

## EFFECT OF DIETARY REPLACEMENT OF GRAM WITH SOYBEAN MEAL ON GROWTH PERFORMANCE OF YEARLING HORSES

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### SUMMARY

A study was conducted to compare gram and SBM as supplemental protein source in the diet of yearling horses to evaluate its effect on growth performance and economics of feeding. Eighteen growing horses were divided into three groups of six animals (degree of freedom) each viz. T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub> randomly on the basis of age and body weight for an experimental period of 90 days. Initial average age and body weight of horses were 21.17±0.60, 21.17±0.60 and 21.50±0.42 months and 349±11.29, 349±9.88 and 349±8.06 kg in T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub>, respectively. Control group (T<sub>1</sub>) was fed gram-based concentrate mixture with ad-lib roughages. In T<sub>2</sub> and T<sub>3</sub>, gram was replaced with soybean meal (SBM) at 35% and 70%, respectively, on crude protein basis. ADG and BWG of the group T<sub>3</sub> was significantly higher (P<0.05) than the control group (T<sub>1</sub>) while ADG and BW gain in the group T<sub>2</sub> were intermediate to T<sub>1</sub> and T<sub>3</sub>. The cost of feeding concentrate was reduced by 8.4% and 24% in T<sub>2</sub> and T<sub>3</sub>, respectively.

**Keywords:** Average daily gain, Economics, Gram, Soybean meal, Yearling horse

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For a horse, a complete forage diet is generally lower in nutrient digestibility and do not meet the nutrient requirements without additional supplementation (Elzinga *et al.*, 2017). The same concern regarding protein requirement exists if the concentrate portion of the diet is made of gram alone as in Indian equine husbandry. Among various protein rich feeds, soybean meal (SBM) is the most used protein source worldwide. In India, increasing the amount of crushed gram in the ration of horses is a general practice to increase the nutrient to calorie ratio for optimum growth. Gram has 33.5-39.4% starch and 22.5-23.0% crude protein (Bampidis and Christodoulou, 2011). In contrast, SBM has got only 2% starch on DM basis (NRC, 2007) but about 46% of protein. Therefore, keeping the above facts, the present study was planned to assess the effect of replacing gram (*Cicer arietinum*) with soybean meal (*Glycine max*) as a protein source in the dietary regimen of yearling horses.

Eighteen fillies with an average initial body weight of 349 kg were divided randomly into three dietary treatment groups (T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub>) of six animals each following completely randomized design. Animals were dewormed against internal parasites and dipped against ectoparasites. Water and roughages were provided ad lib in separate troughs. The experiment was conducted for 90 days. Crushed gram/chickpea was used as a primary protein source in control group (T<sub>1</sub>), and SBM was used as protein source replacing gram (on CP basis) at 35% and 70% levels in T<sub>2</sub> and T<sub>3</sub>, respectively. All the rations were isocaloric. Amount and composition of concentrate mixture fed daily has been presented in table 1. Although, the daily amount

of concentrate mixture fed was different but the amount of nutrients supplied to the animals was kept similar among all treatments. The rate of feeding different concentrate was calculated as 0.81, 0.77 and 0.74% BW on DM basis at the beginning of experiment. The cost of gram and SBM was Rs. 70.0 and 37.95 per kg, respectively.

Body weights of experimental animals (average of two consecutive days) were recorded in the morning before feeding at the start and thereafter at progressive monthly intervals. ADG was calculated by dividing BWG by the total number of days of the feeding trial. Height of the animals was measured from floor level to highest point of withers using a measuring stick. Shank circumference was measured by using a flexible, non-stretchable measuring tape.

Feed and fodders were analysed for different proximate components and cell wall fractions as per AOAC (2005) and Van-Soest *et al.* (1991), respectively. DE and NFC were estimated with the recommendations of NRC (2007). Data obtained were subjected to statistical analysis as per Snedecor and Cochran (1994) using Completely Randomized Design (CRD). All the data were subjected to ANOVA using the General Linear Models procedure of SPSS-20. The mean differences among different treatments were separated by Duncan's multiple range tests. Consequently, a level of (P<0.05) was used as the criterion for statistical significance.

Chemical composition of concentrate mixtures used in different dietary treatment has been presented in Table 2. The crude protein content values of oat hay and green lucerne were 6.50 and 22.32 percent, respectively. The NDF and ADF values of oat hay and green lucerne were 71.24 and

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**Table 1. Ingredient composition of concentrate mixtures and (kg) and nutrients fed daily to the experimental horses**

Parameter	Treatments		
	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>
<b>Ingredient composition of concentrate mixtures (CM) fed daily</b>			
Gram (kg)	1.130	0.735	0.340
SBM (kg)	-	0.170	0.342
Veg Oil (kg)	-	0.075	0.148
Barley (kg)	0.910	0.910	0.910
Wheat Bran	1.020	1.020	1.020
Common Salt	0.040	0.040	0.040
Mineral Mixture	0.050	0.050	0.050
Total (kg)	3.150	3.000	2.850
Cost of CM/kg	38.16	36.70	31.65
<b>Nutrients fed per day</b>			
CP (g/animal/day)	397.91	398.35	399.62
DE* (Mcal/animal/day)	9.28	9.29	9.29
g CP/DE Mcal	42.87	42.87	43.01

\*Calculated values as per NRC (2007).

**Table 2. Chemical composition (% DM basis) of different concentrate mixtures**

Attributes	Treatments		
	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>
<b>Chemical composition (on %DM basis)</b>			
DM	90.09	90.17	90.24
CP	14.00	14.71	15.52
DE*	3.27	3.43	3.61
EE	3.30	5.70	8.30
OM	93.26	92.80	92.30
Total Ash	6.74	7.19	7.69
NFC	49.74	46.63	43.20
NDF	26.22	25.77	25.29
ADF	12.30	11.80	11.24

\*Calculated values as per NRC (2007).

56.30 percent; and 48.35 and 34.19 percent, respectively. The cost of feeding per animal (Rs./animal/day) of the different concentrate mixture was Rs. 120.21, 110.11 and 90.23, for T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub>, respectively.

Statistical analysis of the data revealed that total body weight gain (table 3) during the experimental period was significantly (P<0.05) higher T<sub>3</sub> as compared to control diet (T<sub>1</sub>). Total weight gain in the T<sub>2</sub> group did not differ (P>0.05) from the control group and the T<sub>3</sub> group. Similar results were found in ADG. These results were consistent with the findings of Godbee *et al.* (1983). FCR was improved significantly in SBM based diets. Feeding of T<sub>3</sub> concentrate reduced the cost by 25% in comparison to the conventional gram-based concentrate (T<sub>1</sub>) feeding; similarly feeding of concentrate ration T<sub>2</sub> was also 8.4% cheaper than the feeding of T<sub>1</sub> concentrate.

There was no significant difference in height gain among the groups fed different concentrate rations supplying equal amounts of DE and CP. Also, percentage

**Table 3. Growth performance of experimental yearling horses under different dietary treatments**

Period (month)	Treatments		
	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>
Initial BW, kg	349.00±11.29	349.00±9.88	349.00±8.06
BW at month I, kg	366.50±10.82	368.50±8.75	371.83±8.05
BW at month II, kg	384.50±12.32	393.00±9.31	395.67±7.38
BW at month III, kg	405.00±10.57	415.50±9.38	425.67±7.60
Total gain, kg	56.00 <sup>a</sup> ±3.23	66.50 <sup>ab</sup> ±4.43	76.67 <sup>b</sup> ±3.75
ADG, g	622.00 <sup>a</sup> ±35.00	738.00 <sup>ab</sup> ±49.00	851.00 <sup>b</sup> ±41.00
DM Intake, kg/day	10.61±0.35	10.64±0.36	10.69±0.37
FCR	17.05 <sup>a</sup> ±0.35	14.41 <sup>b</sup> ±0.36	12.56 <sup>c</sup> ±0.37
Cost of concentrate fed/ animal/day	120.21	110.11	90.23
<b>Height (cm) at withers</b>			
Initial	153.00±0.81	150.00±0.68	152.17±0.65
Final	158.00±0.68	155.50±0.76	157.67±1.08
Gain	5.00±0.57	5.50±0.42	5.50±0.67
<b>Shank circumference (cm)</b>			
Initial	18.41±0.15	18.33±0.16	18.66±0.21
Final	19.50±0.12	19.33±0.10	19.50±0.31
Gain	1.08±0.08	1.00±0.18	0.83±0.16

The values bearing different superscripts in a row differ significantly (P<0.05)

increase in height gain did not differ significantly among the three groups. There was no influence of feeding different concentrate ration on growth in terms of circumference of shanks. Also, the numerical values of shank circumference did not differ significantly (P>0.05) among the groups, throughout the experiment.

It was inferred that replacement of 70% of gram with SBM in the concentrate mixture of growing horses improves the average daily gain and total body weight gain significantly (P<0.05) and economise the ration with a reduction of 25% in the cost of concentrate mixture.

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