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MAGNESIUM SUPPLEMENT OR ADJUSTING DIETARY CATION-ANION BALANCE TO IMPROVE THE UTILIZATION OF WATER HYACINTH HAY BY SHEEP

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SUMMARY

Relationships between mineral contents of water hyacinth (WH) plant samples and water collected from three locations (River Nile at El- Kanater; El-Serw ditch at Domiatte and El-Zomor canal at Giza were studied.

Water hyacinth hay was supplemented with either sodium bicarbonate (WH+ Na) to adjust its dietary cation-anion balance (DCAB) to be similar that of berseem hay or with magnesium oxide (WH+ Mg) to maintain the Mg: K ratio recommended by NRC (1985).

Unsupplemented or supplemented WH were evaluated in comparison with berseem hay (control) in eight metabolism trials using 12 rams. Rougheges were fed either alone without concentrate or with 60% corn grains.

Growth performance of 24 lambs in four groups fed rations composed of 40% roughages and 60% corn was also studied.

There were marked variations in the proportion of the plant (leaf, stem and root) as well as the chemical composition depending on the sampling location. Mineral contents of WH tissues were much higher than those in water.

Nutrient digestibilities of WH hay as a sole feed showed comparable values to that of berseem hay except the lower crude fiber digestibility of WH hay. Adjusting DCAB or potassium detoxification had no significant effect on nutrient digestibilities of WH hay fed alone but the treatments improved the digestibilities of DM, OM, CF and NFE when WH hay was fed with corn.

Lambs fed unsupplemented or supplemented WH hay with corn showed poor growth performance (lower feed intake, body weight gain and efficiency) compared to the berseem hay fed lambs.

Keywords: Sheep, water hyacinth, cation-anion balance, magnesium supplement

INTRODUCTION

Water hyacinth (*Eichhornia crassipes*) was introduced to Egypt as ornamental plants. But nowadays, these plants represent great problems, they block water ways, damage the canal walls, increase loss of water, restrict movement and feeding of fish and cause hygienic dubious fastening the breeding grounds for disease carriers. On the other hand, water hyacinth was reported as an environment cleaner through its high capacity to uptake the minerals specially heavy metals from the water.

In Egypt, water hyacinth have been controlled by different ways i.e. mechanical, chemical and biological methods. However, the most effective control methods is to find out an alternative use for water hyacinth. Therefore, numerous attempts were made to utilize water hyacinth as a feed for ruminants (El-Serafy *et al.*, 1980 a& b; Borhami *et al.*, 1989 and 1991; Abdelhamid and Gabr 1991 a & b Abou Raya *et al.*, 1980; Ahmed *et al.*, 1992) but its high content of various anti-nutritional factors make it unpalatable and less consumable. It may also cause severe clinical symptoms and death due to the potassium toxicity (Dutta *et al.*,1984 and Mishra *et al.*, 1987).

The present study suggested two approaches to decrease the potassium toxicity of water hyacinth which is considered the main constraint for its use as ruminant feed. The first was to feed water hyacinth in an adjusted dietary cation-anion balance (DCAB). This approach is based on that the absorption and metabolism of an element depends on the biological interactions with other minerals in finishing swine (Hydon *et al.*, 1990) or dairy cows (Jackson *et al.*, 1992). The second approach was to utilize the antagonistic relationship between potassium and magnesium to reduce potassium toxicity (NRC, 1985).

The objectives of the present study were to verify water hyacinth capacity to trap the mineral specially the heavy metal from water through the study of relationship between mineral concentration in both water hyacinth tissue and water, and to reduce potassium toxicity of water hyacinth by adjusting the DCAB or by magnesium supplement.

MATERIALS AND METHODS

A. Relationship between minerals in water and water hyacinth tissues.

Samples of water and water hyacinth were collected from three locations, River Nile at El-Kanater, El-Serw ditch, Domiatte Governorate and El-Zomor canal, Giza Governorate. Plants from each location were deviled into leaves, stem and roots, weight of plants and their portions were weighed, dried, ground and kept for later analysis. Concentrations of sodium (Na), potassium (K), calcium (Ca), magnesium (Mg), iron (Fe), copper (Cu), zinc (Zn) and manganese (Mn) were determined by Atomic Absorption spectrophotometer, phosphorus (P) was determined by the molybdate- vanadate methods (A.O.A.C. 1980) and chloride (Cl) was determined using silver nitrate method (Piper, 1947).

B. Treatments of WH hay

Twenty tones of fresh whole plant water hyacinth were collected from Sannor, Beni-Suef Governorate, dried in thin layers on polyethylene sheets for three weeks to reduce the moisture content to 12%.

1. Adjustment of DCAB of WH hay

The DCAB was calculated using the formula suggested by Mongin (1981) as follows:

$$DCAB = (K^+ + Na^+) - Cl^-$$

The DCAB (m. eq./100 g) of WH hay was found to be 21.4. It was adjusted to be comparable to that of berseem hay (55.57) by adding sodium bicarbonate (5.5 Kg/ 100 Kg dried water hyacinth). Sodium bicarbonate was dissolved in 10 liter water and sprayed on WH hay.

2. Magnesium supplement

Magnesium oxide was added at rate of 720g/100 Kg DM of WH hay to maintain the ratio between potassium to magnesium as 4.3:1 as recommended by the NRC (1985).

C. Nutritive evaluation of WH hay

Two consecutive sets of digestion trails were conducted each with twelve mature Ossimi rams of 45 Kg body weight in four groups each of three animals. Animals in the first experiment were *ad libitum* fed the four following rations:

1- Berseem hay (BH)
2- Water hyacinth hay (WH)
3- Water hyacinth hay with sodium bicarbonate (adjusted DCAB), (WH+Na)
4-Water hyacinth hay with magnesium oxide (WH+Mg)

In the second experiment, the same animal groups were fed *ad libitum* the previous four feeds with 60% yellow corn in rations of 40:60 roughage: concentrate ratio. Chemical composition of the experimental rations are shown in Table 1.

Table 1. Chemical composition of the experimental rations.

Item	Without corn				With corn			
	BH	WH	WH+ Na	WH+ Mg	BH	WH	WH+ Na	WH+ Mg
DM(%)	89.87	88.65	87.64	88.65	89.19	89.08	90.82	89.22
DM composition, %								
OM	89.48	74.66	73.20	73.59	93.01	84.02	80.48	80.97
CP	15.32	8.20	8.22	8.27	11.26	8.37	8.20	8.38
EE	2.62	1.74	1.77	1.76	3.10	2.12	2.25	2.21
CF	24.77	19.60	20.23	19.46	14.57	7.89	7.69	9.62
NFE	46.77	45.12	42.98	44.10	64.08	65.64	62.34	60.76
Ash	10.52	25.34	26.80	26.41	6.99	15.98	19.52	19.03

Each digestion trial lasted for 15 days preliminary and 7 days total collection periods. Daily *ad libitum* feed intake was determined. Urine samples were kept in two separate containers, one in sulfuric acid for nitrogen analysis and the other with no preservants being kept frozen for other mineral analyses. Nutritive and mineral analyses for different samples were performed according to the A.O.A.C (1980).

D- Growth performance trial

Twenty-four Ossimi lambs, five month old with initial average body weight of 22 kg were randomly distributed in four similar groups, six of each. Lambs were *ad libitum* fed the four experimental rations consisting of 40% roughage and 60% yellow corn for 24 weeks. Daily DM intake, average daily body weight gain (ADG) and feed efficiency were measured at 2 week intervals.

Data collected were statistically analyzed as one-way analysis of variance (Steel and Torrie, 1980) according to the following model:

$$Y_{ij} = \mu + X_i + E_{ij}$$

where

Y_{ij} = Observation

μ = Overall mean

X_i = Effect of feeding treatment (i= 1-4)

E_{ij}= Random error

Duncan's Multiple Range Test was applied to compare means when the main effect of treatment was significant.

RESULTS AND DISCUSSION

A. Relationship between minerals in water and water hyacinth tissues.

Concentrations of all studied minerals in water hyacinth tissues were much higher than those in water samples. Stems contained higher levels of Na, K, Cl, Ca and Mg than leaves and roots. However, the heavy metals showed higher concentrations in roots than the top of the WH plant (Table 2). The ability of WH to trap heavy metals have been extensively applied in Zimbabwe (Zaranyika and Ndapwadza, 1995) and Akcin *et al.* (1994) used WH to control water pollution in Turkey.

B. Composition of water hyacinth

Fresh water hyacinth plant consisted. of 11.97 % leaf, 48.52 % stem and 39.42.%.The corresponding percentages on dry matter basis were 18.59 %, 32.26% and 49.03%.and 39.42%, respectively. The differences in the composition of fresh and dry water hyacinth were due to the variation of water content of its parts. Sampling location had great effect on the plant proportions (Table 3). Samples collected from River Nile were characterized by higher stem but lower root proportions than those collected from the smaller water canals (El-Serw ditch and El-Zomor canal).

Water hyacinth leaves contained more DM, OM, CP and EE than stem which had more in CF and NFE percentages. However, roots showed the highest ash content. Results in Table 4, also showed that the chemical composition of water hyacinth varied according to sampling location. This result agreed with the findings of El-Serafy *et al.* (1980a); Hathout *et al.* (1980) and Abdelhamid and Gabr (1991a).

C. Nutritive evaluation of WH hay

1 - Nutrient digestibilities

The nutrient digestibilities of WH hay as a sole roughage showed comparable values to those of berseem hay except the lower CF digestibility of WH hay. Adjusting DCAB by sodium bicarbonate supplement or reducing potassium toxicity by adding magnesium oxide had no significant effect on the nutrient digestibility of WH hay fed alone (Table 5). However these treatments improved the nutrient digestibilities of DM, OM, CF and NFE when WH hay was fed with 60% corn. The nutrient digestibilities of the rations containing hay and corn were higher than those containing berseem hay or WH hay alone. The improvement in the nutrient digestibilities of the ration of treated WH and corn might be due to that sodium bicarbonate and magnesium oxide act as buffer in the rumen of sheep fed 60% corn and 40% berseem hay or WH hay.

These results agreed with those found by El-Bedawy *et al.* (1989) on dairy goats and Hydon and West (1990) on growing pigs.

Table 2. Relationship between mineral concentrations (ppm) in water and fresh water hyacinth tissues.

Location		Water	Water hyacinth		
			Leaves	Stems	Roots
Sodium					
River Nile	(N)	14.20	455	330	258
El-Serw ditch	(S)	190.67	142	1076	725
El-Zomor canal	(Z)	22.20	102	270	277
Potassium					
	N	8.14	5667	2742	5022
	S	8.85	1222	760	1560
	Z	7.43	1436	1188	5725
Chloride					
	N	54.10	3455	7878	1264
	S	64.90	1836	3405	560
	Z	237.90	1342	7745	1079
Calcium					
	N	2.42	1915	1864	486
	S	9.47	487	367	299
	Z	4.40	373	831	782
Magnesium					
	N	9.80	762	835	176
	S	38.83	500	921	798
	Z	11.12	298	842	540
Phosphorus					
	N	0.46	331	181	177
	S	2.56	164	126	103
	Z	0.54	154	389	334
Iron					
	N	0.04	0.18	0.15	2.12
	S	0.01	0.14	0.13	0.99
	Z	0.03	0.09	0.29	2.87
Copper					
	N	0.02	4.37	3.16	6.75
	S	0.03	1.48	1.77	2.53
	Z	0.03	1.38	3.42	13.56
Zinc					
	N	0.04	8.03	6.35	9.09
	S	0.01	3.85	3.11	4.27
	Z	0.02	3.25	1.48	20.54
Manganese					
	N	0.10	36.36	42.82	237
	S	0.19	50.19	78.32	358
	Z	0.11	8.78	34.15	87

Table 3. Proportion percentage of leaves, stems and roots of water hyacinth

Location	Fresh basis			Dry matter basis		
	Leaf	Stem	Root	Leaf	Stem	Root
River Nile	8.89	47.11	44.00	17.94	39.60	42.46
El-Serw ditch	11.18	48.58	40.24	16.82	30.24	52.94
El-Zomor canal	15.85	49.88	34.27	21.00	26.87	52.13
Average	11.97	48.52	39.51	18.59	32.24	49.17

Table 4. Dry matter composition (%) of water hyacinth

Item	DM	OM	CP	EE	CF	NFE	Ash
River Nile							
Leaf	12.08	84.62	19.61	3.68	16.90	44.43	15.38
Stem	5.03	77.83	6.38	2.27	24.54	44.64	22.17
Root	3.78	60.14	6.70	1.59	14.77	37.08	39.86
Plant	5.86	69.64	9.04	2.05	18.19	40.36	30.36
El-Serw ditch							
Leaf	11.62	78.19	17.34	2.77	13.94	44.14	21.81
Stem	4.81	72.72	7.11	2.02	20.49	43.10	27.28
Root	10.61	32.71	3.96	0.93	9.58	18.24	67.29
Plant	7.86	55.18	6.83	1.60	13.34	33.41	44.82
El-Zomor canal							
Leaf	8.78	81.38	20.25	4.55	15.45	41.13	18.62
Stem	3.57	69.35	12.45	1.99	20.71	34.20	30.65
Root	10.08	34.51	9.02	1.66	12.95	10.88	65.49
Plant	5.62	58.10	17.57	2.33	14.07	24.13	41.90

2- Nutritive value

Results in Table 5 also showed that the starch value of WH hay was 30.64% which was comparable to the values reported by Hathout *et al.* (1980), Abdelhamid and Gabr, (1991a) and Kabak (1993) as range from 32.96 to 36.54%. Adjusting the DCAB or potassium detoxification did not improve the nutritive value of WH when it was fed alone but the treatments improved the SV and DCP of the ration containing WH hay and corn. No significant differences in the nutritive values were detected between berseem hay and WH hay when fed in rations containing 60% corn.

3. Dry matter and nutrient intakes

Sheep consumed significantly less DM, SV, TDN and DCP (g/Kg$W^{0.75}$) from WH hay than berseem hay (Table 6). The low DM intake from WH hay might be due to its high ash content (Becker *et al.*, 1987) specially potassium (Mishra *et al.*, 1987) and the depression in its SV, TDN and DCP intake was related to lower DM intake and nutrient digestibilities. Sheep achieved only one third of their energy and protein maintenance requirements (NRC, 1985) when they were fed WH alone either with or without sodium bicarbonate or magnesium oxide supplements.

4. Nitrogen and potassium balances

Table 7 showed the intake, fecal loss, urinary loss and retention of nitrogen and potassium. Sheep fed WH hay alone showed negative nitrogen balance (-.84g/h/day)

Table 5. Nutrient digestibilities and nutritive values of the experimental rations.

Item	Without corn					With corn				
	BH	WH	WH+ Na	WH+Mg	SE	BH	WH	WH+Na	WH+Mg	SE
Digestibility, %										
DM	58.40	56.09	45.56	57.10	2.90	76.60a	59.31b	73.85a	69.19a	2.25
OM	61.41	62.95	55.71	57.73	4.48	77.33a	62.11b	76.31a	74.61a	1.91
CP	64.43a	45.14b	38.62b	43.17b	3.22	60.75a	30.13c	47.10ab	37.27bc	4.09
EE	58.24	45.88	62.96	55.77	3.36	78.08a	76.81ab	67.71b	80.34a	2.75
CF	54.48	55.35	55.44	56.14	2.31	63.49a	40.38b	53.35ab	60.86a	4.03
NFE	64.26	57.25	65.42	61.05	4.28	83.49a	64.21b	82.93a	80.61a	3.98
Nutritive value,%										
TDN	56.52a	42.52b	45.01b	41.89b	2.07	75.42a	51.25c	62.76b	67.58ab	2.94
SV	41.37a	30.64b	32.17b	30.17b	2.20	66.03a	46.17b	57.39a	62.19a	2.88
DCP	9.88a	3.70b	3.40b	3.57b	0.26	6.68a	2.52b	3.86b	3.34b	0.29

a,b,c Means in the same row within each trait having different superscripts differ ($P<0.05$).

Table 6. Dry matter and nutrient intakes (g/KgW$^{0.75}$) by sheep fed the experimental rations.

Item	Without corn					With corn				
	BH	WH	WH+Na	WH+Mg	SE	BH	WH	WH+Na	WH+Mg	SE
DM	56.87a	30.61b	32.37b	28.83b	6.06	68.73	58.24	67.67	63.22	2.39
TDN	32.14a	13.02b	14.57b	12.08b	4.84	51.84a	29.85b	42.45a	42.72a	4.52
SV	23.90a	9.38b	10.64b	8.70b	3.69	46.18a	26.89c	38.82b	39.32ab	4.01
DCP	5.62a	1.31b	1.03b	1.03b	1.13	4.08a	1.47d	2.61b	1.97c	0.57

a,b,c,d Means in the same row within each trait having different superscripts differ ($P<0.05$)

Table 7. Nitrogen and potassium balances (g/h/day) by sheep fed the experimental rations.

Item	Without corn					With corn				
	BH	WH	WH+Na	WH+Mg	.SE	BH	WH	WH+Na	WH+Mg	SE
Nitrogen										
Intake	24.62^{a}	6.96^{b}	7.40b	6.60^{b}	0.91	21.87^{a}	13.50^{b}	15.39^{b}	14.69^{b}	0.82
Fecal	8.76^{a}	3.80^{b}	4.53^{b}	3.75^{b}	0.49	8.56	9.44	8.13	9.20	0.79
Urinary	11.04^{a}	5.00^{b}	4.36^{b}	4.79^{b}	0.45	6.92^{a}	2.93^{b}	3.67^{b}	3.23^{b}	0.83
Balance	4.82^{a}	-1.84^{b}	-1.49^{b}	-1.94^{b}	0.43	6.39^{a}	1.13^{c}	3.59^{b}	2.26^{b}	0.44
Potassium										
Intake	24.01	19.19	20.34	18.00	1.88	17.24^{b}	17.64^{b}	19.00^{b}	22.69^{a}	1.06
Fecal	4.43	5.44	4.58	4.24	0.64	3.74^{c}	8.09^{a}	4.80^{bc}	6.32^{b}	0.48
Urinary	13.22^{a}	3.76^{b}	4.91^{b}	5.48^{b}	1.34	6.43	3.34	5.60	5.13	0.68
Balance	6.36	9.99	10.85	8.28	2.33	7.07	6.21	8.60	11.24	1.15

a,b,c Means in the same row within each trait having different superscripts differ ($P<0.05$)

which was improved to +1.13 g/h/day by feeding WH hay with corn. The improving effect of adjusting the DCAB was more evident than potassium detoxification when WH hay was fed with corn.

Adjusting the DCAB of WH increased the urinary potassium excretion by about 31% when WH hay was fed alone or by 68% when it was fed with corn. The corresponding increases due to magnesium supplement were 46% and 54%. Increasing DCAB was reported to increase urinary potassium (Gaynor *et al.*, 1989; Tucker *et al.*, 1992). Moreover, Durate (1974) found an increase in urinary potassium by increasing dietary manganese.

D- Growth performance trial

Lambs fed berseem hay ration consumed more dry matter and showed higher average daily gain (ADG) than those fed WH ration (Table 8). El-Serafy *et al.* (1980b) found that lambs fed ration containing 16 or 24% WH hay decreased ADG by 10 and 20%, respectively. Sodium or magnesium supplements improved the energy and protein intake of WH rations but decreased the ADG. Therefore, lambs fed the supplemented WH rations showed lower energy and protein utilization efficiency than those fed unsupplemented WH ration.

Table 8. Growth performance of lambs fed water hyacinth hay or berseem hay with corn

Item	BH	WH	WH + Na	WH + Mg
Initial body weight, Kg	22.0	22.0	22.0	22.0
Final body weight, Kg	50.2a	36.3b	33.8b	30.7b
Gain , Kg	28.2a	14.3b	11.8b	8.7b
Average daily gain, g/day:	168	85	70	52
DM intake	1427	942	935	809
TDN intake	1076	483	587	547
SV intake	942	435	537	503
DCP intake	95.3	23.7	36.1	27.0
Feed conversion ratio:				
DM	8.49	11.08	13.36	15.56
TDN	6.40	5.68	8.39	10.52
SV	5.61	5.12	7.67	9.67
DCP	0.57	0.28	0.52	0.52

a,b Means in the same row having different superscripts differ ($P<0.05$)

It was concluded that the proportion and composition of water hyacinth parts are not consistent. They varied according to sampling location. Water hyacinth plant showed great capacity to captivate minerals specially heavy metals from water. The suggested treatments by adjusting the dietary cation-anion balance by sodium bicarbonate supplement or reducing potassium toxicity by magnesium oxide supplement increased the urinary potassium output and improved the nutrient utilization of WH fed with corn but this improvement was not evident by feeding WH without concentrate.

REFERENCES

Abdelhamid, A.M. and A.A. Gabr, 1991a. Utilization of water hyacinth hay in comparison with berseem hay as a sole feed by sheep with emphasis on its hazardous effect. J. Agric. Sci., Mansoura Univ., 16:507-517.

Abdelhamid, A.M. and A.A. Gabr, 1991b. Evaluation of water hyacinth as feed for ruminants. Arc. Anim. Nutr., Berlin, 41:745-756.

Abou Raya A.K., M.K. Hathout, Y. El-Talty and A.M. Abdel-Khabir, 1980. Utilization of water hyacinth as animal feed: II. Evaluation of welted shoots in metabolism trials with sheep with reference to N, Ca, Na, K balances. Agric. Res. Rev., 58:49.

Ahmed S.A., S.M. Mousa and E.A.M. Beddiny, 1992. Variation in certain nutrient contents of water hyacinth and associated molluscs in Assuit area. Proc. National Symposium on Water Hyacinth, pp 41-53. Assuit, 25-26 February 1992

Akcin, G., O. Satabas and H. Afseret,1994. Removal of lead by water hyacinth (*Eichhornia crassipes*). J. Enviromental Science and Health. 29:2177-2183.

A.O.A.C., 1980. Official Methods of Analysis. Association of Official Analytical Chemists. 13 *th* Ed. Washington, D.C.

Becker, K., F. Mahler and C. Gall, 1987. Water hyacinth in animal nutrition. The present situation and new research approches. Anim. Res. Develop. 25: 45.

Borhami, B.E., S.M. Zahran, W.G. Fahmy and A. Somma, 1991. The utilization of protein extraction residues from berseem and water hyacinth for fattening buffalo calves. J. Anim. Sci., 35:440-445.

Borhami, B.E., W. Fahmy, S. Zahran and K. El-Shazly, 1989. Effect of different sources of nitrogen on the utilization of diets containing water hyacinth residues. Alex. J. Agric. Res., 34:1-12.

Durate, C.G., 1974. Magnesium loading in potassium adapted rats. Amer. J. Physiol., 22:482.

Dutta, R.K., B.K. Sahu, N.C. Panda and B.C. Nayak, 1984. Toxic effects of feeding water hyacinth to goats. Indian J. Anim. Sci., 54, 54:594-597.

El-Bedawy, T.M., M.A. Hanafy and A.Higazy,1989. Effect of feeding all-barley diet with or without sodium bicarbonate on the physiological and productive performance of dairy goats. Proc. The 3*rd* Egyptian Conf. On Animal, Fish and Poultry Production. pp. 377-384.,Alex., 7-10 October, 1989.

El-Serafy, A.M., S.M. Allam, M.A. El-Ashry, H.M. Khattab, H.S. Soliman and F.Z. Swidan, 1980a. Utilization of water hyacinth, as silage or hay by ruminants: I. Chemical composition and *in vitro* study on water hyacinth hay. Alex. J. Agric. Res., 28:40-59.

El-Serafy, A.M., S.M. Allam, M.A. El-Ashry, H.M. Khattab, H.S. Soliman and F.Z. Swidan, 1980b. Utilization of water hyacinth as silage or hay by ruminants: II. The effect on lamb performance of replacing berseem hay with different levels of sun dried water hyacinth hay. Alex. J. Agric. Res., 28:61-69.

Gaynor, P.J., F.J. Mudler, J.K. Miller, N. Ramsy, J.P. Coff and R.L. Mosart, 1989. Parturient hypocalcemia in Jersy cow fed alfalfa haylage based diets with different cation to anion ratios. J. Dairy Sci., 72:2525.

Hathout, M.K., A.K. Abou Raya, H.M. El-Nouby, Y. El-Talty and A.M. Abdel-Khabir, 1980. Utilization of water hyacinth as animal feed. 1. Proximate and mineral composition, feeding quality of shoots hay for sheep. Agric. Res. Rev., 58:33-47.

Hydon, K.D. and J.W. West, 1990. Effect of dietary electrolyte balance on nutrient digestibility determined at the end of the small intestine and over the total digestive tract in growing pigs. J. Anim. Sci., 68:3687-3693.

Hydon, K.D., J.W. West and M.N. McCarter, 1990. Effect of dietary electrolyte balance on performance and blood parameters of growing fininshing swine fed in high ambient temperature. J. Anim. Sci., 68:2400-2406.

Jackson, J.A., D.M. Hopkins, Z. Xin and R.W. Hemken, 1992. Influence of cation - anion balance on feed intake, body weight gain, and humral response of dairy calves. J. Dairy Sci., 75:1281-1286.

Kabak, A.N., 1993. Effect of feeding water hyacinth at different levels on animal performance. M.Sc. Thesis, Fac. Agric., Assuit Univ, Egypt.

Mishra, R.M. N.C. Panda, B.K. Sahu and A.T. Rao, 1987. High potassium as incriminting factor in water hyacinth. Indian J. Anim. Sci., 57: 991.

Mongin, P.,1981. Recent advances in dietary anion-cation balance: Application in poultry. Proc. Nutr. Soc. 40:285.

NRC, 1985. Nutrient Requirement of sheep. Sixth revised Ed. National Research Council. National Academy Press. Washington, D.C.

Piper, C.S., 1947. Soil and Plant Analysis. Interscience Publishers Inc., New York, pp 368.

Steel, R.G.D. and J.H. Torrie, 1980. Principles and Procedures of Statistics. Biometric approach, 2 nd ed. McGraw-Hill. kogakusha, Ltd. Tokyo-Japan.

Tucker, W.B., J.F. Hogue and G.D. Adams,1992. Influence of dietary cation-anion balance during the dry period on the occurrence of parturient paresis in cows fed excess calcium. J. Anim. Sci., 70:1238-1250.

Zaranyika, M.F. and T. Ndapwadza, 1995. Uptake of Ni, Zn, Fe,Co, Cr, Pb, Cu and Cd by water hyacinth (*Eichhornia crassipes*) in Mukuvisi and Manyarne rivers, Zimbabwe. J. Environmental Sci. and Health. 30:157-167.

إضافة الماغنسيوم أو ضبط الإتزان الكاتيونى الأنيونى لتحسين استفادة الأغنام من ورد النيل

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درست العلاقة بين ورد النيل والماء المحيط به من حيث محتوى العناصر المعدنية فى ثلاثه مناطق هى مجرى نهر النيل بالقرب من القناطر الخيرية و مصرف السرو بمحافظة دمياط وترعة الزمر بمحافظة الجيزة.

اضيفت كربونات الصوديوم لدريس ورد النيل لضبط الإتزان الكاتيونى الأنيونى ليكون كمثيله فى دريس البرسيم وفى معاملة غذائية أخرى أضيف أكسيد الماغنسيوم الى ورد النيل للحفاظ على نسبة الماغنسيوم :البوتاسيوم الموصى بها.

وتم تقييم دريس ورد النيل الغير معامل أو المعامل بالمقارنه مع دريس البرسيم بصورة منفردة أو فى عليقة تحتوى على ٦٠٪ ذرة من خلال تجارب تمثيل غذائى باستخدام ١٢ كبش.

كما درس نمو ٢٤ حمل فى أربع مجموعات غذيت على دريس البرسيم ، دريس ورد النيل، دريس ورد النيل مضاف اليه بيكربونات الصوديوم ودريس ورد النيل مضاف اليه أكسيد الماغنسيوم كل بنسبة ٤٠٪ مع ٦٠٪ ذرة صفراء.

اوضحت النتائج أن نسبة الأوراق والسيقان والجذور وأيضا التركيب الكيماوى لورد النيل ليس ثابتا ويتغير حسب المنطقة التى يوخذ منها النبات. وأن محتوى ورد النيل من العناصر المعدنية أعلى بكثير من الماء المحيط به مما يدلل على قدرته العالية على تركيز هذه العناصر بأنسجته.

ومن ناحية قيمته الغذائية، لم تختلف معاملات هضم المركبات الغذائية لدريس ورد النيل المغذى بمفرده عن دريس البرسيم فيماعدا معامل هضم الألياف الخام المنخفض فى ورد النيل. وقد حسنت اضافه بيكربونات الصوديوم وأكسيد الماغنسيوم من معاملات هضم المادة الجافة والمادة العضوية والألياف الخام ومستخلص خالى النيتروجين لدريس ورد النيل عندما غذى مع ٦٠٪ ذرة صفراء ولم يظهر هذا التأثير المحسن بتغذية ورد النيل بمفرده.

وقد أظهرت الحملان النامية المغذاه على دريس ورد النيل الغير معامل أو المعامل نموا وكفاءة غذائية أقل من تلك المغذاه على دريس البرسيم