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Mineral contents of some plant seeds assessed as fodder

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Abstract

In this study, mineral contents of some plant seeds assessed as fodder were determined by Inductively Coupled Plasma-Atomic Emission Spectroscopy (ICP-AES). Ca, Mg, K, P, S were the main elements of plant seed samples. While Ca contents of plants change between 138.77 mg/Kg (*Trifolium repens*) and 23497.38 mg/Kg (*Potaryum songisorba*), K contents of samples ranged from 3772.94 mg/Kg (*Festuca pratensis*) and 18773.53 mg/Kg (*Kochia prostrata*). Also, Mg contents of plant seed samples vary between 1451.07 mg/kg (*Festuca pratensis*) and 4179.17 mg/Kg (*Kochia prostrata*), P contents of seed samples were determined between 2167.76 mg/kg (*Kochia prostrata*) and 4601.09 mg/kg (*Trifolium repens*). Ni, Cd and Mo contantes of plant seeds were found low compared with results of other elements. Fe contents of samples changed between 41.71 mg/Kg (*Potaryum songisorba*) and 289.50 mg/kg (*Kochia prostrata*).

Keywords: plant seed, minerals, fodder, ICP-AES

1. Introduction

Accumulation of mineral elements in plants depends on soil properties, total and plant-available amounts of elements, cultivation and fertilization system, climate, as well as plant properties [1-3]. Moreover, various plant species have a different ability to accumulate mineral elements, even if they are grown under the same conditions [3]. Pastures can furnish high quality, low-cost feed for domestic animals. Efficient use of pastures, however, requires very careful planning and good management of both animals and forage crops [4,5]. Total yield, quality and seasonal distribution of forage may be greater importance to the livestock producer. The most important aspect of forage quality is the amount of usable or metabolic energy consumed by the animal. Forage quality is usually measured by the amount and availability of nutrients contained in the forage [6].

Minerals are usually allocated as supplements in dairy cow feeding to avoid deficiency. A range of plant species could thus help to balance the mineral status of the diet [7,8]. There are several advantages to growing grass-legume mixtures in pastures. Grass-legume mixtures will usually result in better forage production and animal performance than will a single species grown alone [4]. The aim of this study was to determine mineral contents of some plant seeds assessed as fodder.

2.Material and Method

2.1.Material

The plant seeds were provided from Department of Field Crop Herbarium, Faculty of Agriculture, Selçuk Unıversity in Konya in Turkey (Table 1). The samples were cleaned, and were dried under clear air conditions. Each sample was ground in a mill, and kept in colour vial till analyses.

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2.2.Methods

2.2.1.Determination of mineral

Plant seeds were dried at 70 ºC in a drying cabinet with air-circulation until they reached constant weight. Later, about 0.5 g dried and ground samples were digested by using 5ml of 65% HNO_3 and 2 ml of 35% H_2O_2 in a closed microwave system (Cem-MARS Xpress). The volumes of the digested plant seeds were completed to 20 ml with ultra-deionized water, and mineral contents were determined by ICP AES (Varian-Vista, Australia) [9].

Working conditions of ICP-AES:

Instrument:ICP-AES (Varian-Vista)
RF Power: 0.7-1.5 kw (1.2-1.3 kw for Axial)
Plasma gas flow rate (Ar): 10.5-15 L/min. (radial) 15 " (Axial)
Auxilary gas flow rate (Ar) :1.5 "
Viewing height: 5-12 mm
Copy and reading time:1-5 s (max.60 s)
Copy time: 3 s (max. 100 s)
Results of the research were analysed for mean±standard deviation (MSTAT C) [10].

3.Results and Discussion

Mineral contents of some plant seeds assessed as fodder are given in Table 2. Ca, Mg, K, P, S were the main elements of plant seed samples. While Ca contents of plants change between 138.77 mg/Kg (*Trifolium repens*) and 23497.38 mg/Kg (*Potaryum songisorba*), K contents of samples ranged from 3772.94 mg/Kg (*Festuca pratensis*) and 18773.53 mg/Kg (*Kochia prostrata*). Also, Mg contents of plant seed samples vary between 1451.07 mg/kg (*Festuca pratensis*) and 4179.17 mg/Kg (*Kochia prostrata*), P contents of seed samples were determined between 2167.76 mg/kg (*Kochia prostrata*) and 4601.09 mg/kg (*Trifolium repens*). Ni, Cd and Mo contantes of plant seeds were found low compared with results of other elements. Fe contents of samples changed between 41.71 mg/Kg (*Potaryum songisorba*) and 289.50 mg/kg (*Kochia prostrata*). Also, Zn contents of plant seeds ranged from 15.47 mg/kg (*Potaryum songisorba*) to 81.75 mg/kg (*Kochia prostrata*). Generally, mineral contents of seed samples changed depending on plant species. Tajeda et al. [11] reported that forage crops should contain at least 0.3% of Ca, 0.2% of Mg, 0.8% of K for ruminants. All the plants contained sufficient amounts of Fe and Zn. *Kochia prostrata* seed accumulated more Ca, Cu, Fe, K, Mg, Mn, S and Zn as compared to the other plants. The changes in element content with maturity are related to the increasing stem to leaf ratio. Leaves are richer in mineral nutrients than stems [12]. Most plants show a similarity in declining nutrient composition with advancing development towards maturation [13-15]. As a result, mineral element contents in the plant seeds were found to be species and family dependent.

Table 1. Plants used in experiment

Cod Numbers	Plant name	Used part
R1	*Festuca arundinacea*	Seed
R2	*Arrhenatherum elatius*	Seed
R3	*Trifolium repens*	Seed
R4	*Korunga*	Seed
R5	*Festuca pratensis*	Seed
R6	*Phleum pratense*	Seed
R7	*Trifolium pratense*	Seed
R8	*Kochia prostrata*	Seed
R9	*Festuca ovina*	Seed
R10	*Dactylis glomerata*	Seed
R11	*Agropyron cristatum*	Seed
R12	*Lolium perene*	Seed
R13	*Agropyron intermedium*	Seed
R14	*Potaryum songisorba*	Seed

Table 2. Mineral contents of some plant seeds assessed as fodder (mg/Kg)

	Ni	Cd	Mo	Ca	B	Cu	Fe	K	Mg	Mn	Na	P	S	Zn
R-1	1.15 ±0.09*	0.08 ±0.03	-**	1275.35 ±1.45	2.89 ±0.24	5.54 ±0.37	178.55 ±1.56	5432.49 ±11.36	1907.34 ±5.47	49.30 ±1.98	48.74 ±1.32	3324.17 ±10.32	1745.40 ±2.46	23.63 ±0.46
R-2	2.10 ±0.11	0.02 ±0.01	0.42 ±0.09	399.24 ±2.11	4.40 ±0.32	5.45 ±0.21	47.43 ±3.28	4895.69 ±26.58	1137.33 ±8.64	40.49 ±1.21	6.32 ±0.67	3090.96 ±13.27	1927.63 ±2.98	18.47 ±0.91
R-3	1.53 ±0.17	0.06 ±0.01	0.63 ±0.11	138.77 ±3.57	13.14 ±0.17	7.65 ±0.13	84.23 ±1.29	9637.46 ±13.78	2000.32 ±3.68	4.47 ±0.97	130.24 ±3.57	4601.09 ±15.87	2008.54 ±1.67	34.11 ±0.93
R-4	6.78 ±0.21	0.09 ±0.03	1.51 ±0.17	5500.32 ±2.67	20.56 ±0.37	7.02 ±0.45	50.23 ±3.78	9738.75 ±21.35	1921.84 ±2.89	18.85 ±0.45	40.22 ±6.59	4353.33 ±12.56	2226.21 ±3.59	17.36 ±0.87
R-5	0.45 ±0.03	0.07 ±0.01	1.95 ±0.19	2381.25 ±6.28	6.32 ±0.56	4.47 ±0.33	80.59 ±2.89	3772.94 ±32.65	1451.07 ±5.76	50.99 ±3.28	14.91 ±1.28	2715.75 ±10.98	1951.99 ±8.29	22.91 ±0.38
R-6	0.32 ±0.01	0.05 ±0.01	1.15 ±0.23	731.21 ±5.23	5.64 ±0.11	5.45 ±0.27	45.42 ±1.76	3871.63 ±18.35	1537.19 ±5.38	60.47 ±1.78	16.42 ±0.97	3552.74 ±19.37	2134.67 ±3.76	32.01 ±0.49
R-7	3.01 ±0.13	0.03 ±0.01	1.41 ±0.09	8913.97 ±6.48	10.76 ±0.19	10.35 ±0.17	110.99 ±5.38	7915.21 ±13.76	1646.92 ±4.39	13.99 ±2.34	31.32 ±1.28	4255.09 ±12.48	2400.86 ±1.55	41.31 ±0.56
R-8	2.29 ±0.24	0.10 ±0.03	0.31 ±0.03	22676.22 ±9.48	42.52 ±0.34	10.49 ±0.48	289.50 ±6.37	18773.53 ±20.36	4179.17 ±7.23	192.52 ±3.78	69.41 ±1.13	2167.76 ±11.49	3149.56 ±2.78	81.75 ±0.73
R-9	2.03 ±0.19	0.08 ±0.01	2.54 ±0.07	1010.71 ±6.71	3.43 ±0.45	9.42 ±0.56	72.95 ±3.89	4133.99 ±17.38	1566.02 ±5.28	10.03 ±0.45	87.32 ±1.21	3721.26 ±13.29	2240.58 ±3.87	32.73 ±0.46
R-10	1.67 ±0.11	0.06 ±0.01	2.22 ±0.13	1365.43 ±3.48	2.94 ±0.26	4.41 ±0.47	60.56 ±5.61	4728.35 ±32.78	1418.96 ±6.39	19.55 ±0.71	55.53 ±2.34	3343.70 ±11.58	1910.99 ±5.91	25.48 ±0.13
R-11	1.05 ±0.09	0.05 ±0.01	1.26 ±0.15	1202.95 ±1.37	2.46 ±0.39	4.36 ±0.35	68.29 ±4.78	5503.82 ±23.48	1562.86 ±4.98	14.58 ±0.75	25.89 ±1.38	3493.50 ±17.39	1949.66 ±2.58	26.80 ±0.32
R-12	2.10 ±0.14	0.06 ±0.03	1.78 ±0.09	1462.32 ±3.29	2.06 ±0.43	5.12 ±0.23	83.12 ±6.46	4209.59 ±19.78	1561.40 ±2.58	13.72 ±0.67	92.10 ±3.28	3810.98 ±21.47	1967.84 ±5.39	24.08 ±0.48
R-13	2.60 ±0.27	0.07 ±0.03	1.79 ±0.11	2655.66 ±7.35	11.40 ±0.62	5.89 ±0.12	84.69 ±4.67	9047.99 ±21.38	1517.44 ±6.39	60.94 ±1.45	24.31 ±1.32	2863.99 ±13.45	1677.17 ±4.37	26.52 ±0.69
R-14	2.15 ±0.13	0.06 ±0.01	0.09 ±0.03	23497.38 ±5.98	13.42 ±0.56	6.07 ±0.26	41.71 ±3.28	6538.69 ±13.78	2896.63 ±5.78	44.76 ±3.27	136.13 ±4.37	2528.36 ±11.69	1271.78 ±2.56	15.47 ±0.53

*mean±standard deviation;**nondetected

Compliance with Ethics Requirements. Authors declare that they respect the journal's ethics requirements. Authors declare that they have no conflict of interest and all procedures involving human / or animal subjects (if exist) respect the specific regulation and standards.

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