

Determination of Feed Nutritive Value of *Smyrniium cordifolium* Boiss in Animal Nutrition

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Abstract: *Smyrniium cordifolium* boiss is a range plant belonging to the umbelliferae family. The leaves' colors are light green with yellow color flowers. The roots, stems and leaves contain strongly odored phenolic essence. This plant is used by people as a herbal medicine and as a feed by herbivorous animals. This study was conducted to determine different important nutritional values; Dry Matter, Crude Protein, Crude Fiber, Ether Extract, Crude Ash, Neutral Detergent Fiber, Acid Detergent Fiber and Gross Energy for three growth stages (vegetative, mid-bloom and mature) and also three different growing regions of *Smyrniium Cordifolium* as animal feed. Completely randomized experimental design with 3 treatments and 3 replicates in each treatment was used. The chemical composition analyzed according to AOAC (2005) procedures and neutral detergent fiber (NDF), acid detergent fiber (ADF) was analyzed according to standard method. The results showed that as the plant grew, the amounts of Crude Protein, Crude Ash and the Ether Extract, decreased. The highest percentages of these values were 22.4, 12.4 and 1.2 respectively in vegetative stage and the lowest were 4.8, 6 and 1.07 percent in mature stage respectively ($P < 0.05$). Dry Matter, Crude Fiber, Neutral Detergent Fiber and, Acid Detergent Fiber and Gross Energy were increased. The lowest numbers measured were 92.7, 11.2, 15.7, 12.3% and 4188 kcal/Kg in vegetative stage and the highest amounts were 95.5, 25.7, 38.8, 27.6% and 4268.4 kcal/Kg in mature stage respectively where they showed significant difference. This study showed that this plant contain its highest nutritive value in its vegetative stage.

Key words: *Smyrniium cordifolium* • Nutritive value • Vegetative • Mid-bloom • Mature growing stages

INTRODUCTION

Range plants have important roles in animal nutrition for providing energy, protein, minerals and vitamins. *Smyrniium cordifolium* is one of the range plants in native pasture in mid-south of Iran especially in Kohgiluyeh and Bovir Ahmad province (south west of Iran). Genus *Smyrniium* belongs to Umbelliferae family and is used by people as a herbal medicine in treatments for internal organ edema, especially in bladder and kidney problems. The leave's color is light green with colored flowers. The roots, stems and leaves contain strongly odored phenolic essence [1]. However, there is limited information about this plant but Khanahmadi *et al* studied the antioxidant and antibacterial activities of ethanol soluble compounds in extracts from the aerial parts of fresh plants of *Smyrniium cordifolium* Boiss and reported that the extracts of this plant contain antioxidant and

antibacterial activities which show the ability of inhibiting Gram positive bacteria significantly higher than Gram negative ones[2]. In another study reported that essential oils obtained from stem leaves, roots and fruit of *Smyrniium cordifolium* have antibacterial effects, which they claim are due to the large amounts of sesquiterpene hydrocarbons such as curzerene, curzerenone and germacrone [1]. Some researchers reported that only a few reports on the analysis of essential oils of *Smyrniium* species have been published [3].

Among the extracted compounds, sesquiterpens, monoterpens, lactones, flavonoids and acid folic were reported as major constituents of essential oils for seven genius of this species. The essential oils obtained from some species of Umbelliferae family such as *Psammogeton canescens* have shown antimicrobial activity against both Gram-positive and Gram-negative bacteria [4]. Other studies revealed that extractions from

ome species of this family (*Anethum graveolens*, *Foeniculum vulgare*, *Trachyspermum ammi*, *Ferula halophila*, *Seseli gummiferum*, *S. resinosum* and *S. hartvigii* have antimicrobial activity against *Staphylococcus aureus*, *Salmonella thyphi*, *Salmonella thyphimurium*, *Shigella flexneri*, *Klebsiella pneumonia*, *Vibrio cholera*, *Pseudomonas aeruginosae*, *Escherichia coli*, *Bacillus subtilis* and *Candida albicans* [5,6].

The aim of this study was to determine the nutritive value of *Smyrniun cordifolium* in different growth stages and sites. The plant harvested at vegetative, mid-bloom and mature stages and used for measurement of its chemical composition.

MATERIALS AND METHODS

Three growth stages of *Smyrniun cordifolium* were examined at vegetative, mid-bloom and mature in three regions of Kohgiluyeh and Bovir Ahmad Province (southwest of Iran). The locations of the collected samples were 30° 41' N and 51° 35' E at altitude 2018 m, 30° 41' N and 51° 36' E at altitude 1959 m and 30° 39' N and 51° 38' E at altitude 2181-2196 m above mean sea level.

Samples were hand cut with scissors at 2.0 cm height randomly. The first cut was in March at the plant's vegetative growth stage, another one in April at mid-bloom stage and a third one in mature stages when the plant carried its seeds in May 2010. The samples were dried in the shade and were prepared by grinding to 2.0-millimeter length and sent to the laboratory for measuring their Dry Matter, Crude Protein, Crude Fiber, Ether Extract, Crude Ash, Neutral Detergent Fiber, Acid Detergent Fiber and Gross Energy.

The samples were oven-dried to constant weight at 105°C for determination of dry matter (DM) crude protein (CP), ether extract (EE), crude fiber (CF) and ash content

were as outlined by AOAC [7]. Neutral detergent fiber (NDF), acid detergent fiber (ADF) was analyzed by Van Soest *et al.* procedure [8]. The GE was determined using an adiabatic calorimeter bomb (IKA C7000, Staufen, Germany). Experimental design used was a CRD with 3 treatments and 3 replication within each treatment. Data were analyzed, using GLM procedure of SAS [9] and the mean values were compared by using the Duncan Test.

RESULTS

Statistical analysis and comparison means (\pm SE) of chemical composition of *Smyrniun cordifolium* in three stages of growth in different regions are shown separately in Tables 1-6. Data in Table 1 shows that there are significant differences ($P \leq 0.05$) between the amounts of Dry Matter, Crude Protein, Crude Fiber, Ether Extract, Crude Ash, Neutral Detergent Fiber, Acid Detergent Fiber and Gross Energy in three growth stages (vegetative, mid-bloom and mature) in region 1. Crude Protein, Ether Extract and Crude Ash were decreased from vegetative to mature stage. The highest percentage of these values with 21.58, 12.57, 1.3 percent respectively in vegetative stage were significantly different with comparisons to the lowest values, 7.18, 5.87, 1.21 percent in mature stage. Dry Matter, Crude Fiber, Neutral Detergent Fiber and, Acid Detergent Fiber and Gross Energy were increased. The lowest numbers measured were 93.23, 10.30, 14.80, 12.20 percent and 4143 kcal per kg in vegetative stage and the highest amounts were 95.83, 26.80, 40.30, 29.10 percent and 4348 kcal per kg in mature stage respectively where they showed significant differences.

Data in Table 2 indicates that in region 2 there are significant differences between Dry Matter, Crude Protein, Crude Fiber, Ether Extract, Crude Ash, Neutral Detergent Fiber and Acid Detergent Fiber contents of this plant in

Table 1: Comparison means (\pm Se) of chemical analysis in three stages of phonology in region 1

Stages	DM	CP	Ash	EE	CF	NDF	ADF	GE
Growing	93.23 \pm 0.03c	21.58 \pm 0.26a	12.57 \pm 0.04a	1.30 \pm 0.05a	10.30 \pm 0.05c	14.80 \pm 0.46c	12.20 \pm 0.34c	4143 \pm 25.98c
Flowering	95.30 \pm 0.05b	11.53 \pm 0.08b	7.67 \pm 0.01b	0.95 \pm 0.02b	17.90 \pm 0.40b	26.80 \pm 0.23b	20.10 \pm 0.17b	4410 \pm 10.39a
Seed yielding	95.83 \pm 0.03a	7.18 \pm 0.10c	5.87 \pm 0.01c	1.21 \pm 0.12a	26.80 \pm 0.0a	40.30 \pm 0.17a	29.10 \pm 0.05a	4348 \pm 40.41b

DM (Dry matter), CP (Crude protein), Ash (Minerals), EE (Ether Extract), CF (crude Fiber), NDF (Neutral Detergent Fiber), ADF (Acid Detergent Fiber), GE (Gross Energy), SE (standard error), Values with different letters in the same row are significantly different from $P \leq 0.05$.

Table 2: Comparison means (\pm Se) of chemical analysis in three stages of phonology in region 2

Stages	DM	CP	Ash	EE	CF	NDF	ADF	GE
Growing	92.76 \pm 0.03c	24.16 \pm 0.19a	12.12 \pm 0.21a	1.68 \pm 0.12a	10.90 \pm 0.17c	15.70 \pm 0.63c	11.80 \pm 0c	4327.67 \pm 6.06b
Flowering	94.06 \pm 0.54b	9.32 \pm 0.06b	7.17 \pm 0.01b	0.79 \pm 0.05b	0b23.40 \pm	32.60 \pm 0.23b	23.50 \pm 0.05b	4414.33 \pm 5.48a
Seed yielding	95.96 \pm 0.08a	3.74 \pm 0.22c	5.87 \pm 0.12c	1.34 \pm 0.20ab	25.30 \pm 0.51a	38.40 \pm 0.57a	27.40 \pm 0.34a	4353.00 \pm 18.47b

DM (Dry matter), CP (Crude protein), Ash (Minerals), EE (Ether Extract), CF (crude Fiber), NDF (Neutral Detergent Fiber), ADF (Acid Detergent Fiber), GE (Gross Energy), SE (standard error), Values with different letters in the same row are significantly different from $P \leq 0.05$

Table 3: Comparison means (\pm Se) of chemical analysis in three stages of phonology in region 3

Stages	DM	CP	Ash	EE	CF	NDF	ADF	GE
Growing	92.23 \pm 0.03c	21.59 \pm 0.31a	12.60 \pm 0.23a	0.64 \pm 0.10a	12.10 \pm 0.05c	16.8 \pm 0.11c	13.10 \pm 0.05c	4093.33 \pm 8.37b
Flowering	94.40 \pm 0.17b	14.62 \pm 0.58b	8.75 \pm 0.02b	0.53 \pm 0.07a	15.60 \pm 0b	20.6 \pm 0b	17.30 \pm 0.17b	4138.33 \pm 27.71a
Seed yielding	95.00 \pm 0a	3.74 \pm 0.22c	6.35 \pm 0c	0.68 \pm 0.04a	25.20 \pm 0.11a	37.7 \pm 0.63a	26.50 \pm 0.40a	4104.33 \pm 12.41ab

DM (Dry matter), CP (Crude protein), Ash (Minerals), EE (Ether Extract), CF (crude Fiber), NDF (Neutral Detergent Fiber), ADF (Acid Detergent Fiber), GE (Gross Energy), SE (standard error), Values with different letters in the same row are significantly different from $P \leq 0.05$

Table 4: Comparison means (\pm Se) of chemical analysis in growing stage in different regions

Region	DM	CP	Ash	EE	CF	NDF	ADF	GE
1	93.23 \pm 0.03a	21.58 \pm 0.26b	12.57 \pm 0.04a	1.30 \pm 0.05b	10.30 \pm 0.05c	14.80 \pm 0.46a	12.20 \pm 0.34b	4143 \pm 25.98b
2	92.76 \pm 0.03b	24.16 \pm 0.19a	12.12 \pm 0.21b	1.68 \pm 0.12a	10.90 \pm 0.17b	15.70 \pm 0.63a	11.80 \pm 0b	4327.6 \pm 6.06a
3	92.23 \pm 0.03c	21.59 \pm 0.31b	12.60 \pm 0.23a	0.64 \pm 0.10c	12.10 \pm 0.05a	16.8 \pm 0.11a	13.10 \pm 0.05a	4093.33 \pm 8.37c
Average	92.7	22.4	12.4	1.2	11.1	15.7	12.3	4188

DM (Dry matter), CP (Crude protein), Ash (Minerals), EE (Ether Extract), CF (crude Fiber), NDF (Neutral Detergent Fiber), ADF (Acid Detergent Fiber), GE (Gross Energy), SE (standard error), Values with different letters in the same row are significantly different from $P \leq 0.05$

Table 5: Comparison means (\pm Se) of chemical analysis in flowering stage in different regions

Region	DM	CP	Ash	EE	CF	NDF	ADF	GE
1	95.30 \pm 0.05a	11.53 \pm 0.08b	7.67 \pm 0.01b	0.95 \pm 0.02a	17.90 \pm 0.40b	26.80 \pm 0.23b	20.10 \pm 0.17b	4410 \pm 10.39a
2	94.06 \pm 0.54a	9.32 \pm 0.06c	7.17 \pm 0.01c	0.79 \pm 0.05ab	0a23.40 \pm	32.60 \pm 0.23a	23.50 \pm 0.05a	4414.33 \pm 5.48a
3	94.40 \pm 0.17a	14.62 \pm 0.58a	8.75 \pm 0.02a	0.53 \pm 0.07b	15.60 \pm 0c	20.6 \pm 0c	17.30 \pm 0.17c	4138.33 \pm 27.71b
Average	94.5	11.8	7.8	0.75	19.6	26.6	20.3	4320.8

DM (Dry matter), CP (Crude protein), Ash (Minerals), EE (Ether Extract), CF(crude Fiber), NDF (Neutral Detergent Fiber), ADF (Acid Detergent Fiber), GE (Gross Energy), SE (standard error), Values with different letters in the same row are significantly different from $P \leq 0.05$

Table 6: Comparison means (\pm Se) of chemical analysis in seed yielding in different regions

Region	DM	CP	Ash	EE	CF	NDF	ADF	GE
1	95.83 \pm 0.03a	7.18 \pm 0.10a	5.87 \pm 0.01b	1.21 \pm 0.12a	26.80 \pm 0a	40.30 \pm 0.17a	29.10 \pm 0.05a	4348 \pm 40.41a
2	95.96 \pm 0.08a	3.74 \pm 0.22b	5.87 \pm 0.12b	1.34 \pm 0.20aa	25.30 \pm 0.51b	38.40 \pm 0.57ab	27.40 \pm 0.34b	4353.00 \pm 18.47a
3	95.00 \pm 0b	3.74 \pm 0.22b	6.35 \pm 0a	0.68 \pm 0.04a	25.20 \pm 0.11b	37.7 \pm 0.63b	26.50 \pm 0.40b	4104.33 \pm 12.41b
Average	95.5	4.8	6	1.07	25.7	38.8	27.6	4268.4

DM (Dry matter), CP (Crude protein), Ash (Minerals), EE (Ether Extract), CF(crude Fiber), NDF (Neutral Detergent Fiber), ADF (Acid Detergent Fiber), GE (Gross Energy), Se (standard error), Values with different letters in the same row are significantly different from $P \leq 0.05$

its three phonology stages. Crude Protein, Ether Extract and Crude Ash were decreased from vegetative to mature stage. The highest percentage of these values measured 24.16, 12.12, 1.68 percent in vegetative stage and the lowest were 3.74, 5.85 and 1.34 respectively in mature stage with significant difference ($P \leq 0.05$). Dry Matter, Crude Fiber, Neutral Detergent Fiber and Acid Detergent Fiber and Gross Energy were increased. The lowest measurements were 92.76, 10.90, 15.70, 11.80 and 4327.67 kcal per kg in vegetative stage and highest were 95.96, 25.30, 38.40, 27.40, 4353 kcal per kg respectively in mature stage and again they had statistical difference ($p < 0.05$).

Data in Table3 shows that there are significant differences ($P \leq 0.05$) between the amounts of Dry Matter, Crude Protein, Crude Fiber, Ether Extract, Crude Ash, Neutral Detergent Fiber and Acid Detergent Fiber in three growth stages vegetative, mid-bloom and mature) in region 3. Crude Protein, Ether Extract and Crude Ash were decreased from vegetative to mature stage. The highest

percentage of these values with 21.59, 12.60, 0.64 percent respectively in vegetative stage were significantly different with compare to the lowest values, 3.74, 6.35, 0.68 percent in mature stage. Dry Matter, Crude Fiber, Neutral Detergent Fiber and, Acid Detergent Fiber and Gross Energy were increased. The lowest numbers measured were 92.23, 12.10, 16.8, 13.10 percent and 4093.33 kcal per kg in vegetative stage and the highest amounts were 95, 25.20, 37.7, 26.50 percent and 4104 kcal per kg in mature stage respectively where they showed significant difference.

These results showed that the plant's growing stages have effective impacts on nutritive values of *Smyrniun cordifolium*. Statistical analysis and comparison means (\pm SE) of separate phonology stages in various regions displayed in tables 4-6 , where differences are shown for Dry Matter, Crude Protein, Crude Fiber, Ether Extract, Crude Ash, Neutral Detergent Fiber and Acid Detergent Fiber ($P \leq 0.05$).

DISCUSSION

Chemical compositions of *Smyrniium cordifolium* plant obtained in different growing stages and from various regions are given in Tables 1-6. Both the region and growing stage had significant ($P<0.05$) effects on the chemical composition of *Smyrniium cordifolium* plant.

Variations in the DM content of the plant during maturation development caused an increasing substitution of crude fiber and other nutrients for moisture content in different parts of the plant. This finding is in agreement with work done by Shamaa *et al.* [10]. On the other hand, the amounts of DM showed significant change in different locations covered in this experiment. This could be due to the soil structure, amount of rain, fertilization and altitude of these sites. These results are in agreement with MacDonald *et al.* [11].

One of the valuable nutrients in forages is Crude Protein and it is shown in this study that the amount of Crude Protein decreased as the plant reached maturity and again the values were significantly different in various sites. This is similar to the findings of Bayble *et al.* [12], where they indicated that as the plant grows, the proportion of the leaves to the stem decreases and therefore the chemical composition of the plant, including the protein content of the leaves' cytoplasm will change accordingly. Also the site conditions have a profound effect on protein variations [10].

Ash is the main source of the minerals in forages. It is shown that the amounts of Ash decreased as the maturity increased and the location difference had significant impact on this value. These results are in agreement with the finding Bayble *et al.* [12]. Ether Extract is amongst the energy providing resources in forages. Results of this study showed that the amounts of Ether Extract decreased in the flowering stage which is due to changes in its chemical composition and had significant variations in different sites due to changes in soil structures. This finding is in agreement with MacDonald *et al.* [11].

The Crude Fiber, Neutral Detergent Fiber and Acid Detergent Fiber are very important nutrients in all forages. This investigation showed that the amounts of these nutrients increased in this plant with maturity stages and obviously, they show significant difference in different sites. Gross Energy (GE) provides the energy for all physiological activities and productions in animals. Our results indicates that seed yielding stage of *Smyrniium cordifolium* plant have high GE which increases during the growing stages and differs significantly in different sites due to the change in its chemical composition. These

results also showed that nutritive values of vegetative stage in all regions had better quality than other stages of growth.

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