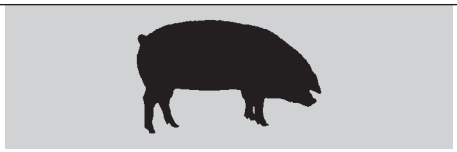
The Professional Animal Scientist 25 (2009):17–25
©2009 American Registry of Professional Animal Scientists



Inclusion of Yellow Field Peas and Carbohydrase Enzyme in Nursery Pig Diets to Improve Growth Performance

K. R. Brooks,*[1] B. R. Wiegand,† A. L. Meteer,‡ G. I. Petersen,§ J. D. Spencer,# J. R. Winter,‡ and J. A. Robb‡

*Department of Agricultural Economics, Oklahoma State University, Stillwater 74078; †Division of Animal Sciences, University of Missouri, Columbia 65211; ‡Department of Agriculture, Illinois State University, Normal 61790-5020; §Department of Animal Science, University of Illinois, Champaign 61824; and #JBS United Inc., Sheridan, IN 46069

ABSTRACT

The main objective was to determine if yellow, short-season field peas could partially replace corn and soybean meal in mid- and late-nursery pig diets (6.5 to 7.5 kg BW in phase 1 and 10 to 13 kg BW in phase 2, respectively), and to evaluate the efficacy of a fungal hemicellulase-cellulase preparation (enzyme). Two experiments with 366 nursery pigs (n = 240 in Exp. 1, and n = 126 in Exp. 2) were conducted feeding a 2-phase program, 14 d each. Experiment 1 used a 2 × 2 factorial arrangement of treatments with 0 or 20% peas with or without enzyme addition. Experiment 2 evaluated enzyme supplementation to nursery diets containing 20% peas. There were 40 pens with 10 replications (6 pigs/pen) in Exp. 1 and 18 pens with 9 replications (7 pigs/pen) in Exp. 2. In Exp. 1, significant increases were found in ADG (385 vs. 418 g/d for the control diet and diet with peas, respectively; P = 0.01), ADFI (561 vs. 632 g/d for the control diet and diet with peas, respectively; P = 0.01), and significant decreases were found in G:F from 0 to 28 d (685 vs. 658 g/kg for the control and pea diet; P = 0.01). Enzyme supplementation tended to increase ADG (P = 0.10) from 0 to 28 d. Inclusion of yellow field peas (20%) in the mid- and late-nursery periods provided significant improvements in nursery pig growth performance compared with corn- and soybean meal-based diets. Diets including field peas, enzymes, or both were economically competitive but not superior to the corn-soybean meal diet. However, inclusion of the enzyme improved animal performance and net value in the pea diet.

Key words: field pea, nursery pig, carbohydrase, growth performance, cost analysis

INTRODUCTION

One opportunity for swine producers to improve profit margin could be by identifying alternative feed ingredients for pigs. Feed ingredients must be economical, be nutritionally adequate, and support efficient animal performance if they are to be used in swine diets. Substituting corn and soybean meal with short-season field peas in the diets of the nursery pig is one alternative.

Field peas are grown in Canada, Australia, Europe, and the United States. Research results indicate that field peas are an excellent source of amino acids and energy for growing and finishing pigs (Thaler and Stein, 2003). Stein et al. (2004) reported that field peas grown in South Dakota have an energy concentration almost identical to that of corn. Research has focused on including field peas in the diets of beef cattle, dairy, poultry, and adult and feeder swine (Schatz, 2002; Anderson et al., 2007). Stein et al. (2004) reported that feeding up to 18% of raw field peas to nursery pigs had no adverse affects on performance when the diet was balanced for indispensable amino acids. However, Landblom and Poland (1997) concluded that pigs weighing at least 7.26 kg can be fed a diet containing no more than 20% raw field peas and no more than 20% extruded field peas. As inclusion rates of field peas were

[1]Corresponding author: kblubau@okstate.edu

Table 1. Profile of fungal hemicellulase-cellulase preparation (enzyme)

Component	Activity (minimum)
α-Galactosidase	7,000 (unit[1]/kg)
Galactomannanase	22,000 (unit[1]/kg)
Xylanase	300,000 (unit[2]/kg)
β-Glucanase	220,000 (unit[3]/kg)

[1]Unit is equal to 1 µmol *p*-nitrophenyl-β-D-galactopyranoside hydrolyzed within 1 min at 30°C and pH 4.0.

[2]Unit is equal to 1 mg total reducing sugars (glucose equivalent) released within 1 min at 30°C and pH 4.0.

[3]Unit is equal to 1 µmol total reducing sugars (glucose equivalent) released within 1 min at 30°C and pH 4.0.

increased in the diet, pig performance decreased, which could be due to fiber content of the pea diet. Inclusion of field peas at 20% of the total diet will result in an increase in total dietary fiber compared with a common corn-soybean meal diet. Therefore, we found it appropriate to evaluate the efficacy of a mixed enzyme (α-galactosidase, galactomannanase, xylanase, β-glucanase) to improve utilization of this fiber component by the nursery pig.

The objectives were to evaluate the impact of field pea inclusion in nursery pig diets on animal performance, and to evaluate the efficacy of a carbohydrase enzyme in nursery pig diets with and without peas. Cost analysis was also conducted to evaluate the price at which peas can be incorporated into the diet as the prices of soybean meal and corn increase.

MATERIALS AND METHODS

The research was conducted according to the Illinois State University Animal Care and Use Committee Guidelines (IACUC 11-2005). Two feeding trials were conducted with 366 nursery pigs (n = 240 in Exp. 1, and n = 126 in Exp. 2) to determine whether yellow short-season field peas could partially replace corn and soybean meal in the mid- and late-nursery diets (6.5 to 7.5 kg BW in phase 1, and 10 to 13 kg BW in phase 2, respectively) and to evaluate the efficacy of a fungal hemicellulase-cellulase preparation containing α-galactosidase, galactomannanase, xylanase, and β-glucanase (hereafter, called "enzyme") on nursery diets with and without peas. The enzyme profile is represented in Table 1. All pigs were fed a 2-phase program (**P1** and **P2**) provided for 14 d each. A 2 (control vs. pea diet) × 2 (enzyme vs. no enzyme) factorial arrangement of

Table 2. Nursery pig diets for phase 1 (0 to 14 d)

	Treatment			
Item	Control	Control + enzyme[1]	Pea[2]	Pea + enzyme
Ingredient, %				
Corn	50.00	49.80	32.50	32.30
Soybean meal 48%	27.58	27.58	25.57	25.57
Field peas	0.00	0.00	20.00	20.00
Whole whey	14.25	14.25	14.25	14.25
Blended species blood plasma	2.50	2.50	2.50	2.50
Mono-calcium 21% phosphorus	1.31	1.31	1.14	1.14
Limestone	1.03	1.03	1.03	1.03
Fish meal	1.00	1.00	1.00	1.00
Bentonite	0.50	0.50	0.50	0.50
Other[3]	0.47	0.47	0.47	0.47
ZnO	0.35	0.35	0.35	0.35
Salt	0.30	0.30	0.30	0.30
L-Lys·HCl	0.27	0.27	0.02	0.02
Choice white grease	0.25	0.25	0.25	0.25
DL-Met	0.12	0.12	0.12	0.12
L-Thr	0.08	0.08	0.02	0.02
L-Trp	0.01	0.01	0.00	0.00
Enzyme mixture[2]	0.00	0.20	0.00	0.20
Total	100.00	100.00	100.00	100.00
Calculated analysis, %				
Crude fat	3.28	3.27	2.72	2.71
Crude fiber	1.92	1.92	2.55	2.54
CP	22.01	22.00	23.44	23.43
Lys, digestible	1.35	1.35	1.35	1.35
Met + Cys, digestible	0.75	0.75	0.76	0.75
Thr, digestible	0.84	0.84	0.84	0.83
Trp, digestible	0.24	0.24	0.24	0.24
Ile, digestible	0.81	0.81	0.88	0.88
Val, digestible	0.93	0.92	0.98	0.98
P	0.78	0.78	0.77	0.76
Ca	0.94	0.94	0.92	0.92
Na	0.35	0.35	0.35	0.35
ME, kcal/kg	672.54	671.13	670.56	669.14

[1]Enzyme mixture: α-galactosidase, galactomannanase, xylanase, and β-glucanase.

[2]Amino acid digestibility was estimated for pea diets as defined by Stein et al. (2004).

[3]Provided per kilogram of complete feed: 0.30 mg Se as sodium selenite, 0.025% Ca as calcium carbonate, 11 kIU retinyl acetate, 2.6 kIU cholecalciferol, 44.1 IU DL-α-tocopherol acetate, 1.25 mg vitamin K as menadione nicotinamide bisulfite, 24 mg D-pantothenic acid as D-calcium pantothenate, 6.6 mg riboflavin, 0.50 mg folic acid, 88.9 mg niacin, 0.03 mg vitamin B_{12}, 150.1 mg Zn as zinc oxide, 150.1 mg Fe as ferrous sulfate monohydrate, 50.07 mg Mn as manganous oxide, 12.83 mg Cu as copper chloride, and 1.20 mg I as ethylenediamine dihydriodide.

Download English Version:

https://daneshyari.com/en/article/2454461

Download Persian Version:

https://daneshyari.com/article/2454461

Daneshyari.com