-1 line and Genotype-1 genotype (*Trigonella foenum-graecum* L.) obtained from Eskişehir Transition Zone Agricultural Research Institute and Gürarlan fenugreek variety obtained from Ankara University, Faculty of Agriculture, Department of Field Crops were used as materials. In this study; it was carried out in the trial land of KSU Faculty of Agriculture in the Eastern Mediterranean Transition Zone Agricultural Research Station in the 2013-2014 growing season. According to the soil analysis results of the test soil samples taken from 0-30 cm depth where the research was carried out, the soil in which the experiment was carried out has a sandy loam structure and the lime rate is high. It has been determined that the soil, which has a strong alkaline character, is insufficient in terms of organic matter, nitrogen and potassium, but rich in phosphorus. Kahramanmaraş is located in the Eastern Mediterranean region of our country. In terms of climatic features, it shows typical Mediterranean climate characteristics. During the plant growing period of 2013-2014, in which the experiment was carried out, the month with the highest precipitation was determined as March with 117.7 mm, and the month with the lowest precipitation was July with 0.0 mm in the period from November to July. It is seen that precipitation decreases after March. During the 2013-2014 plant growing period, it is observed that the average temperature ranges from November to July, with an average of 5.6-28.5 (°C) and an average relative humidity of 27.7-60.9%. The highest average temperature was measured in July, and the highest relative humidity was measured in January.

Methods

Two different planting times (winter and spring planting) were applied in this study, which was carried out to determine the most suitable planting time of fenugreek plant in Kahramanmaraş ecological conditions. The winter planting experiment carried out in the 2013-2014 growing season was established with two replications on November the 13th, and the spring planting experiment was established on March the 7th, 2014 with three replications according to the factorial randomized blocks experimental design. Planting dates were placed in the main plots and the varieties were placed in the sub plots. The plots were formed from 4 rows of 3 m in length and a gap of 2 meters was left between the blocks. Row spacing is 40 cm. The planting process was carried out manually, at a depth of 2-

3 cm, on the lines opened with a marker, with the calculation of 3 kg da⁻¹ seed (Kızıl and Arslan, 2003). Before planting, 20-20-0 base fertilizer was applied, with 6 kg P₂O₅ and 6 kg N per decare. On April the 15th 2014, Ammonium Sulphate [(21% Nitrogen (N) 24% Sulfur (S)] fertilizer was applied to the soil as top fertilizer with the calculation of 3 kg da⁻¹ pure N. To protect the developing fenugreek seedlings from weeds, to prevent the loss of water in the soil by evaporation, Hand hoeing was done to enable the roots of the seedlings to develop and go deep. When the plants were about 10 cm tall, thinning was done to reduce the plant density. Considering the development status of the plants and the water condition of the soil, a sprinkler irrigation system was established. The first irrigation was done on November 20th 2013 and the second irrigation was done on December the third 2013. When the plants are fully mature, the 1st and 4th rows of each parcel are left with the edge effect, and the plants in the middle two rows of the parcel are harvested manually according to their maturation status depending on the planting time. Harvested plants were hand-blended and the following characteristics were examined.

Soil analysis results of the samples taken from 0-30 cm depth of the trial soils where the research was carried out Table 1. has also been given.

The data on the examined features were analyzed using the SPSS statistical package program according to the randomized block design in factorial design (Efe et al., 2000) and the averages of the features were compared with the Duncan multiple comparison test (Bek and Efe, 1995).

Results and Discussion

The findings obtained in this study, which was carried out in order to determine the effects of winter and spring planting on some growth and development characteristics, yield and yield characteristics and quality characteristics of three fenugreek (*Trigonella foenum-graecum* L.) genotypes in the 2013-2014 growing season are given below.

Growth and Development Characteristics

Plant height, number of branches per plant, first pod height and pod length were investigated as growth and development characteristics.

Plant Height

When the average plant height values regarding the planting dates are examined; it is seen that the average plant height is 47.5 cm in winter planting and 30.3 cm in spring planting, and the averages are in a different group statistically (Table 3). When the average plant height values of the varieties are examined, it is seen that the average plant height is 38.4 cm in Gürarlan fenugreek variety, 38.8 cm in Genotype-1 and 39.5 cm in Candidate Line-1, and the average plant heights are in the same group statistically. It is seen that the average plant height of the genotype x planting date interaction varies between 29.8 cm and 48.9 cm, and there are no different groups in terms of this feature (Table 3). Sade et al. (1994) investigated the effects of different plant density on the yield and some morphological characteristics of fenugreek (*Trigonella foenum-graecum* L.).

Table 1. Soil analysis results of the trial field

Analysis	Result			The reference range	Evaluation
pH	7.73			7.5-8.5	Strong alkali
Lime (%)	24.8			15-50	Too chalky
Salt (%)	0.13			0.0-0.015	Without salt
Organic matter (%)	0.2			0-1	Very little
Phosphorus (ppm)	84.5 mg/kg			80	Too much
Potassium (ppm)	112.5			50-140	Little
Nitrogen	0.08			0.045-0.090	Little
Saturation (%)	Clay(%)	Silt(%)	Sand(%)	Sandy loam soil	
	30.3	18.7	69.7		

*Soil analyzes were carried out in Kahramanmaraş Sütçü İmam University, Faculty of Agriculture, Soil Department laboratory.

Table 2. Some climatic data for the months in which the experiment was conducted

Months	Average Temperature (°C)	Average Relative Humidity (%)	Total Precipitation (mm)
2013 October	17.5	32.8	35.1
2013 November	14.1	52.5	28.7
2013 December	5.6	50	48.7
2014 January	8.6	60.9	59.4
2014 February	9.7	39	30.0
2014 March	13.4	43.4	117.7
2014 April	17.3	41.5	31.2
2014 May	21.1	34.9	22.1
2014 June	25.7	27.7	11.8
2014 July	28.5	31.7	0.0

*Anonim 2014 b

Table 3. Average values of growth and development characteristics of different fenugreek genotypes and planting times and the resulting groups

	Plant height (cm)		First Pod Height (cm)		Number of branches per plant (number plant ⁻¹)		Pod length (cm)	
	WP	SP	WP	SP	WP	SP	WP	SP
Gürarlan	45.9	30.9	17.8	16.8	5.0	2.7	12.6	12.7
Genotype-1	47.9	29.8	18.2	15.9	6.5	3.3	12.6	12.6
Candidate Line-1	48.9	30.1	15.0	16.9	7.0	3.0	13.8	13.0
Planting Date Mean	47.5	30.2	17.0	16.5	6.16	3.0	13.0	12.7
Variety Mean	38.8		16.7		3.0		12.8	

*WP: Winter Planting, SP: Spring Planting.

Table 4. Average values of yield characteristics of different fenugreek genotypes and planting dates and the resulting groups

	Number of Pods Per Plant (number plant ⁻¹)		Number of Seeds Per Plant (number pod ⁻¹)			
	WP	SP	WP	SP		
Gürarlan	28.3	12.3	13.1	14.0		
Genotype-1	31.3	14.0	12.6	13.7		
Candidate Line-1	37.8	15.7	14.6	15.0		
Planting Date Mean	32.4	14	13.4	14.2		
Variety Mean	23.2		13.8			
	Seed Yield Per Plant (g plant ⁻¹)		Seed Yield Per Decare (kg da ⁻¹)		Thousand Seed Weight (g)	
	WP	SP	WP	SP	WP	SP
Gürarlan	4.0	2.9	151.4	111.1	18.5	20.4
Genotype-1	6.6	3.4	127.5	84.1	17.8	20.3
Candidate Line-1	6.0	3.8	125.4	143.6	17.5	18.3
Planting Date Mean	5.5	3.3	134.7	112.9	17.9	19.6
Variety Mean	4.4		123.8		18.7	

*WP: Winter Planting, SP: Spring Planting.

Table 5. Average values of quality characteristics of different fenugreek genotypes and planting dates and the resulting groups

	Musilage Rate (%)		Fixed Oil Ratio (%)		Crude Protein Ratio (%)		Humidity (%)		Crude Ash Ratio (%)	
	WP	SP	WP	SP	WP	SP	WP	SP	WP	SP
Gürarslan	27.2	25.3	5.9	6.6	27.0	29.0	6.3	6.4	3.0	4.7
Genotype-1	24.2	24.7	6.4	6.3	26.4	29.8	6.6	6.8	2.8	3.7
Candidate Line-1	24.7	24.7	5.4	6.0	25.4	29.1	6.3	6.0	3.9	3.9
Planting Mean Time	25.3	24.9	5.9	6.3	26.3	29.3	6.4	6.4	3.2	4.1
Variety Mean	25.1		6.1		27.7		6.4		3.6	
	Linoleic acid (%)		Alpha linoleic acid (%)		Oleic acid (%)		Palmitic acid (%)		Stearic acid (%)	
	WP	SP	WP	SP	WP	SP	WP	SP	WP	SP
Gürarslan	37.9	36.5	23.5	20.8	16.0	19.6	10.3	13.1	3.0	4.7
Genotype-1	40.0	43.3	24.7	25.5	15.5	13.2	10.8	10.1	2.8	3.7
Candidate Line-1	36.4	36.2	22.7	15.3	18.3	16.9	13.8	16.8	3.9	3.9
Planting Mean Time	38.1	38.6	23.6	20.5	16.6	16.5	11.6	13.3	3.2	4.1
Variety Mean	38.3		22.0		16.5		12.4		3.6	

*WP: Winter Planting, SP: Spring Planting.

Plant height values obtained as a result of this study Sade et al. (1994) were found to be similar to the results reported. Majid et al. (2019) reported that plant height could change between 46.00-84.89 cm in their study in which they examined the effect of planting date and humic acid spraying on the growth characteristics of fenugreek (*Trigonella foenum-graecum* L.). They obtained different results from the results we obtained with this study. The plant, which has a stronger root structure in winter planting, utilizes the water and nutrients in the soil more effectively and is better sorted. As a matter of fact, while the plant height was 47.5 cm in winter planting, it was recorded as 30.2 cm in summer planting. In summer plantings, the vegetation period is shortened. In addition, the increase in temperature forces the plant to develop generatively before its vegetative development is completed, which causes the plant to remain shorter.

First Pod Height

When the average first pod height values regarding the planting dates are examined; It is noteworthy that the average height of the first pod in winter planting was 17 cm, and in spring planting 16.6 cm, and the averages were statistically in the same group (Table 3). Similarly, it is seen that the first pod height averages of the genotype x planting date interaction vary between 15 cm and 18.2 cm, and there are no different groups in terms of this feature. When the average first pod height values of the cultivars are examined, it is seen that the average first pod height is 17.3 cm in Gürarslan fenugreek variety, 17.1 cm in Genotype-1 and 16 cm in Candidate Line-1, and the averages of first pod height are statistically in the same group. The values we obtained from the research were in agreement with the results of Kızıl and Arslan (2003) who reported that the height of the first pod varied between 16.54-19.31 cm.

Number of Branches Per Plant

Considering the average number of branches regarding the planting dates; It is noteworthy that the average number of branches in winter planting is 6.2 number plant⁻¹, and in spring planting 3 number plant⁻¹, and the averages are in a different group statistically (Table 3). It is seen that the average number of branches belonging to the genotype x

planting date interaction varies between 3 number plant⁻¹ and 7 number plant⁻¹. From the same table, it is seen that the interaction averages are not statistically different. When the average branch number values of the cultivars are examined, it is observed that the average number of branches is 3.8 number plant⁻¹ in Gürarslan fenugreek variety, 4.9 number plant⁻¹ in Genotype-1 and 5 number plant⁻¹ in Candidate Line-1 (Table 3). It is seen that the cultivars are statistically similar in terms of the number of branches and are in the same group. Kızıl and Arslan (2003) reported that the number of branches can change between 3.29-4.19 number plant⁻¹ in their study. While the number of branches we obtained as a result of this study was consistent with the results reported by Kızıl and Arslan (2003) in spring planting, it was found higher than the values in the aforementioned study in winter planting.

Pod Length

The pod length is 13 cm in winter planting and 12.8 cm in spring planting. When the average pod lengths of the cultivars are examined, it is observed that it is 12.6 cm in Gürarslan fenugreek cultivar and Genotype-1, 13.4 in Candidate Line-1 and all of them are in the same group. It is seen that the mean pod lengths related to the genotype x planting date interaction varied between 12.6 cm and 13.8 cm, and were not statistically different, and all the averages were in the same group. The values we obtained from the research were similar to the results of Arslan (1994), who stated that the pod length could change between 10.65-13.20 cm.

Plant height, first pod height, number of branches per plant, pod length in winter planting are due to the fact that the plant has more suitable climatic conditions and a longer period for vegetative growth and development and grain filling in winter planting. However, in summer planting, the plant passes into generative development with the effect of high temperature before it can complete its vegetative growth and development.

Yield and Yield Components

As yield and yield components, the number of pods per plant, the number of seeds per pod, the seed yield per plant, the seed yield per decare and the weight of one thousand seeds were examined.

Number of Pods Per Plant

When the averages of the varieties are examined, it is noteworthy that there are two groups in terms of this feature. It is observed that the highest number of pods per plant was obtained from Candidate Line-1 with 26.8 number plant⁻¹, and the lowest number of pods per plant was obtained from Gürarşlan fenugreek variety with 20.3 number plant⁻¹ (Table 4). From Table 4, it is seen that the average number of pods per plant related to the genotype x planting date interaction is statistically in the same group of all averages. The values related to the spring planting obtained from the study were reported by Tamkoç et al. (1997), the values for the winter planting time were found to be higher than these results.

Number of Seeds Per Pod

Considering the variety averages of the number of seeds in the pod, it is noteworthy that different groups are formed in terms of this feature. It is observed that the highest seed number value in the pod was obtained from Candidate Line-1 with 14.8 number pod⁻¹, 13.5 number pod⁻¹ in Gürarşlan fenugreek variety and 13.1 number pod⁻¹ in Genotype-1 (Table 4). The number of seeds per pod at both planting times was higher than the values reported by Yılmaz and Akdağ (1994) (5.4-7.8 units). Majid et al. (2019) examined the effect of planting date and humic acid spraying on the growth characteristics of fenugreek (*Trigonella foenum-graecum* L.) and found the number of seeds to be 14.44 seed plant⁻¹. The results we obtained with this study Majid et al. (2019) was found to be similar.

Seed Yield Per Plant

While the highest seed yield per plant was obtained from Genotype-1 with 5 g plant⁻¹ and Candidate Line-1 with 4.9 g plant⁻¹, the lowest value was obtained from Gürarşlan fenugreek variety with 3.4 g plant⁻¹ (Table 4). It is seen that the average of the interaction of genotype x planting date related to seed yield per plant varies between 2.9 g plant⁻¹ and 6.6 g plant⁻¹ and there are two groups in terms of this feature. Respectively, the highest seed yield per plant was 6.6 and 6.0 g per plant⁻¹ in Genotype-1 and Candidate Line-1, the winter planting date, while all other averages were in the same group. Elçi (2010) reported that the seed yield per plant was between 0.56-0.85 g plant⁻¹. It is noteworthy that the findings obtained are higher than the values reported by the researcher.

Seed Yield Per Decare

When the seed yield averages of the cultivars are examined, it is seen that it is 131.3 kg da⁻¹ in Gürarşlan fenugreek variety, 105.8 kg da⁻¹ in Genotype-1, 134.5 kg da⁻¹ in Candidate Line-1 and all of them are in the same group (Table 4). It is seen that the seed yield averages related to the genotype x planting date interaction ranged between 84.1 kg da⁻¹ and 151.4 kg da⁻¹ and were not statistically different and all averages were in the same group. Ayanoğlu and Mert (1999) reported that the seed yield could vary between 13.23-22.01 kg da⁻¹, Kızıl and Arslan (2003) 147.6-180.5 kg da⁻¹, and Özdemir (1999) 142.5-305.5 kg da⁻¹. Seed yield values per decare obtained as a result of this study were found to be consistent with the values reported by Ayanoğlu and Mert (1999), but

lower than the values reported by Kızıl and Arslan (2003) and Özdemir (1999).

Thousand Seed Weight

Looking at the thousand-grain weight averages related to the planting dates from Table 4, it is observed that the average thousand seed weight in winter planting is 17.9 g, and 19.7 g in spring planting, and the averages are statistically different from each other. From the same chart, it is seen that the average thousand seed weight of the cultivars is 19.4 g in Gürarşlan fenugreek, 19.1 g in Genotype-1, 17.9 g in Candidate Line-1 and all of them are in the same group (Table 4). It is observed from Table 4 that the average thousand seed weights related to the genotype x planting date interaction vary between 17.5 and 20.4. Yılmaz and Akdağ (1994) reported that the weight of one thousand seeds of fenugreek varies between 18.8-22.8 g. The findings obtained are in accordance with the values reported by the researchers.

Quality Features

Mucilage ratio, fixed oil ratio, fixed oil yield, crude protein ratio, moisture ratio, crude ash ratio and important fatty acids as quality characteristics; linoleic acid, alpha linoleic acid, oleic acid, palmitic acid, stearic acid values were examined.

Mucilage Rate

It is seen from Table 5 that there is no statistical difference between the average mucilage ratio values of the planting dates and the average mucilage ratio values are 25.4% in the winter planting date, and 24.9% in the spring planting date (Table 5). When the average mucilage ratio of the cultivars is examined, it is seen that it is 26.3% in Gürarşlan fenugreek variety, 24.4% in Genotype-1, 24.7% in Candidate Line-1 and all of them are in the same group. From Table 5, it is observed that the averages of mucilage ratios related to the interaction of genotype x planting date vary between 24.2 and 27.2 and all averages are in the same group. Seen the results, it is seen that the obtained values are in agreement with the 20% mucilage amount reported by Rao and Sharmo (1987).

Fixed Oil Ratio

Considering the averages of cultivars belonging to the said trait, it is noteworthy that two groups are formed in terms of this trait. While the highest fixed oil content (%) was obtained from Genotype-1 with 6.4% and from Gürarşlan fenugreek variety with 6.3%, the lowest value was obtained from Candidate Line-1 with 5.7% (Table 5). From the same chart, it is seen that the average fixed oil ratio (%) of the interaction of planting, genotype x planting date varies between 5.4% and 6.6% and the averages are in the same group (Table 5). Rao and Sharma (1987) reported that the fixed oil ratio was 7.9%. The results obtained were lower than the values reported by the researchers.

Crude Protein Ratio

When the average crude protein ratio values of the cultivars are examined, it is observed that it is 28% in Gürarşlan fenugreek variety, 28.1% in Genotype-1 and 27.3% in Candidate Line-1 (Table 5). As a result of the examination of the crude protein ratio averages of the

genotype x planting date interaction, it is seen that the crude protein ratio values vary between 25.4 to 29.8 and all averages are statistically similar (Table 5). Nour et al. (1986) showed that the protein ratio in fenugreek plant was 27.3%. The crude protein ratio values obtained as a result of this study were found to be compatible with the results reported by the researchers. Differences between summer and winter planting dates in terms of oil and protein ratios are due to the development of plants and physiological activities within the plant. Due to the better development of the plants and the longer vegetation period in winter planting, the oil storage period in the seeds is prolonged and as a result, the oil rate in the seed body increases. In other words, oil accumulation increases as the seed development period increases. In summer plantings, the oil accumulation period of the seeds is shorter and the developmental course and physiological formation of the plants are not as regular as in the winter. Therefore, oil ratios in seeds are lower (Yılmaz, 1997).

Raw Ash Ratio

When the raw ash ratio (%) of the varieties is analyzed from Table 5, it is observed that it is 3.9% in Gürarşlan and Candidate Line-1, 3.2% in Genotype-1 and all of them are in the same group. It is observed that the ash averages related to the genotype x planting date interaction vary between 2.8% and 4.7% (Table 5). Nour et al. (1986) reported that the raw ash ratio in the fenugreek plant was 3.8%. The values obtained in the study were found to be compatible with the aforementioned study.

Linoleic Acid

While the highest amount of linoleic acid was found in Genotype-1 with 41.6%, it was observed that it was 37.2% in Gürarşlan, 36.3% in Candidate Line-1, and both were in the same group (Table 5). It can be seen from Table 5 that the averages of linoleic acid related to the genotype x planting date interaction vary between 36.2% and 43.3%. Küçük and Gürbüz (1999) reported that the amount of linoleic acid in the fenugreek plant was 44.64%. The findings obtained in the study were found to be compatible with the aforementioned study.

Alpha Linoleic Acid

It is seen that the averages of alpha linoleic acid (%) belonging to the planting dates are statistically similar to each other. It is seen that the mentioned feature is 23.6% in winter planting and 20.5% in spring planting (Table 5). When the alpha linoleic acid (%) averages of the cultivars are analyzed from Table 5, it is observed that it is 22.1% in Gürarşlan, 25% in Candidate Line-1, 19% in Genotype-1 and all of them are in the same group. It is striking that the ash averages related to the genotype x planting date interaction vary between 15.3% and 25.5% and all averages are in the same group (Table 5).

Oleic Acid

It is seen that the highest oleic acid (%) values are in Genotype-1 with 17.8% and Candidate Line-1 with 17.6%, while it is 14.4% in Genotype-1 and Genotype-1 is in a different group. It is observed that the oleic acid averages related to the genotype x planting date interaction varied between 13.2% and 19.6%, were not statistically different,

and all averages were in the same group (Table 5). Küçük and Gürbüz (1999) reported that the rate of oleic acid in fenugreek was 19.34%. The values obtained in the study were found to be compatible with the aforementioned study.

Palmitic Acid

When the averages of the varieties are examined, it is noteworthy that there is no group in terms of this feature. Palmitic acid content was 11.7% in Gürarşlan, 10.4% in Genotype-1 and 15.3% in Candidate Line-1 (Table 5). It can be seen from Table 5 that the palmitic acid averages related to the genotype x planting date interaction vary between 10.1% and 16.8%, and statistically all averages are in the same group. Küçük and Gürbüz (1999) reported that the rate of palmitic acid in fenugreek was 0.33%. The palmitic acid values obtained in this study were found to be considerably higher than the value reported by Küçük and Gürbüz (1999).

Stearic Acid

It can be seen from Table 5 that the stearic acid averages related to the genotype x planting date interaction vary between 4.3% and 5.4%, and statistically all averages are in the same group.

Conclusion

In this study, the effect of two different planting dates on the yield and quality characteristics of Fenugreek (*Trigonella foenum-graceum* L.) was tried to be determined and the results obtained were presented. In the study, plant height, number of branches per plant, first pod height, pod length, number of pods per plant, number of seeds per pod, seed yield per plant, seed yield per decare of different fenugreek genotypes (Gürarşlan, Genotype-1, Candidate Line-1) at different planting times were determined. Yield, thousand seed weight, mucilage ratio, fixed oil ratio, fixed oil yield, crude protein ratio, crude ash ratio, moisture ratio, and the ratio of important fatty acids such as linoleic acid, alpha linoleic acid, oleic acid, palmitic acid, stearic acid ratio were studied.

The interaction of genotype x planting date was found to be significant in terms of seed yield per plant and fixed oil yield. Regarding the genotype x planting date interaction, the highest seed yield per plant was in Genotype-1 (6.6 g plant⁻¹) in winter planting date, and the lowest seed yield per plant was in Gürarşlan fenugreek variety (2.9 g plant⁻¹) in the spring planting date was found to be obtained. When the amount of linoleic acid, which is one of the fatty acids, is examined, it is seen that the highest value is in Genotype-1 with 41.6%. It was found to be 37.2% in Gürarşlan and 36.3% in Candidate Line-1. In terms of linoleic acid amount, the difference between planting dates was found to be insignificant. Considering the amount of oleic acid from fatty acids, the highest value is seen in Gürarşlan with 17.8% and in Candidate Line-1 with 17.6%. In Genotype-1, it was recorded as 14.4%. Planting dates were found to be insignificant in terms of the amount of oleic acid.

As a result of the study, the highest seed yield per plant was obtained in winter planting. Although the seed yield in terms of planting dates was found to be statistically

insignificant, it was observed that the seed yield, which was 134.8 kg da⁻¹ in winter planting, decreased to 113 kg da⁻¹ with a decrease of 21.8 kg da⁻¹ in spring planting. The decrease in seed yield and seed yield per plant in spring planting can be attributed to the shortening of the vegetation period and the formation of fruit before the plant completes its full development.

The findings obtained from this study showed that fenugreek cultivation can be done in Kahramanmaraş ecological conditions. In this study, which can form a basis for future research, it was determined that the most suitable planting time for fenugreek cultivation in the region where the research was carried out was in winter planting, where the highest plant height, number of pods per plant, and seed yield per plant were obtained. The difference between the genotypes was found to be significant only in terms of seed yield per plant and fixed oil ratio. While the best results for seed yield per plant were obtained from Genotype-1, Candidate Line-1 was obtained in terms of fixed oil yield.

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