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Editorial

Does Alfalfa Stand Up for The Claim "The Father of All Foods"?

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The Arabs called alfalfa (or Lucerne) (*Medicago sativa*) by its grandeur name "The Father of All Foods," and this claim became well-known among the botanists and the herbalists. The name is, of course, in recognition of its nutritive value. Modern science has collaborated this claim by revealing its actual content. Alfalfa, as a plant, is extensively used in animal feed worldwide. However, people can also consume this plant for its nutritive content and potential medicinal effects. The plant is known to contain phytoestrogens, namely coumestrol and apigenin [1]. In the United States, alfalfa has been used to produce hay suitable to maintain the life of livestock such as dairy cattle, mature ruminants, and horses [2]. When compared to other animal feed sources (Rhodes hay, Cynodon pasture, and linseed cake-maize mixture), alfalfa had the highest in Crude Protein (CP) content (approximately 24% vs. 7.5%) [3]. Alfalfa belonged to the plant family Leguminosae (Fabaceae) and was originally native to Iran. However, the plant has been cultivated worldwide since the Roman Empire [4].

Generally speaking, factors that affect a plant's composition include irrigation conditions, exposure to the sun, air quality, the time of harvesting, and soil's pH and its chemical composition, among others [5]. For example, acidic soil (pH < 5.0) is known to affect the plant's growth significantly, and so do toxic concentrations of manganese and aluminum in the soil [6]. Under drought conditions, it was shown that the fraction of CP in the plant was significantly reduced, while that of fiber (Neutral Detergent Fiber NDF and Acid Detergent Fiber ADF) was increased [7]. Studies have also shown that the content of alfalfa in nutritional components decreased as the season progressed from mid-May to early September [8]. In these experiments, researchers have demonstrated a progressive decline in CP by 10 percentage point, while ADF fraction increased by approximately the same percentage point [8]. Processing of alfalfa plant after harvesting by elevated temperatures (30 °C to 100 °C) was shown to chemically degrade various available nutritive fractions, in particular the CP fraction [9]. On the other hand, freezing freshly prepared alfalfa juice in the chest freezer (-25 °C) for 5 days protected against chemical degradation of the plant's various nutrients [10]. The addition of vinasse to the soil resulted in a reduction in the amount of calcium, magnesium, and phosphorous found in alfalfa plant leaves [11].

The nutritive composition profile of alfalfa is found in table 1. As shown, the plant is rich in macronutrients (proteins, fiber, soluble sugars. carbohydrates, starch, and lipids), major minerals (potassium, sodium, calcium, magnesium, manganese, and phosphorous), micronutrients (copper, iron, and zinc), and

vitamins (E, K, and β-carotene). Because of this plethora of nutritive value, the Arabs were correct in naming this plant "The Father of All Foods."

Perhaps, future usage of this plant will be in making alfalfa one of the essential dietary supplements available to the public along with the other multivitamins and minerals already existing on the market to supplement the diet.

Components	Concentration or Percent	Comments	Reference
Antioxidant Capacity (1,1-Diphenyl-2-Picrylhydrazyl) (Trolox equivalents per gram of dry weight)	13.62 mg TE/g	Freeze-dried juice	[5]
Ash (Inorganic Matter)	54 g/kg	Frozen concentrate	[10]
	103 g/kg (early bud) 82 g/kg (late flowering)	Freeze-dried	[9]
	10.45%	Alfalfa forage	[3]
	11.57 g/100 g (harvested in May)	Freeze-dried juice	[5]
	9.84%	Fresh-cut alfalfa forage	[2]
	154.8 g/kg dry matter	Alfalfa forage	[12]
	10.6% dry matter (early bloom)	Alfalfa forage	[13]
	102.3 g/kg	Alfalfa Protein-xanthophyll Concentrate (APC) (in literature also referred to as protein-xanthophyll concentrate-PX or l'Extrait Foliaire de Luzerne-EFL)	[14]
Buffering Capacity mEq HCl 0.5 and 100 g/kg dry matter)	118.1	Alfalfa forage	[12]
Calcium	47.9 g/kg	Frozen concentrate	[10]
	1939.55 mg/100 g (harvested in May)	Freeze-dried juice	[5]
	2.2% dry matter (early bloom)	Alfalfa forage	[13]
	32.9 g/kg	Alfalfa Protein-xanthophyll Concentrate (APC) (in literature also referred to as protein-xanthophyll concentrate-PX or l'Extrait Foliaire de Luzerne-EFL)	[14]
Carbohydrates	62.92 g/100 g (harvested in May)	Freeze-dried juice	[5]
	29.15%	Fresh-cut alfalfa forage	[2]
Copper	26.66 mg/g	Frozen concentrate	[10]
	10.2 mg/kg	Alfalfa Protein-xanthophyll Concentrate (APC) (in literature also referred to as protein-xanthophyll concentrate-PX or l'Extrait Foliaire de Luzerne-EFL)	[14]
Crude Fiber Neutral Detergent Fiber	44.99%-47.63% (% of dry mass; early harvest) 47.74%-49.96% (% of dry weight; late harvest)	Gold Queen alfalfa	[7]
	335.0 g/kg (early bud) 460 g/kg (late flowering)	Freeze-dried	[9]
	49%	Alfalfa forage	[3]
	334.8 g/kg dry matter	Alfalfa forage	[12]
	34.7% dry matter (early bloom)	Alfalfa forage	[13]
	98.5 g/kg	Alfalfa protein-xanthophyll concentrate (APC) (in literature also referred to as protein-xanthophyll concentrate-PX or l'Extrait Foliaire de Luzerne-EFL)	[14]

Acid Detergent Fiber	34.52%-36.51% (% of dry mass; early harvest) 36.23%-39.66% (% of dry weight; late harvest)	Gold Queen alfalfa	[7]
	274 g/kg (early bud) 380 g/kg (late flowering)	Freeze-dried	[9]
	25.3%	Mature alfalfa	[8]
	30.2%	Alfalfa forage	[3]
	262.0 g/kg dry matter	Alfalfa forage	[12]
	27.6% dry matter (early bloom)	Alfalfa forage	[13]
	10.6 g/kg	Alfalfa Protein-xanthophyll Concentrate (APC) (in literature also referred to as protein-xanthophyll concentrate-PX or l'Extrait Foliaire de Luzerne-EFL)	[14]
Crude Protein	18.98%-19.60% (% of dry mass; early harvest) 17.80%-18.19% (% of dry mass; late harvest)	Gold Queen alfalfa	[7]
	522 g/kg	Frozen concentrate	[10]
	220 g/kg (early bud) 171 g/kg (late flowering)	Freeze-dried	[9]
	25.6%	Mature alfalfa	[8]
	23.6%	Alfalfa forage	[3]
	26.97 g/100 g (harvested in May)	Freeze-dried juice	[5]
	284.4 g/kg dry matter	Alfalfa forage	[12]
	24.6% dry matter (early bloom)	Alfalfa forage	[13]
Crude Protein	533.9 g/kg	Alfalfa Protein-xanthophyll Concentrate (APC) (in literature also referred to as protein-xanthophyll concentrate-PX or l'Extrait Foliaire de Luzerne-EFL)	[14]
Dry Matter	175 g/kg (early bud) 241 g/kg (late flowering)	Freeze-dried	[9]
	20.6%	Alfalfa forage	[3]
	21.83%	Fresh-cut alfalfa forage	[2]
	308.6 g/kg	Alfalfa forage	[12]
	910.4 g/kg	Alfalfa Protein-xanthophyll Concentrate (APC) (in literature also referred to as protein-xanthophyll concentrate-PX or l'Extrait Foliaire de Luzerne-EFL)	[14]
Iron	169.02 mg/g	Frozen concentrate	[10]
	20.99 mg/100 g (harvested in May)	Freeze-dried juice	[5]
	497.0 mg/kg	Alfalfa Protein-xanthophyll Concentrate (APC) (in literature also referred to as protein-xanthophyll concentrate-PX or l'Extrait Foliaire de Luzerne-EFL)	[14]
L-canavanine	3.2 mg/kg	Alfalfa Protein-xanthophyll Concentrate (APC) (in literature also referred to as protein-xanthophyll concentrate-PX or l'Extrait Foliaire de Luzerne-EFL)	[14]
Lignin	6.69%	Fresh-cut alfalfa forage	[2]
	5.6% dry matter (early bloom)	Alfalfa forage	[13]

Magnesium	0.7 g/kg	Frozen concentrate	[10]
	1.5 g/kg	Alfalfa Protein-xanthophyll Concentrate (APC) (in literature also referred to as protein-xanthophyll concentrate-PX or l'Extrait Foliaire de Luzerne-EFL)	[14]
Manganese	12.13 mg/g	Frozen concentrate	[10]
	81.8 mg/kg	Alfalfa Protein-xanthophyll Concentrate (APC) (in literature also referred to as protein-xanthophyll concentrate-PX or l'Extrait Foliaire de Luzerne-EFL)	[14]
Moisture	6.81 g/100g	Freeze-dried juice	[5]
Organic Matter	10.15%	Alfalfa forage	[3]
pH	7.1	Alfalfa forage	[12]
Phosphorus	0.32%	Mature alfalfa	[8]
	0.24% dry matter (early bloom)	Alfalfa forage	[13]
	7.9 g/kg	Alfalfa Protein-xanthophyll Concentrate (APC) (in literature also referred to as protein-xanthophyll concentrate-PX or l'Extrait Foliaire de Luzerne-EFL)	[14]
Potassium	6.7 g/kg	Frozen concentrate	[1]
	7.4 g/kg	Alfalfa Protein-xanthophyll Concentrate (APC) (in literature also referred to as protein-xanthophyll concentrate-PX or l'Extrait Foliaire de Luzerne-EFL)	[14]
Sodium	469.54 mg/g	Frozen concentrate	[10]
	204.55 mg/100 g (harvested in May)	Freeze-dried juice	[5]
	0.13 g/kg	Alfalfa Protein-xanthophyll Concentrate (APC) (in literature also referred to as protein-xanthophyll concentrate-PX or l'Extrait Foliaire de Luzerne-EFL)	[14]
Soluble Sugars	210 g/kg	Frozen concentrate	[10]
Starch	48 g/kg	Frozen concentrate	[10]
Total Essential Amino Acids (His, Ile, Leu, Lys, Met, Val, Phe, and Thr)	58.41 mg/g	Freeze-dried juice	[5]
Total Flavonoid Content (Catechin equivalents per gram of dry weight) Total Lipids	2.06 mg CE/g	Freeze-dried juice	[5]
	305 g/kg	Frozen concentrate	[10]
	3.3 g/100 g (harvested in May)	Freeze-dried juice	[5]
	5.37%	Fresh-cut alfalfa forage	[2]
	103.7 g/kg	Alfalfa Protein-xanthophyll Concentrate (APC) (in literature also referred to as protein-xanthophyll concentrate-PX or l'Extrait Foliaire de Luzerne-EFL)	[14]
Total Phenolic Components (Gallic acid equivalents per gram of dry weight)	18.86 mg GAE/g	Freeze-dried juice	[5]
Vitamin E (as α-tocopherol)	428.2 mg/kg	Alfalfa Protein-xanthophyll Concentrate (APC) (in literature also referred to as protein-xanthophyll concentrate-PX or l'Extrait Foliaire de Luzerne-EFL)	[14]
Vitamin K	95.3 mg/kg	Alfalfa Protein-xanthophyll Concentrate (APC) (in literature also referred to as protein-xanthophyll concentrate-PX or l'Extrait Foliaire de Luzerne-EFL)	[14]

Zinc	68.26 mg/g	Frozen concentrate	[10]
	3.32 mg/100 g (harvested in May)	Freeze-dried juice	[5]
	19.4 mg/kg	Alfalfa Protein-xanthophyll Concentrate (APC) (in literature also referred to as protein-xanthophyll concentrate-PX or l'Extrait Foliaire de Luzerne-EFL)	[14]
β-carotene	303.7 mg/kg	Alfalfa Protein-xanthophyll Concentrate (APC) (in literature also referred to as protein-xanthophyll concentrate-PX or l'Extrait Foliaire de Luzerne-EFL)	[14]

Table 1: The chemical composition of alfalfa plant or products.

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