

Yearling horse growth and development: Acceptability and replacement value of field peas for oats

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Summary

Yearling growing horses averaging 745 pounds were used to evaluate the acceptability and replacement value of field peas for oats in an 84d feeding study. Field peas replaced 0, 33 and 67% of the oats in complete pelleted supplements that were divided into two meals and fed twice daily. Feeding a supplement containing the highest inclusion level of field pea (67%P) was readily consumed by horses without invoking digestive disturbances. Supplements were fed such that uniform energy was fed across treatments. With the exception of forearm circumference that was larger when oats were replaced by 33%P, body growth and physical measurements were linear from trial initiation to the end of the study and did not differ. The data suggests that field peas can be a very useful feed grain for yearling growing horses.

Introduction

The production of field peas (*Pisum sativum*) in North Dakota, and surrounding states, has been increasing steadily since the early 1990's. The crop, which fits well into small grain production in the cooler regions of northern plains, is grown primarily for domestic and export human food markets and, to a lesser extent, livestock feed. Estimates from the ND Dry Pea and Lentil Council (personal communication) suggest production available for livestock feed has varied from 10 to 37% annually during the 2002-2004 period. Field peas are an excellent source of nutrients containing: protein (22-26% CP), lysine (1.50%), ADF (8.0%), NDF (15.1%), digestible energy (1.54 Mcal/lb), starch (48-52%), fat (1.6%), calcium (.05%) and phosphorus (.48%). Peas are also a rich source of microminerals, water soluble and fat soluble vitamins. Oats are the most common feed grain fed to horses because they are palatable and possess a desirable hull to groat ratio making them a very safe energy source for horses. Nutritionally, oats are also an excellent feed grain containing: protein (13-15%CP), lysine (.40%), ADF (15.3%), NDF (27.0%), digestible energy (1.36 Mcal/lb), fat (5.1%), calcium (.05%) and phosphorus (.35%). Increased production of peas in the region have raised questions relative to their feeding value in horse diets. Many legume seeds, like peas, contain antinutritive factors (trypsin inhibitors, chymotrypsin, amylase inhibitors, haemagglutinins, tannins) that interfere with digestion, although modern pea varieties

are low. Research with peas in horse diets is limited, however, Landblom, et al. (1997) the substitution value of field peas in non-ruminant swine diets and found raw ground peas to be an adequate substitute for soybean meal in growing and finishing diets. In Europe, Frape (1998), reported white and purple flowered peas to be a very useful protein source for horses, however, no research information exists relative to feeding peas to horses in North America. Therefore, investigating the potential replacement value of peas in growing horse supplements is a logical area of study, since field pea production is expected to increase following announcement that pulse crops like field peas have been accepted into the USDA commodity loan and LDP programs.

Growing horses develop most rapidly from birth to 12 months of age; attaining 50 to 60% of mature weight and height the first year and 80 to 90% of mature weight and height by 24 months of age (Freeman and Topliff, 2002). Under nourishment during growth of the young horse can have long-term detrimental effect on skeletal development. Because the rapidly growing, young horse, attains 80-90% of its mature size within the first two years of life, the yearling horse is an ideal growth stage to evaluate the suitability of field peas for horses. This project was designed to evaluate the acceptability of peas for horses and to measure physical growth changes when peas replaced 0, 33 and 67% of the oats in growing supplements.

Materials and Methods

Twenty-four yearling filly (n=18) and stud colt (n=6) quarter horses, averaging 745 pounds, were assigned in a completely randomized design, based on starting weight, to an 84d feeding study to evaluate three growing supplements. There were eight horses in each treatment and individual horse served as the experimental unit. The three growing supplements evaluated are described as follows: 1) 100% Oat Pellet (C), 2) 67% Oat/33% Pea (33P), 3) 33% Oat/67% Pea (67P). Cubed hay fed in the study was approximately one-third brome grass and two-thirds alfalfa and was prepared by Northwest Alfalfa Products, Tioga, ND. The complete pelleted supplements were prepared commercially and the amount fed daily was divided into two equal meals. Hay was fed first followed by the first half of the supplement at approximately 8:30 a.m. each day. The remaining half was fed at approximately

2:00 p.m. each afternoon. When the study started, two pounds of supplement was offered at the morning and afternoon feedings. The supplements were not isocaloric, however, based on calculated energy content, the total amount of supplement fed daily to each horse within treatment was adjusted so that all horses received the same amount of energy each day. Supplement delivered to each horse was gradually increased to full intake during the first three weeks of the study. Supplement ingredient composition is shown in Table 1. Hay, supplement, total daily feed deliveries to each horse and diet nutrient analysis is shown in Table 2. The horses were housed and handled in accordance with procedures approved by the North Dakota State University Institutional Animal Care and Use Committee. Each horse was housed individually in rectangular 32' x 128' pens. Continuous steel fencing in the pens provided face to face contact and social interaction, but allowed for individual feeding.

Horses in the study were weighed and measurements to include weight, body length, wither height, hip height, heart girth circumference, cannon bone circumference, forearm circumference and gaskin muscle circumference were taken at 28d intervals. With the exception of body weight, dual measurements were taken by two research technicians and the mean value of the two measurements was recorded.

Data was analyzed using the statistical analysis procedures of SAS (1999).

Results

Supplement acceptability was an important criteria in the study. The horses readily consumed all supplements without any indication of digestive upset. Horses grew steadily in a linear manner throughout the 84d study, as shown in Table 3. Horses receiving the 67P diet were slightly heavier at the end of the feeding period, but the difference was not significant. Final weights were 849.8, 844.8 and 860.0 for the 0P, 33P and 67P, respectively.

Body measurements for length, wither height and hip height are shown in Table 4 and indicate growth for these measurements was linear but did not differ.

Heart girth, forearm, cannon bone and gaskin circumferences are summarized in Table 5. With the exception of forearm circumference, that was greater ($P=0.058$) in the 33P group, measurements for heart girth, cannon bone and gaskin were linear and did not differ. Although not directly measured, hoof integrity did not appear to be compromised due to treatment.

As supplements with pea replacement were fed, growth did not plateau at the highest 67P replacement level. These data indicate that field peas are a safe, readily accepted, high protein and energy source for horses and can be considered a very useful feed grain for formulation in yearling horse diets.

Literature Cited

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- Frape, D.** 1998. Equine Feeding & Nutrition, 2nd ed. Iowa State University Press, A Blackwell Science Company, Ames, IA, pp 133.
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- SAS.** 1999. SAS Users Guide: Statistics. SAS Institute Inc., Cary, NC.

Table 1. Experimental supplement ingredient composition.

	0% Pea	33% Pea	67% Pea
Oats	1588.764	1146.573	660.0
Peas	0	571	1229.014
Molasses	100	100	100
Crude Protein,%	16.96	17.5	17.78
Crude Fat,%	3.13	2.6	2.01
Crude Fiber,%	10.06	9.12	8.12
Calcium,%	.22	.23	.23
Copper,P PM	26.98	27.02	27.01
Selenium,Lb	2.7	2.7	2.7
Zinc,P PM	59.98	60	60.82
Potassium,%	.79	.85	.89
Salt,%	.3	.3	.3
Magnesium,%	.19	.17	.15
Choline, Mg/Lb	557.7	380.31	169.02
Vitamin K,Mg/Lb	.09	.09	.09
Vitamin A,IU/Lb	2.6	2.6	2.7
Vitamin D3,IU/Lb	.43	.43	.45
Vitamin E,IU/Lb	21.66	21.66	22.5

Table 2. Daily cubed hay and supplement fed per horse.

	0% Pea	33% Pea	67% Pea
Daily Feed:			
Alfalfa-Brome Hay, lb.	9.5	10.0	10.5
Supplement Pellet, lb.	7.5	7.0	6.5
Total Fed/Day, lb.	17.0	17.0	17.0
Diet Analysis:			
Crude Protein, %	17.0	17.2	17.3
Lysine, %	.85	.84	.86
Calcium, %	.84	.88	.92
Phosphorus, %	.29	.29	.29
Digestible Energy, Mcal/lb.	1.09	1.10	1.10

Table 3. Growth of yearling horses fed oat supplements with increasing field pea levels.

	0% Pea	33% Pea	67% Pea	P-Value
Body Weights, lb				
Initial	746.25	744	746.75	.9948
Day 28	761.3	753	763.3	.8919
Day 56	802.5	787.75	816.88	.4701
Final	849.75	844.75	860	.7673
ADG, lb				
28 Day, lb.	.5375	.3214	.5910	.7084
56 Day, lb.	1.471	1.241	1.91357	.2929
84 Day, lb.	1.6875	2.0357	1.54	.5474
Overall	1.232	1.1994	1.348	.5701

Table 4. Body length, hip height and wither height for yearling horses fed oat supplements with increasing field pea levels.

	0% Pea	33% Pea	67% Pea	P-Value
Body Length, in				
Initial	54.180	53.547	54.434	.7751
Day 28	54.875	54.531	55.180	.6931
Day 56	55.578	55.281	56.117	.3812
Final	56.141	56.133	56.367	.9314
Hip Height, in				
Initial	56.008	56.617	56.289	.5611
Day 28	56.609	57.313	56.953	.5264
Day 56	56.828	57.922	57.164	.1612
Final	57.469	58.359	57.641	.2212
Wither Height, in				
Initial	54.188	54.840	54.109	.3726
Day 28	54.648	55.602	54.719	.0981
Day 56	55.102	56.063	55.102	.1371
Final	55.492	56.453	55.672	.2084

Table 5. Heart girth, cannon bone, forearm and gaskin muscle circumference for yearling horses fed oat supplements with increasing field pea levels.

	0% Pea	33% Pea	66% Pea	P-Value
Heart Girth Circum., in				
Initial	62.703	62.641	62.438	.9396
Day 28	63.719	63.563	63.313	.8354
Day 56	64.547	64.453	64.203	.8408
Final	65.891	65.891	65.750	.9699
Cannon Circum., in				
Initial	6.914	6.785	6.922	.9460
Day 28	7.031	7.047	7.094	.8203
Day 56	7.094	7.102	7.117	.9683
Final	7.234	7.156	7.234	.7562
Forearm Circum., in				
Initial	18.280	18.320	18.612	.5999
Day 28	18.5	18.750	18.836	.5803
Day 56	18.617	18.703	18.953	.6422
Final	18.680 ^a	19.5 ^b	18.813 ^a	.0576
Gaskin Circum., in				
Initial	16.148	15.906	16.141	.7176
Day 28	16.289	16.125	16.313	.7055
Day 56	16.281	16.234	16.359	.8443
Final	16.531	16.344	16.594	.4357