EFFICIENCY OF DIFFERENT SOURCES OF ROUGHAGE ON GROWING PERFORMANCE OF YOUNG HORSES[1]

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ABSTRACT - Twelve colts and twelve fillies aged 11,5 months were housed in individual stalls during 112-day trial and fed with concentrate at the rate of 1% of body weight, roughage and mineralized salt. The treatments consisted of: alfalfa hay (AH) (*Medicago sativa* L.); perennial soybean hay (SH) (*Glycine wightii* Willd.); corn silage (CS) (*Zea mays* L.) and elephant grass (EG) (*Pennisetum purpureum* Schum.) Cv. Vruckwona. The average daily weight gain was 1.19, 0.99, 1.00 and 0.83 kg, respectively. AH and EG treatments were significantly different at 0.05 level. The average growth rate at the withers was 1.92 cm per period of 28 days without any significant difference between treatments ($P > 0.05$). The average hearth girth gain was 5.13, 3.88, 3.42 and 3.92, respectively; the AH treatment was significantly different from the CS treatment at 0.05 level. The dry matter (DM) intake was greater for hay ($P < 0.05$) compared to fresh roughage, respectively: 90.45, 82.04, 34.91 and 35.37 g/day/$kg^{0.75}$. Maximum growth was obtained with AH; however, when fed ad libitum it increased the cost of colt production.

Index words: growth of horses, corn silage, elephant grass, legume hay.

EFICIÊNCIA DE DIFERENTES VOLUMOSOS NA ALIMENTAÇÃO DE EQUINOS EM CRESCIMENTO

RESUMO - Doze potros e doze potras, com 11,5 meses de idade, foram alojados em boxes individuais durante 112 dias e alimentados com concentrado à razão de 1% do peso vivo, mais volumoso e sal mineral. Os tratamentos consistiram de feno de alfafa (FA) (*Medicago sativa* L.), feno de soja perene (FS) (*Glycine wightii* Willd.), silagem de milho (SM) (*Zea mays* L.) e capim-elefante (CE) (*Pennisetum purpureum* Schum.), cultivar Vruckwona. O ganho médio diário de peso vivo foi de 1,19, 0,99, 1,00 e 0,83 kg, respectivamente, com diferença ($P < 0,05$) entre FA e CE. O aumento médio da altura na cernelha foi de 1,92 cm/período de 28 dias, sem diferença ($P > 0,05$) entre os tratamentos. O aumento médio no perímetro torácico foi de 5,13, 3,88, 3,42 e 3,92 cm/período, respectivamente com diferença ($P < 0,05$) entre FA e SM. O consumo de matéria seca (MS) foi de 90,45, 82,04, 34,91, 35,37 g/dia/$kg^{0,75}$, respectivamente, com diferença ($P < 0,05$) entre os fenos e os outros tratamentos. O crescimento máximo foi obtido com FA, contudo quando fornecido à vontade elevou o custo de produção dos potros.

Termos para indexação: crescimento de eqüinos, silagem de milho, capim-elefante, feno de leguminosas.

INTRODUCTION

Growing horses selected for show-jumping demand an extra sources of feed besides pasture to obtain maximum development. Alfalfa hay, traditionally used, is an excellent roughage due to its high nutritional content but it is very expensive tō produce in countries of tropical climate.

Growth rate of jumpers fed only on corn silage was studied by Tosi et al. (1979). They concluded that horses fed on corn silage *ad libitum* and receiving a concentrate as a supplementation obtained good growth performance.

Manzano et al. (1979a) reported that Arabian colts fed either on chopped elephant grass (EG) or Rhodes grass hay (RH) as 40% of the daily ration showed a better performance for the EG treatment. They also noted that this might have occurred due to bad quality of the RH.

Working with Arabian and Mangalarga fillies, Manzano et al. (1979 b) studied the substitution of alfalfa hay by Rhodes grass hay and demonstrated that the alfalfa hay produced a better average daily weight gain than the Rhodes grass hay at. 50 level. On the other hand the economical analysis indicated that the Rhodes grass hay was far better than the alfalfa hay.

The reports above demonstrate the necessity

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for further study of roughages for growing horses in countries of tropical climates.

The proposed experiment intended to evaluate the efficiency of four different types of roughage for growing horses. The dependent variables were weight gain, growth, heartgirth measurement and dry matter intake.

MATERIAL AND METHODS

The experiment took place at the Posto de Eqüideocultura de Colina, Colina, SP, Brazil, a research station of the Instituto de Zootecnia de São Paulo, from August to December of 1978. Twelve colts and twelve fillies of the Brasileiro de Hipismo breed were used. The average age was 11.5 months at the begining of the experiment and with an average weight of 250.04 kg.

Individual stalls were used. The area of each stall was 10.5 m^2, with a roughage, water and mineral supplement fed *ad libitum*. The floor of the stall was cemented and bedded with wood shavings removed every other day.

The rations were: concentrate at the rate of 1% of body weight (checked at every 28 days) fed twice at 7:00 a.m. and 1:00 p.m. Roughage - four treatments ad libitum were checked and weighed twice a day at 9:00 a.m. and 3:00 p.m.

The mineral mixture fed *ad libitum* supplied calcium, phosphorus and the micro mineral required by horses according to the N.R.C. recommendations.

The four roughage types evaluated were; corn silage, alfalfa hay, perennial soybean hay and chopped elephant grass Cv. Vruckwona (Table 1).

The concentrate was a mixture of 50% cracked corn, 30% of wheat meal, 10% of soybean meal and 10% of cracked oats.

The animals went through a twelve - day adaptation

TABLE 1. Feed composition.

Periods	D.M. (%)	C.P.[1] (%)	CF (%)	EE (%)	Ash (%)	NFE (%)
			Concentrate feed			
	90.95	15.28	6.09	2.67	3.36	72.60
			Corn silage			
I	26.23	7.85	22.64	7.02	5.20	57.29
II	26.90	9.86	21.03	9,54	4.80	59.57
III	27.62	9.39	20.99	8.64	4.29	56.69
IV	26.64	10.04	31.88	6.89	5.09	46.10
Average	26.85	9.28	24.14	8.02	4.85	54.91
			Elephant grass			
I	16.95	11.11	29.81	4.11	10.28	44.69
II	17.66	10.47	30.67	4.91	8.50	45.45
III	14.41	10.66	33.22	5.58	10.70	39.84
IV	18.95	9.49	31.45	4.89	10.01	44.46
Average	16.99	10.43	31.29	4.87	9.87	43.61
			Alfalfa hay			
I	89.28	21.52	31.81	4.31	8.70	33.66
II	88.05	15.89	24.46	5.17	6.87	47.61
III	89.45	23.45	25.72	4.95	9.07	36.81
IV	87.81	19.92	31.07	4.91	9.32	34.98
Average	88.65	20.19	28.26	4.79	8.49	38.26
			Perennial soybean hay			
I	90.45	12.51	35.08	3.39	7.51	41.51
II	89.87	9.68	41.70	1.98	3.81	42.83
III	90.20	19.34	31.33	3.10	7.76	38.47
IV	89.54	17.54	32.47	3.36	10.25	36.38
Average	90.01	14.77	35.15	2.96	7.33	39.80

[1] Dry matter basis.

CP = crude protein, CF = crude fiber, EE = ether extract, and NFE = nitrogen free extract.

period, at the end of which they were weighed and measured for three consecutive days and the average values were used.

The experimental period of 112 days started on 10.9.1978 and the animals were measured and weighed every 28 days.

The statistical design was a complete block design with four main treatments and four secondary treatments with three repetitions, per block. The main treatments were a 4-by-2 factorial (four roughages by two sexes) and the secondary treatments were the four periods of 28 days. The treatments' average were analyzed by the Tukey Test.

RESULTS AND DISCUSSION

The average 28 days weight gain is seen on Table 2. The treatments and the four 28-day periods were significantly different at .05 level. There was no statistical difference beteween male and female. The highest weight gain for a 28-day period was achieved with alfalfa hay (33.31 kg) but it was not statistically different from the corn silage (28.08 kg) and perennial soybean hay (27.78 kg) treatments. But it was significantly different from the elephant grass treatment (23.13 kg).

The average daily gains for colts 12-month old with mature weight of 500 kg, were greater and superior than that suggested by National Research Council (1978).

The roughage supplementation with concentrate feed at the level of 1% of live wight according to Wolter (1977), seems to have achieved its purpose according to the weight gain.

The daily weight gain of the alfalfa hay treatments was 43.37% (.036 kg) superior to the elephant grass treatment, a very important difference if a long period is considered.

The corn silage treatments (1.00 kg/head/day-gain), a nontraditional feed for horses (Tosi et al. 1979), gave similar daily gain as the perennial soybean hay (.99 kg/head/day).

The average weight gain of the three first experimental periods were significantly different (32.85 kg; 22.22 kg and 27.18 kg). The fourth period was different from the second period only (30.04 kg). The gain on the first period suggests a compensatory gain due to the change in the diet and environment. This was also reported by Manzano (1977) and Tosi et al. (1979).

TABLE 2. Growth measurements: weight gain, height at withers and heart girth increase.

	Treatments				
	Corn silage	Elephant grass	Hay		Average
			Alfalfa	Perennial soybean	
		Weight gain (kg)			
Colts	29.89	23.17	31.56	29.14	28.44
Fillies	26.28	23.08	35.05	26.42	27.71
Average (28-day period)	28.08 ab	23.13 b	33.31 a	27.78 ab	28.07
Daily gain	1.003	0.826	1.190	0.992	1.003
		Height at withers gain (cm)			
Colts	1.84	1.83	2.42	1.41	1.87
Fillies	1.92	2.00	2.33	1.67	1.98
Average (28-day period)	1.88 a	1.91 a	2.38 a	1.54 a	1.92
		Heart girth gain (cm)			
Colts	3.50	4.75	5.91	3.92	4.52
Fillies	3.33	3.08	4.33	3.83	3.65
Average (28-day period)	3.42 b	3.92 ab	5.13 a	3.88 ab	4.09

a, b, c. Means in same line not sharing the same superscript are significantly different ($P < 0,05$).

The greater weight gain demonstrated by this experiment was in part probably due to the compensatory gain, since the animals at the begining of experimental periods were below 75 kg from the average weight suggested by the National Research Council (1978) and 84.5 kg below the weight reported by Hintz et al. (1979) for Thoroughbred colts in the same age group.

Table 2 also shows the growth data and height at the withers. There was no significant difference (.05 level) for treatments, periods and between male and female. The average height increase was of 1.92 cm per 28-day period. This average was 0.50 cm higher than that achieved by Hintz et al. (1979) with Throughbred colts, maybe due to the compensatory growth also. The initial height was of 138.00 cm compared to that of Hintz report of 145.05 cm. Gatti (1972/73) also reported an average height higher than this experiment; 147.4 and 146.0 cm respectively for males and females for colts of 11.5 months of age.

The greater increase on heart girth measurement/period was achieved with alfalfa hay (5.13 cm). This measurement was significantly different from the one obtained by the corn silage treatments. There was no significant difference between experimental periods and sex.

The increase on heart girth measurement for the animals in the alfalfa hay treatment was 50% greater than that for the corn silage treatment and 31% and 32% greater than that for the elephant grass and perennial soybean hay treatments respectively. Comparing the average heart girth perimeters of this experiment - 148.37 cm initial and 164.73 cm final - to those reported by Gatti (1972/73) - of 158.88 and 167.46 cm respectively -, one can see that the initial difference was of 10.5 cm and the final difference of 2.73 cm. This sugests again that there was a compensatory growth for this parameter in a short period of times to compensate the effect of a bellow requirements diet prior to the experiment.

The highest consumption rates of dry matter measured by metabolic weight were seen in the alfalfa and soybean treatments (Table 3) and their values were significantly different from the values of corn silage and elephant grass treatments. The dry matter consumption of alfalfa hay was greater than perennial soybean hay by 11% and greater

TABLE 3. Feed consumption (D.M. g/day/kg$^{0.75}$).

Periods	Treatments				Average
	C.S.	E.G.	A.H.	P.S.H.	
		Colts			
I	26.45 X	22.56 X	77.37 X	66.07 X	48.11
II	29.83 XY	31.31 XY	83.83 X	77.14 XY	55,53
III	40.01 Y	35.94 Y	96.80 Y	85.78 YZ	64.63
IV	40.82 Y	49.66 Z	97.33 Y	94.43 Y	70.56
Average	34.28	34.87	88.83	80.86	59.71
		Fillies			
I	30.45 X	26.69 X	75.97 x	68.40 X	50.38
II	33.65 X	30.34 X	84.85 X	71.69 X	55.13
III	37.67 X	32.20 X	106.97 Y	98.18 Y	68.75
IV	40.38 X	54.27 Y	100.48 Y	94.60 Y	72.43
Average	35.54	35.87	92.07	83.22	61.67
General average	34.91 b	35.37 b	90.45 a	82.04 a	60.69

X, Y, Z. Means in same raw with different superscripts differ ($P < 0,05$).

a, b Means in same line not sharing same superscript are significantly different ($P < 0,05$).

than the corn silage and elephant grass consumption by 159.09% and 155.73% respectively.

Fonnesbeck at al. (1967) reported a consumption rate of the alfalfa hay of 9.07 to 10.55 kg of DM/head/day by adult standardbreed geldings. During this experiment the consumption was of 5.05 to 8.11 kg DM/head/day.

The low consumption of corn silage (34.91 g/day/$kg^{0.75}$) may be explained by the low DM content of this feed (26.85% DM). Coppock & Stone (1968) reported that consumption of corn silage increased when corn silage with a greater DM content was offered.

The DM intake of elephant grass (35.37 g/day/$kg^{0.75}$) was inferior to that reported by Tosi at al. (1980) (80.80 g/day/$kg^{0.75}$) by colts 17.5 months of age.

The analysis of variance did not show statistical difference between sexes, although these was significant difference for periods with exception to the corn silage treatment, showing that for the other treatments there was a significant increase in DM intake during the experiment.

CONCLUSIONS

1. Among the treatments, alfalfa hay demonstrated a higher weight gain when compared to the elephant grass and a greater increase in heart girth when compared to the corn silage.

2. The high DM intake suggested that both hays are highly palatable. The other two roughages (low DM) showed low DM intake although this fact did not affect the performance of the experimental units.

3. The feed conversion for hays was higher than for the other two roughages.

4. The legume hays when fed *ad libitum* increased the cost of production of colts.

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