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

D.G. Landblom[1], D.K. Olson[1], K.A. Ringwall[1], D. Olson[2] and B. Knudson[3]
[1]NDSU-Dickinson Research Extension Center
[2]NDSU-Animal and Range Science Department
[3]Dickinson State University

**Abstract**: Forty-eight yearling growing horses (colts: n = 18; fillies: n = 30) averaging 349.9 kg were used in a two year study to evaluate acceptability and replacement value of field peas for oats in an 84d feeding study. Field peas replaced 0, 33.3 and 67.7% of the oats in a complete pelleted supplement that was divided into two feedings and fed twice daily at 8:30 a.m. and 2:00 p.m. Forage was a 15% CP hay pellet [60% alfalfa (Medicago sativa) and 40% bromegrass (Bromus inermis)]; DE value of 0.477 Mcal/kg. Oat grain(Avena sativa) was 13.3% CP with an energy value of 0.658 Mcal/kg. Field peas (Pisum sativum) contained 23.0% CP and had an energy value of 0.713 Mcal/kg. Experimental supplement DM, CP, LYS, NEg, ADF and NDF were 86.75%,19.81%, 0.85%, 0.245Mcal/kg, 13.74%, 27.18%; 87.55%, 20.8%, 0.84%, 0.256 Mcal/kg, 12.30%, 24.83% and 88.49%, 21.13%, 0.86%, 0.267 Mcal/kg, 10.86%, 22.59% for 0, 33 and 67.7% field pea, respectively. Average 84d hay cube consumption was 5.23, 5.44 and 5.09 kg/d and experimental supplement consumption was 3.26, 3.05 and 2.86 kg/d for 0, 33.3 and 67.7% field pea replacement, respectively. Horses readily consumed all experimental pea replacement supplements without noticeable signs of digestive disorders. Growth measurements included body weight change and physical measurements for body length, hip and wither height, and girth, forearm, cannon bone and gaskin muscle circumferences. Treatment means did not differ for final weight (P=.395), ADG (P=.419), body length (P=.392), hip height (P=.536), wither height (P=.584) girth (P=.414), forearm circ. (P=.648), cannon bone circ. (P=.255) and gaskin muscle (P=.633). There was a significant linear growth effect for body length (P<.01), hip height (P<.01), forearm (P<.01), and gaskin muscle (P<.01). A quadratic effect was identified for wither height (P<.01) and girth (P<.01), and a treatment x time interaction was identified for cannon bone (P<.05). Results of this experiment suggest that the yearling growing horse will readily consume field peas and that field peas can replace up to 67.7% of the oats in yearling growing horse supplements without creating digestive upset or giving rise to abnormal hoof development When compared to an all oat supplement, feeding a 67.7% field pea formulation yielded similar growth response with 12.4% less daily supplement per horse.

**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 and are expected to increase, since field peas have been accepted into the USDA commodity loan and LDP programs. 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 has raised questions relative to their feeding value in horse diets. Many legume seeds, like peas, contain antinutritive factors (trypsin inhibitors, chymotrypsin, amylase inhibitors, haemagglutinins, and tannins) that interfere with digestion, although modern pea varieties are low.

Research with peas in horse diets is limited, however, Landblom, et al. (1997) evaluated 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.

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 at an ideal development 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**:

Forty-eight yearling quarter horses (Fig. 8 and 9) [filly (n=30) and stud colt (n=18, averaging 338 kg were assigned in a completely randomized design, based on starting weight, to an 84d feeding study to evaluate three growing supplements. Eight horses were assigned to each treatment and individual horse serving as the experimental unit. The three growing supplements evaluated (Table 1) are described as follows: 1) 100% Oat Pellet (**C**), 2) 67% Oat/33% Pea (**33P**), 3) 33% Oat/67% Pea (**67P**). Supplements were prepared to meet the nutritional requirements of the yearling growing horse (NRC,1989). The supplements were not isocaloric, however, based on calculated energy content, the amount of supplement fed daily to each horse was adjusted such that all horses received the same amount of daily energy across treatments. Cubed alfalfa-brome grass mixed hay was fed that contained approximately 60% alfalfa and 40% brome grass hays.

A split-time feeding regime was utilized for supplement delivery. Hay was fed first followed by one-half of the supplement at approximately 8:30 a.m. each day. The remaining one-half was fed at approximately 2:00 p.m. each afternoon. Initially, two pounds of supplement was offered at each morning and afternoon feeding and then daily supplement was gradually increased over the next three weeks until the full 7.5, 7.0, and 6.5 pounds/horse/day was delivered for the C, 33P, and 67P, respectively. Hay, supplement, total daily feed deliveries to each horse and calculated diet nutrient analysis is shown in Table 2.

Horses in the study were weighed and measurements to include weight, body length, wither height, hip height, 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.

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.

Data was analyzed using general linear model procedures of SAS (1996). Means, linear effect, quadratic effect and interactions were analyzed.

**Results and Discussion**

Horses in the study readily consumed the experimental supplements with no visible evidence of digestive upset or feed refusal.

Horses that received the 67P supplement were numerically heavier at the end of the 84d study, but body weight and ADG did not differ ($P>.1$). A quadratic effect for body weight change over time was observed ($P<.01$), Fig. 1.

Measurements for body length, wither, and hip height are shown in figures 2, 3, and 4. Treatment differences for body length ($P>.1$) and hip height ($P>.1$) did not differ, however, a significant linear effect was identified for body length and hip height ($P<.01$). For wither height, treatments differed ($P<.01$) and over time a quadratic effect ($P<.01$) was identified.

Circumference changes were monitored and included girth (Fig. 5), cannon bone (Fig. 6), forearm (Fig.7) and gaskin muscle (Fig. 8). Circumference change for treatment during the 84d period did not differ for girth ($P>.1$), cannon bone ($P>.1$), forearm ($P>.1$) or gaskin ($P>.1$). A linear effect was found for cannon bone ($P<.01$), forearm ($P<.01$) and gaskin

(P<.01) and a quadratic effect was identified over time for girth (P>.05). A treatment x time interaction for the cannon bone (P<.05) was also identified.

While hoof development was not measured directly in this study, no indication of abnormal hoof growth was observed at the end of the 84d feeding study. Horses used in the evaluation were inspected for unusual hoof development at 2 years of age; one year after the feeding study was completed, and no evidence of abnormal hoof development was observed.

**Implications:**

These data indicate that field peas are a safe, readily accepted, high protein and energy source for horses and should be considered a useful feed grain for diet formulations fed to the rapidly growing yearling horse.

**Literature Cited**:

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**Freeman, D.W. and D.R. Topliff**. 2002. Managing young horses for sound growth. Oklahoma State University, Oklahoma Cooperative Extension Service Bulletin F-3977.

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**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 |
| Selenuim,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, kg | 4.3 | 4.5 | 4.7 |
| Supplement Pellet, kg | 3.4 | 3.2 | 3.0 |
| Total fed/Day, kg | 7.7 | 7.7 | 7.7 |
| **Diet Analysis** | | | |
| Crude Protein, % | 17.0 | 17.2 | 17.3 |
| Lysine, % | 0.85 | 0.84 | 0.86 |
| Calcium, % | 0.84 | 0.88 | 0.92 |
| Phosphorus, % | 0.29 | 0.29 | 0.29 |
| Digestible Energy, Mcal/kg | 0.49 | 0.49 | 0.49 |

**Figure 1.**

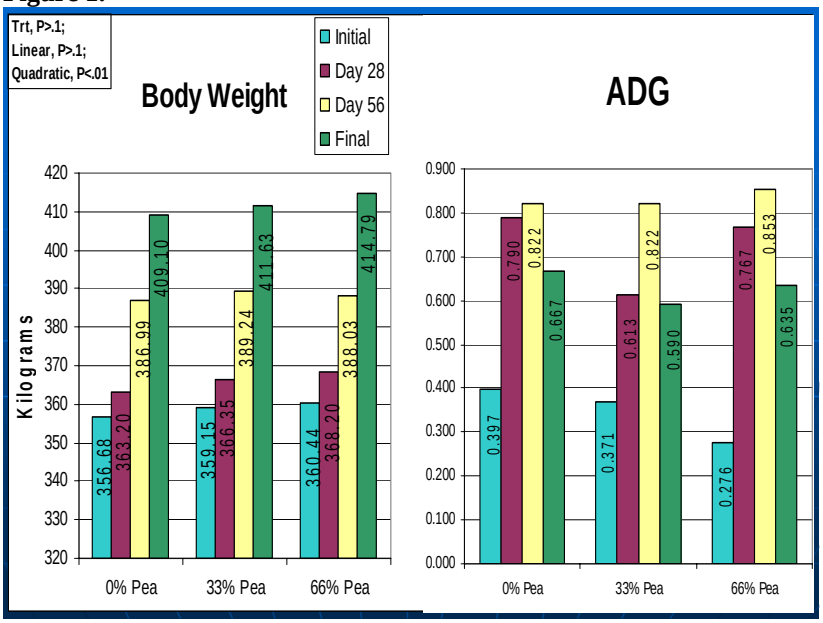
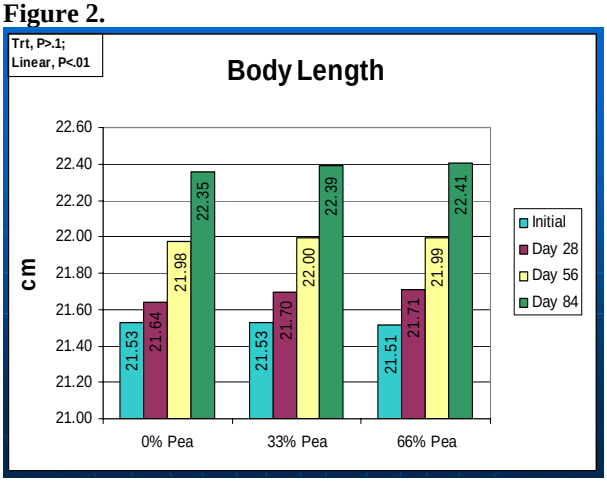


**Figure 2.**

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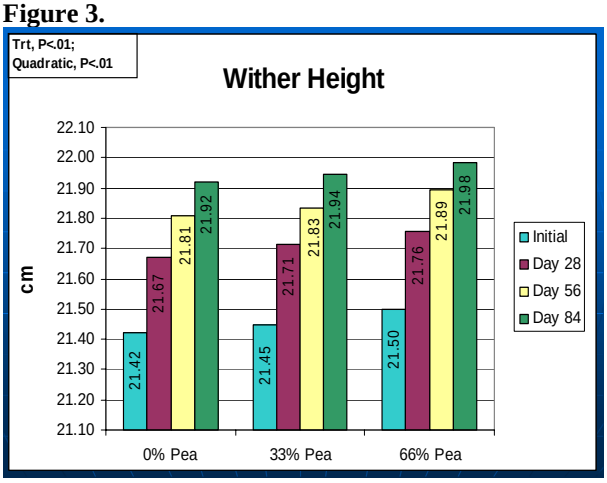


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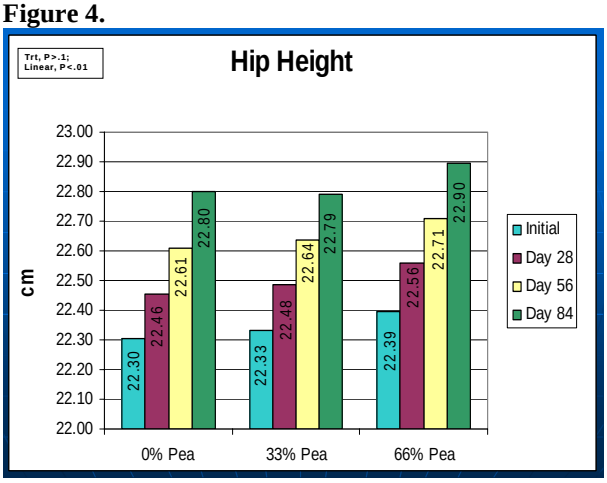

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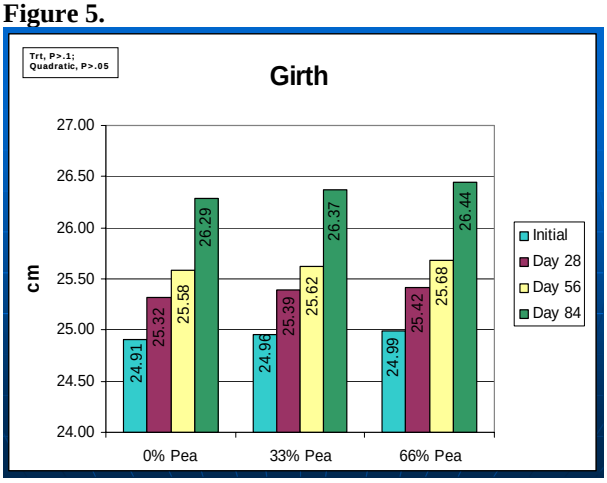


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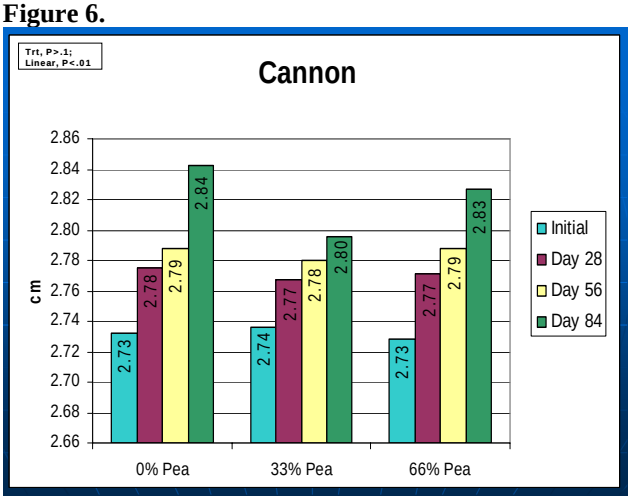


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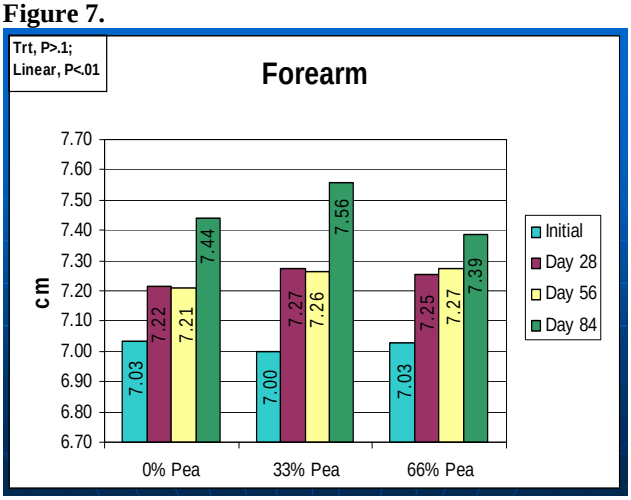

**Figure 8.**

**Figure 9.**