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Chemical Contents of Fennel (*Foeniculum vulgare* var. Dulce) Grown North East Anatolian Region

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The aim of this study was to assess the chemical content of fennel (*Foeniculum vulgare* var. dulce) bulb and leaves. The plant species were grown in summer and early autumn and analyzed for their mineral content. When the planting times were compared, there were significant differences in terms of N, P, Zn and Fe contents in leaves and K, Zn, Fe and Mn contents in bulb of fennel vegetable species. The best time to grow fennel was the second planting time in terms of high nutritional value. In general, mineral contents of leaf and bulb were relatively abundant in fennel vegetable species. Therefore, it may provide a source of macro and micro minerals and contribute to taste and colour diets. As a result, fennel vegetable species could be a very important alternative plant species for the region.

Key Words: Fennel, Chemical contents, Planting time, Anatolia.

INTRODUCTION

Vegetables commonly grown in Turkey today consist of annual crops including Solanaceous, Crucifers, Cucurbits, Bulb crops, Leguminous and other indigenous vegetable species. Turkey has favourable ecological conditions for vegetable growth and is one of the most important vegetable producers in the world. Turkey is fourth important producer (25.3 million tones) country regarding of vegetable production in the world[1]. In terms of economic value, nutrition, consumer's preference, general adaptability and extent of cultivation, the most commonly grown vegetable crops are tomato, watermelon, cucumber, pepper, eggplant, squash, onion, snap bean, melon, salad vegetables and *etc*. In recent decades, growing new vegetable species in all around of the world has become common for producing alternative vegetable species. However, there is little published literature available on the comprehensive mineral and nutrient content of these kinds of species. Such information is valuable for several reasons, not least in ascertaining the

nutrient contents which may be used to supplement the nutritional value of the normal diet. It is also valuable information for environmentalists involved in the design of conservation programs aimed at protecting and propagating nutritionally valuable plant resources[2].

The aim of this study was to determine chemical contents of fennel plant grown in North East Anatolian region in Turkey.

EXPERIMENTAL

The experiment was carried out on fennel in the Department of Horticulture at Ataturk University under field condition in Erzurum, Turkey, in 2006. The plant species were grown in summer and early autumn. The experiment was made based on a completely randomized design with four replicates. End of the vegetation period, the plant were harvested with bulb. The effect of the planting time on the plant nutrient elements of leaf and bulb was evaluated. It was also made based on a completely randomized design with four replicates.

Leaf and bulb analysis: In order to determine the mineral contents of leaf and bulb, each sample was washed in deionized water, blotted dry with paper towelling, placed in a paper bag and dried in a forced air drying oven at 68 ºC for 48 h and then ground for chemical analysis[3]. The micro-Kjeldahl procedure was applied for determination of N. K^+, Ca^{2+} and Mg^{2+} were determined after wet digestion of dried and ground sub-samples in a H_2SO_4-Se-salisilic acid mixture. In the diluted digests, P was measured spectrophotometrically by the indophenol-blue method and after reaction with ascorbic acid. Potassium and Ca^{2+} were determined by flame photometry, Fe, Na, Mg^{2+}, Mn, Zn and Cu by atomic absorption spectrometry using the method of AOAC[4].

Data analysis: All data were subjected to a one-way analysis of variance (ANOVA) and separated by Duncan's multiple range tests using SAS statistical software[5].

RESULTS AND DISCUSSION

Chemical contents (N, P, K, Zn, Fe, Cu, Mn, Na, Ca and Mg) of leaf and bulb of the plant grown two planting time were given in Tables 1 and 2, respectively.

Nitrogen content: There were significant differences in terms of nitrogen content of leaf between planting times. But, there were no significant differences in bulb in that situation (Tables 1 and 2).

Phosphorus content: Effects of planting time on phosphorus content of leaf was significant between the planting times. However, it was not significant at bulb of the plant grown in this condition (Tables 1 and 2).

Potassium content: Potassium content of bulb was significantly affected from the planting times. But, there was no significant differences in terms of the planting time in leaf (Tables 1 and 2).

Zinc content: Zinc contents of leaf and bulb were significantly affected from the planting times (Tables 1 and 2).

Iron content: Iron contents of leaf and bulb were also significantly affected from the planting times (Tables 1 and 2).

Cupper content: Copper contents of leaf and bulb were not significantly influenced from planting time (Tables 1 and 2).

Manganese content: Planting times significantly affected manganese contents of bulb. However, it was not significant at leaf of the plant grown in this condition (Tables 1 and 2).

Sodium content: Sodium contents of leaf and bulb were not significantly influenced from planting time (Tables 1 and 2).

Calcium content: Effects of planting time on calcium contents of leaf and bulb were not statistically significant (Tables 1 and 2). However, the highest calcium content of leaf and bulb was obtained from second planting times.

Magnesium content: Similarly, planting times were not significantly effective on magnesium contents of leaf and bulb (Tables 1 and 2).

Plants require mineral nutrient (macro and micro) elements for growth. The elements that are required or necessary for plants to complete their life cycle are called essential plant nutrients. All plants, whether they are grown in soil or with hydroponics require a balance of nitrogen, phosphorous and potassium (N-P-K) and trace elements to grow properly. These nutrients are available to plants in soil in small amounts, but over time they get depleted and need to be supplied separately to make up the deficit. In growing media, it is important to ensure that plants get the right nutrients in the right amounts. Plant mineral contents are especially depending on plant species and its growing condition such as using of mineral nutrient.

The parts of the plants analyzed in the present study were found to contain significant quantities of a variety of essential nutrients. Data obtained from fennel plants showed that they had a very high nutritional potential especially in terms of N, P, K, Zn, Fe, Cu, Mn, Na, Ca and Mg (Tables 1 and 2) when compared to some cultivated vege-tables (Table-3). All nutritional elements are important for human health; however some of them are highly important. For instance, calcium, which is important for bone growth and muscle[6], iron, requiring for haemoglobin formation and also Anaemia, a problem due to hookworms and iron defici-ency[7] and similarly zinc, a trace mineral that is especially important for the normal functioning of the immune system, was relatively abundant in fennel plant.

TABLE-1
MACRO AND MICRO ELEMENT CONTENTS OF LEAVES

Planting time	N (%)	P (ppm)	K (ppm)	Zn (ppm)	Fe (ppm)	Cu (ppm)	Mn (ppm)	Na (ppm)	Ca (ppm)	Mg (ppm)
1th Planting	4.12 a*	227.40 b**	4112.50 ns	7.74 b**	817.55 b*	0.80 ns	14.25 ns	959.63 ns	8955.38 ns	1309.00 ns
2nd Planting	3.60 b	350.16 a	4167.50	15.93 a	1519.43 a	1.11	16.15	1176.85	9818.75	1309.00
LSD (0.05)	0.33	34.41		3.18	332.00					

*Significantly important at $p < 0.05$; **Significantly important at $p < 0.01$; ns: Not Significant

TABLE-2
MACRO AND MICRO ELEMENT CONTENTS OF BULB

Planting time	N (%)	P (ppm)	K (ppm)	Zn (ppm)	Fe (ppm)	Cu (ppm)	Mn (ppm)	Na (ppm)	Ca (ppm)	Mg (ppm)
1th Planting	2.49 ns	259.63 ns	3642.50 b*	11.55 b*	785.40 b**	0.96 ns	3.56 b**	1254.38 ns	6930.50 ns	1303.50 ns
2nd Planting	2.71	255.71	4258.50 a	16.22 a	1710.00 a	1.11	11.21 a	1237.65	7473.25	1303.50
LSD (0.05)			399.50	2.86	44.54		1.44			

*Significantly important at $p < 0.05$; **Significantly important at $p < 0.01$; ns: Not Significant

TABLE-3
MINERAL CONTENT OF SOME SELECTED CULTIVATED VEGETABLES (Turan et al., 2003)

Vegetable species	N %	mg 100 g^{-1} Dw							
		P	K	Ca	Mg	Fe	Cu	Zn	Mn
Spinach	0.35	28	230	160	34	1.6	0.01	0.50	0.5
Radish	0.57	44	370	100	26	3.8	0.01	0.50	0.5
Pepper	0.46	80	220	30	24	1.2	0.01	0.40	0.5
Lettuce	0.13	28	220	28	6	0.7	0.01	0.20	0.3
Cabbage	0.16	25	120	33	4	0.3	0.01	0.30	0.2
Broccoli	0.50	57	170	40	13	1.0	0.02	0.40	0.2
Celery	0.15	63	330	40	63	0.7	0.03	0.30	0.1
Asparagus	0.26	50	220	25	13	0.6	0.08	0.08	0.2

The present study reveals that fennel vegetable species had a very high nutritional potential and its nutritional value was greater than that of some cultivated vegetables (Table-3). In general, N, P, K, Zn, Fe, Cu, Mn, Na, Ca and Mg contents of leaf and bulb were relatively abundant in fennel vegetable species. Therefore, it may provide a source of macro and micro minerals and they contribute to taste and colour diets. As a result, fennel vegetable species could be important alternative plant species for the region and the best time to grow fennel was the second planting time in terms of high nutritional value.

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